# ULTIMATE STRENGTH ANALYSIS OF PARTIALLY COMPOSITE AND FULLY COMPOSITE OPEN-WEB STEEL JOISTS


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(ABSTRACT)

The behavior of composite steel joists with various degrees of shear connection is investigated. The results of eight full-size composite joist tests, conducted as a portion of the study, are presented. Joist spans range from 24 ft. to 30 ft. and depths from 8 in. to 18 in. Six types of mechanical connectors provide horizontal shear transfer capacity. Steel deck supported slabs, from 3 in. to 4 in. thick, are used for all tests. The results of the experiments are used to evaluate the flexural strength and associated failure modes of partially composite and fully composite joists.

The results of each test are compared to theoretical calculations based on an ultimate strength flexural model. The joists are classified by how the provided amount of shear connection compares to the bottom chord yield force and by how the provided amount of shear connection in conjunction with the top chord capacity compares to the bottom chord yield force. Behavior typical of each classification is discussed. Correlation with previously conducted composite joist tests of similar configuration is also discussed.

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## LIST OF SYMBOLS

$a$ Effective concrete flange thickness, in.

$A$ Applied load (spreader beam weight and ram load) per jack point, kips

$A_{bc}$ Cross-sectional area of bottom chord, in.$^2$

$A_{sc}$ Cross-sectional area of stud shear connector, in.$^2$

$A_{tc}$ Cross-sectional area of top chord, in.$^2$

$b$ Width of concrete slab, in.

$B$ Spreader beam weight per jack point, kips

$C$ Compression force in concrete slab due to total load, kips

$C_a$ Compression force in concrete slab due to applied load, kips

$C_{ac}$ Calculated compression force in concrete slab due to applied load, kips

$C_{ae}$ Experimental compression force in concrete slab due to applied load, kips

$C_c$ Calculated compression force in concrete slab due to total load, kips

$C_e$ Experimental compression force in concrete slab due to total load, kips

$d_{joist}$ Out-to-out depth of joist, in.

$e$ Distance between bottom chord centroid and resultant concrete force, in.

$e'$ Distance between centroids of top and bottom chords, in.

$E_c$ Modulus of elasticity of concrete, ksi

$e_t$ Distance between top chord centroid and resultant concrete force, in.

$F$ Total load (dead load and applied load) per jack point, kips

$f'_c$ Compressive strength of concrete, ksi

$f_u$ Tensile coupon ultimate stress, psi

$F_u$ Minimum specified tensile strength of a stud shear connector, ksi

$f_y$ Tensile coupon yield stress, psi

$F_{ybc}$ Measured yield stress of bottom chord, ksi

$F_{ytc}$ Measured yield stress of top chord, ksi

$h_r$ Nominal rib height, in.

$H_s$ Length of stud connector after welding, in.

$J$ Ram load per jack point, jack load, kips

$L$ Theoretical joist span, ft.

$M$ Midspan moment due to total load, ft-k

## LIST OF SYMBOLS (continued)

$M_a$ Midspan moment due to applied load, ft-k
$M_{ac}$ Calculated midspan moment due to applied load, ft-k
$M_{ae}$ Experimental midspan moment due to applied load, ft-k
$M_c$ Calculated midspan moment due to total load, ft-k
$M_d$ Midspan moment due to dead load, ft-k
$M_{dc}$ Calculated midspan moment due to dead load, ft-k
$M_{de}$ Experimental midspan moment due to dead load, ft-k
$M_e$ Experimental midspan moment due to total load, ft-k
$N$ Top chord force due to total load, kips
$N_a$ Top chord force due to applied load, kips
$N_{ac}$ Calculated top chord force due to applied load, kips
$N_{ae}$ Experimental top chord force due to applied load, kips
$N_c$ Calculated top chord force due to total load, kips
$N_{cr}$ Top chord buckling capacity, kips
$N_d$ Top chord force due to dead load, kips
$N_{dc}$ Calculated top chord force due to dead load, kips
$N_{de}$ Experimental top chord force due to dead load, kips
$N_e$ Experimental top chord force due to total load, kips
$N_{max}$ Predicted top chord capacity in either tension or compression, kips
$N_r$ Number of stud connectors in one rib at a beam intersection
$N_y$ Top chord yield force taken from tensile coupon results, kips
$P$ Total load (dead load and applied load) per joist, kips
$P_a$ Applied load (spreader beam weight and ram load) per joist, kips
$P_{ac}$ Calculated applied load per joist, kips
$P_{ae}$ Experimental applied load per joist, kips
$P_c$ Calculated total member load per joist, kips
$P_d$ Dead load per joist (joist self-weight, metal deck, and concrete slab), kips
$P_{dc}$ Calculated dead load per joist, kips
$P_{de}$ Experimental dead load per joist, kips
$P_e$ Experimental total load per joist, kips

## LIST OF SYMBOLS (continued)

$q$ Unreduced strength of individual shear connector, kips

$\Sigma Q_{ac}$ Calculated shear connector capacity, kips

$\Sigma Q_{ae}$ Experimental shear connector capacity, kips

$r_p$ Stud reduction factor

$R_t$ Reduction factor for thin base metal

$T$ Bottom chord tension force due to total load, kips

$T_a$ Bottom chord force due to applied load, kips

$T_{ac}$ Calculated bottom chord force due to applied load, kips

$T_{ae}$ Experimental bottom chord force due to applied load, kips

$T_c$ Calculated bottom chord force due to total load, kips

$T_d$ Bottom chord force due to dead load, kips

$T_{dc}$ Calculated bottom chord force due to dead load, kips

$T_{de}$ Experimental bottom chord force due to dead load, kips

$T_e$ Experimental bottom chord force due to total load, kips

$t_s$ Total slab thickness, in.

$T_y$ Bottom chord yield force taken from tensile coupon results, kips

$w$ Unit weight of concrete, pcf

$w_d$ Uniformly distributed dead load per joist, (metal deck, concrete slab, and joist self weight), klf

$w_r$ Average width of concrete rib or haunch, in.

$y_{bc}$ Distance from centroid of bottom chord to outer fiber, in.

$y_{tc}$ Distance from centroid of top chord to outer fiber, in.

# CHAPTER 1

# INTRODUCTION

## 1.1 Background

Steel joist supported floor systems have been common for many years. Steel joists are economically fabricated using well-developed techniques and standards. The joist openings readily accept ductwork, electrical conduit, and piping, eliminating the need for these to pass under the member. Services are easily added or relocated if modifications become necessary.

Composite construction, usually consisting of a steel member and concrete slab integrally connected, is also common. Mechanically joining the slab with the beam offers the advantage of being able to use shallower supporting members. This results in steel savings and a reduction in overall building height. The increased stiffness of a composite floor reduces deflection and consequently allows longer clear spans. Ideally, composite members supply substantial return on the extra labor invested.

This paper examines the combination of steel joist supported floor systems with composite construction, composite steel joist floor systems. Although composite joist systems have been used, this type of floor construction is not common and a U.S. specification is not available for their design. Composite joists constructed utilizing design procedures from other countries (e.g., "Limit" 1989) are typically provided with a fairly large degree of shear connection. Most of the joists tested in this study had a comparatively small amount of shear connection.

## 1.2 Joist Nomenclature

Composite joists as discussed in this report consist of an open-web steel joist acting as a unit with a concrete slab by means of some type of mechanical shear connection. Top and bottom horizontal members, known as chords, separated by a web system, form the steel joist. Web members are welded at discrete points to the chords. Steel deck placed across the top chords serves as a stay-in-place form for the concrete slab and braces the joists laterally. The steel deck supported slab may be either a composite or non-composite design. The joists are simply supported on seats usually made from the same material as the top chord.

The distinguishing feature of the composite joist system as compared to a non-composite system is the presence of shear connectors. A shear connector is a device permanently attached to the top chord and embedded in the concrete slab during casting to mechanically join the two together and resist slip at their interface. The quantity of shear connectors provided is denoted by "shear connectors per half-span" or "shear connectors per shear span", the total number of connectors per member being twice this amount.

When used in this report, the terms "under-connected" and "over-connected" will refer to how the shear connection force compares to the yield force of the primary tension resisting component, either the steel beam in a conventional composite member or the bottom chord in a composite joist. An under-connected composite joist has a shear connection force less than the bottom chord yield force and an over-connected joist has a shear connection force greater than the bottom chord yield force.

A fully composite joist will be defined as one in which both the concrete crushing strength and the shear transfer capacity exceed the bottom chord yield strength, without regard to any tensile component which may be provided by the top chord. Partially composite joists have a shear connection capacity lower than both the concrete crushing strength and the bottom chord yield strength, again neglecting any contribution of the top chord.

### 1.3 Previous Research

A thorough literature survey on composite joists has been performed by Unterkofler et al. (1989), Strocchia et al. (1991), and Sublett et al. (1992) and therefore will not be undertaken here. While not exhaustive, the papers described in this section are a collection that provides useful background information for either the shear connection schemes or the strength model used herein.

Wang and Kaley (1967) conducted some of the earliest tests involving composite joists. They tested four specimens, three composite and one similarly configured non-composite specimen for comparison purposes. The span of each joist was 16 ft.-8 in.; the depth was approximately 10 in. Two of the specimens were constructed according to a proprietary design referred to as the K-composite system. Top and bottom chords were cold-formed hat-shaped sections. The top chord was positioned with the open side up such that a concrete "key" formed within the top chord when the slab was placed. The top chord was formed in a wedge shape in an effort to restrain the hardened concrete from separating from the joist. In addition the slab was haunched for a distance at the ends of the joist, fully encasing the top chord. This provided extra bond in the region of highest horizontal shear. No mechanical connectors were provided for shear connection. The joists relied on bond between the slab and the top chord to tie the two together. The slab for the K-composite system was cast on removable plywood forms. The third composite specimen utilized a joist cross-section similar to the previous tests, but substituted a uniform 2-1/2 in. slab cast on corrugated sheet steel forms plug welded to the top chord.

Two analytical solutions were described which closely predicted the bottom chord stress and deflection found in the test specimens. The models assumed complete interaction between the slab and joist top chord. The average bond stress between the top chord and the concrete slab was calculated by dividing the highest force in the bottom chord by the contact area provided by the top chord.

Davies (1969) investigated the effects of varying the spacing of studs and varying the amount of transverse reinforcement used in composite beam construction. Three beams were tested to address each issue plus one beam common to each series for a total of seven tests. All tests had the same number of 3/8 in. dia. headed studs arranged in a straight line over the beam web (different stud spacings were achieved between specimens by varying the beam span). The tests utilized a 5 in. deep wide-flange section spanning from 4 ft. to 10 ft. to simulate a half-scale model. The beams were tested to failure using a midspan point load.

Davies' second series of beams showed that resistance to longitudinal cracking in composite slabs is significantly impacted by decreasing transverse reinforcement. Transverse reinforcement area as a fraction of longitudinal slab cross-sectional area ranged between 0.118% and 0.94%. Beams with reinforcing less than 0.5% of the slab cross-sectional area could not achieve the calculated ultimate capacity due to longitudinal cracking along the studs. Cracks were observed to start at the base of the shear connectors and propagate to the upper surface of the slab. It was concluded that reinforcement beyond a certain limit (1% for the beams tested) is of little benefit. An empirical equation was presented based on the test results to predict the capacity of the slab to resist longitudinal splitting. It should be noted that the beam with the least amount of reinforcement still reached 80% of its theoretical ultimate moment.

Cran (1971) conducted a series of ten push-out tests using five types of shear connector. Shear connectors tested were:

1. 1/2 in. dia., 3 in. long headed stud
2. 3/4 in. dia. puddle weld
3. 2 in. hat
4. plug weld with weld washer
5. 3 in. strap

Push-out specimens were constructed in pairs using 0.110 in. thick cold-formed steel base members, meant to represent a composite joist top chord. The shear connectors were welded through 1-1/2 in. steel deck. A 3 in. concrete slab (total thickness) was cast on the deck.

The push-out specimens were tested to failure and the load per connector recorded. The headed stud, hat section, and plug weld with weld washer provided ductile shear connection. The puddle weld and shear strap failed abruptly after reaching a peak load.

Cran also tested three full-size composite joists. On the first test, 1/2 in. dia. headed studs were used on one side of the joist centerline and 2 in. tall hat connectors on the other. Shear transfer capacity per half-span was nearly equal. Top and bottom chords were cold-formed hat-shaped sections; webs were cold-formed tubular sections. This joist had a span of 40 ft. and depth of 26 in. The next test, which had a span of 50 ft. and depth of 32 in., was a more conventional design constructed using double angle chords. Web members were double angles and bars. Shear connection was provided by 3/4 in. dia. headed studs. These tests used a 4 in. concrete slab (total thickness) cast on 1-1/2 in. steel decking. The final test was a proprietary design, which spanned 20 ft.-4 in. and was 12-1/2 in. deep. Shear connection was provided by a cold-formed top chord embedded in a 2-1/2 in. solid concrete slab. Temporary plywood formwork was used in lieu of metal decking. The bottom chord consisted of two rods, 5/8 in. dia. and 3/4 in. dia. Webs were 5/8 in. dia. round bars welded between the round bars of the bottom chord and to one side of the formed sheet steel top chord. Based on predicted shear connection forces, the first specimen was under-connected and the second slightly over-connected. The third joist was assumed to be fully composite, i.e., to have a shear capacity capable of developing the bottom chord yield force.

The first two joist specimens were loaded to failure using a two-point loading system. The third specimen was loaded with concrete blocks but not to failure. The ultimate strength of the specimens was calculated as the couple formed by the steel tensile force and the concrete compressive force. The bottom chord force was limited to the minimum of the bottom chord yield strength and the horizontal shear strength, assuming the crushing strength of the concrete was not exceeded. Any contribution of the top chord force was not included in the flexural model. The short lever arm between the top chord and the concrete resultant and the relatively low top chord strain were cited as justification for its omission. For the first two tests, top chord strain from dead load was observed to diminish with the application of live load. The embedded top chord of the third specimen proved adequate to develop the bottom chord yield strength. The calculated moment capacities were conservative and compared favorably with the measured values.

Robinson et al. (1978) reported the results of seven composite open-web joists and one non-composite joist. An analysis of six of these specimens was previously reported by Azmi (1972). The joists spanned 50 ft. and 51 ft. Five of the joists were constructed with cold-formed members and three with hot-rolled shapes. All joists were 32 in. deep and had a 4 in. concrete slab cast on 1-1/2 in. ribbed metal deck. Puddle welds, 1/2 in. dia. headed studs, and 3/4 in. dia. headed studs provided slab-joist interface shear connection. The horizontal shear transfer mechanisms were designed to develop from 48% to 157% of the bottom chord yield force.

It was suggested that the behavior of the top chord is a good indicator of the general behavior of the joist. The researchers observed a relationship between the amount of shear connection, the shape of the top chord load-strain plot, and to some degree the resulting failure mode. Joists with significant shear connection showed little increase in top chord compressive strain beyond that caused by the fresh concrete load. Upon yielding of the bottom chord, this compression was relieved and in some cases a net tension force in the top chord resulted. Severely under-connected joists displayed a gradual, continuous increase in top chord strain for the duration of the test. These tests were prone to top chord buckling failure.

The researchers presented a series of three flexural models used to compute the ultimate capacity of the composite joists. The three flexural models, called under-connected, balanced, and over-connected, were distinguished by the provided amount of shear connection relative to the bottom chord yield force. Balanced joists had a shear connection force equal to the bottom chord yield force. Under- and over-connected joists had a lower and higher shear connection, respectively, compared to the bottom chord yield force. The under-connected and over-connected categories were further divided depending on whether the shear connection capacity in combination with the top chord capacity was smaller or larger than the bottom chord yield force. The models considered the contribution of the concrete force, top chord force, and bottom chord force in computing the ultimate strength. When applied to the composite joist configurations tested, experimental/theoretical strength ranged from 0.84 to 1.22. These flexural models provide the basis of the analysis conducted for the composite joist tests presented in this report.

The tests conducted by Robinson et al. (1978) showed that there is a tendency in partially connected joists for the top chord to be active in resisting applied loads. With very low degrees of partial connection, top chord buckling was often the governing mode of failure. It was noted that the consequences of low shear capacity are compounded by the lack of shear connectors because, when placed between panel points, they tend to provide lateral and vertical restraint to the top chord. Robinson and Fahmy (1978) presented an iterative method to determine the top chord buckling strength of partially composite joists.

Gibbings et al. (1991) tested eight full-scale composite joists to failure. Joist spans ranged from 40 ft. to 56 ft. and depths from 14 in. to 36 in. Normal weight concrete slabs were cast on ribbed metal deck and joined with the joist top chord using 3/4 in. dia. headed shear studs. Seven of the specimens in this study were over-connected, meaning shear connector capacity exceeded the yield strength of the bottom chord. The remaining specimen was very nearly fully composite.

The researchers used an ultimate strength design method and verified its applicability to the test joists. The method was based on a flexural model in which the internal couple formed by the concrete slab in compression and bottom chord in tension resists bending. Any additional tension or compression provided by the top chord was neglected in computing the ultimate capacity. It was concluded that this assumption is reasonable for the joists tested.

Sublett et al. (1992) conducted 36 push-out tests to determine the strength of headed shear studs when used with metal deck. Studs were welded either to WT shapes to represent a composite beam section or to equal leg double angles to represent a composite joist top chord. Metal deck with 1-1/2 in., 2 in., or 3 in. rib height (Vulcraft 1.5VL, 2VLI, 3VLI) was tested. Slab thickness varied to accommodate differing rib height and stud length combinations.

Results obtained from the push-out tests were compared to values from four analytical methods for predicting ultimate strength of headed shear studs. The AISC specification ("Load" 1986), Eurocode 4 specification ("Eurocode" 1992), Canadian

Standards Association specification ("Limit" 1989), and a method proposed by Lawson (preliminary paper reported by Mottram and Johnson 1990) were investigated. It was concluded that the Lawson method was the most accurate of those investigated for predicting the strength of headed shear studs in corrugated metal deck. The configurations tested achieved from 72.6% to 121.8% of the theoretical capacity. The method developed by Lawson is summarized next.

Lawson (1993) examined the influence of metal deck on the basic shear stud connector capacity. Formulas for computing strength reduction factors were presented for single and multiple stud shear connectors. Reduction factors were included for deck placed perpendicular and parallel to the supporting member. In addition, the formulas attempted to account for off-center positioning of the studs within deck ribs with a central stiffener. Test results from various research projects that focused on push-out tests incorporating metal deck were compiled to evaluate the proposed reduction factors. Based on the experimental data and a calculated solid slab stud strength, a test reduction factor was found for each specimen. Comparison was then made between the test factor and the proposed factor for each test. For reference, a specification-based reduction factor was also computed and given alongside the test factor and proposed factor. It was concluded that the proposed strength reduction factors more closely aligned with the experimental data than did the specification-based values, over a broad sampling of deck profiles. The specification-based value was in some cases unconservative.

### 1.4 Scope of Research

A multi-phase research program has been ongoing at Virginia Tech to explore the viability of short-span composite joist floor systems. Described in this section is an overview of three phases of the research.

Phase 1 of the research program examined the feasibility of using the steel deck as the shear connector in composite joist floor systems (Unterkofler et al. 1989). Twenty-three push-out tests were conducted to measure the capacity of several deck profiles to resist horizontal shear. Puddle welds were used to fasten the deck to the joist top chord.

Two full-size composite joist specimens were constructed and tested to study the behavior of two of the systems using the metal deck to resist horizontal shear. The first test used 5/8 in. dia. puddle welds to fasten the deck to the top chord and the second used #14 self-drilling screws, otherwise the tests were identical. Each specimen consisted of two 12 in. deep joists on 48 in. centers and spanning 25 ft. All joists were fabricated using grade 50 steel for double angle top and bottom chords and round bar web members. Based on the push-out results, Vulcraft 1.5 VLI 22 gage steel deck was selected for these tests. Concrete slabs, 4 in. thick, were cast on the metal deck.

In Phase 2 of the study Strocchia et al. (1991) conducted 13 push-out series, totaling 36 push-out tests. Two categories of fastening system were investigated, fasteners which were flush to the deck after installation and fasteners which protruded into the slab after installation. Six deck fasteners were tested and their strength and ductility evaluated. Fasteners in the first category were self-tapping screws, air fired pins, and puddle welds. Self-tapping screws with stand-off sleeves of lengths 1-1/4 in., 1-3/4 in., and 2-1/4 in. comprised the latter category. Vulcraft 1.5VL, 22 gage composite deck, either right side up or inverted, was used for all tests.

The current phase of the project is an investigation into the adequacy of several short-span composite joist floor systems. The study is carried out by examining the results of eight full-size composite joist tests, each representing a portion of a floor bay. The parameters used to evaluate each system are capacity, deflection, ductility, and failure mode. Construction techniques unique to the shear connection systems are also considered. Economic feasibility is not discussed here, but was addressed in the pre-design stage of selecting the connection system. The ability of an analytical method to predict the capacity of each joist is investigated in this report. The specimens are not evaluated for vibration response.

The report is divided into five chapters. The details of the experimental program including test configuration, member loading, and data collection are given in Chapter 2. Results for the eight composite joist tests comprising this phase of the research are described in Chapter 3. The experimental data collected during testing is presented graphically and in tabular form in the appendix. Chapter 4 is a discussion of the analysis techniques used to predict the capacity of each system. Chapter 5 summarizes the investigation and provides recommendations for further research.

# CHAPTER 2

# EXPERIMENTAL STUDY

## 2.1 General

The test joists were designed specifically for the experimental program by Nucor Research and Development and fabricated by Vulcraft. Specimen construction and testing were carried out at the Virginia Tech Structures and Materials Research Laboratory. Typically the test specimens consisted of two simply supported joists joined by mechanical shear connectors to a cast-in-place concrete slab. Joist spacing was 40 in. Test CSJ-3, however, was a single simply supported composite joist. Joist spans ranged from 24 ft. to 30 ft. and joist depths from 8 in. to 18 in.

The joist members were arranged in a Warren truss configuration. Top and bottom chords were double angles except for one test which used a structural tee top chord (test CSJ-5). Round bars, double angles, and crimped single angles were used for the web members. Web members were numbered beginning with designation W2 and increasing toward midspan as shown in Fig. 2.1. Web members were located and numbered symmetrically about the joist centerline beginning with designation W2R at the opposite end of the joist. An additional member was included at each end of the joist between the first and second webs, labeled W2D and W2DR. Whether the pair of webs meeting at midspan intersected top chord or the bottom chord depended on the number of webs. Web members were over-designed to prevent their failure from governing the collapse of the specimen. Grade 50 steel was used throughout, with the exception of the tee-shaped top chord.

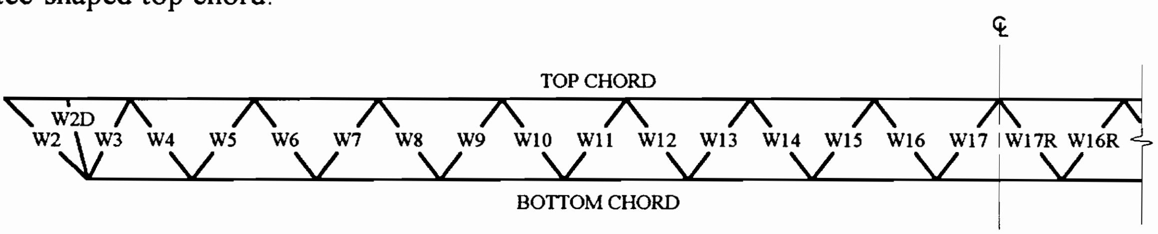



Figure 2.1 Typical Web Configuration

Ribbed metal deck, placed with ribs perpendicular to the joists, was used to support the concrete slab in all tests. Cold-formed pour stop was fastened around the perimeter of the deck prior to placing the concrete. Shoring was required to support the deck edges for CSJ-3 and CSJ-4. No shoring was used for any other test. Welded wire fabric (6 × 6 - W1.4 × W1.4) was placed on top of the deck to control shrinkage cracking and to match typical field conditions. Concrete test cylinders were cast along with each slab.

Six types of shear connection were investigated. Two sizes of commonly used headed shear stud, two types of self-drilling stand off screw, and two specially designed angle shear connectors were used among the eight tests. The test matrix, summarizing the components of each specimen, is given in Table 2.1.

## 2.2 Test Construction

### 2.2.1 Tests CSJ-1 and CSJ-2

CSJ-1 and 2 consisted of a two-joist arrangement in which the joists spanned 24 ft.-3 in. and had a depth of 8 in. The joist member sizes for these tests are summarized in Table 2.2.

Construction of the first two tests was identical with one exception, which was the type of deck used. CSJ-1 had Vulcraft 1.0C 26 gage metal deck and CSJ-2 had Vulcraft 1.5VL 22 gage metal deck. The deck was continuous over the joists and ribs were oriented perpendicular to the joists. The total length of the deck sheets was 80 in. The slab consisted of 3 in. of normal weight concrete (total thickness) for both tests. Metal deck profiles for the testing program are shown in Fig. 2.2.

Shear connection was provided by 5/16 in. dia. × 2 in. long self-drilling standoff screws. The screws were installed by first placing the metal deck over the joists, then drilling through both the deck and top chord. Screws were positioned in every third rib of the deck for CSJ-1 and every other rib for CSJ-2. Closer spacing was necessary near the ends of the joist to accommodate a total of 14 screws per half span. Placement was alternated between the top chord angles to help provide an even distribution of load to the top chord. A schematic of the shear connector used for CSJ-1 and CSJ-2 is shown in Fig. 2.3. The cross-sections of tests CSJ-1 and CSJ-2 are shown in Figs. 2.4 and 2.5, respectively.

### 2.2.2 Test CSJ-3

CSJ-3 was a single joist arrangement in which the joist had a span of 24 ft. and depth of 10 in. The joist member sizes are summarized in Table 2.3.

Table 2.1 Test Matrix

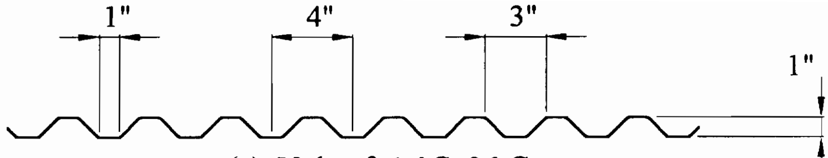
| Test Designation | Joist Span (ft-in) | Joist Depth (in.) | Slab Thickness (in.) | Deck Designation | Shear Connector | Shear Connectors per Half-Span |
|---|---|---|---|---|---|---|
| CSJ-1 | 24-3 | 8 | 3 | 1.0C | Buildex 5/16 in. dia. × 2 in. long standoff screw | 14 |
| CSJ-2 | 24-3 | 8 | 3 | 1.5VL | Buildex 5/16 in. dia. × 2 in. long standoff screw | 14 |
| CSJ-3 | 24-0 | 10 | 6 | 1.5VLI | L-1.25x1.25x0.133 w/ 11/16 in. dia. puddle weld | 20 |
| CSJ-4 | 24-0 | 10 | 3 | 1.0C | Longitudinal shear angle L- 2.00x2.00x0.163 | N/A |
| CSJ-5 | 30-0 | 12 | 3.5 | 1.5VLI | 3/4 in. dia. × 3 in. long headed shear stud | 6 |
| CSJ-6 | 29-7½ | 18 | 4 | 1.0C | 1/2 in. dia. × 3 in. long headed shear stud | 11 |
| CSJ-7 | 29-7½ | 18 | 4 | 1.0C | 1/2 in. dia. × 3 in. long headed shear stud | 6 |
| CSJ-8 | 29-7½ | 18 | 4 | 1.0C | ELCO 5/16 in. dia. × 2 in. long grade 8 standoff screw | 9 |

Table 2.2 Member Sizes for CSJ-1 and CSJ-2

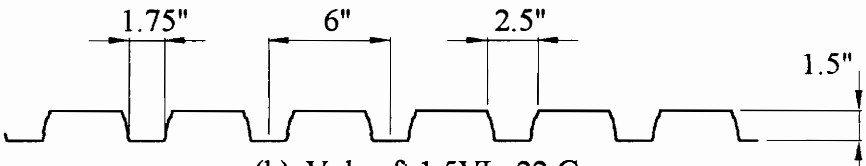
| Member | Vulcraft Section |
|---|---|
| Top Chord | 2L-1.50x1.50x0.170 |
| Bottom Chord | 2L-2.50x2.50x0.250 |
| W2 | 1.0-in. dia. bar |
| W2D - W16 | 0.813-in. dia. bar |

Table 2.3 Member Sizes for CSJ-3

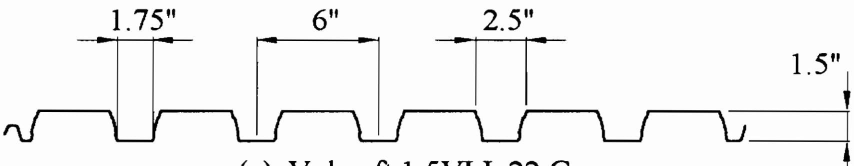
| Member | Vulcraft Section |
|---|---|
| Top Chord | 2L-3.50x3.50x0.375 |
| Bottom Chord | 2L-5.00x5.00x0.500 |
| W2 | 2L-3.00x3.00x0.313 |
| W2D | L-1.50x1.50x0.143 |
| W3 | 2L-3.00x3.00x0.281 |
| W4 | 2L-2.50x2.50x0.250 |
| W5 | 2L-2.50x2.50x0.250 |
| W6 | 2L-2.50x2.50x0.250 |
| W7 | 2L-2.50x2.50x0.250 |
| W8 | 2L-2.00x2.00x0.187 |
| W9 | 2L-2.00x2.00x0.187 |
| W10 | 2L-2.00x2.00x0.187 |
| W11 | 2L-2.00x2.00x0.187 |
| W12 | 2L-1.50x1.50x0.123 |
| W13 | 2L-1.50x1.50x0.138 |
| W14 | 2L-1.50x1.50x0.123 |
| W15 | 2L-1.50x1.50x0.138 |
| W16 | 2L-1.50x1.50x0.123 |
| W17 | 2L-1.50x1.50x0.138 |



(a) Vulcraft 1.0C, 26 Gage



(b) Vulcraft 1.5VL, 22 Gage



(c) Vulcraft 1.5VLI, 22 Gage

Figure 2.2 Steel Deck Profiles

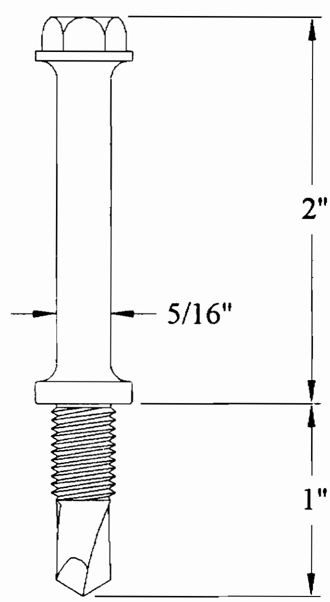


Figure 2.3 Buildex Standoff Screw

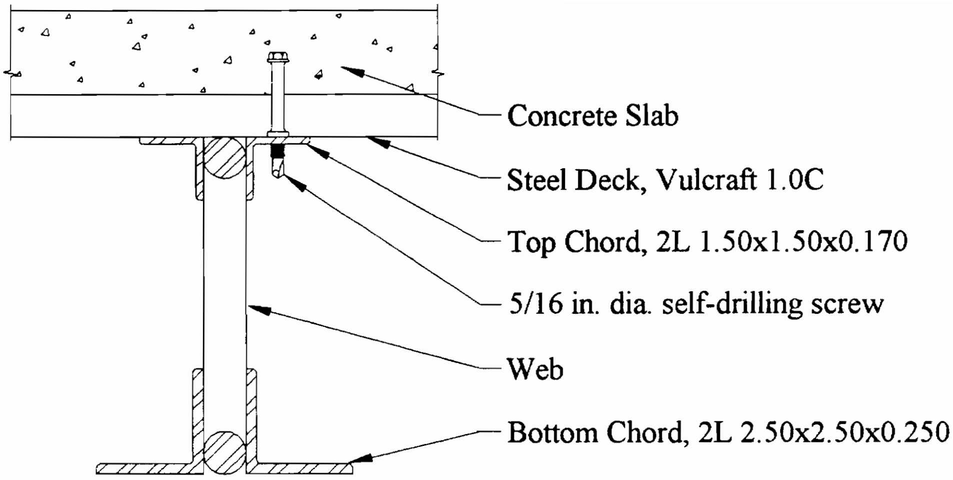



Figure 2.4 CSJ-1 Joist Cross-Section

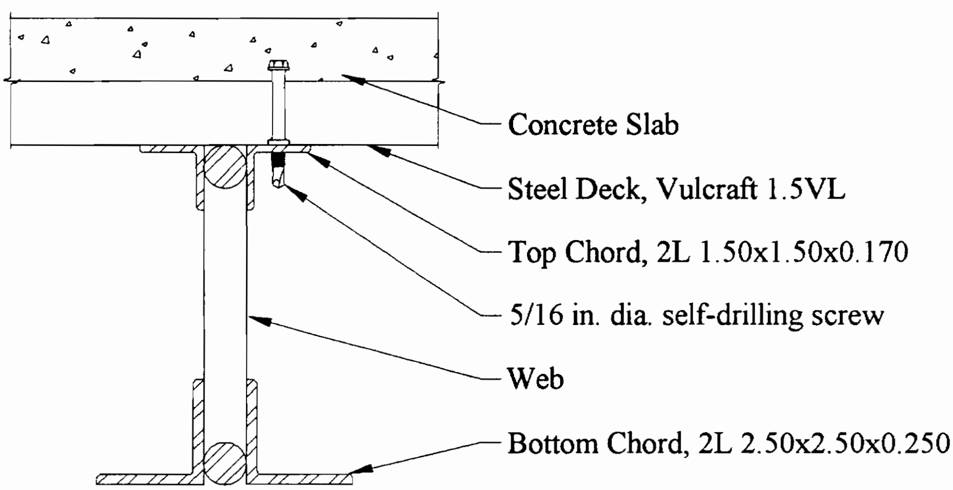



Figure 2.5 CSJ-2 Joist Cross-Section

A cross-section of the specimen is shown in Fig. 2.6. The slab consisted of 6 in. of concrete (total thickness) placed on Vulcraft 1.5VLI 22 gage composite deck. The deck was continuous over the joist with ribs perpendicular to the joist. The deck sheets were 48 in. in length. Shoring between the deck edges and joist bottom chord was used for concrete placement, but was removed prior to testing.

A custom designed shear connector was provided by Nucor R & D. The shear connector consisted of a 1.75 in. length of angle (L-1.25x1.25x0.133) with a 0.6875 in. dia. hole punched in the center of each leg. A puddle weld was made within this hole to fasten the angle shear connector to the joist top chord. Angles were placed in the rib with the vertical leg nearest to the deck web that was toward the near end support. The shear connector is illustrated in Fig. 2.7. All ribs contained an angle shear connector. Placement of the angles was alternated between top chord angles. The deck was puddle welded to the joist top chord at the seam locations.

### 2.2.3 Test CSJ-4

CSJ-4 was a two-joist configuration in which the joists spanned 24 ft. and were 10 in. deep. Web members were double angles and crimped single angles. All member sizes are summarized in Table 2.4.

Shear connection was provided by a third angle (L-2.00x2.00x0.163), referred to as the shear angle, that was attached to the double angle top chord as shown in Fig. 2.8. The shear angle was placed longitudinally the full length of the top chord, with its horizontal leg resting almost equally on the horizontal legs of the top chord beneath it. The shear angle was welded intermittently along its length on either side of its horizontal leg to the top chord. Each longitudinal shear angle contained twenty-two, 11/16 in. dia. holes per half span. It was anticipated that shear connection would be provided by chemical bond and aggregate interlock with the shear angle. The shear angle of each joist was facing the same side.

The slab consisted of 3 in. of normal weight concrete (total thickness) placed on Vulcraft 1.0C 26 gage metal deck. No. 7 stone was used in the concrete in an attempt to obtain interlock with the holes punched in the shear angle. The deck was placed in three pieces for the given cover width. A 40 in. piece placed between the top chord shear angles and a 20 in. piece cantilevered to the outside of each joist centerline provided an 80 in. slab width. The deck was attached with 1/2 in. dia. puddle welds. Shoring between the slab edges and joist bottom chord supported the cantilevered portions of deck for

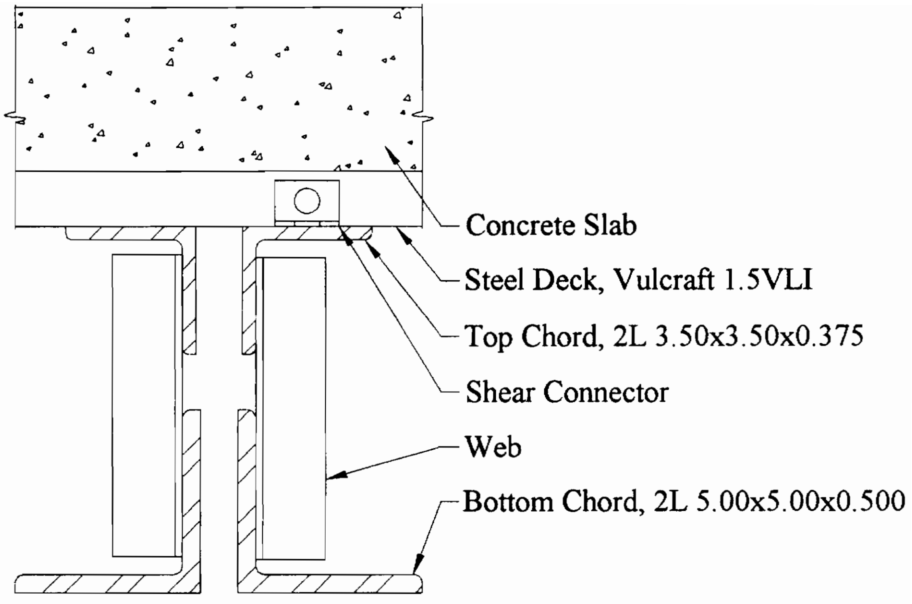



Figure 2.6 CSJ-3 Joist Cross-Section

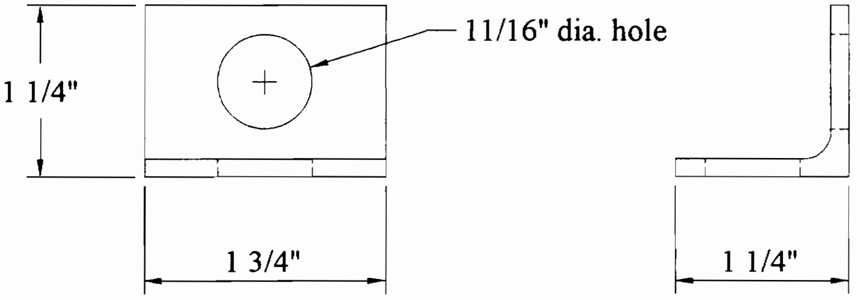



Figure 2.7 CSJ-3 Shear Connector

Table 2.4 Member Sizes for CSJ-4

| Member | Vulcraft Section |
|---|---|
| Top Chord | 2L-2.50x2.50x0.212 |
| Bottom Chord | 2L-3.50x3.50x0.375 |
| W2 | 2L-2.00x2.00x0.176 |
| W2D | L-1.50x1.50x0.143 |
| W3 | 2L-2.00x2.00x0.205 |
| W4 | 2L-1.50x1.50x0.155 |
| W5 | 2L-1.50x1.50x0.170 |
| W6 | 2L-1.50x1.50x0.170 |
| W7 | 2L-1.50x1.50x0.170 |
| W8 | 2L-1.25x1.25x0.133 |
| W9 | 2L-1.25x1.25x0.133 |
| W10 | 2L-1.25x1.25x0.133 |
| W11 | 2L-1.25x1.25x0.133 |
| W12 | L-1.25x1.25x0.133 |
| W13 | L-1.50x1.50x0.123 |
| W14 | L-1.25x1.25x0.133 |
| W15 | L-1.50x1.50x0.123 |
| W16 | L-1.25x1.25x0.133 |
| W17 | L-1.50x1.50x0.123 |

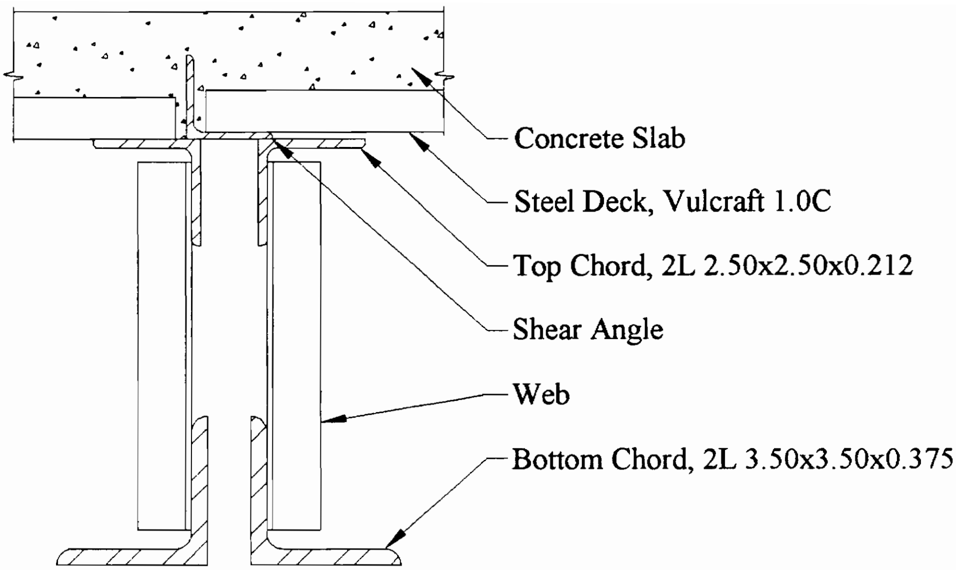



Figure 2.8 CSJ-4 Joist Cross-Section

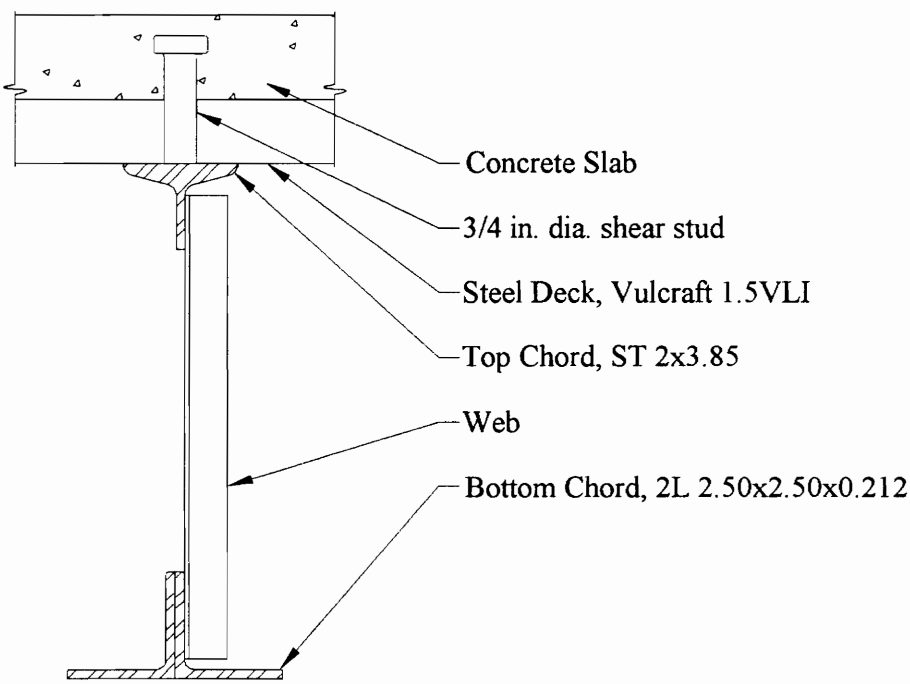



Figure 2.9 CSJ-5 Joist Cross-Section

concrete placement. The shores were left in place throughout the test. The shoring for CSJ-3 and CSJ-4 was not shoring in the traditional sense, in that it did not support the structural member, but only braced the deck relative to the structural member.

### 2.2.4 Test CSJ-5

CSJ-5 was a two-joist arrangement in which the joists had a span of 30 ft. and depth of 12 in. The joists for CSJ-5 were different from the other tests in that the top chord was a structural tee. Also, the bottom chord angles were intermittently welded flush back-to-back. Single angle web members were used on only one side of the chords resulting in an asymmetrical joist cross-section. The joists were oriented such that the sides with the webs were facing the same direction. Member sizes for CSJ-5 are shown in Table 2.5.

Six 3/4 in. dia. × 3 in. long (after welding) headed shear studs per half-span were used for shear connection. The studs were placed as near to the center of the top flange as possible.

The slab consisted of 3.5 in. of normal weight concrete (total thickness) placed on Vulcraft 1.5VLI 22 gage composite deck. The deck sheets were 80 in. long and were fastened to the joist top chord every 12 in. either by a stud weld or by a 5/8 in. dia. puddle weld. The joist cross-section is shown in Fig. 2.9.

### 2.2.5 Tests CSJ-6, CSJ-7, and CSJ-8

Construction of tests CSJ-6, 7, and 8 was identical with the exception of the shear connection. Two 18 in. deep joists spanning 29 ft.- 7½ in. were used for each specimen. All slabs were 4 in. of normal weight concrete (total thickness) placed on Vulcraft 1.0C 26 gage deck. Slabs for CSJ-7 and 8 were cast from the same batch of concrete. Member sizes for these specimens are shown in Table 2.6.

Two types of shear connector were used for the three tests. CSJ-6 and 7 used a 1/2 in. dia. × 3 in. long headed shear stud welded to the top chord. Self-drilling standoff screws, which were dimensionally similar to the screws for CSJ-1 and 2, but fabricated from different material, were used for CSJ-8. A typical cross-section for CSJ-6 and 7 is shown in Fig. 2.10. The CSJ-8 cross-section is shown in Fig. 2.11. The test joist cross-sections are shown side-by-side in Fig. 2.12 for comparison of the configurations tested.

Table 2.5 Member Sizes for CSJ-5

| Member | Vulcraft Section |
|---|---|
| Top Chord | ST-2x3.85 |
| Bottom Chord | 2L-2.50x2.50x0.212 |
| W2 | 2L-1.25x1.25x0.133 |
| W2D | L-1.00x1.00x0.109 |
| W3 | 2L-1.50x1.50x0.138 |
| W4 | L-1.50x1.50x0.138 |
| W5 | L-1.50x1.50x0.143 |
| W6 | L-1.50x1.50x0.138 |
| W7 | L-1.50x1.50x0.155 |
| W8 | L-1.50x1.50x0.138 |
| W9 | L-1.25x1.25x0.133 |
| W10 | L-1.25x1.25x0.109 |
| W11 | L-1.25x1.25x0.133 |
| W12 | L-1.25x1.25x0.109 |
| W13 | L-1.00x1.00x0.109 |
| W14 | L-1.00x1.00x0.109 |
| W15 | L-1.00x1.00x0.109 |
| W16 | L-1.00x1.00x0.109 |
| W17 | L-1.00x1.00x0.109 |

Table 2.6 Member Sizes for CSJ-6, CSJ-7, and CSJ-8

| Member | Vulcraft Section |
|---|---|
| Top Chord | 2L-1.50x1.50x0.123 |
| Bottom Chord | 2L-2.00x2.00x0.163 |
| W2 - W5 | 0.938-in. dia. bar |
| W6 - W15 | 0.875-in. dia. bar |

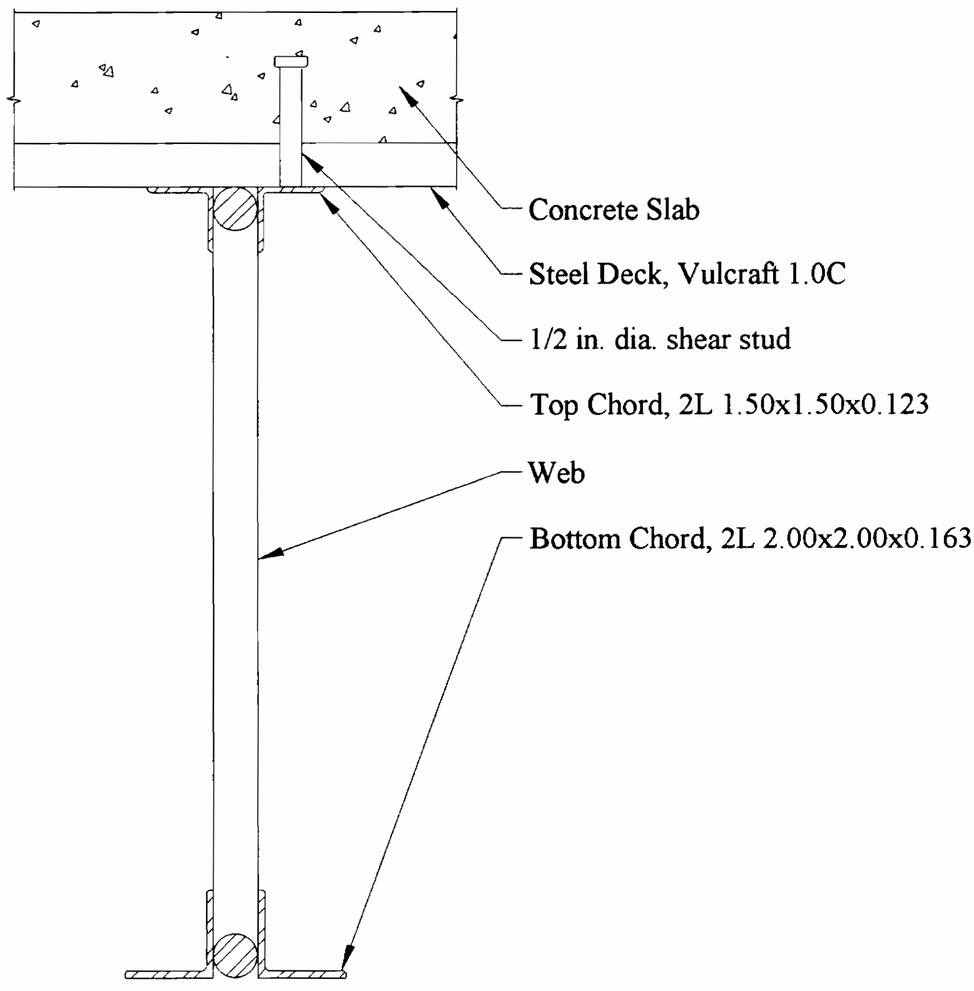



Figure 2.10 CSJ-6 and CSJ-7 Joist Cross-Section

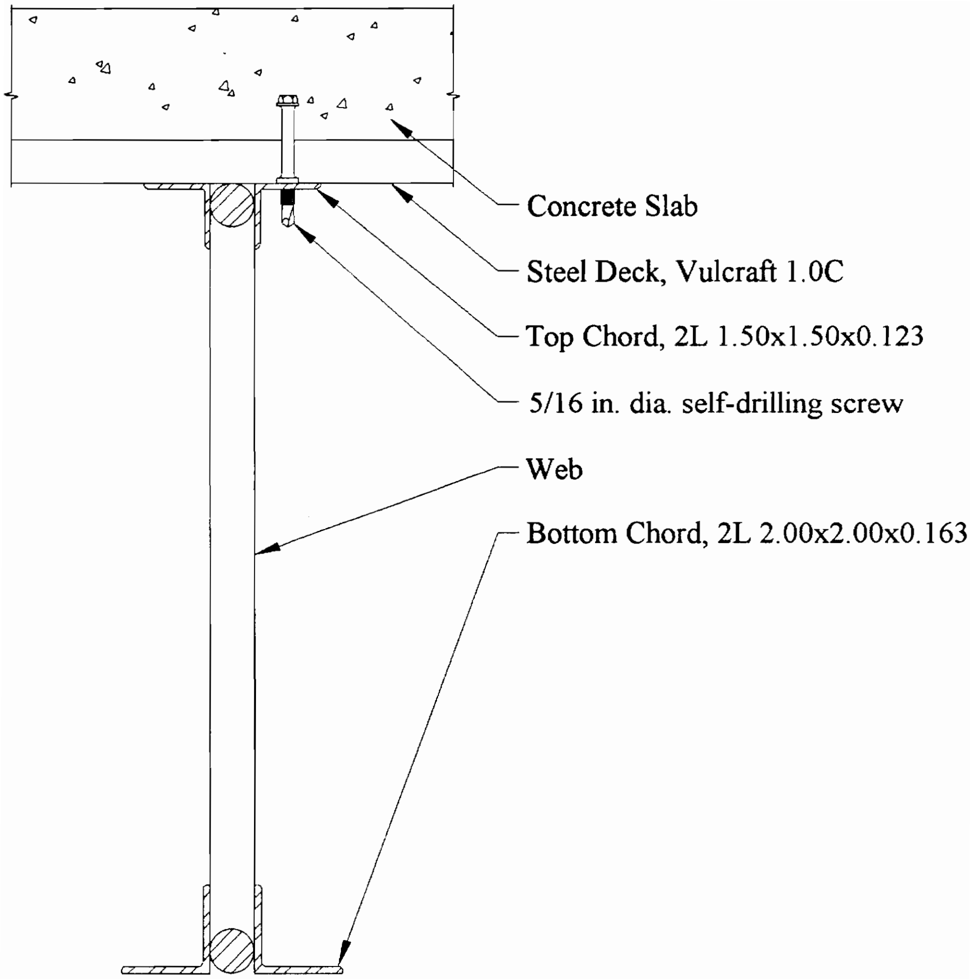



Figure 2.11 CSJ-8 Joist Cross-Section

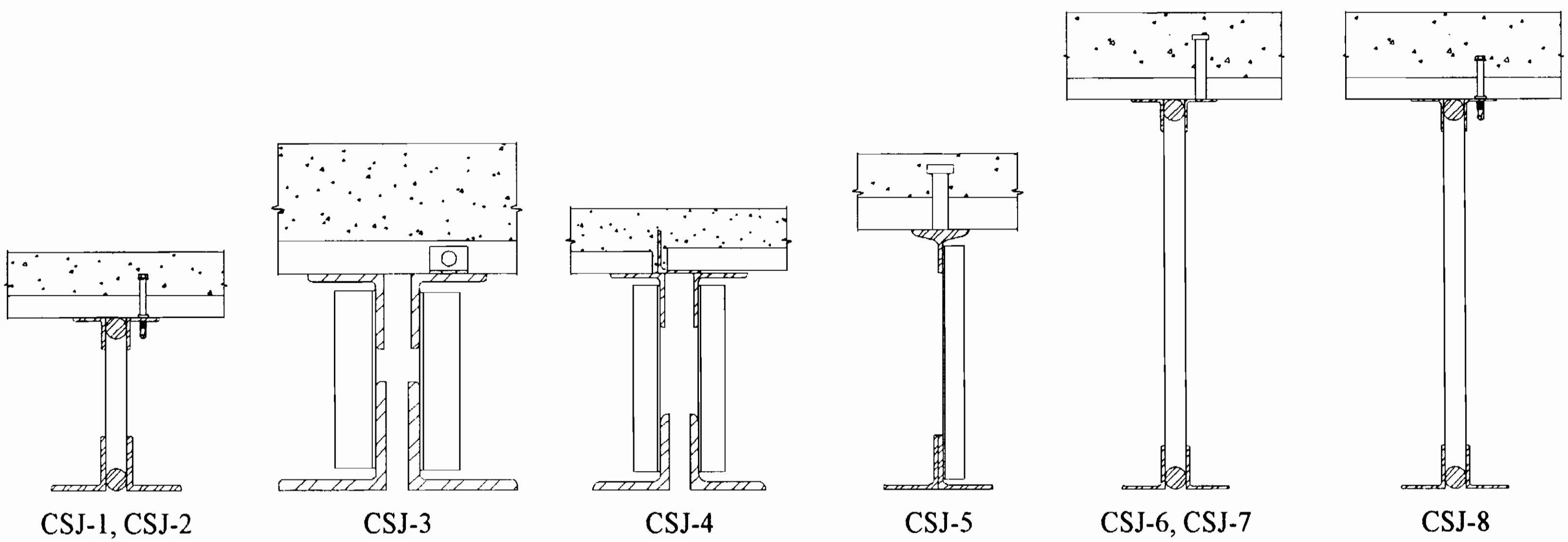



Figure 2.12 Comparison of Joist Cross-Sections

## 2.3 Instrumentation

Similar instrumentation patterns were used for each test. Joist strains and deflections were monitored during placement of the concrete. Strains, deflections, and slip at the slab-joist interface were measured under applied loading. To provide a baseline for total joist deflection, the initial camber in the joists was measured before beginning specimen construction. Initial sweep in the joists was also recorded. The joists were whitewashed and allowed to dry prior to testing to aid the observation of yielding under load.

Strain gage locations for each test are shown on the Test Summary Sheets in Appendix A. Four gages were used for each double angle member, one on each vertical leg and one on each horizontal leg. Three gages were used on the T-shaped top chord of CSJ-5.

Midspan and quarter point deflections were measured using linear displacement transducers. The transducers were attached to the top chords of CSJ-1, CSJ-2, CSJ-3, and CSJ-4, and to the bottom chord of CSJ-5. Relative displacement of the top and bottom chord of these tests was measured by placing a dial gage between the chords at midspan. Displacement transducers were attached to both the top and bottom chord of CSJ-6, 7, and 8. Support stand settlement was monitored with transducers and found to be negligible.

Movement of the slab with respect to the joist (slip) was measured using potentiometers. Potentiometers were clamped to the horizontal leg of the joist top chord. The arm of a potentiometer was connected to a pin embedded in the slab through a hole that was drilled in the deck prior to placing concrete. Potentiometer locations for each test are identified on the Test Summary Sheets in Appendix A.

A load cell was placed between each hydraulic cylinder and the load frame to measure ram load. The hydraulic cylinders were plumbed in a closed loop; therefore, the hydraulic pressure in each cylinder was virtually identical.

## 2.4 Load Apparatus

Joist seats were simply supported on appropriately spaced beams. The beams were bolted to short columns to form support stands. The support stands were bolted to the reaction floor.

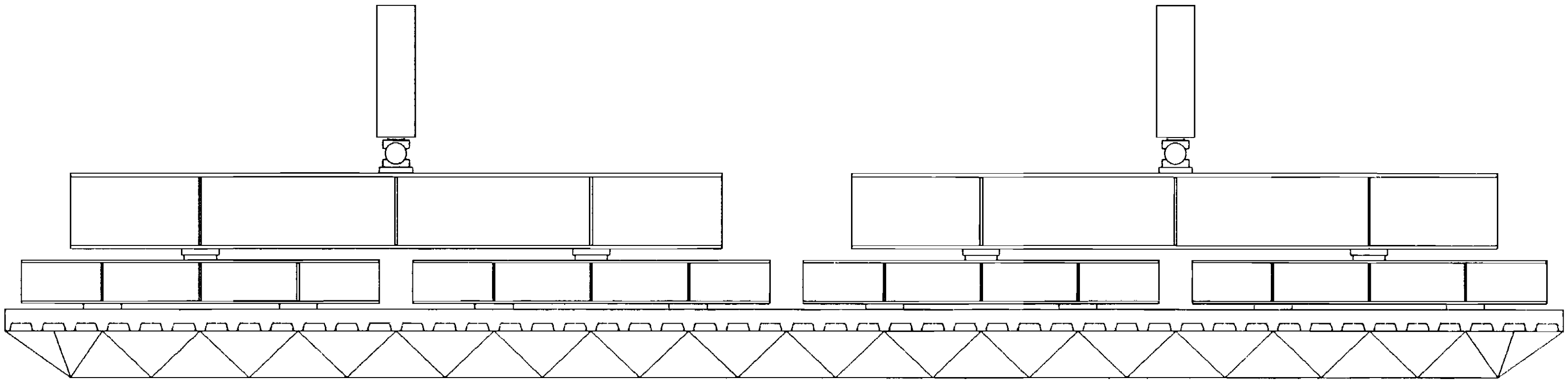
Load was applied using two 100 kip hydraulic rams, each placed between a load frame and the specimen. Each load frame consisted of two W21x62 columns joined at the top by two C15x50 horizontal members. A short piece of column section, against which the hydraulic rams could bear, was fabricated and bolted between the channels at midspan. The hydraulic ram jacked against this member and ultimately against the reaction floor.

Beneath the rams was a series of spreader beams, used to distribute the applied load to the test specimens. The two-joist arrangements (CSJ-1, 2, 4, 5, 6, 7, 8) used a three-tiered pyramid of load beams beneath each ram, as shown in Fig. 2.13a. The uppermost beam (W14x53) split the ram load between its end reactions. The ends of the top beam rested at the midspan of two intermediate beams (W8x24), further dividing each ram load into four point loads. The bottom layer, four beams (W6x20) placed perpendicular to the joists, carried the four point loads out to the joists. Because CSJ-3 was a single joist test, the joist could be centered in the load frame, directly under the rams. Consequently the lowest layer of spreader beams was not needed, as shown in Fig. 2.13b. In each case, the use of two rams and the series of spreader beams results in 8 concentrated loads uniformly spaced along each joist. Elastomeric bearing pads (1.0 in. thick) were placed between each tier of spreader beams. Bearing pads also separated the lowest tier of spreader beams from the concrete slab.

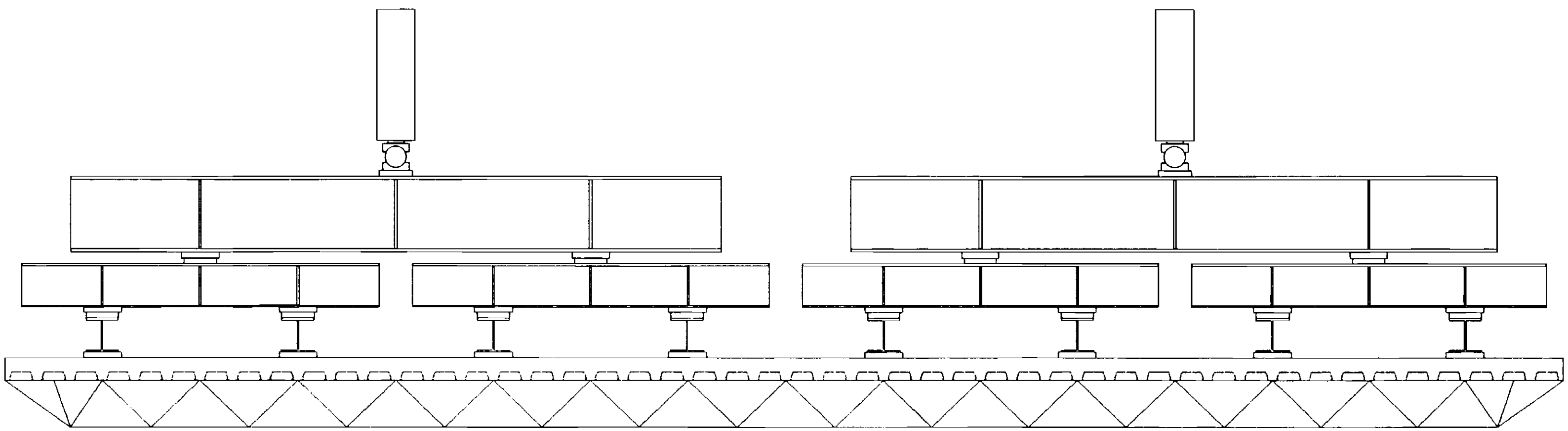
## 2.5 Loading Procedure

The test specimen was initially seated by applying a load of approximately 10 percent of the estimated maximum applied load. The specimen was then unloaded and all the instrumentation re-zeroed.

The specimen was loaded to its service load in 1 to 6 kip increments. Following each load increment, the specimen was given a chance to stabilize and then a reading of all instrumentation was taken. Data was electronically gathered at each load point using a PC-based data acquisition system. Dial gage readings were recorded only at some load points during the test. The specimen was then unloaded. Data was also collected during the unloading cycle. The specimen was reloaded to approximately first yield and again unloaded. Finally, the specimen was loaded to failure. On the yield plateau, readings were taken in displacement increments of 1/4 in. to 1/2 in. All tests followed a similar procedure; however, some had additional unload-reload cycles.



(b) Single Joist Test



(a) Double Joist Test

Figure 2.13 Loading Beam Arrangements

# CHAPTER 3

# TEST RESULTS

## 3.1 General

The test results are displayed graphically in a series of plots prepared from data collected during the tests. Typically load per joist is plotted along the ordinate, while the desired response (e.g., deflection, strain) appears on the abscissa. Although some tests consisted of two joists, all load data are reported on a per joist basis. The first nonzero load point represents the non-composite deflection (or strain) due to the weight of the joist plus deck. The next load point corresponds to placement of the concrete. Because measurements began after the joists were in place on the support stands with the deck attached, it was necessary to extrapolate the response to joist self weight and deck weight (the first nonzero load point) from the response to the wet concrete load (the second nonzero load point). Note that the weights of the joist, deck, and concrete were calculated and not measured. The next load point corresponds to the addition of the spreader beam system to the composite joist. Subsequent load increments are due to the application of ram pressure. A complete set of graphs for each test is contained in Appendix A.

The term "dead load" will be used to describe the weight of one joist plus the deck weight per joist plus the concrete weight per joist. Load added to the composite system (spreader beam weight and ram load) is referred to as "applied load." In the case of a single joist test, applied load includes the load from the entire spreader beam system and the load from both rams. For a test with two joists, the weight of entire spreader beam system plus the ram load from both rams is divided in half so that applied load is always reported on a per joist basis. The sum of dead load and applied load is the "total load" per joist. A loading summary for each test is presented in Table 3.1.

Concrete cylinder strengths at the time of testing are given in Table 3.2. The yield and tensile stresses for top and bottom chords are given in Table 3.3. Tensile coupon tests were conducted at the Virginia Tech Structures and Materials Laboratory and by Vulcraft as indicated.

Table 3.1 Loading Summary

| Test Designation | Dead Load per Joist (kips) | Applied Load per Joist* (kips) | Total Load per Joist* (kips) |
|---|---|---|---|
| CSJ-1 | 2.89 | 19.47 | 22.4 |
| CSJ-2 | 2.49 | 19.66 | 22.2 |
| CSJ-3 | 7.52 | 104.94 | 112.5 |
| CSJ-4 | 3.22 | 56.58 | 59.8 |
| CSJ-5 | 3.66 | 28.70 | 32.4 |
| CSJ-6 | 4.44 | 29.60 | 34.0 |
| CSJ-7 | 4.44 | 24.29 | 28.7 |
| CSJ-8 | 4.44 | 23.84 | 28.3 |

* Applied load and total load are recorded at failure

Table 3.2 Concrete Compressive Strength

| Test Designation | $f'_c$ (psi) |
|---|---|
| CSJ-1 | 3700 |
| CSJ-2 | 3600 |
| CSJ-3 | 3600 |
| CSJ-4 | 4000 |
| CSJ-5 | 4400 |
| CSJ-6 | 4200 |
| CSJ-7 | 3600 |
| CSJ-8 | 3600 |

Table 3.3 Joist Member Steel Strength

| Test | Member | $f_y$ (psi) | $f_u$ (psi) | Laboratory |
|---|---|---|---|---|
| CSJ-1 | top chord | 52200 | 79100 | VPI&SU |
| | top chord | 52300 | 79600 | VPI&SU |
| | bottom chord | 53300 | 78600 | VPI&SU |
| | bottom chord | 52000 | 77800 | VPI&SU |
| | bottom chord | 51429 | 73782 | Vulcraft |
| | bottom chord | 52353 | 73950 | Vulcraft |
| | bottom chord | 51008 | 73193 | Vulcraft |
| CSJ-2 | top chord | 52200 | 79200 | VPI&SU |
| | top chord | 51500 | 79900 | VPI&SU |
| | bottom chord | 55050 | 80060 | VPI&SU |
| | bottom chord | 53010 | 78700 | VPI&SU |
| CSJ-3 | top chord | 55000 | 79400 | VPI&SU |
| | bottom chord | 51600 | 81700 | VPI&SU |
| | bottom chord | 54726 | 82089 | Vulcraft |
| CSJ-4 | bottom chord | 53980 | 81420 | VPI&SU |
| | bottom chord | 54800 | 81500 | VPI&SU |
| | bottom chord | 57431 | 84114 | Vulcraft |
| | bottom chord | 57665 | 84634 | Vulcraft |
| CSJ-5 | top chord (stem) | 47400 | 67800 | VPI&SU |
| | bottom chord | 51860 | 77200 | VPI&SU |
| | bottom chord | 55130 | 78500 | VPI&SU |
| CSJ-6 | top chord | 62500 | 89500 | VPI&SU |
| | top chord | 58200 | 88200 | VPI&SU |
| | top chord | 58900 | 89700 | VPI&SU |
| | top chord | 60300 | 88500 | VPI&SU |
| | bottom chord | 60900 | 89900 | VPI&SU |
| | bottom chord | 58600 | 87800 | VPI&SU |
| | bottom chord | 62200 | 91400 | VPI&SU |
| | bottom chord | 60800 | 91100 | VPI&SU |
| CSJ-7 | top chord | 57100 | 87800 | VPI&SU |
| | top chord | 58200 | 88600 | VPI&SU |
| | top chord | 57800 | 88000 | VPI&SU |
| | top chord | 57500 | 88100 | VPI&SU |
| | bottom chord | 60600 | 90500 | VPI&SU |
| | bottom chord | 59600 | 89300 | VPI&SU |
| | bottom chord | 58200 | 87300 | VPI&SU |
| CSJ-8 | top chord | 56300 | 83500 | VPI&SU |
| | top chord | 54400 | 82800 | VPI&SU |
| | top chord | 57100 | 86200 | VPI&SU |
| | bottom chord | 58900 | 88000 | VPI&SU |
| | bottom chord | 58100 | 87000 | VPI&SU |
| | bottom chord | 59600 | 88700 | VPI&SU |
| | bottom chord | 60500 | 89500 | VPI&SU |

## 3.2 CSJ-1 Results

The load-deflection graph for CSJ-1 is shown in Fig. 3.1. The specimen behaved linearly elastically up to a load of approximately 10 kips. Beyond this point, the plot showed increasing amounts of deflection for a given load increment, indicating a lower stiffness and the onset of shear connection deterioration. The specimen appeared to be non-composite at a load of approximately 17 kips. The load increased gradually, without a well-defined yield point, to its maximum load.

Top chord strains at midspan are shown in Fig. 3.2. Beyond the compressive strains due to wet concrete, the top chord strains were essentially constant up to a total load of approximately 10 kips. As can be seen in the figure, the top chord carried increasing amounts of compressive load beyond 10 kips. Horizontal movement between the slab and top chord caused the top chord to be more involved in resisting the applied load. Compressive stress increased in the top chord until it yielded at approximately 21.9 kips of total load. The structure supported less than one-half kip of additional applied load following top chord yield.

The bottom chord began yielding at the panel points near midspan, as indicated by flaking of the whitewash. However, as can be seen in Fig. 3.3, the yielding did not reach the centerline of the bottom chord, which is where the strain gages were placed. The average midspan bottom chord stress at failure was well below the yield stress.

Although overall behavior of the system was ductile, failure of individual standoff screw shear connectors was somewhat brittle. In the middle stages of the test, many screws rotated at their base distorting the top chord angle to which they were fastened. As horizontal movement between the slab and top chord progressed, some screws tore through the deck at their base without shearing off. Screws were not heard to rupture until a total load of 19.8 kips had been reached. At this load level member deflection and interface slip had progressed considerably. Throughout the test, none of the screws pulled out of the top chord angle. Upon removal of the concrete slab after testing, it was found that the failed screws ruptured at the lower part of their shaft, just above the flared portion and not through the threads. Some screws near the ends of the joist were distorted but were not broken.

Failure occurred by yielding of the top chord at 22.4 kips with an average midspan deflection of 5.1 in. With continued application of load, buckling occurred locally in each angle of the double angle top chord at the location of a shear connector between webs W10 and W11.

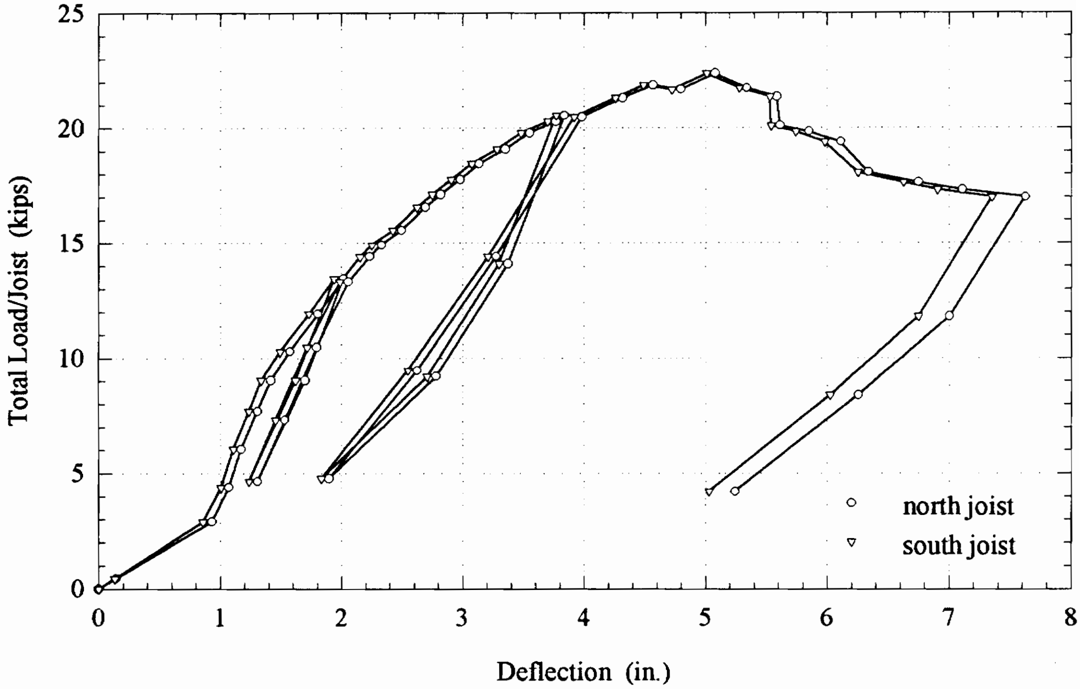



Figure 3.1 CSJ-1 - Total Load/Joist vs. Midspan Deflection

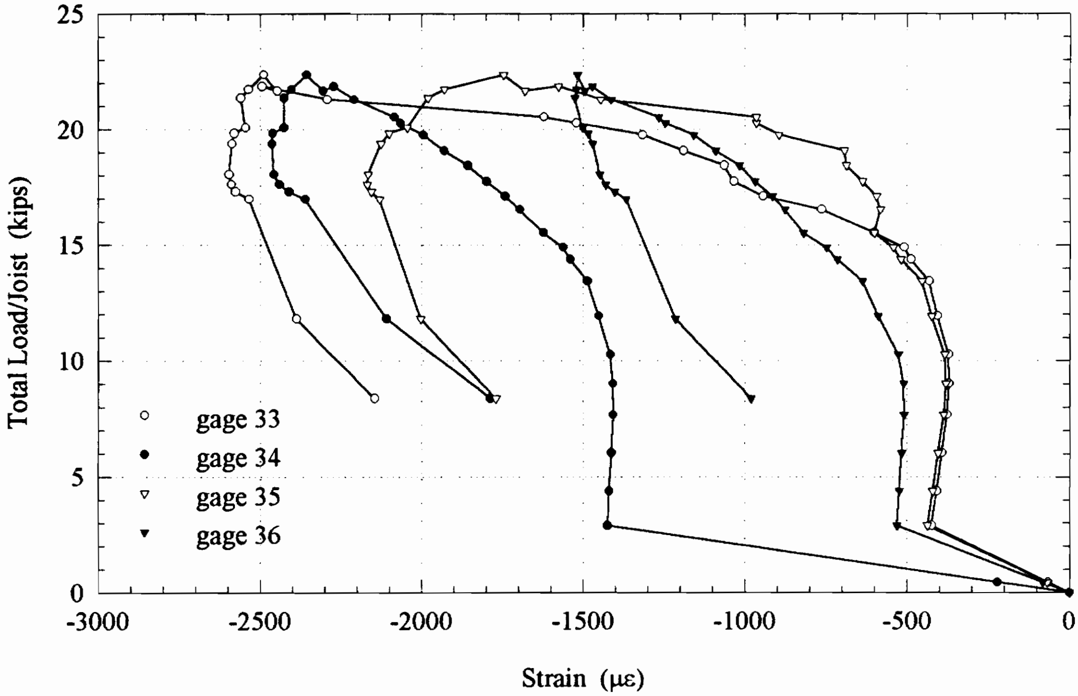



Figure 3.2 CSJ-1 - Total Load/Joist vs. Midspan Top Chord Strain

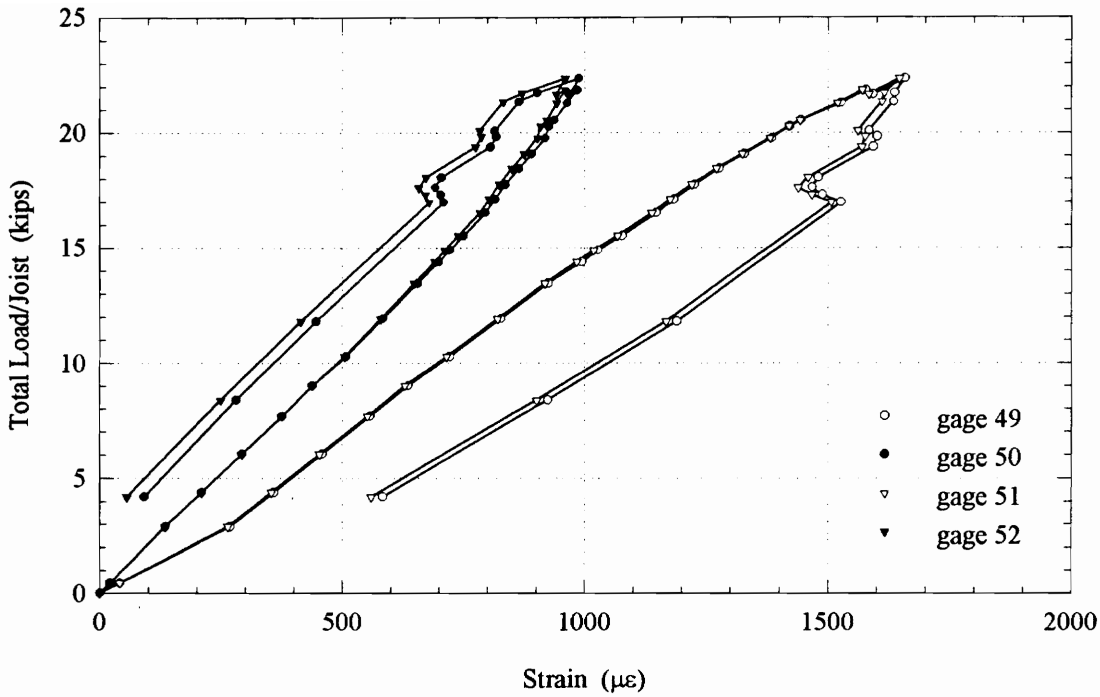



Figure 3.3 CSJ-1 - Total Load/Joist vs. Midspan Bottom Chord Strain

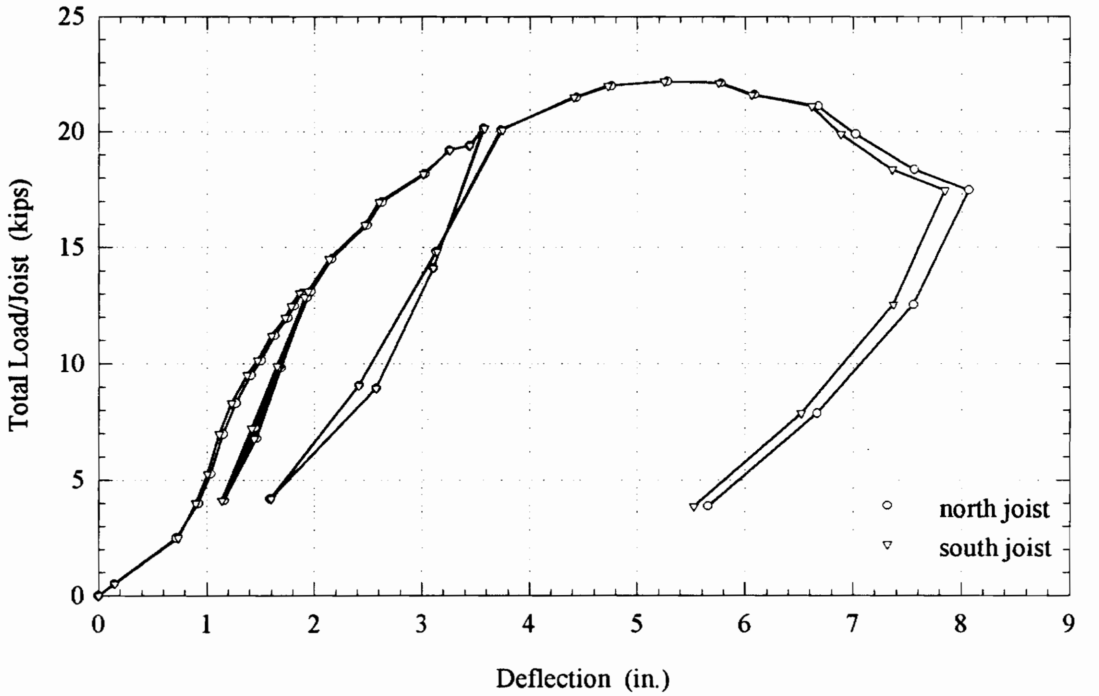



Figure 3.4 CSJ-2 - Total Load/Joist vs. Midspan Deflection

### 3.3 CSJ-2 Results

CSJ-2 behaved similarly to CSJ-1. The load-deflection plot is shown in Fig. 3.4. The specimen appeared to begin losing shear connection at 9 kips and by 17 kips was acting non-compositely. As with the previous test, the specimen did not have a well-defined yield point. The total load dropped gradually from a maximum of 22.2 kips.

The load-top chord strain plot, Fig. 3.5, followed a pattern similar to the load-deflection plot. The strains were fairly constant up to the point where composite action began diminishing. At a total load of approximately 9 kips the strains began to increase and beyond 17 kips increased rapidly to the maximum member load. The top chord yielded at midspan two load increments before the maximum joist load was reached. The joist carried only 700 pounds of applied load after first yield of the top chord. Continued yielding of the top chord corresponded to the gradual drop in member capacity shown in the load-deflection plot.

The performance of the bottom chord was similar to the previous test. Yielding began at the panel points near midspan and expanded into the panels of the bottom chord. As with CSJ-1, yielding of the bottom chord was incomplete. The bottom chord strain response in shown in Fig. 3.6.

CSJ-2 reached a maximum total load of 22.2 kips with an average midspan deflection of 5.3 in. Failure occurred by yielding of the top chord. The failure mode was the same as CSJ-1, as could be expected because these tests had few differences in their construction. Continued application of load caused local buckling between webs W12 and W13.

### 3.4 CSJ-3 Results

The results of CSJ-3 showed similarities to CSJ-1 and 2 despite the differences in construction. The load-deflection plot, Fig. 3.7, had a generally linear portion from initial application of applied load to approximately 36 kips. The remainder of the load-deflection plot displayed gradually increasing measures of deflection for equal increments of applied load. Thus the graph is characterized by the "rolling over" which was observed in the previous two tests. There was not a well-defined yield point.

The correlation between top chord strain graph and the load-deflection graph observed for CSJ-1 and 2 also occurred for CSJ-3. Over the linear portion of the load-deflection plot, top chord compressive strain remained constant at the level induced by the

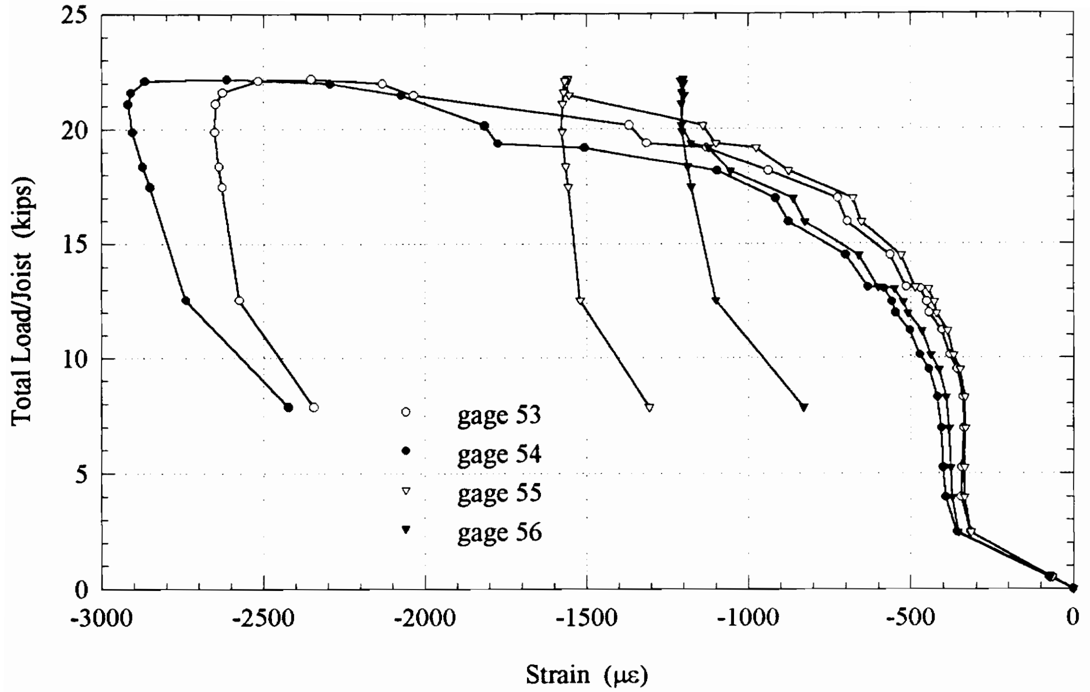



Figure 3.5 CSJ-2 - Total Load/Joist vs. Midspan Top Chord Strain

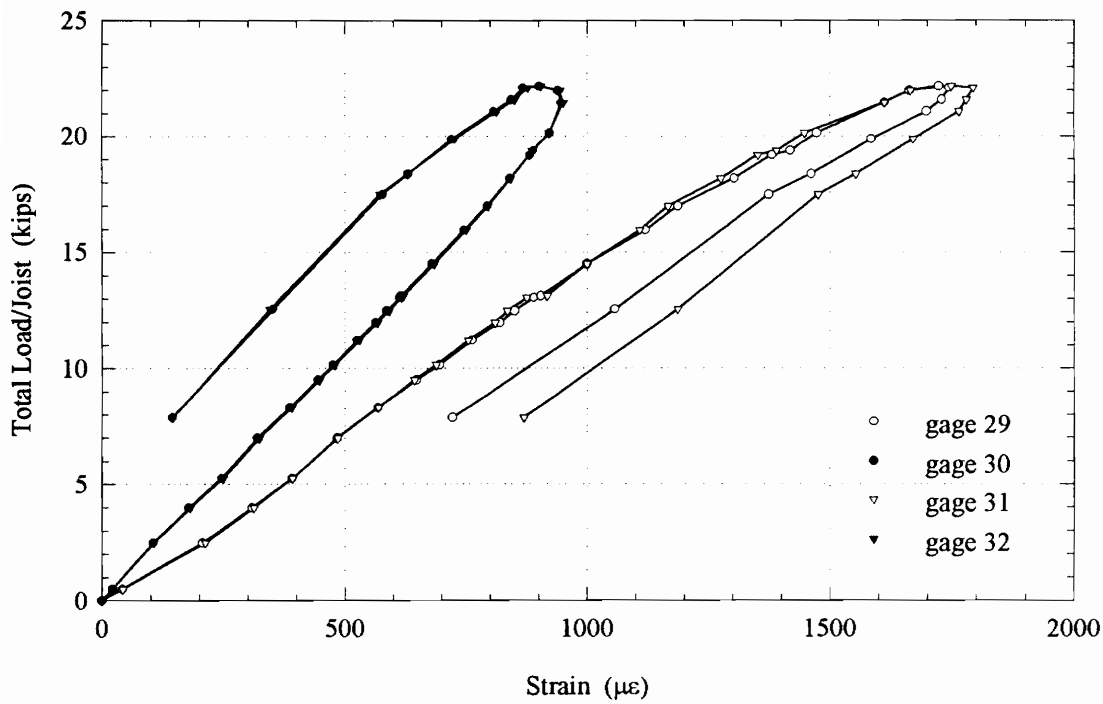



Figure 3.6 CSJ-2 - Total Load/Joist vs. Midspan Bottom Chord Strain

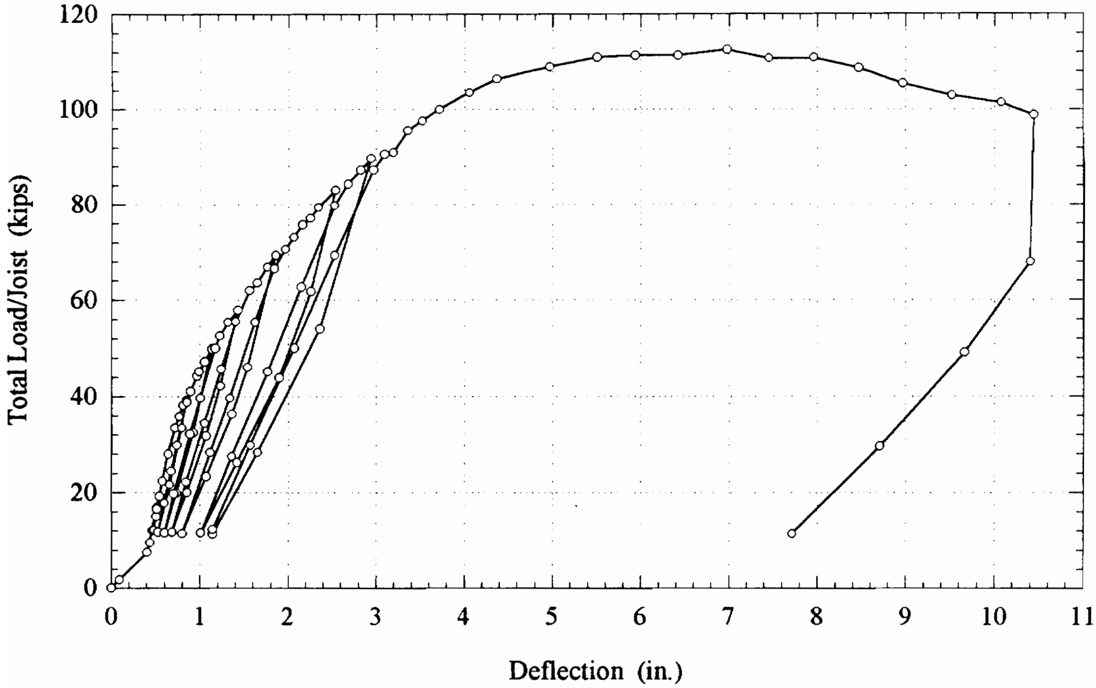



Figure 3.7 CSJ-3 - Total Load/Joist vs. Midspan Deflection

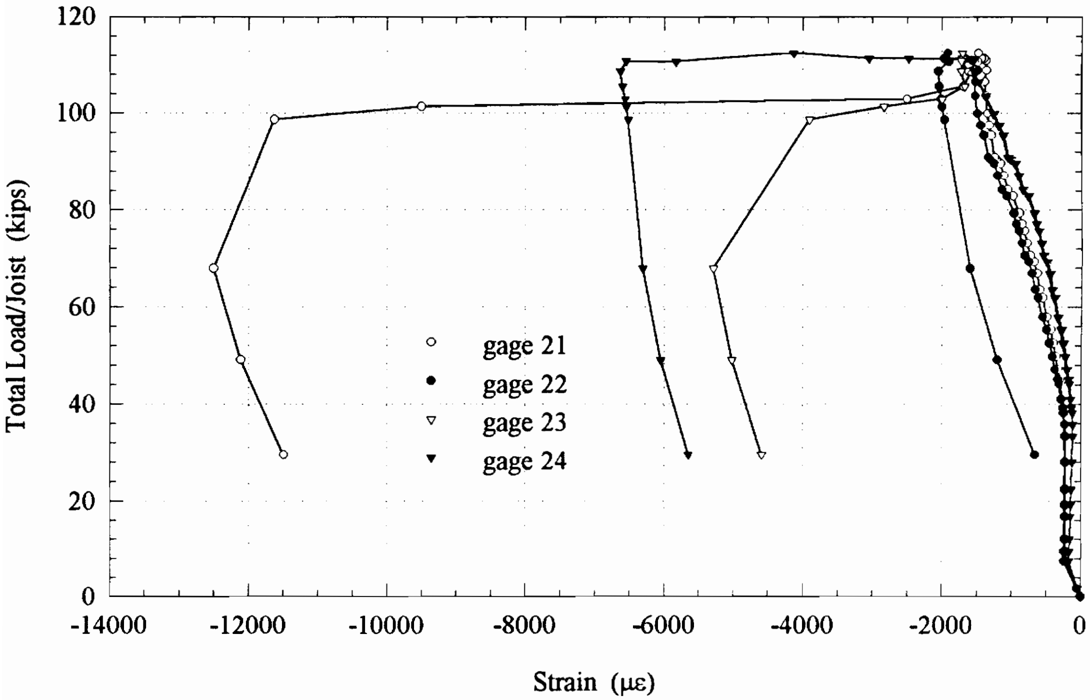



Figure 3.8 CSJ-3 - Total Load/Joist vs. Midspan Top Chord Strain

weight of the wet concrete. Actually a close examination of the top chord strain response, Fig. 3.8, revealed a slight tension strain in the lower portion of the top chord relative to initial value prior to applied load. Above 36 kips of total load, strain in the top chord increased as it became effective in resisting the applied load. The entire top chord cross-section was in compression for the remainder of the test, and eventually yielded. The maximum force in the top chord occurred just prior to reaching the maximum member load.

Loss of interaction appeared to be caused by concrete rib failure, rather than connector failure. Separation of the deck from the concrete slab was evident beginning at 45.0 kips of total load. With increased loading and slip, substantial deck deformation and bulging at the locations of shear connectors was observed. Many shear connectors punched through the deck at their base as the concrete ribs failed and slip became excessive. Upon dismantling the specimen at the conclusion of the test, it was observed that the concrete ribs failed on a plane at the bottom of the solid portion of the slab. The failure plane averaged 10-1/2 in. in length, centered around the shear connector.

All of the angle shear connectors remained securely fastened to the top chord throughout testing. The horizontal leg of the angle provided clamping area around the puddle weld, which assured sound attachment of the metal deck to the top chord. Vertical legs of angle shear connectors were bent backwards up to 80 degrees from their original orientation. Shear connectors at the ends of the joist had the most deformation. Average deformation was 23 degrees from vertical.

The bottom chord used in this test was large compared to the depth and span. The resulting stocky cross-section caused the bottom chord to function to some extent as a bending member, rather than just a tension member. The bottom chord strain plot is shown in Fig. 3.9. Although there was yielding at one gage location in the outer fibers of the angle, the majority of the bottom chord remained in the elastic range.

Failure occurred at a total load of 112.5 kips and midspan deflection of 7.0 in. by top chord yielding. The top chord then buckled locally between members W14 and W15, under the interior-most load point. Due to excessive deflection, a transverse crack formed in the slab at this location.

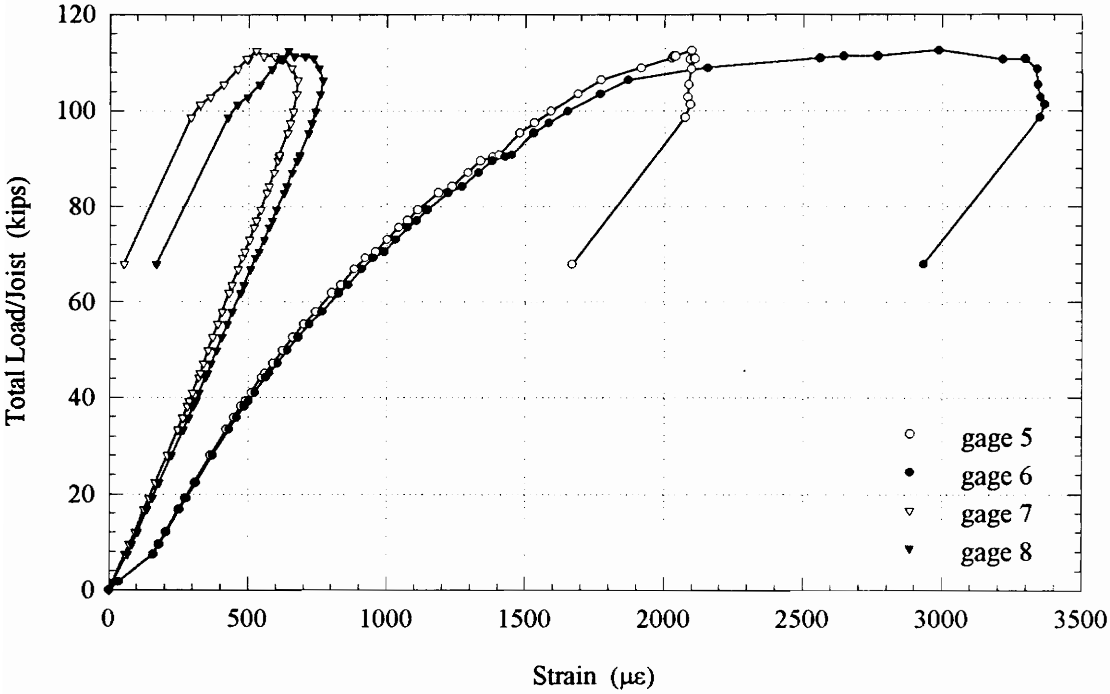



Figure 3.9 CSJ-3 - Total Load/Joist vs. Midspan Bottom Chord Strain

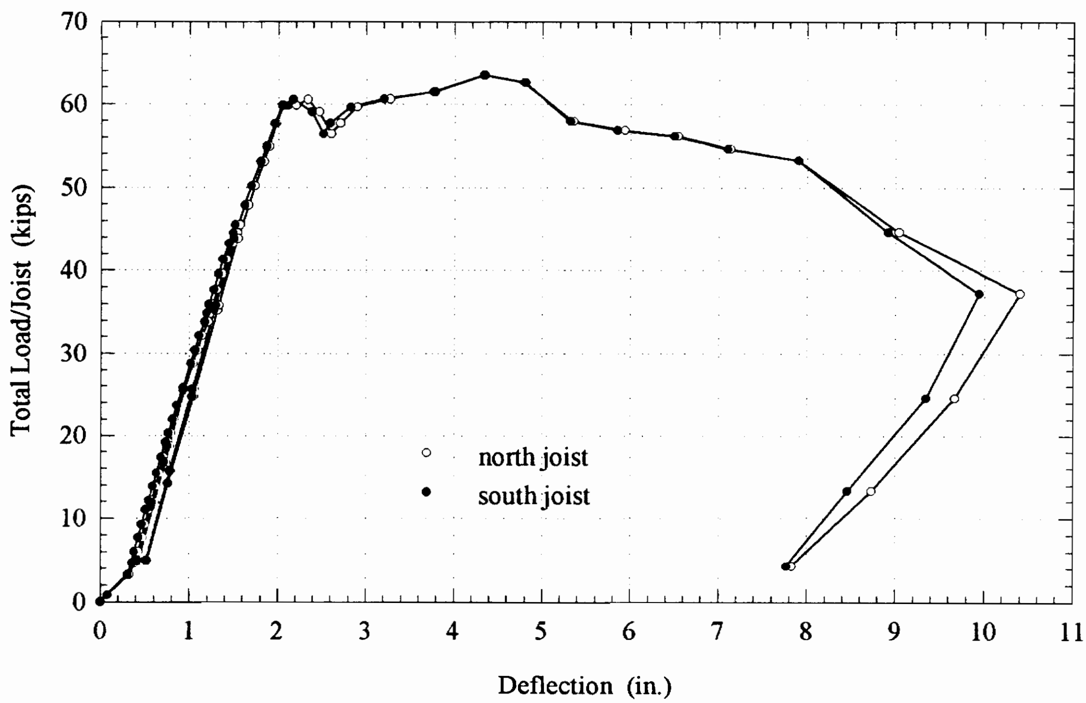



Figure 3.10 CSJ-4 - Total Load/Joist vs. Midspan Deflection

### 3.5 CSJ-4 Results

CSJ-4 behaved linearly elastically up to a total load of about 60 kips. Beyond this were two load points on a very short plateau followed by an abrupt decrease in capacity. The total load then rose to a maximum of 63.5 kips. The deflection response is shown in Fig. 3.10.

The failure mode for CSJ-4 was loss of shear connection, characterized by longitudinal cracks in the slab directly over the shear angle of each joist. In general, the cracks emanated from the ends of the joist and progressed toward midspan. The first crack appeared at a load of 59.8 kips beginning at the west end of the north joist and continuing 9 ft.-9 in. toward the center of the slab. The next crack appeared over the south joist two load points later at 59.1 kips. It was 9 ft.-3 in. long beginning at the east end of the joist. An additional increment of load caused a crack over the east end of the north joist, equally as long as the first crack. The next two load points, 57.7 kips and 59.7 kips, extended the south-end crack by 7 in. and 4 in. respectively. With the next load application, the cracks in the north side of the slab were joined, completing the crack over the full length of the north joist shear angle. The following load point, 61.5 kips, completed the crack over the south joist shear angle. As the longitudinal cracking progressed, the member load first dropped sharply, then rebounded presumably as mechanical transfer between the concrete ribs and metal deck was established.

Fig. 3.11 shows horizontal slip, measured at various positions along the span, plotted against applied load (spreader beam weight plus ram load). This graph shows that there was virtually no movement of the slab relative to the top chord until an applied load of approximately 56.0 kips was reached. This corresponded to a total load of 59.8 kips, the load at which the longitudinal cracks began to form. Positive interaction between the top chord and the concrete slab was provided by the longitudinal top chord angle but disappeared suddenly with the onset of cracking.

Fig. 3.12 is a graph of the top chord strain vs. total load. Relative to the initial (casting) strain, the vertical leg strains were tensile and the horizontal leg strains were compressive. This indicates that the joist neutral axis was in the top chord between these gages. This remained the case up to the failure load at which point the entire top chord carried a compressive load. Continued application of load beyond the maximum resulted in local buckling in the shear angle, as well as the top chord double angle, between webs W14 and W15. This occurred at 63.5 kips of total load, just one increment of load beyond that at which longitudinal cracks were completely formed over both joists.

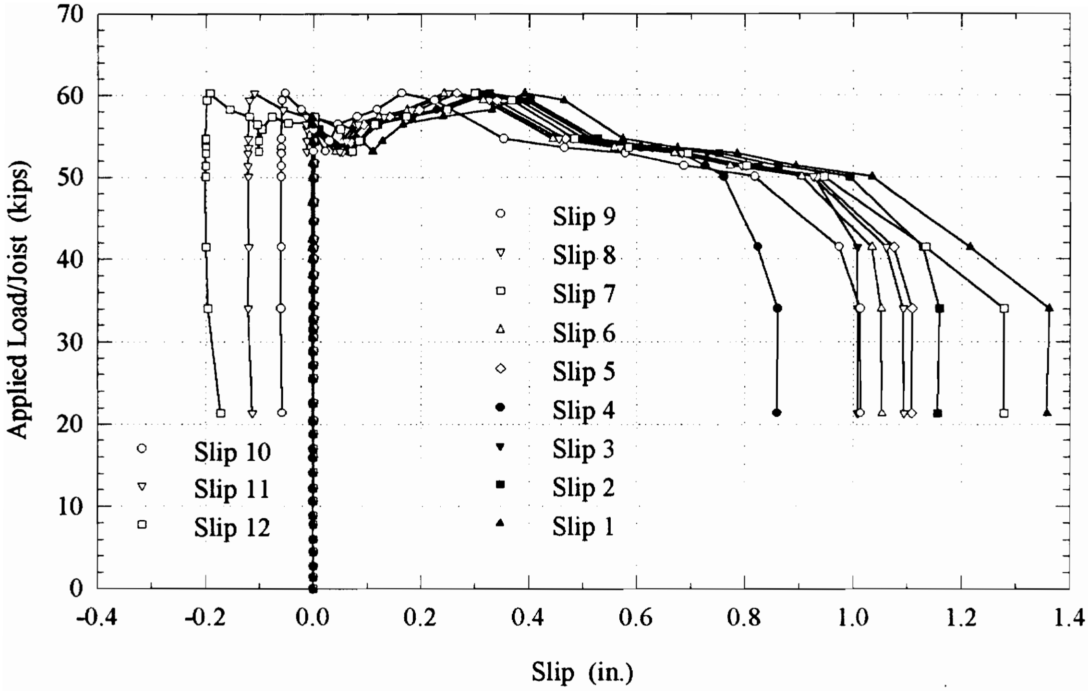



Figure 3.11 CSJ-4 - Applied Load/Joist vs. Slip

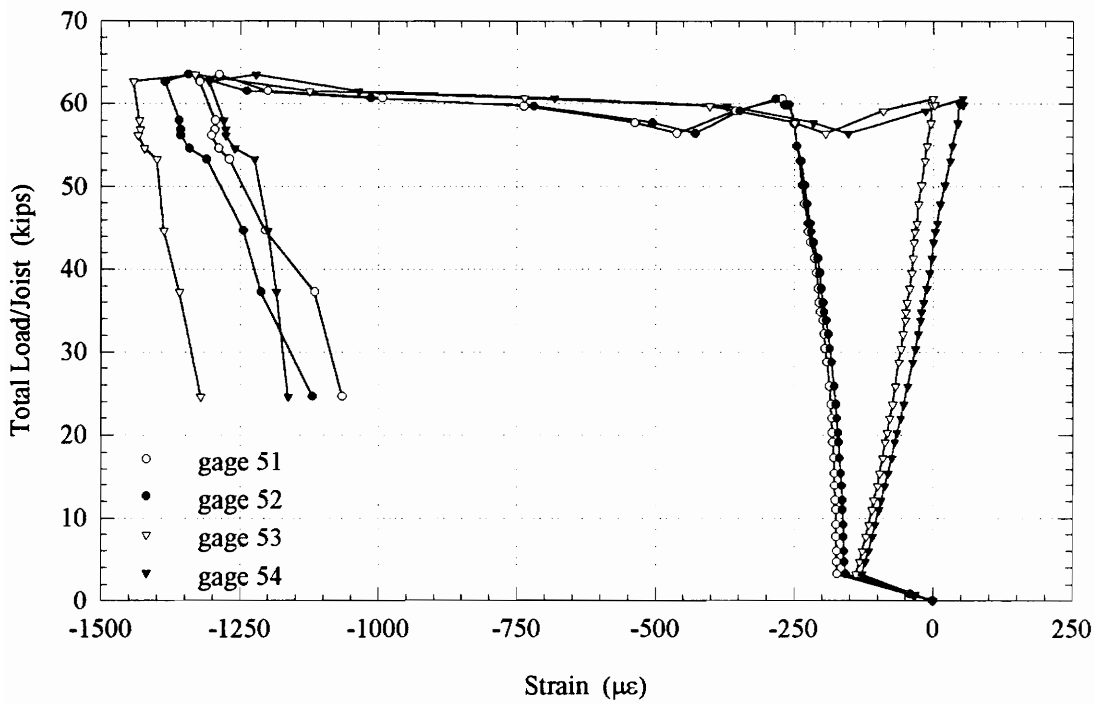



Figure 3.12 CSJ-4 - Total Load/Joist vs. Midspan Top Chord Strain

Bottom chord strains are shown in Fig. 3.13. The bottom chord behaved linearly elastically up to the failure load. As the loading proceeded, the bottom chord was observed to yield through its horizontal leg near midspan but not through its entire depth.

### 3.6 CSJ-5 Results

The load-deflection curve for CSJ-5 is shown in Fig. 3.14. The response was linear up to the approximate yield load of 31 kips. Deflection then continued along a horizontal yield plateau. The specimen capacity dropped off slowly from an ultimate load of 32.2 kips. Throughout the test, each joist deflected nearly the same amount for a given load point.

The top chord strain graph, Fig. 3.15, indicates that at midspan the neutral axis was located in the top chord during the linear portion of loading. The top chord was a structural tee with three strain gages, one on either side of the stem, and the third on top of the flange directly over the stem. The flange gage displayed nearly constant compression and the stem gages displayed slightly increasing tension up to the specimen yield point, indicating very little contribution to moment resistance from the top chord prior to first yield of the bottom chord. At first yield the top chord compressive strain was released and continued to decrease as the loading progressed on the yield plateau. Top chord strain reversed direction again when the shear connection failed. The reversal back to a compression force coincided with the maximum total load carried by the system. This top chord behavior was most pronounced where bottom chord yielding was most severe. At locations away from midspan, where bottom chord yielding was not present, the top chord remained in compression throughout the loading cycle.

At the failure load, bottom chord yielding had proceeded well away from the panel points toward the interior of the chord segments. Near midspan the bottom chord had yielded through the depth of the section, but did not quite reach the location of the strain gages. Bottom chord strain is plotted against total load in Fig. 3.16.

Vertical displacement of the bottom chord angles, relative to the top chord, was measured on one of the joists using dial gages. The bottom chord angle to which web members were not directly connected deflected 0.134 in. at midspan with respect to the top chord. The web side bottom chord angle deflected 0.055 in. at midspan with respect to the top chord, less than half that of the unconnected side. The bottom chord rotated

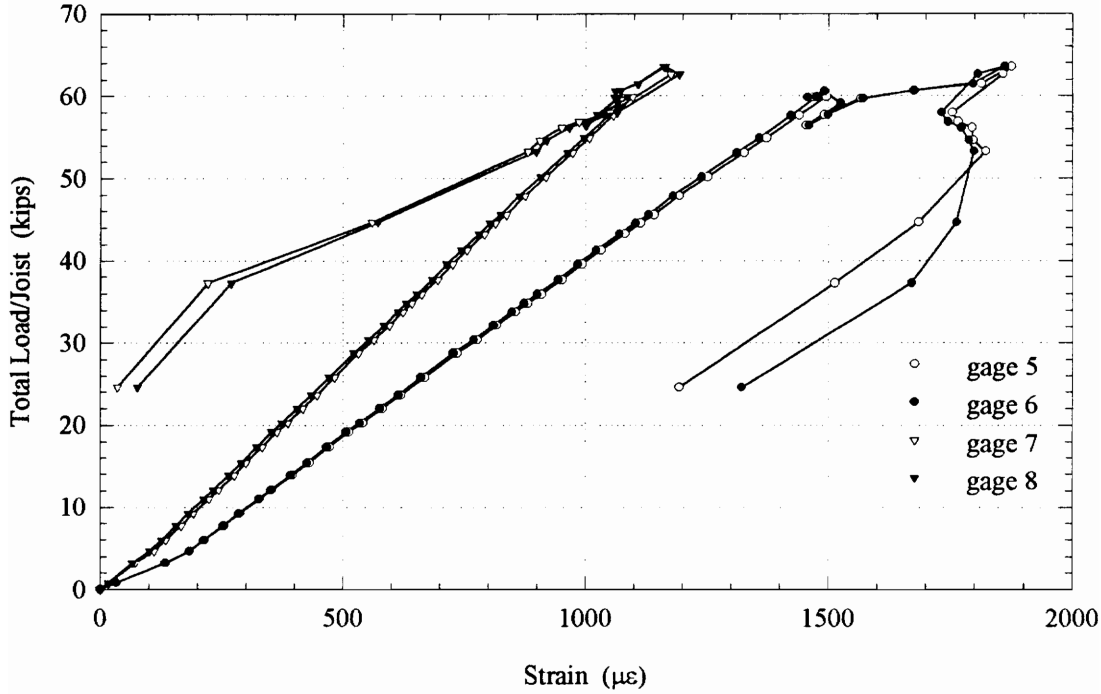


Figure 3.13 CSJ-4 - Total Load/Joist vs. Midspan Bottom Chord Strain

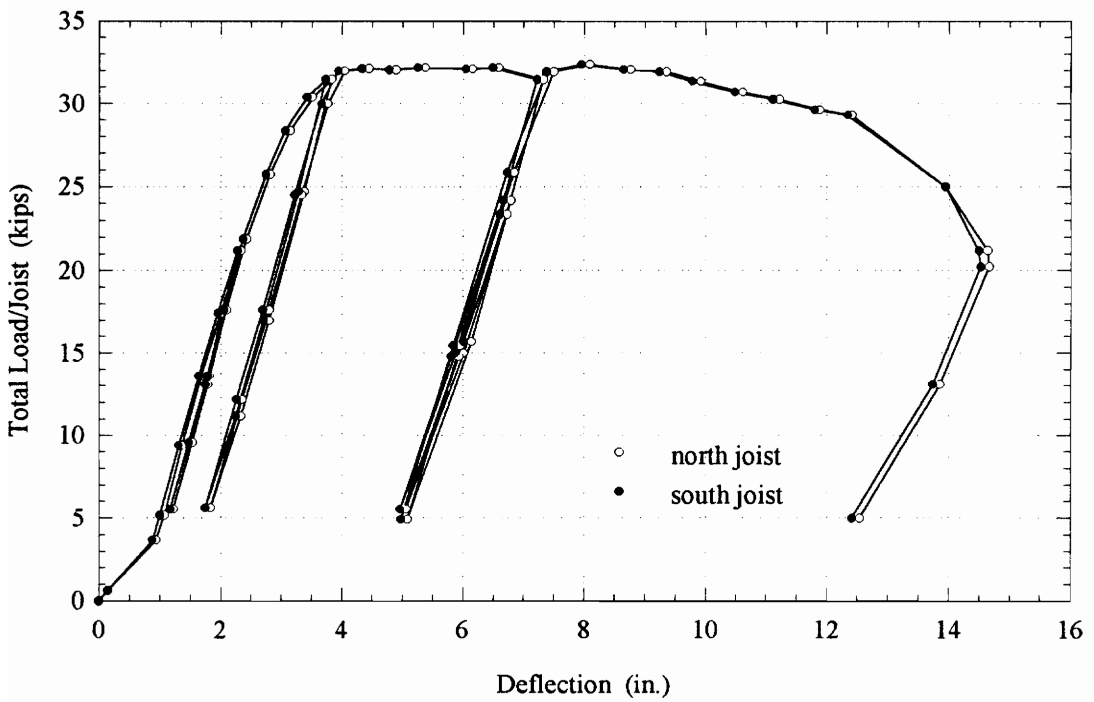


Figure 3.14 CSJ-5 - Total Load/Joist vs. Midspan Deflection

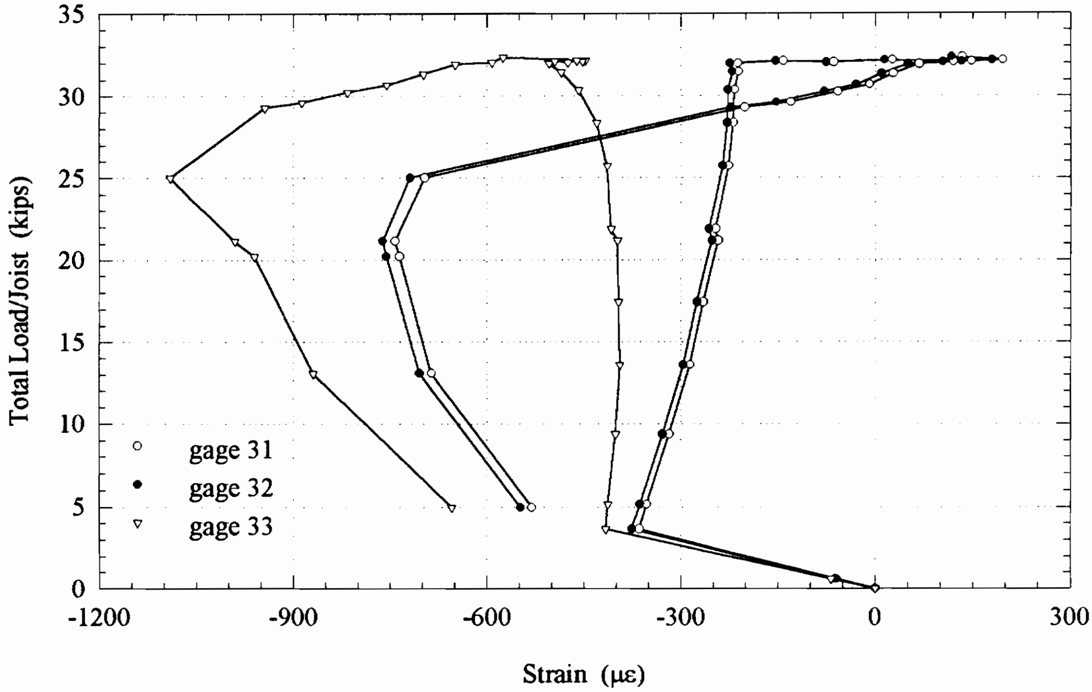



Figure 3.15 CSJ-5 - Total Load/Joist vs. Midspan Top Chord Strain

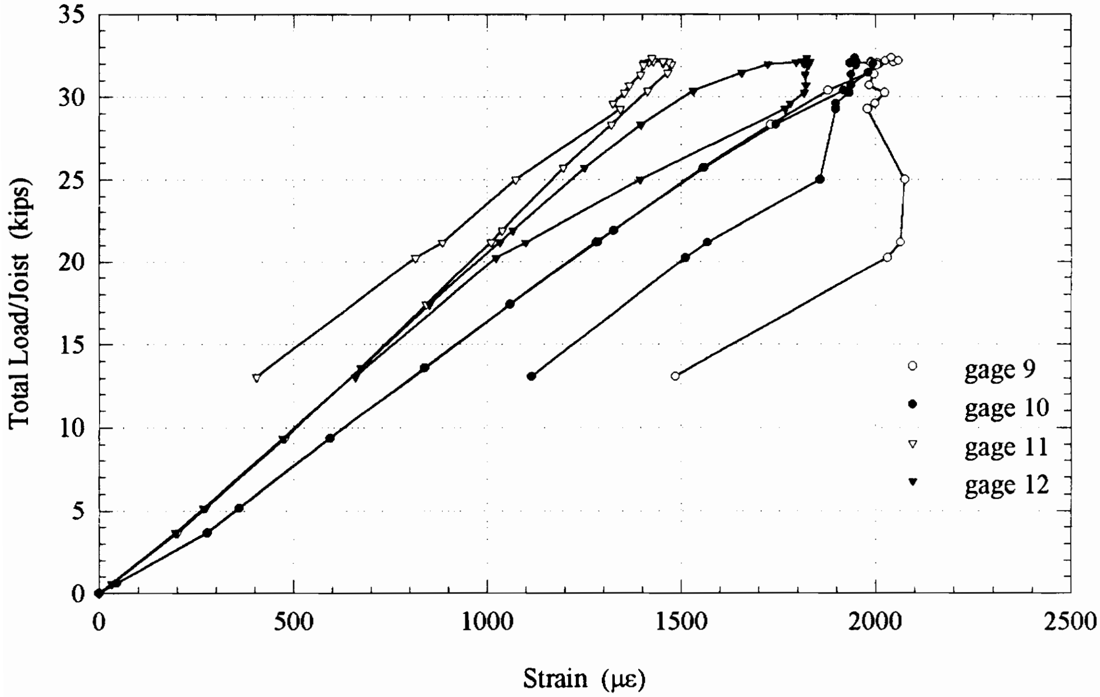



Figure 3.16 CSJ-5 - Total Load/Joist vs. Midspan Bottom Chord Strain

about its own longitudinal axis but moved out of plane less than 1/2 in. Initial sweep of the bottom chord was 3/16 in. in the direction of the lateral movement.

A post-test examination of the specimen showed that two studs had sheared off at their base. On the north joist, the second stud from the end tore out just below the weld leaving a small crater in the top chord. This stud was incompletely fused with the base metal. Lack of stud distortion indicated that this stud broke away early in the test and carried very little load. The outermost stud on the same end of the south joist sheared off above the weld and was heavily distorted. It was observed that this stud was undercut during welding, which probably precipitated its failure. Due to the amount of bending, it is believed that this stud carried significant shear and remained secure into the latter stages of the test.

The failure mode was yielding of the bottom chord and subsequent loss of shear connection. Maximum load was 32.4 kips with an average midspan deflection of 8.0 in. Continued application of load past failure caused buckling of web members W15 and W16 and top chord local buckling. A transverse crack in the slab accompanied the top chord local buckle as in previous tests.

### 3.7 CSJ-6 Results

The load-deflection plot for CSJ-6, Fig. 3.17, resembled that of CSJ-5. CSJ-6 exhibited linear elastic behavior up to the yield load of approximately 33 kips. Loading continued on a long yield plateau then began to drop after about 5.4 in. of vertical deflection.

The top chord for this test also experienced loading similar to CSJ-5. Top chord strain is plotted against total load in Fig. 3.18. The strain response was generally vertical, indicating little change in the top chord force under applied load up to the yield point. As the bottom chord yielded, the top chord responded by releasing the compressive force due to slab placement. The top chord strain continued in tension beyond the zero strain point, as loading on the yield plateau progressed. The top chord then returned to compression when the shear connection failed and slip became excessive. The loss of composite action and return to compressive top chord force occurred just after the maximum specimen load was recorded. The resulting shape of the load-top chord strain plot is similar to the previous test.

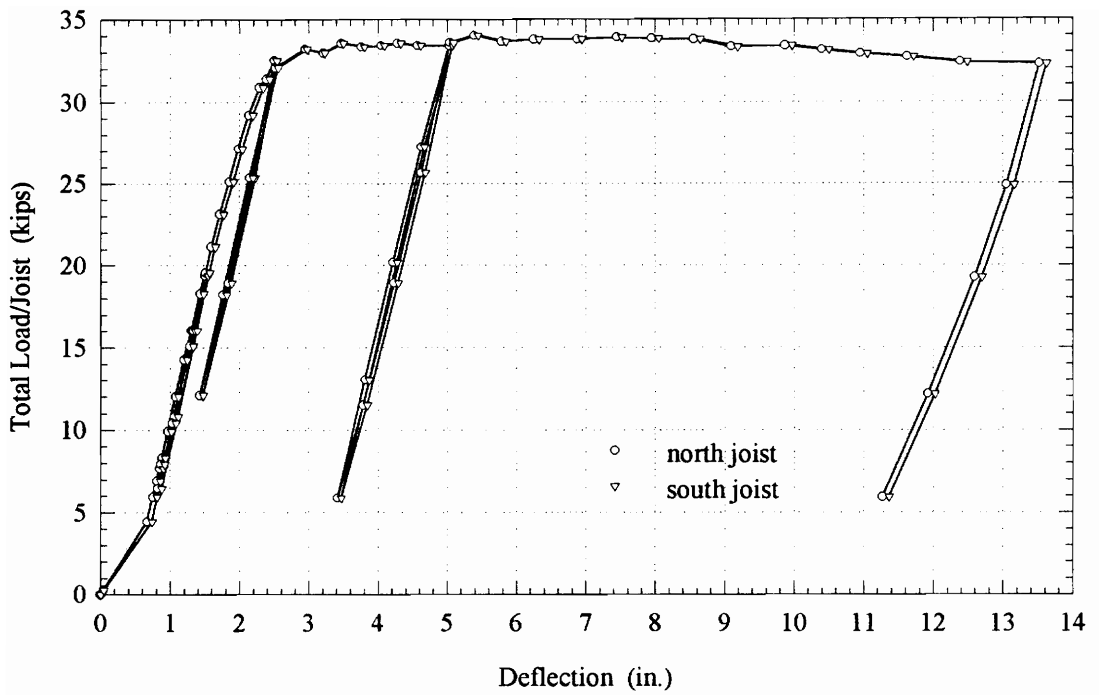


Figure 3.17 CSJ-6 - Total Load/Joist vs. Midspan Deflection

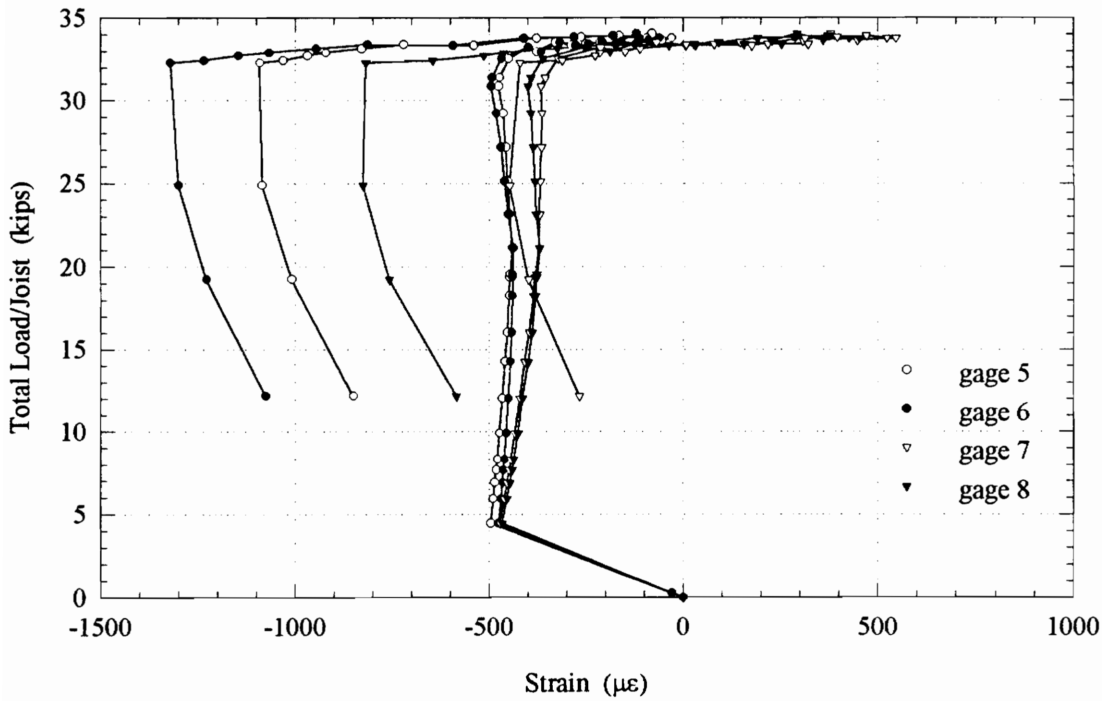


Figure 3.18 CSJ-6 - Total Load/Joist vs. Midspan Top Chord Strain

The bottom chord strain response is plotted in Fig. 3.19. The bottom chord exhibited linearly elastic behavior up to a load of approximately 33 kips. The onset of bottom chord yielding coincided with first yield of the joist system as depicted in the load-deflection plot.

With increasing applied load, a circular yielding pattern was observed on the underside of the top chord at the location of many of the shear studs. As the specimen approached failure, some studs tore away leaving a hole in the top chord at the base of the stud. An examination of the specimen after testing showed that nine studs failed on each joist, all in a tear-out mode. All of the failed studs were located on the same half of the specimen.

Failure of CSJ-6 was due to yielding of the bottom chord and loss of interaction between the slab and top chord. The specimen reached a maximum load of 34.0 kips at 5.4 in. of vertical deflection, well out on the yield plateau.

### 3.8 CSJ-7 Results

The load-deflection plot for CSJ-7, Fig. 3.20, is of the same general shape as CSJ-1, 2, and 3. The member load and midspan deflection increased uniformly without formation of a yield plateau. The test reached a maximum total load of 28.7 kips with only 3.3 in. of deflection at midspan. The load then dropped off from its peak much more rapidly than did the previous tests.

The bottom chord strain plot, Fig. 3.21, shows that these strains remained elastic over the majority of the cross-section.

The top chord strain at midspan is shown in Fig. 3.22. The top chord experienced little change in force up to a total load of approximately 14 kips. The top chord force then increased gradually under increasing applied load. All top chord strains remained in compression as the test progressed to its maximum load. Up to this point in the loading cycle the top chord behavior closely resembled that of tests CSJ-1, 2, and 3.

Failure of this specimen was by a sudden buckling of the top chord. The failure is reflected in the midspan displacement and top chord strain plots by the abrupt drop in the curves at approximately 28.7 kips of total load. Rather than the gradual drop in member load displayed by CSJ-1, 2, and 3, which failed by top chord yielding, the plots for CSJ-7 dropped immediately upon buckling of the top chord. The maximum total member load coincided with failure of the top chord.

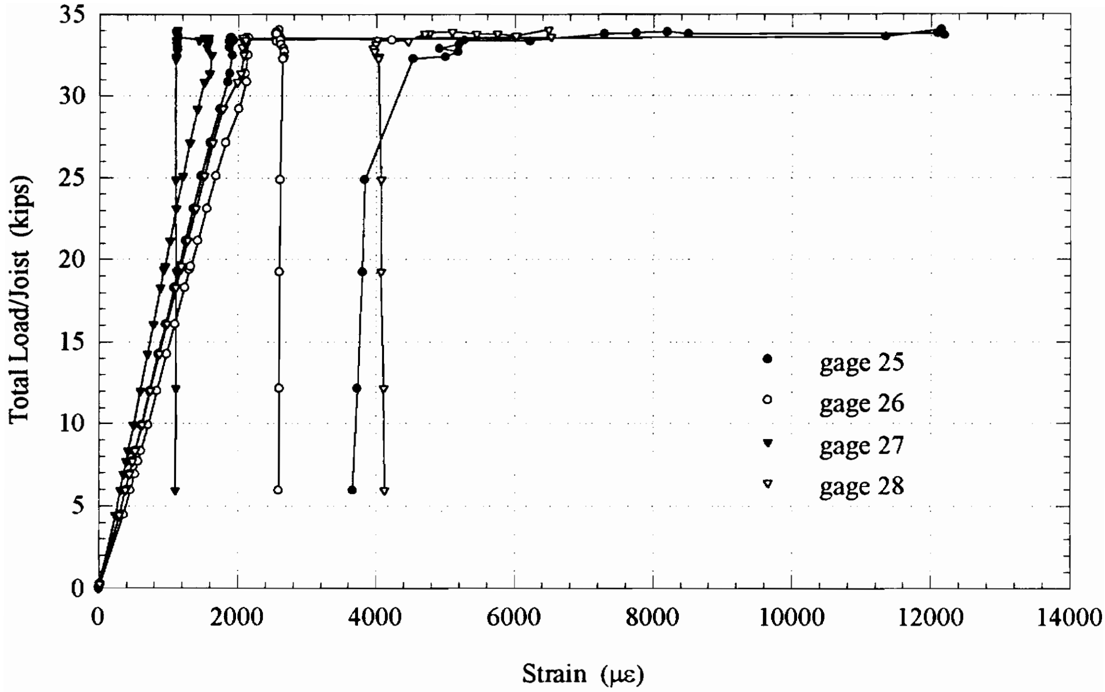



Figure 3.19 CSJ-6 - Total Load/Joist vs. Midspan Bottom Chord Strain

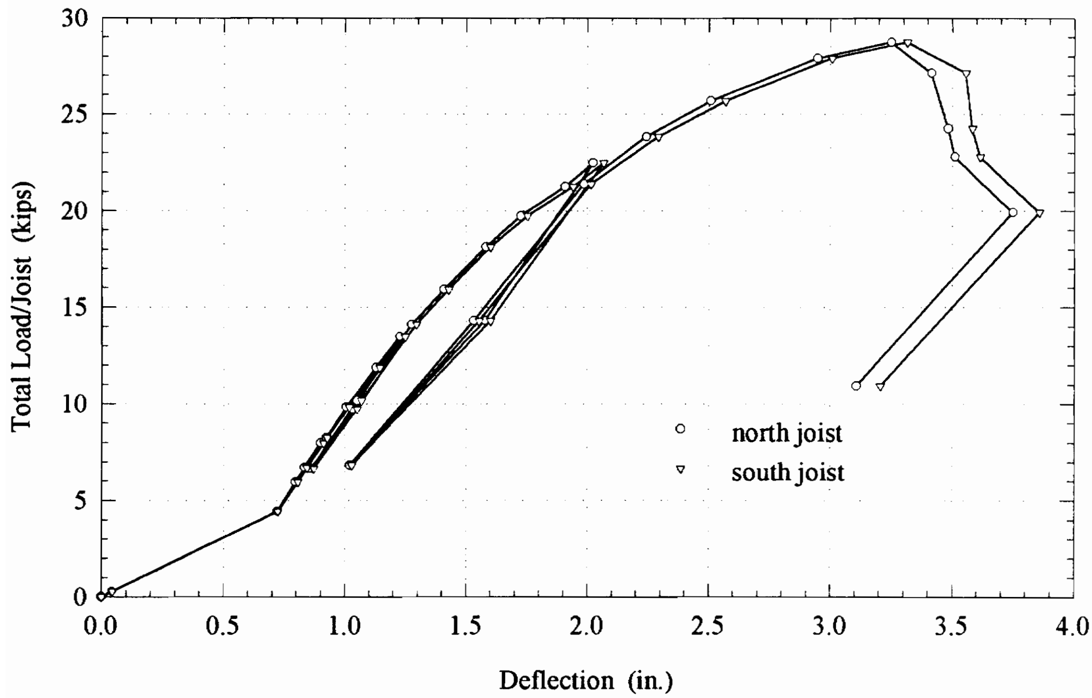



Figure 3.20 CSJ-7 - Total Load/Joist vs. Midspan Deflection

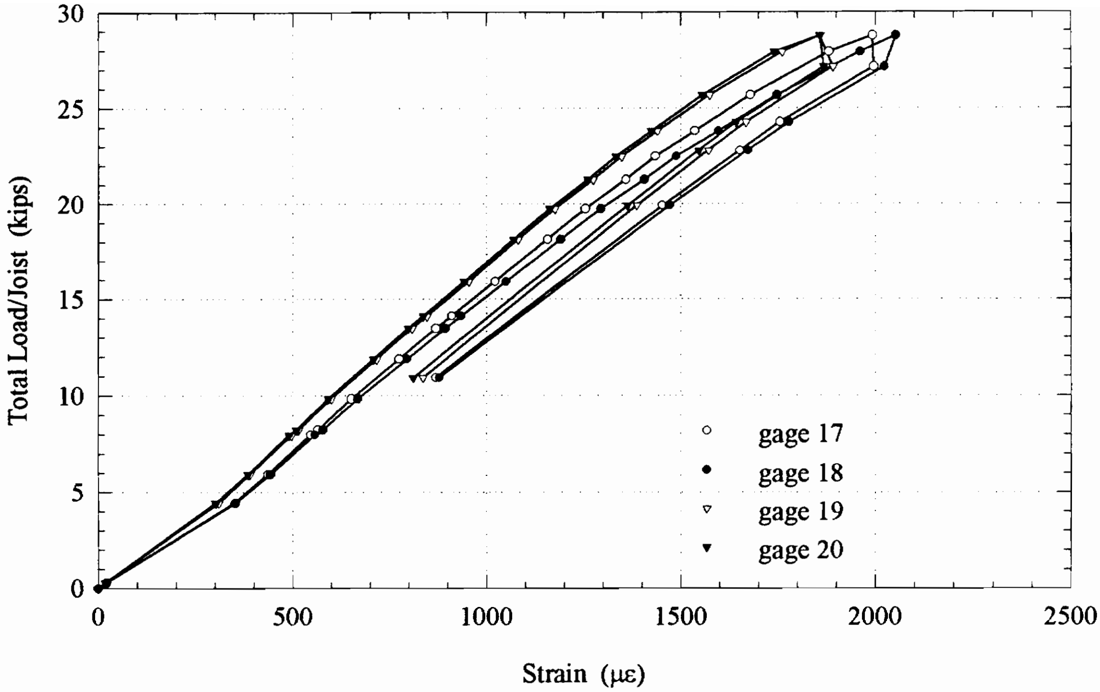



Figure 3.21 CSJ-7 - Total Load/Joist vs. Midspan Bottom Chord Strain

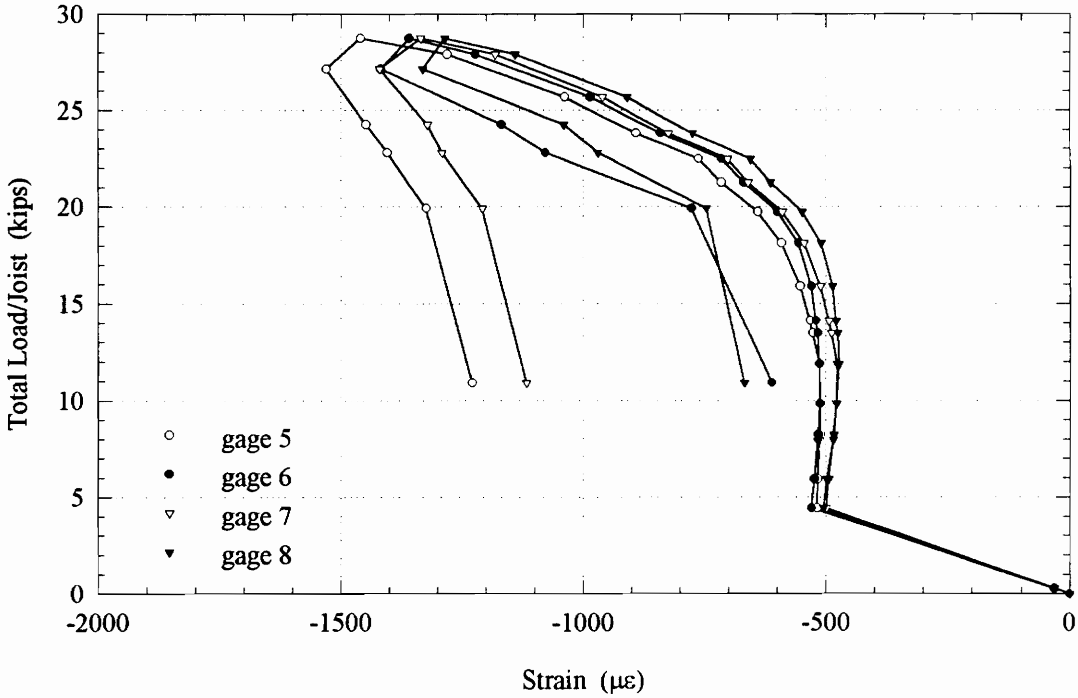



Figure 3.22 CSJ-7 - Total Load/Joist vs. Midspan Top Chord Strain

The shear studs for CSJ-7 were identical to those of CSJ-6, except that only six per half-span were used compared to eleven for the previous test. As expected, this specimen allowed substantially more slip at the concrete-top chord interface. Some whitewash flaking was observed on the underside of the outstanding legs of the top chord as slip increased and the studs rotated. Examination of the specimen after testing showed that many of the studs rotated at their base but none tore completely away from the top chord.

### 3.9 CSJ-8 Results

The critical aspects of CSJ-8 were nearly identical to those of the previous test. This was to be expected because of the similarity of their construction. The load-deflection plot, Fig. 3.23, had the rounded shape typical of the tests without a defined yield plateau.

The bottom chord strains for this test are shown in Fig. 3.24. The bottom chord response was similar to that of the previous test. However, the bottom chord yielded slightly at the outer fibers just prior to failure.

Under composite loading, the top chord strain plot was nearly vertical up to approximately 10 kips of total load. The strains then began to increase as connection deteriorated at the slab-chord interface. The top chord became increasingly active in resisting applied load as the test progressed. The shape of the top chord strain plot was similar to that of the previous test as shown in Fig. 3.25.

Again failure of the specimen was caused by buckling of the top chord. The sudden nature of the collapse is evident in the concurrent, abrupt drop in the midspan deflection and top chord strain plots at approximately 28.3 kips of total load.

The self-drilling screws used in this test were similar to those for CSJ-1 and CSJ-2. As loading increased on the specimen, the screws were observed to rotate at their base and twist the top chord angle. During testing none of the screws ruptured or pulled out of the base metal.

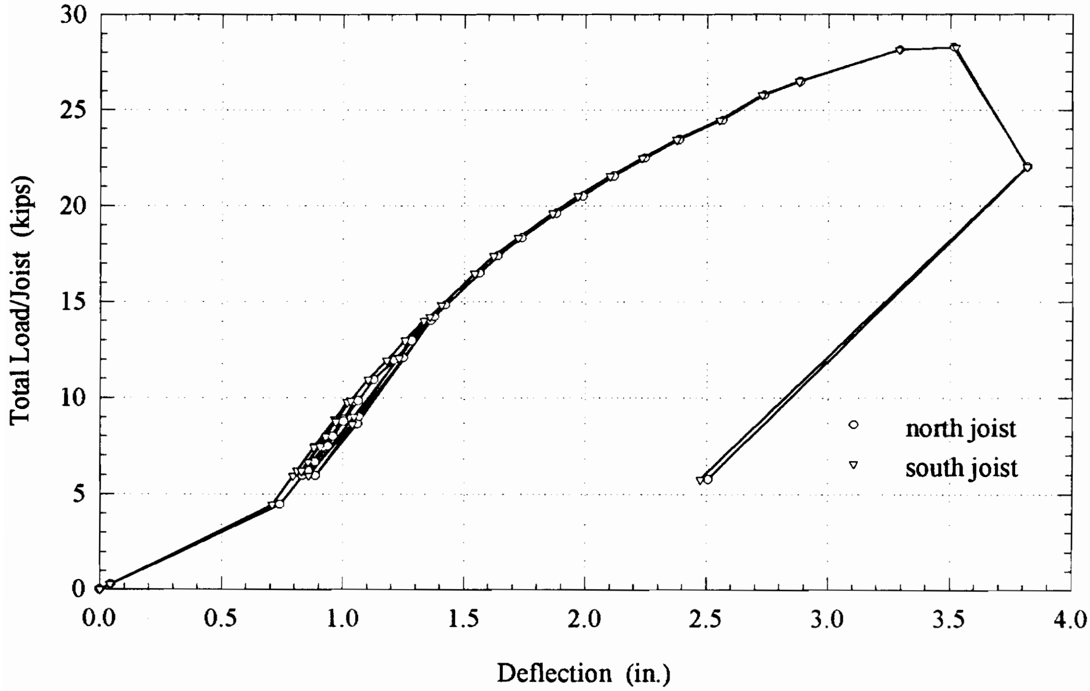



Figure 3.23 CSJ-8 - Total Load/Joist vs. Midspan Deflection

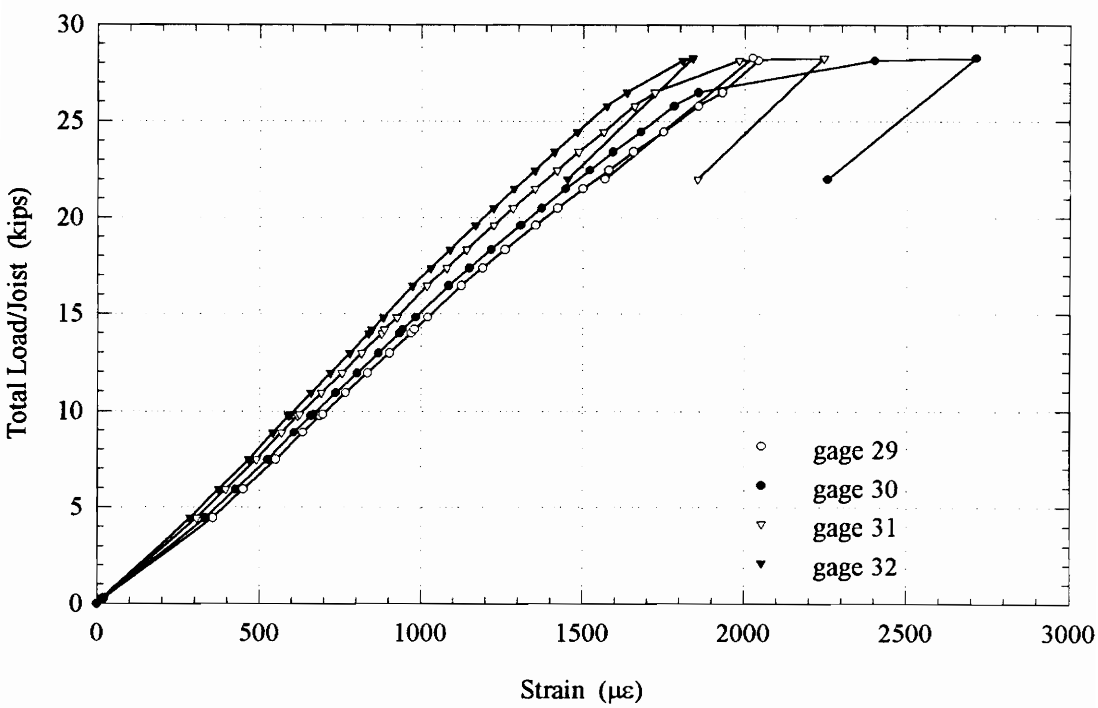



Figure 3.24 CSJ-8 - Total Load/Joist vs. Midspan Bottom Chord Strain

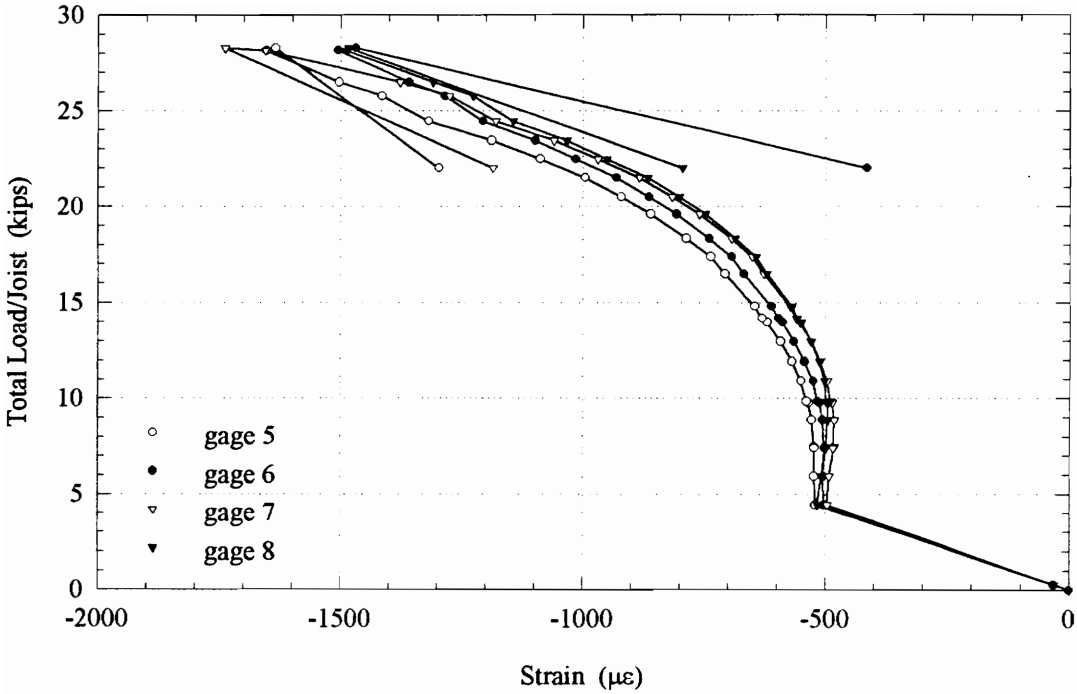



Figure 3.25 CSJ-8 - Total Load/Joist vs. Midspan Top Chord Strain

# CHAPTER 4

# ANALYSIS AND INTERPRETATIONS

## 4.1 Analytical Models

Calculated moment capacities for the composite joists of this study are based on the ultimate strength models presented by Azmi (1972). These are shown slightly modified in Fig. 4.1. Two categories, "Over-Connected" and "Under-Connected", are distinguished by how the supplied amount of shear connection, $\Sigma Q$, compares to the yield force of the bottom chord, $T_y$. Under-connected joists have a shear connection force less than the bottom chord yield force ($\Sigma Q < T_y$); over-connected joists have a shear connection force greater than the bottom chord yield force ($\Sigma Q > T_y$). An amount of shear connection equal to the yield force of the bottom chord ($\Sigma Q = T_y$), is the transition point between under-connected and over-connected and is assigned the value 100% shear connection. This condition is shown as a third category termed "Balanced." It should be noted that the balanced case is just a unique situation between under-connected and over-connected where the supplied shear connection, $\Sigma Q$, balances the yield force of the bottom chord, $T_y$. The balanced model is only included to show its central position and to clearly define the configuration against which the others are measured.

Among the three major categories are five cases, numbered from least composite to most composite. The top chord force can be either tensile or compressive depending on the classification of the joist. For the under-connected cases (Cases 1 and 2) equilibrium of horizontal forces requires that the top chord be in compression, whereas for the over-connected cases (Cases 4 and 5) additional tension in the top chord balances the force in the slab. Again, Case 3 is just a unique situation within Cases 2 and 4 where the supplied shear connection force, $\Sigma Q$, matches the bottom chord yield force, $T_y$. Accordingly, the equation defining the top chord force, $N$, in Cases 2 and 4, results in $N = 0$, indicating no net force in the top chord. Case 3 can be viewed as the upper limit of under-connection and lower limit of over-connection. The top chord force is exactly midway between tension and compression.

The degree to which the joist is under- or over-connected determines the magnitude of the top chord force. It is assumed in the models that the top chord will be utilized to the extent necessary to satisfy horizontal force equilibrium, not exceeding $N_{max}$, the maximum compression or tension force achievable in the top chord. With Case 1 and

Case 1. $\Sigma Q + N_{max} \leq T_y$

$C = \Sigma Q$
$N = N_{cr}$
$T = \Sigma Q + N_{cr}$

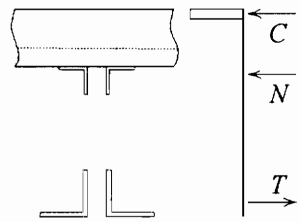
Case 2. $\Sigma Q + N_{max} \geq T_y$

$C = \Sigma Q$
$N = T_y - \Sigma Q$
$T = T_y$

**UNDER - CONNECTED**

$\Sigma Q \leq T_y$

$N$ is compression force



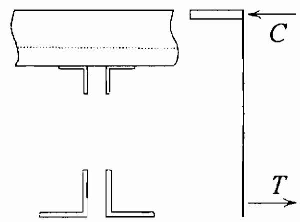

Case 3. $\Sigma Q = T_y$

$C = \Sigma Q$
$N = 0$
$T = T_y$

**BALANCED**

$\Sigma Q = T_y$

$N = 0$




Case 4. $\Sigma Q \leq T_y + N_{max}$

$C = \Sigma Q$
$N = \Sigma Q - T_y$
$T = T_y$

Case 5. $\Sigma Q \geq T_y + N_{max}$

$C = T_y + N_y$
$N = N_y$
$T = T_y$

**OVER - CONNECTED**

$\Sigma Q \geq T_y$

$N$ is tension force

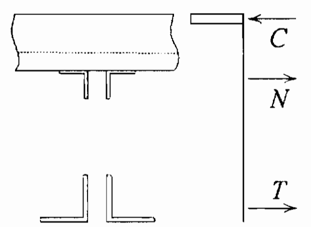



Figure 4.1 Flexural Models (Adapted from Azmi (1972))

Case 5, the most under-connected and over-connected, the top chord is fully developed in compression or tension respectively. Cases 2, 3, and 4, the intermediate cases, require only a portion of the force available in the top chord for equilibrium of forces. The variation in the top chord force at failure with each case is summarized in Fig. 4.2.

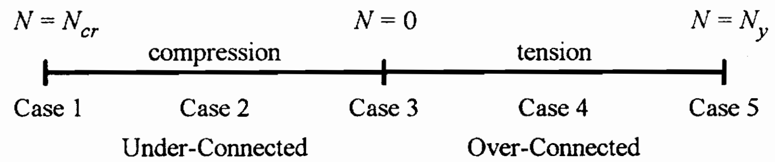



Figure 4.2 Top Chord Force at Failure

Fig. 4.1 shows that in each case two of the three force components reach their maximum possible value at failure. In the first case, compression components $C$ and $N$ are maximized. The slab compression force and bottom chord tension force, $C$ and $T$, attain their limiting values in Cases 2, 3, and 4. With Case 5, chord forces $N$ and $T$ reach their maximum tension forces, $N_y$ and $T_y$. The remaining force is at somewhat less than its limiting value and can be found from the equilibrium of horizontal forces.

For typical steel-concrete composite members it is often assumed, for analysis purposes, that all loads are resisted by the composite section regardless of the method of construction. For the (unshored) composite joists in this study, it was decided to distinguish loads resisted by the steel alone from those resisted by the composite section, and to conduct the analysis accordingly, because the role of the top chord in controlling failure is better depicted. Also, separation of the loading sequence closely resembles the experimental loading and measurement. The loading stages leading to the ultimate strength models depicted in Fig. 4.1 are shown in Fig. 4.3 and described below.

The first loading stage is the dead load stage. Dead loads include the joist self-weight, deck weight, and concrete weight. Because unshored construction was used for the tests, dead loads are supported by the structural members. Consequently, forces $N_d$ and $T_d$ are present in the top and bottom chords (but no compression force exists in the slab) prior to applying load, as illustrated in the leftmost portion of Figs. 4.3a and 4.3b. The subscript $d$ refers to dead load. Theoretically, chord forces due to dead load are equal. Typically the top chord cross-sectional area is smaller than that of the bottom chord, so the dead load strain is somewhat greater in the top chord.

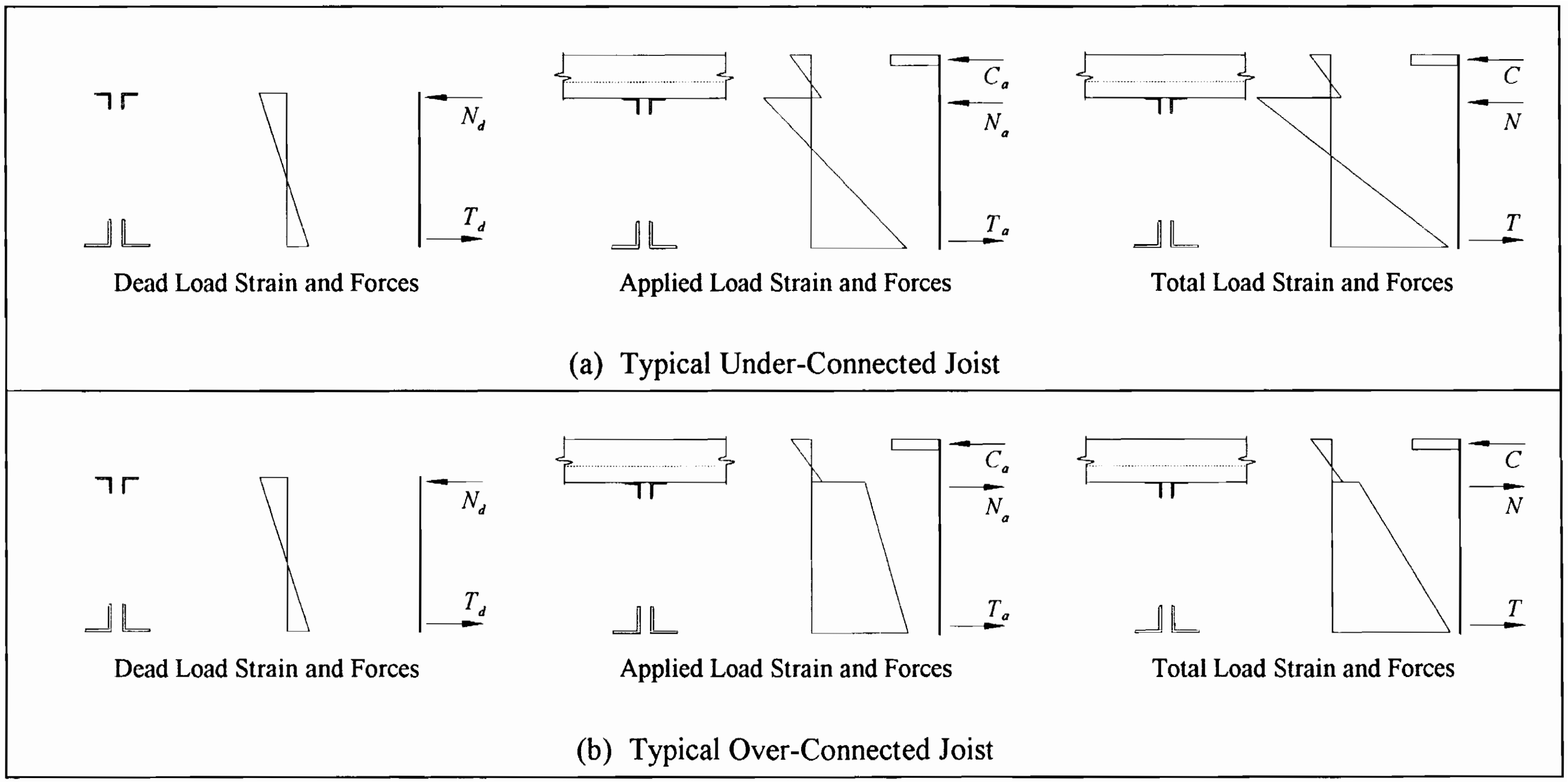



Figure 4.3 Composite Joist Loading Stages

The second loading stage, the applied load stage, is shown in the center of Figs. 4.3a and 4.3b. Applied loads are those loads imposed after the concrete has cured and carried by the composite section. Chord strains under applied loading may be greater or less than the yield strain of the material, depending on the joist configuration. Top and bottom chord forces resisting the applied load are $N_a$ and $T_a$, where the subscript $a$ is used for applied loads. Under applied loading, the bottom chord force is always tension, whereas the top chord force may be either tension or compression. Furthermore, the magnitude of the top chord force from applied load may be either greater or less than that from dead load. The figure shows that the slab compressive force, $C_a$, is added to the model at the applied load stage. A discontinuity exists between the slab and the joist due to horizontal slip at the interface.

The applied load stage is combined with the dead load stage to obtain the total load stage, shown in the rightmost portion of Figs. 4.3a and 4.3b. No new loads are added at this stage; it merely describes the superposition of the two previous stages. Because there is no slab force at the dead load stage, the slab force at the total load stage is identical to that at the applied load stage. Fig 4.1 defines the internal force components at the total load stage.

### 4.2 Analysis Methods

Two series of computations were carried out in evaluating the joists, the first based on calculated (predicted) values, and the second based on experimental (measured) values. The variables which are analyzed in each series of calculations are

$C, N, T$ - internal forces
$M$ - midspan moment
$P$ - member load

Additionally, the analysis follows the loading stages described in the previous section in that calculated and experimental values of these variables are found at each stage. The experimental values are compared to the calculated values to test the accuracy of the flexural models. The notation used for the calculated and experimental variables at each loading stage is summarized in Table 4.1.

Predicted values are calculated at the dead load stage and at the total load stage. The predicted applied load variables are found by subtracting the dead load forces and moments from the total load forces and moments.

Table 4.1 Summary of Joist Analysis Notation

| | | Loading Stage | | |
|---|---|---|---|---|
| | | Dead | Applied | Total |
| General | Slab Force | - - | $C_a$ | $C$ |
| | Top Chord Force | $N_d$ | $N_a$ | $N$ |
| | Bottom Chord Force | $T_d$ | $T_a$ | $T$ |
| | Midspan Moment | $M_d$ | $M_a$ | $M$ |
| | Member Load | $P_d$ | $P_a$ | $P$ |
| Calculated | Slab Force | - - | $C_{ac}$ | $C_c$ |
| | Top Chord Force | $N_{dc}$ | $N_{ac}$ | $N_c$ |
| | Bottom Chord Force | $T_{dc}$ | $T_{ac}$ | $T_c$ |
| | Midspan Moment | $M_{dc}$ | $M_{ac}$ | $M_c$ |
| | Member Load | $P_{dc}$ | $P_{ac}$ | $P_c$ |
| Experimental | Slab Force | - - | $C_{ae}$ | $C_e$ |
| | Top Chord Force | $N_{de}$ | $N_{ae}$ | $N_e$ |
| | Bottom Chord Force | $T_{de}$ | $T_{ae}$ | $T_e$ |
| | Midspan Moment | $M_{de}$ | $M_{ae}$ | $M_e$ |
| | Member Load | $P_{de}$ | $P_{ae}$ | $P_e$ |

The ultimate load calculations are typical strength analyses in which the internal forces are the starting values, and the moment capacity of the section is to be determined using the ultimate strength models from Fig. 4.1. Knowing the moment capacity, the member load which can be carried is back calculated using statics. This progression of calculations can be shown diagrammatically as,

$$C_c, N_c, T_c \xrightarrow{\text{model}} M_c \xrightarrow{\text{statics}} P_c$$

where the subscript $c$ indicates calculated values. These calculations can be performed before conducting a test because the starting values are predicted values.

Experimental values are measured at the dead load stage and the applied load stage. The applied load response is superimposed on the dead load response to obtain the experimental total forces and moments, which can be compared to the predicted values previously calculated.

The evaluation of the experimental applied load is the reverse of the previous method and can be shown diagrammatically as,

$$P_{ae} \xrightarrow{\text{statics}} M_{ae} \xrightarrow{\text{model}} C_{ae}, N_{ae}, T_{ae}$$

where the subscript $ae$ is used because the evaluation is performed at the applied load stage using experimental values. The experimental applied member load, $P_{ae}$, is converted to midspan moment using statics. Knowing the moment, the internal resisting forces which must be present can be back calculated using the appropriate flexural model. This sequence of calculations begins with the experimental member load. Therefore, it cannot begin until after the test results are obtained.

The majority of the joists for this study are under-connected. Four of the specimens are classified as Case 1, three as Case 2, and one as Case 4. Because no tests were conducted for Case 5, less explanation of the analysis methodology for this case is given in the following sections. This report is an analysis of experimental results and as such does not include any load factors, resistance factors, or factors of safety.

## 4.3 Calculated Values

### 4.3.1 Calculated Shear Connection

For partially composite beams the slab force is controlled by the shear connection capacity rather than the compressive strength of the concrete. Similarly, for those composite joist cases where the compression force $C$ is taken to its limit (Cases 1, 2, 3, and 4), it is assumed in the models that the concrete crushing strength is greater than the shear connection force. Because the shear connection controls the slab compressive force, it can be said that $C_{ac} = \Sigma Q_{ac}$ and $C_c = \Sigma Q_c$. Also, because the slab compressive force does not occur at the dead load stage, the slab compressive force under applied load is interchangeable with that under total load, that is, $C_{ac} = C_c$ and $\Sigma Q_{ac} = \Sigma Q_c$.

The first step in analyzing a composite joist is calculation of the shear connection force and the bottom chord yield force to enable the proper classification to be selected. In estimating the shear connection force of the test specimens, both analytical and experimental techniques were used. The common forms of shear connection were predicted analytically using previously established formulas and procedures. For the less common shear connectors, push-out test results were used to determine the amount of shear connection.

Calculation of the shear transfer capacity was made with benefit of knowing the observed failure mode of the full-size specimen. This would not be the case in a typical design situation; therefore, methods to reliably predict shear connection behavior should continue to be pursued. It should be emphasized that, while evaluation of the connectors is an important aspect of the report, investigation of the over-all behavior of the composite joists is the primary objective.

Table 4.2 CSJ-1 and CSJ-2 Shear Connection Parameters

| Test Parameter | push-out | CSJ-1 | CSJ-2 |
|---|---|---|---|
| deck | 1.0C | 1.0C | 1.5VL |
| slab thickness, in. | 4.0 | 3.0 | 3.0 |
| $f'_c$, psi | 4100 | 3700 | 3600 |
| base metal thickness, in. | 0.123 | 0.170 | 0.170 |

Estimation of shear connection for CSJ-1 and 2 was taken from push-out test results of the companion study by Hankins (1994). A comparison of the relevant parameters, Table 4.2, shows that the full-scale tests did not significantly differ from the push-out test configuration. Fastener rupture was the governing failure mode in all of the push-out specimens. It was assumed that the concrete compressive strength of the full-size specimens was not sufficiently less than that of the average push-out test to result in a concrete-related failure. Therefore, the value 2.93 kips/screw found in the push-out study was used without modification in predicting the shear capacity for CSJ-1 and CSJ-2. With 14 connectors per half span, the CSJ-1 and 2 predicted shear capacity is

$$\Sigma Q_c = 14 \times 2.93 = 41.0 \text{ kips}$$

Push-out test results in a previous study by Strocchia et al. (1991) provided the basis for estimating the shear connection for CSJ-3. Both the push-out test and the full-size test used the same deck profile connected to the base member by puddle welds. Based on the calculated strength of the puddle welds, it was anticipated that the welds would govern the capacity of the specimens, rather than a concrete rib shear failure. The observed failure mode in both cases was rib shear failure at the plane between the solid portion and the ribbed portion of the concrete slab. Strocchia found that each rib of the push-out test (push-out series 12, specimen 12A) carried 5.6 kips at failure. The push-out test had a concrete strength of 4800 psi while the full-size specimen had 3600 psi concrete. It was thought that any reduction for lower concrete strength in the full-size test would likely be offset by the wider and taller slab dimensions and increased shear resistance provided by the shear angle connector. Therefore, the value recorded in the previous study was used without modification for CSJ-3. For CSJ-3, which had 24 ribs per half span, the resulting total shear connection is

$$\Sigma Q_c = 24 \times 5.6 = 134.4 \text{ kips}$$

Similar push-out tests by Unterkofler et al. (1989) indicate that this is a reasonable value.

Prior to testing it was not known conclusively how CSJ-4 would behave. Based on previous findings (Wang and Kaley 1967, Cran 1971), it was anticipated that the embedment of the longitudinal angle would be sufficient to develop the bottom chord and would not control the failure. If this were true, the joist would have been classified as over-connected and could be either Case 4 or Case 5, depending on the extent to which the shear connection exceeded the bottom chord yield force. The test results show that the hypothesized degree of shear connection and associated mode of failure were incorrect. The specimen failed by loss of shear connection well before bottom chord yield. For purposes of this discussion, the theoretical shear connection is not predicted but is taken as that which was found to be provided during testing. That is

$$\Sigma Q_c = \Sigma Q_{ae} = 179.6 \text{ kips}$$

The measured shear connection, $\Sigma Q_{ae}$, will be discussed in a subsequent section.

The predicted shear connection value for CSJ-5 was based on the findings of Sublett et al. (1992). These tests indicated that, among the methods evaluated, the basic stud strength from the Eurocode 4 specification ("Eurocode" 1992), combined with the reduction for metal deck reported by Lawson (1993), best represented the experimental data. The solid slab strength from the Eurocode 4 specification is

$$q = 0.7(\pi d^2 / 4) f_u$$

where

$d$ = stud diameter, in.

$f_u$ = ult. stud strength, ksi

Headed shear studs typical of those used in this test have been found to have a measured tensile stress $f_u$ = 65 ksi. If this value is assumed for CSJ-5,

$$q = 0.7(\pi \cdot 0.75^2 / 4)65 = 20.1 \text{ kips}$$

The applicable stud strength reduction factor from the Lawson study is

$$r_p = \frac{0.75}{\sqrt{N}} \frac{b_a}{D_p} \frac{h}{h + D_p} \leq 1.0$$

where

$r_p$ = stud strength reduction factor for metal deck

$b_a$ = average rib width, in.

$D_p$ = profile height, in.

$h$ = height of shear connector, in.

$N$ = number of shear connectors per rib

Substituting the values for Vulcraft 1.5VL deck,

$$r_p = \frac{0.75}{\sqrt{1}} \frac{2.125}{1.5} \frac{3}{3 + 1.5} = 0.708$$

The predicted stud strength is then the basic stud strength times the reduction factor for metal deck,

$$Q_c = q r_p = 20.1 \times 0.708 = 14.2 \text{ kips}$$

and the total shear connection for CSJ-5 is

$$\Sigma Q_c = 6 \times 14.24 = 85.4 \text{ kips}$$

Although CSJ-6 also used headed shear studs, the connector strength was not predicted in the same manner as the previous test because 1/2 in. dia. studs were not investigated in the study by Sublett et al. Instead, the nominal shear connector strength was predicted using the provisions of the AISC LRFD specification ("Load" 1986). Individual shear connector strength is given as,

$$Q_n = 0.5 A_{sc} \sqrt{f'_c E_c} \leq A_{sc} F_u$$

where

$A_{sc}$ = cross-sectional area of stud shear connector, in.$^2$

$f'_c$ = compressive strength of concrete, ksi

$F_u$ = tensile strength of stud shear connector, ksi.

$E_c$ = modulus of elasticity of concrete, ksi

The concrete modulus can be taken as

$$E_c = w^{1.5} \sqrt{f'_c} = (145)^{1.5} \sqrt{4.2} = 3578 \text{ ksi}$$

where $w$ is the unit weight of concrete expressed in pcf and $f'_c$ is expressed in ksi. Substituting the values for CSJ-6, the individual shear connector strength is the smaller of

$$q = 0.5 A_{sc} \sqrt{f'_c E_c} = 0.5 (0.1963) \sqrt{4.2 \times 3578} = 12.0 \text{ kips}$$

or, assuming $F_u$ the same as in the previous test,

$$q = A_{sc} F_u = 0.1963 \times 65 = 12.8 \text{ kips}$$

therefore the first expression controls the shear connector capacity. The strength reduction factor for metal deck oriented perpendicular to the joist span from the LRFD specification is

$$RF = \left( \frac{0.85}{\sqrt{N_r}} \right) \left( \frac{w_r}{h_r} \right) \left( \frac{H_s}{h_r} - 1.0 \right) \leq 1.0$$

where

$h_r$ = nominal rib height, in.

$H_s$ = length of stud connector after welding, in.

$N_r$ = number of stud connectors in one rib

$w_r$ = average width of concrete rib or haunch, in.

Application of this equation to Vulcraft 1.0C metal deck results in

$$RF = \left( \frac{0.85}{\sqrt{1}} \right) \left( \frac{2.0}{1.0} \right) \left( \frac{3.0}{1.0} - 1.0 \right) = 3.4 > 1.0$$

therefore no reduction. The recommended minimum flange thickness from Goble (1968) is approximately

$$\text{minimum } t_f = 0.4 \text{ (stud dia.)}$$

For CSJ-6, using 0.123 in. thick top chord angles and 1/2 in. dia. studs results in a provided flange thickness (in terms of stud dia.),

$$\text{actual } t_f = 0.246 \text{ (stud dia.)}$$

The reduction for thin base metal is the ratio of actual flange thickness to the recommended minimum flange thickness,

$$R_t = \frac{0.246}{0.4} = 0.615$$

Including this reduction, the capacity for individual 1/2 in. dia. studs is

$$Q_c = qR_t = 12.0 \times 0.615 = 7.38 \text{ kips}$$

The combined shear transfer capacity of CSJ-6, which contained 11 studs per half span, is

$$\Sigma Q_c = nQ_c = 11(7.38) = 81.2 \text{ kips}$$

Like CSJ-6, CSJ-7 used 1/2 in. dia. headed shear studs placed in Vulcraft 1.0C deck. In contrast to the previous test, however, CSJ-7 contained only 6 studs per half-span and had a lower concrete compressive strength. Using the AISC LRFD specification ("Load" 1986), the individual shear connector strength is governed by

$$q = 0.5A_{sc}\sqrt{f'_c E_c} = 0.5(0.1963)\sqrt{3.6 \times 3313} = 10.7 \text{ kips}$$

where the modulus of elasticity of concrete is

$$E_c = w^{1.5}\sqrt{f'_c} = (145)^{1.5}\sqrt{3.6} = 3313 \text{ ksi}$$

Including the same reduction for thin base metal as the previous test, the calculated shear capacity per connector is

$$Q_c = qR_t = 10.7 \times 0.615 = 6.58 \text{ kips}$$

and

$$\Sigma Q_c = nQ_c = 6(6.58) = 39.5 \text{ kips}$$

is the predicted horizontal transfer capacity per shear span.

The shear connector in CSJ-8 was similar to that used in CSJ-1 and 2 and again the screw strength was based on push-out test results. Hankins (1994) reported an average value of 3.69 kips/screw for six push-out tests. The observed failure mode in each case was excessive screw deformation followed by rupture. Average concrete strength for the push-out tests was 4200 psi. It was thought that the lower slab strength of the full-size specimen would not significantly alter its behavior compared to the push-out tests. Base metal thickness, deck type, and slab thickness matched that used in the push-out tests. The predicted shear connection is the predicted stud strength times the number of studs in a half-span

$$\Sigma Q_c = 9 \times 3.69 = 33.2 \text{ kips}$$

The calculated shear transfer capacity, $\Sigma Q_c$, for each test is summarized in Table 4.3.

Table 4.3 Joist Classification

| | $\Sigma Q_c$ (kips) | $N_{max}$ (kips) | $T_y$ (kips) | $\frac{\Sigma Q_c}{T_y}$ | CASE |
|---|---|---|---|---|---|
| CSJ-1 | 41.0 | 50.23 | 125.2 | 0.33 | 1 |
| CSJ-2 | 41.0 | 49.94 | 128.3 | 0.32 | 1 |
| CSJ-3 | 134.4 | 273.28 | 490.2 | 0.27 | 1 |
| CSJ-4 | 179.6 | 101.50[a] | 270.3 | 0.66 | 2 |
| CSJ-5 | 85.4 | 40.68[b] | 108.6 | 0.79 | 2 |
| CSJ-6 | 81.2 | 42.48 | 75.8 | 1.07 | 4 |
| CSJ-7 | 39.5 | 40.85 | 74.4 | 0.53 | 2 |
| CSJ-8 | 33.2 | 39.58 | 74.2 | 0.45 | 1 |

[a] Based on nominal yield stress, $F_y = 50$ ksi

[b] Based on nominal yield stress, $F_y = 36$ ksi

$\Sigma Q_c$ Calculated shear connector capacity, kips

$N_{max}$ Predicted top chord capacity in either tension or compression, kips

$T_y$ Bottom chord yield force taken from tensile coupon results, kips

### 4.3.2 Calculated Chord Forces

Knowledge of the bottom chord yield force is necessary to determine whether a joist is under- or over-connected. The bottom chord yield strength was found by averaging the results of the tensile coupon tests reported in Chapter 3. This calculation is summarized for each test in Table 4.4. The bottom chord yield strength, $T_y$, is also listed in Table 4.3 adjacent to the predicted shear connector strength, $\Sigma Q_c$. The degree to which a joist is under- or over-connected can be represented by the ratio $\Sigma Q_c/T_y$. A ratio less than 1.0 indicates an under-connected configuration, while a ratio greater than 1.0 indicates an over-connected configuration. A comparison of the predicted shear connector strength and the bottom chord yield force shows that all of the specimens except CSJ-6 were under-connected.

Having determined whether the specimen is under- or over-connected, it is further classified by considering the contribution of the top chord. The specimens are divided into five cases which depend on the maximum tension force available in the top chord if the joist is over-connected and the maximum compression force available in the top chord if the joist is under-connected. The symbol $N_{max}$ denotes the maximum available tension or compression force. For over-connected joists the top chord is in tension at failure and the top chord capacity ($N_{max}$) is the yield force $N_y$. For under-connected joists the top chord is in compression at failure and the top chord capacity ($N_{max}$) is the buckling load $N_{cr}$. Using measured or estimated material properties, the top chord yield force is easily determined. Several complications arise, however, in predicting the top chord buckling load. These are described in the following paragraphs.

Accurately modeling the top chord boundary conditions is difficult using simple computation techniques. Although often assumed to be pin ended members, a complicated stress state exists at the ends of the top chord segments due to intersecting web forces, continuity of the top chord, and inherent fixity of the joint. End conditions are not truly pinned nor fixed at the panel points. Yielding of the top chord during testing was observed always to begin at the panel points and progress toward the center of the member.

The top chord loading is also complex. Horizontal shear forces are transferred at the steel-concrete interface by the shear connectors. Hence concentrated forces exist in the top chord at the base of the shear connector. The shear connectors produce both axial forces and concentrated moments in the top chord at the attachment point. In computing

Table 4.4 Top and Bottom Chord Yield Forces

| | $A_{tc}$ (in.$^2$) | $A_{bc}$ (in.$^2$) | $F_{ytc}$ (ksi) | $F_{ybc}$ (ksi) | $N_y$ (kips) | $T_y$ (kips) |
|---|---|---|---|---|---|---|
| CSJ-1 | 0.9622 | 2.3760 | 52.2 | 52.7 | 50.23 | 125.22 |
| CSJ-2 | 0.9622 | 2.3760 | 51.9 | 54.0 | 49.94 | 128.30 |
| CSJ-3 | 4.9688 | 9.5000 | 55.0 | 51.6 | 273.28 | 490.20 |
| CSJ-4 | 2.0301 | 4.9688 | 50.0[a] | 54.4 | 101.50 | 270.30 |
| CSJ-5 | 1.13 | 2.0301 | 36.0[b] | 53.5 | 40.68 | 108.61 |
| CSJ-6 | 0.7080 | 1.2510 | 60.0 | 60.6 | 42.48 | 75.81 |
| CSJ-7 | 0.7080 | 1.2510 | 57.7 | 59.5 | 40.85 | 74.43 |
| CSJ-8 | 0.7080 | 1.2510 | 55.9 | 59.3 | 39.58 | 74.18 |

[a] Nominal yield stress, $F_y$ = 50 ksi

[b] Nominal yield stress, $F_y$ = 36 ksi

$A_{tc}$ Cross-sectional area of top chord, in.$^2$

$A_{bc}$ Cross-sectional area of bottom chord, in.$^2$

$F_{ytc}$ Measured yield stress of top chord, ksi

$F_{ybc}$ Measured yield stress of bottom chord, ksi

$N_y$ Top chord yield force $A_{tc}F_{ytc}$, kips

$T_y$ Bottom chord yield force $A_{bc}F_{ybc}$, kips the top chord compression capacity, the influence of rotational deformation is difficult to assess.

While the shear connectors introduce concentrated forces into the top chord, shear connectors also brace the top chord, tending to increase its capacity. A qualitative distinction can be made between horizontal and vertical restraint and the ability of a shear connector to resist movement in each direction. For example, the shear angles of CSJ-3 provided reliable lateral restraint but probably little vertical restraint. Headed shear studs prevent vertical separation between the slab and top chord as well as lateral movement. Robinson et al. (1978) noted that composite specimens with puddle welds rely on the bond between the deck and the concrete slab for vertical connection. Embossments in the metal deck help maintain the connection. In any case, quantifying the restraint provided by the shear connectors or the deck is complex. Also, when a composite member is loaded to failure, the bracing condition can change as the loading progresses.

Unless the placement of shear connectors is carefully controlled, adjacent top chord panels will likely have differing degrees of lateral restraint. The more connectors that are placed within top chord segments the better. Shear connectors placed at the panel points do little to increase the top chord buckling capacity. It can be concluded that a joist may not fail at the location of highest applied moment if the top chord capacity more than offsets the higher moment. An adjacent panel may have a lower moment but much reduced bending capacity due to lack of top chord restraint. These bracing considerations are of little consequence for joists with higher degrees of connection because often the highest top chord force for these joists occurs at the time of concrete placement.

Due to the complexity of accurately predicting the top chord buckling load, the capacity of the top chord ($N_{max}$) was taken as the top chord yield force ($N_y$) for the under-connected test joists as well as the over-connected joists. Although the top chord of some of the under-connected test joists reached the yield force, it should be emphasized that assuming the yield force, rather than some reduced buckling load, is unconservative. The value for $N_{max}$ (taken as $N_y$) is tabulated in Table 4.3, alongside $\Sigma Q_c$ and $T_y$. Assuming that the shear connection force and top chord capacity are accurately predicted, it can be determined that tests CSJ-1, 2, 3, and 8 are Case 1; CSJ-4, 5, and 7 are Case 2; and CSJ-6 is Case 4. (It will be discussed in a later section that, due to overestimating these properties, CSJ-7 is misclassified and should be Case 1.) Calculation of the top chord yield force $N_y$ is summarized in Table 4.4.

Calculated chord forces due to dead load were found by computing the dead load moment at midspan and dividing by the distance between chord centroids,

$$N_{dc} = \frac{M_{dc}}{e'} \; (= T_{dc})$$

$M_{dc}$ is the calculated midspan moment due to the uniformly distributed dead load of the joist, deck, and concrete slab, and will be discussed further in the next section.

The calculated chord forces at failure, $N_c$ and $T_c$, can be found directly using the defining equations in Fig. 4.1. (The subscript $c$ is added to the symbol from Fig. 4.1 to indicate a calculated value.) Terms involved in the calculation of the chord forces at failure are $\Sigma Q_c$, $N_{cr}$, $N_y$, and $T_y$. Shear connection $\Sigma Q_c$ and top chord buckling load $N_{cr}$ are taken as the values described in previous sections. Chord yield forces $N_y$ and $T_y$ are measured values from tensile coupons but could be easily estimated in a typical design situation. Calculation of the chord yield forces is summarized in Table 4.4.

The chord force available to resist applied loads is the difference between the force at failure and the force existing in the chord from dead load,

$$N_{ac} = N_c - N_{dc}$$

$$T_{ac} = T_c - T_{dc}$$

This reduces the capacity of the chord by the amount consumed by the dead load. The reduction is most important for the chord which is stressed to yield (or buckling) in a particular joist. For the joist configurations tested, the bottom chord force and top chord force due to dead load were as high as 15% and 30% of the respective yield forces, which indicates the importance of accounting for the dead load. The top chord and bottom chord forces for each loading stage are tabulated in Tables 4.5 and 4.6 respectively. The chord yield forces (from tensile coupon tests) are shown in the first column of each table for comparison.

### 4.3.3 Calculated Moment Capacities

Predicted moment capacities are computed using the flexural models developed by Azmi (1972), described in Section 4.1. Typical under-connected and over-connected cases are shown in Fig. 4.4. The strength of the under-connected joists is derived from the internal resisting couples formed by $C_c$ and by $N_c$ separated from tension force $T_c$ a distance $e$ and $e'$ respectively. For the over-connected joists, chord forces $N_c$ and $T_c$,

Table 4.5 Calculated and Experimental Top Chord Forces

| | $N_y$ (kips) | $N_{dc}$ (kips) | $N_{ac}$ (kips) | $N_c$ (kips) | $N_{de}$ (kips) | $N_{ae}$ (kips) | $N_e$ (kips) |
|---|---|---|---|---|---|---|---|
| CSJ-1 | 50.23 | 15.36 | 34.9 | 50.23 | 13.5 | 36.8 | yield |
| CSJ-2 | 49.94 | 13.23 | 36.7 | 49.94 | 9.5 | 40.4 | yield |
| CSJ-3 | 273.28 | 35.84 | 237.4 | 273.28 | 30.0 | 243.3 | yield |
| CSJ-4 | 101.50[a] | 14.00 | 76.7 | 90.72 | 9.3 | 0.3 | 9.6 |
| CSJ-5 | 40.68[b] | 15.17 | 8.0 | 23.18 | 13.5 | 0.8 | 14.3 |
| CSJ-6 | 42.48 | 11.59 | -17.0 | -5.39 | 9.8 | -11.1[c] | -1.3 |
| CSJ-7 | 40.85 | 11.59 | 23.3 | 34.93 | 10.6 | 17.6 | 28.2 |
| CSJ-8 | 39.58 | 11.59 | 28.0 | 39.58 | 10.5 | 21.8 | 32.3 |

[a] Based on nominal yield stress, $F_y$ = 50 ksi

[b] Based on nominal yield stress, $F_y$ = 36 ksi

[c] Negative values are tension

$N_{dc}$ Calculated top chord force due to dead load, kips

$N_{de}$ Experimental top chord force due to dead load, kips

$N_{ac}$ Calculated top chord force due to applied load, kips

$N_{ae}$ Experimental top chord force due to applied load, kips

$N_c$ Calculated top chord force due to total load, kips

$N_e$ Experimental top chord force due to total load, kips

$N_y$ Top chord yield force taken from tensile coupon results, kips

Table 4.6 Calculated and Experimental Bottom Chord Forces [a]

| | $T_y$ (kips) | $T_{dc}$ (kips) | $T_{ac}$ (kips) | $T_c$ (kips) | $T_{de}$ (kips) | $T_{ae}$ (kips) | $T_e$ (kips) |
|---|---|---|---|---|---|---|---|
| CSJ-1 | 125.22 | 15.36 | 75.9 | 91.25 | 15.4 | 81.8 | 97.2 |
| CSJ-2 | 128.30 | 13.23 | 77.7 | 90.96 | 11.7 | 87.5 | 99.2 |
| CSJ-3 | 490.20 | 35.84 | 371.8 | 407.68 | 33.8 | 400.5 | 434.3 |
| CSJ-4 | 270.30 | 14.00 | 256.3 | 270.30 | 14.8 | 178.7 | 193.5 |
| CSJ-5 | 108.61 | 15.17 | 93.4 | 108.61 | 15.0 | 92.4 | 107.4 |
| CSJ-6 | 75.81 | 11.59 | 64.2 | 75.81 | 11.2 | 64.6 | yield |
| CSJ-7 | 74.43 | 11.59 | 62.8 | 74.43 | 12.1 | 59.0 | 71.1 |
| CSJ-8 | 74.18 | 11.59 | 61.2 | 72.82 | 11.9 | 62.3 | yield |

[a] All values are tension

$T_{dc}$ Calculated bottom chord force due to dead load, kips

$T_{de}$ Experimental bottom chord force due to dead load, kips

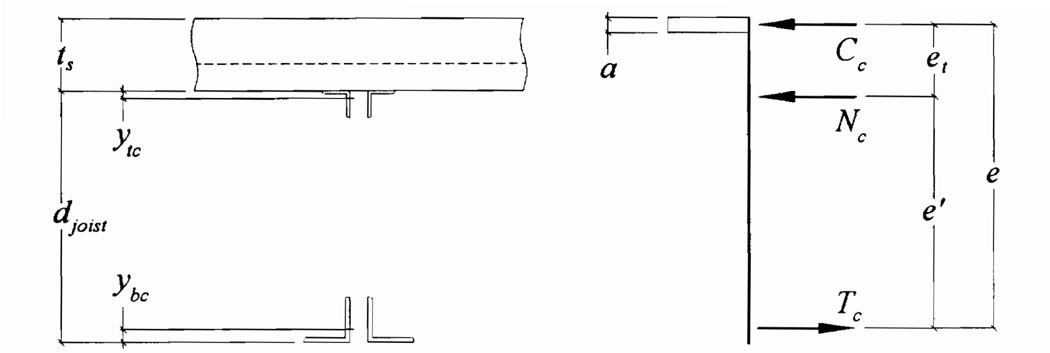
$T_{ac}$ Calculated bottom chord force due to applied load, kips

$T_{ae}$ Experimental bottom chord force due to applied load, kips

$T_c$ Calculated bottom chord force due to total load, kips

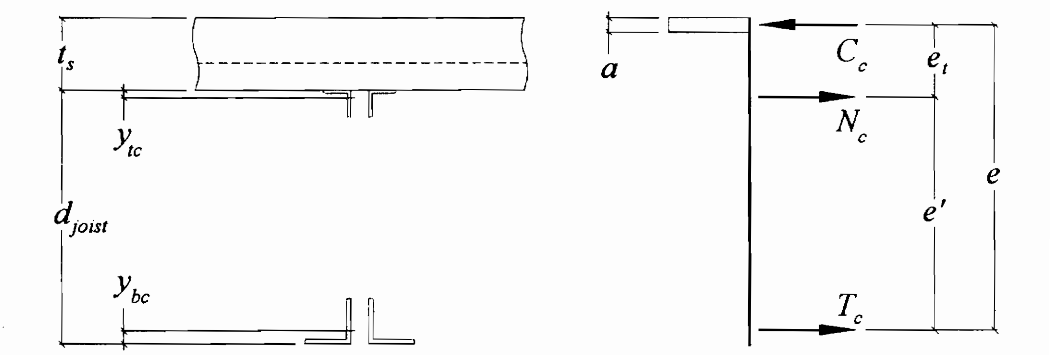
$T_e$ Experimental bottom chord force due to total load, kips

$T_y$ Bottom chord yield force taken from tensile coupon results, kips




$M_c = C_c \cdot e + N_c \cdot e'$ $\quad$ $M_c = C_c \cdot e_t + T_c \cdot e'$ $\quad$ $M_c = T_c \cdot e - N_c \cdot e_t$

(a) Under-Connected Joist




$M_c = C_c \cdot e - N_c \cdot e'$ $\quad$ $M_c = C_c \cdot e_t + T_c \cdot e'$ $\quad$ $M_c = T_c \cdot e + N_c \cdot e_t$

(b) Over-Connected Joist

Figure 4.4 Calculated Moment Capacity of Composite Joist separated from the slab compression resultant $C_c$ by lever arms $e$ and $e_t$, provide the internal moment.

Resultant chord forces $N_c$ and $T_c$ are assumed to act at the centroid of the chord cross-sectional area and not to depend on the degree to which the chord is stressed, as should be the case when the member is not fully developed. Consequently the distance between the chord forces, $e'$, does not change for a given joist, a simplification in the models. The Whitney equivalent stress block, of height $a = C_c / 0.85 f'_c b$, is assumed for distribution of concrete stresses. The resultant compressive force in the concrete acts at a distance $a/2$ measured from the top of the slab. Therefore, the lever arm between the concrete compressive force and the bottom chord force is computed as

$$e = d_{joist} + t_s - y_{bc} - a/2$$

and the separation between the concrete compressive force and the top chord centroid is

$$e_t = y_{tc} + t_s - a/2$$

The models assume that the depth of the concrete compressive block does not exceed the height of concrete over the deck ribs when oriented perpendicular to the joist. Table 4.7 gives the geometric properties of each cross-section.

Three moment equations can be written for the under-connected cases, Fig. 4.4a, and three for the over-connected cases, Fig. 4.4b. For a typical under-connected joist, these equations are

$$M_c = C_c \cdot e + N_c \cdot e'$$

$$M_c = C_c \cdot e_t + T_c \cdot e'$$

$$M_c = T_c \cdot e - N_c \cdot e_t$$

if moments are taken about the bottom chord, the top chord, and the resultant slab force, respectively. For the over-connected joists

$$M_c = C_c \cdot e - N_c \cdot e'$$

$$M_c = C_c \cdot e_t + T_c \cdot e'$$

$$M_c = T_c \cdot e + N_c \cdot e_t$$

are the corresponding equations used to describe the internal moment resistance. Note that equations containing the top chord force are the same except for the sign of this force. Also, identical equations result when moments are summed about the top chord. Combining the equations that include the top chord force, the equations reduce to

$$M_c = C_c \cdot e \pm N_c \cdot e'$$

Table 4.7 Parameters for Calculated Moment Capacity

| | $d_{joist}$ (in.) | $t_s$ (in.) | $y_{tc}$ (in.) | $y_{bc}$ (in.) | $e'$ (in.) | $a$ (in.) | $e$ (in.) | $e_t$ (in.) |
|---|---|---|---|---|---|---|---|---|
| CSJ-1 | 8 | 3 | 0.437 | 0.717 | 6.846 | 0.33 | 10.12 | 3.27 |
| CSJ-2 | 8 | 3 | 0.437 | 0.717 | 6.846 | 0.34 | 10.12 | 3.27 |
| CSJ-3 | 10 | 6 | 1.013 | 1.434 | 7.553 | 0.92 | 14.11 | 6.56 |
| CSJ-4 | 10 | 3 | 0.703 | 1.013 | 8.284 | 1.32 | 11.33 | 3.04 |
| CSJ-5 | 12 | 3½ | 0.448 | 0.703 | 10.849 | 0.57 | 14.51 | 3.66 |
| CSJ-6 | 18 | 4 | 0.420 | 0.560 | 17.020 | 0.57 | 21.16 | 4.14 |
| CSJ-7 | 18 | 4 | 0.420 | 0.560 | 17.020 | 0.32 | 21.28 | 4.26 |
| CSJ-8 | 18 | 4 | 0.420 | 0.560 | 17.020 | 0.27 | 21.30 | 4.28 |

$a$ Effective concrete flange thickness, in.

$d_{joist}$ Out-to-out depth of joist, in.

$e$ Distance between bottom chord centroid and resultant concrete force, in.

$e'$ Distance between centroids of top and bottom chords, in.

$e_t$ Distance between top chord centroid and resultant concrete force, in.

$t_s$ Total slab thickness, in.

$y_{bc}$ Distance from centroid of bottom chord to outer fiber, in.

$y_{tc}$ Distance from centroid of top chord to outer fiber, in.

$$M_c = C_c \cdot e_t + T_c \cdot e'$$

$$M_c = T_c \cdot e \pm N_c \cdot e_t$$

If application of these equations is limited to Cases 1 through 4, and it is assumed that the concrete crushing strength exceeds the shear connection strength, the resultant slab force can be replaced by the shear connection force ($C_c$ can be replaced by $\Sigma Q_c$), so that

$$M_c = \Sigma Q_c \cdot e \pm N_c \cdot e' \tag{4.1}$$

$$M_c = \Sigma Q_c \cdot e_t + T_c \cdot e' \tag{4.2}$$

$$M_c = T_c \cdot e \pm N_c \cdot e_t \tag{4.3}$$

The calculated total load moment can be found directly using these equations and the internal forces ($\Sigma Q_c$, $N_c$, $T_c$) found previously. Any of the moment equations can be used for a given under- or over-connected joist, as all will give the same result. The most convenient equation to use is that which contains the two forces that are at their limiting force in a particular case ($C$ and $N$ for Case 1; $C$ and $T$ for Cases 2, 3, 4; $N$ and $T$ for Case 5). These forces must be calculated first because the remaining force (which is somewhat less than its ultimate value) is always a combination of the maximized forces, and is found from horizontal force equilibrium.

Predicted dead load moments at midspan are calculated using the formula

$$M_{dc} = w_{dc} L / 8$$

where $w_{dc}$ is the uniformly distributed dead load of the system. Dead loads are the non-composite joist loads: concrete weight, deck weight, and joist self-weight. Joist weight per linear foot was provided by the fabricator.

The calculated moment resistance under applied load is the difference between the total load moment and the dead load moment

$$M_{ac} = M_c - M_{dc}$$

Alternatively, the calculated applied load moment can be found following a procedure similar to that of the calculated ultimate moment, but with the applied load force components ($\Sigma Q_{ac}$, $N_{ac}$, $T_{ac}$) substituted for the total load forces in the flexural model. Calculated moments at each loading stage are summarized in Table 4.8.

### 4.3.4 Calculated Member Load

Predicted member load is the final variable to be found in the initial sequence of calculations. The member load is back calculated from the calculated midspan moment assuming eight point loads equally spaced along the joist as shown in Fig. 4.5. This

Table 4.8 Calculated and Experimental Midspan Moment

| | $M_{dc}$, $M_{de}$ (ft-k) | $M_{ac}$ (ft-k) | $M_c$ (ft-k) | $M_{ae}$ (ft-k) | $M_e$ (ft-k) | $\frac{M_{ae}}{M_{ac}}$ |
|---|---|---|---|---|---|---|
| CSJ-1 | 8.76 | 54.5 | 63.25 | 59.01 | 67.8 | 1.08 |
| CSJ-2 | 7.55 | 55.5 | 63.07 | 59.59 | 67.1 | 1.07 |
| CSJ-3 | 22.56 | 307.5 | 330.02 | 314.82 | 337.4 | 1.02 |
| CSJ-4 | 9.66 | 222.5 | 232.13 | 169.75 | 179.4 | 0.76 |
| CSJ-5 | 13.71 | 110.6 | 124.27 | 107.64 | 121.4 | 0.97 |
| CSJ-6 | 16.44 | 119.1 | 135.51 | 109.60 | 126.0 | 0.92 |
| CSJ-7 | 16.44 | 103.1 | 119.59 | 89.94 | 106.4 | 0.87 |
| CSJ-8 | 16.44 | 98.7 | 115.15 | 88.29 | 104.7 | 0.89 |

$M_{dc}$ Calculated dead load moment at midspan, ft-k

$M_{de}$ Experimental dead load moment at midspan, ft-k

$M_{ac}$ Calculated midspan moment under applied loading, ft-k

$M_{ae}$ Experimental midspan moment under applied loading, ft-k

$M_c$ Calculated total midspan moment, ft-k

$M_e$ Experimental total midspan moment, ft-k loading configuration was chosen, for comparison purposes, to match the experimental loading. Summing moments about midspan,

$$M_c + F(L/16) + F(3L/16) + F(5L/16) + F(7L/16) - R(L/2) = 0$$

where $L$ is the joist span and $F$ are the eighth-point loads which will produce the calculated total load moment, $M_c$, found in the previous section. This can be rewritten as

$$M_c + F(L/16 + 3L/16 + 5L/16 + 7L/16) - 4F(L/2) = 0$$

$$M_c + F(L) - 2F(L) = 0$$

$$M_c - F \cdot L = 0 \tag{4.4}$$

from which $F = M_c / L$. The predicted member load is then $P_c = 8F$ (kips). $M_c$ includes both the dead load moment and the applied load moment; thus $P_c$ is the total member load.

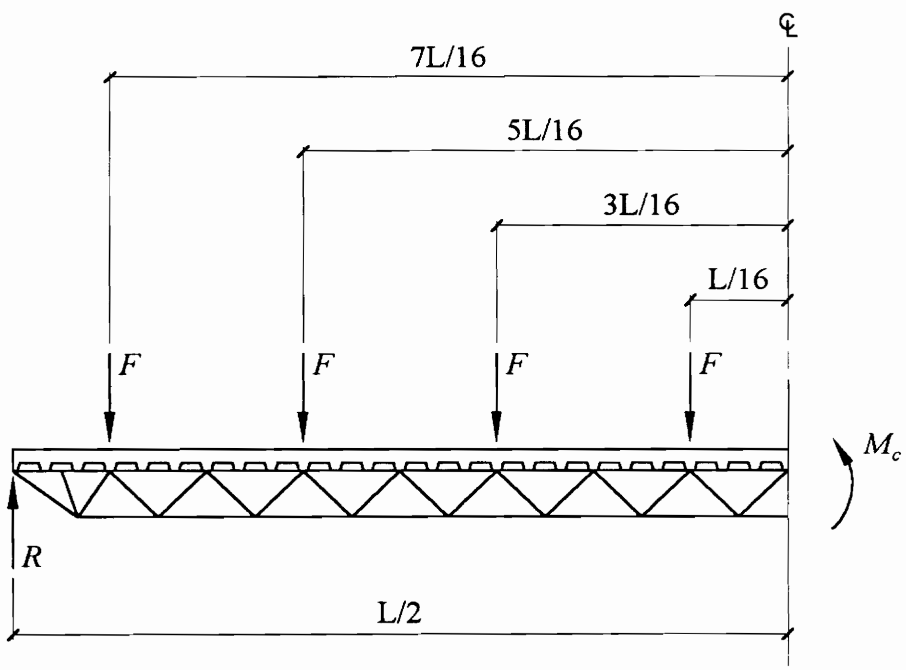



Figure 4.5 Member Load and Calculated Midspan Moment

The calculated member dead load is computed in kips by multiplying the uniformly distributed dead load by the theoretical joist span

$$P_{dc} = w_{dc} \cdot L$$

The joist self-weight, deck weight, and concrete slab weight are included in $w_{dc}$.

Similar to the calculated chord forces and the calculated moment under applied loading, the applied member load is the difference between the total load and the dead load

$$P_{ac} = P_c - P_{dc}$$

This is the maximum load which the joist is predicted to be able to support after the section becomes composite. Calculated member loads at each loading stage are given in Table 4.9.

## 4.4 Experimental Values

### 4.4.1 Experimental Member Load

Experimental member load is the first measured variable that is obtained and the first variable which can be compared to a predicted value. Member dead weight is combined with the applied member load to get the total load supported by the joist.

Because it was not possible to physically weigh the test setup, the calculated dead weight is used in place of a measured dead weight. This approach is verified to be reasonably accurate in a later section by comparing the calculated and measured chord forces due to dead load. The experimental dead load, $P_{de}$, is shown in a single column with the calculated dead load in Table 4.9.

The applied load, that load which is introduced after the section is composite, is from two sources, spreader beam weight and ram load. The ram load is distributed through the spreader beams as eight jack points evenly spaced along the joist span. The spreader beam weight was computed based on the unit weight of the members, while the ram load was measured during testing using electronic load cells. Selection of the applied load at collapse, or failure of the system, is discussed next.

As reported in Chapter 3, the behavior of the composite joist varies depending on its configuration. The models presented in this chapter attempt to represent this behavior, specifically the ultimate capacity of the system. The models assume that two of the three forces will reach their capacity under applied load ($C$ and $N$ for Case 1; $C$ and $T$ for Cases 2, 3, 4; $N$ and $T$ for Case 5). When both of these forces reach their capacity the joist has no more internal moment resistance and cannot support additional load. If the models are reasonable, this load point should be in the vicinity of the maximum load carried by the structure.

Table 4.9 Calculated and Experimental Member Load

| | $P_{dc}$, $P_{de}$ (kips) | $P_{ac}$ (kips) | $P_c$ (kips) | $P_{ae}$ (kips) | $P_e$ (kips) | $\frac{P_{ae}}{P_{ac}}$ |
|---|---|---|---|---|---|---|
| CSJ-1 | 2.89 | 18.0 | 20.86 | 19.47 | 22.4 | 1.08 |
| CSJ-2 | 2.49 | 18.3 | 20.81 | 19.66 | 22.2 | 1.07 |
| CSJ-3 | 7.52 | 102.5 | 110.01 | 104.94 | 112.5 | 1.02 |
| CSJ-4 | 3.22 | 74.2 | 77.38 | 56.58 | 59.8 | 0.76 |
| CSJ-5 | 3.66 | 29.5 | 33.14 | 28.70 | 32.4 | 0.97 |
| CSJ-6 | 4.44 | 32.2 | 36.59 | 29.60 | 34.0 | 0.92 |
| CSJ-7 | 4.44 | 27.8 | 32.29 | 24.29 | 28.7 | 0.87 |
| CSJ-8 | 4.44 | 26.7 | 31.09 | 23.84 | 28.3 | 0.89 |

$P_{dc}$ Calculated dead load (joist self weight, metal deck, and concrete slab) per joist, kips

$P_{de}$ Experimental dead load per joist, kips

$P_{ac}$ Calculated applied load (spreader beam weight and ram load) per joist, kips

$P_{ae}$ Experimental applied load per joist, kips

$P_c$ Calculated total load (dead load, spreader beam weight, and ram load) per joist, kips

$P_e$ Experimental total load per joist, kips

With this discussion in mind, the joist response, as shown by the instrument readings, was carefully examined to choose the load point at which each test failed. It was decided (with the exception of CSJ-4) to take the observed failure of the specimen as the point of maximum applied load. This load point closely corresponded to yielding (or buckling) of the top chord for the Case 1 joists, and loss of the shear connection for the Case 2 and Case 4 joists. The maximum experimental applied load for each test (except CSJ-4) is listed under $P_{ae}$ in Table 4.9.

CSJ-4 is an exception to choosing the maximum applied load as the failure load. The member load was observed to drop sharply with the onset of cracking. The specimen then regained capacity and attained a slightly higher applied member load as mechanical transfer between the concrete ribs and metal deck was established. But this increase was not due to the primary means of shear connection, so the specimen is assumed to have failed with the initiation of cracking at 56.58 kips of applied load (59.81 kips total load).

The experimental total load, $P_e$, is the sum of the experimental applied load and the member dead load

$$P_e = P_{de} + P_{ae}$$

Because the applied load was taken as the maximum observed value (except CSJ-4), total load is also a maximum. The dead load accounted for between 6% and 16% of the total load carried by the joist system, depending on the test configuration.

Experimental and calculated member loads are compared at the applied load stage in the final column of Table 4.9. Tests with ratios less than unity carried less load than calculated, while those with a ratio greater than unity were conservatively predicted. CSJ-1, 2, 3, 5, and 6 carried loads close to the predicted value. It will be seen in a subsequent section that the top chord behavior of these joists was close to that anticipated. CSJ-4, 7, and 8 carried less load than predicted. The lower-than-expected strength of these joists will be linked to overestimating the top chord force.

### 4.4.2 Experimental Moment Capacities

The computation of the experimental moments follows a pattern similar to that of the experimental member loads. The experimental moments are found at the dead load and applied load stages and then combined to obtain the total experimental moment.

Two options are available when assigning a value for the experimental dead load moment, $M_{de}$. It can be computed from the experimental member dead load, in which case the experimental dead load moment will equal the calculated dead load moment because

$P_{de}$ was taken the same as $P_{dc}$ in the previous section. Alternatively, the experimental dead load moment can be computed from the measured dead load chord forces, which also has some inaccuracies that will be discussed in the next section. It was decided to use an experimental dead load moment based on the experimental member load and to check its reasonableness against the measured dead load chord forces. The experimental dead load moment is listed in a single column with the calculated dead load moment in Table 4.8.

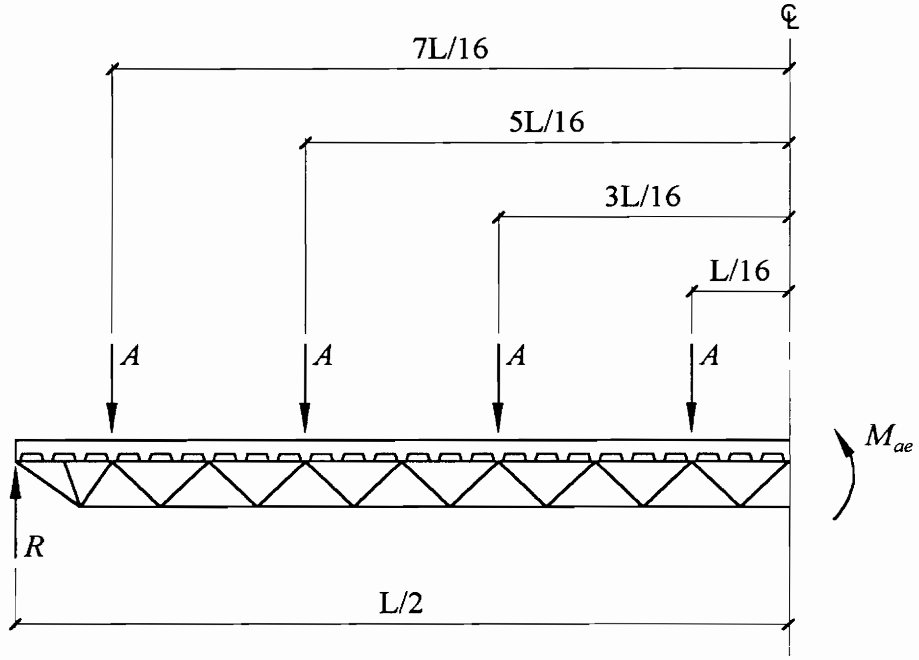



Figure 4.6 Member Load and Experimental Midspan Moment

The experimental applied moment is computed using statics and the maximum applied member load measured during testing, $P_{ae}$. As represented in Fig. 4.6, the experimental applied member load is distributed through the spreader beams as eight equally spaced concentrated loads, $A = P_{ae} / 8$. With reference to Eq. (4.4), the resulting midspan moment can be written

$$M_{ae} = A \cdot L$$

where $L$ is the joist span. The experimental applied load moment at midspan, $M_{ae}$, is to be compared to the calculated applied load moment, $M_{ac}$. This comparison is shown in the final column of Table 4.8. Ratios of experimental to calculated applied moment are identical to the applied member load ratios.

Choosing the experimental moment at midspan is to some extent a simplification in the analysis. For under-connected joists the critical combination of applied moment vs. resisting couple may not occur at midspan due to the variables affecting the loading and capacity of the top chord. The amount of horizontal shear in combination with the applied moment should also be considered in choosing the location at which failure will occur. The penalty certain cross-sections pay for being located under a load point further complicates the analysis. These factors are of lesser concern for the over-connected designs because the top chord is in tension and is not critical to the failure.

The total experimental moment is again the sum of the experimental dead load and applied load moments

$$M_e = M_{de} + M_{ae}$$

The total moments found in this way are shown in Table 4.8 for comparison to the calculated total moment. The percentage of calculated total moment is not given, but the moment ratios would be similar to those at the applied load stage.

### 4.4.3 Experimental Chord Forces

As with the experimental member load and the resulting midspan moment, experimental chord forces are measured at the dead load stage and the applied load stage. The dead load chord forces and applied load chord forces are superimposed to obtain the total chord force at failure.

Experimental chord forces due to dead load, $N_{de}$ and $T_{de}$, were computed from strain measurements taken during construction of the tests. Dead load strains were obtained by first measuring the midspan strains from concrete load, then adding an amount for joist self-weight and deck weight extrapolated backwards from the concrete strains. The weight of the joist and deck, as well as the weight of the concrete, were calculated, not measured, values. The measured bottom chord forces due to dead load compare well with the predicted values, indicating that this procedure is acceptable. For all tests, the bottom chord forces from dead load exceed the top chord forces. It may be that the metal deck, which is fastened to the top chord at the time of concrete placement, carried the balance. Because of the difference in the measured chord forces, they were not used to compute a measured dead load moment.

Experimental top and bottom chord forces due to applied load were taken from strain gage measurements after zeroing out the strains from dead load. The experimental chord forces are based on the midspan strains at failure to correspond to the location and load level at which the experimental moment was computed. These values are listed as $N_{ae}$ in Table 4.5 and $T_{ae}$ in Table 4.6. Under applied loading, the top chord force may be tensile or compressive; the bottom chord force is always tensile.

The total experimental chord force is the sum of the dead load force and the applied load force,

$$N_e = N_{de} \pm N_{ae}$$

$$T_e = T_{de} + T_{ae}$$

Because the applied load chord forces were taken at failure, $N_e$ and $T_e$ are the total load chord forces at failure. These values are given in Table 4.5 and Table 4.6.

The top and bottom chord behavior of CSJ-1, 2, and 3 was close to that expected, based on the ultimate strength models. The top chord was instrumental in resisting applied load. The top chord force increased significantly over the applied load stage and eventually failed, as predicted by the Case 1 flexural model. Furthermore, the top chord was able to reach the predicted top chord capacity, $N_{max}$, which was chosen as the yield force previously. Therefore, the experimental and calculated top chord forces under applied load differ from one another by the same amount as the corresponding top chord forces under dead load. Failure of these joists was coincident with failure of the top chord. The bottom chords of CSJ-1, 2, and 3 had excess capacity as expected.

The behavior or CSJ-4 did not conform to that predicted by the strength model. This test, which was near the lower end of the Case 2 classification, was predicted to have a fairly large top chord force, approximately 78% of yield. It is assumed in the under-connected flexural models that any unbalanced compression force which cannot be accommodated by the shear connection, will be absorbed by the top chord. The previous three tests are a good illustration of this. As the shear connection deteriorated, the top chord force increased and the joist carried additional load. For these tests, resistance to applied loading was shared between the concrete compression force and the top chord compression force. The shear connector used in CSJ-4, however, did not permit a redistribution of load to the top chord. As a result, the top chord provided little resistance to applied load, and the measured force was much lower than expected. The top chord was able to carry load only after the shear connection was lost. The test results show that the combination of shear connection force and top chord force was inadequate to develop the bottom chord yield force because they did not act in unison.

The measured top chord force for CSJ-5 was somewhat lower than the predicted value. This was due mainly to the redistribution of forces which occurred upon yielding of the bottom chord. Near failure, both the location of the neutral axis and the magnitude of the top chord strains fluctuated considerably for this test. While the top chord force changed significantly the applied joist load changed only slightly, making it difficult to ascertain the appropriate experimental top chord force at failure. It is clear, however, that in accordance with the flexural model, the top chord force contributed little to the resistance of applied load (except to transfer horizontal forces between the web members and the concrete slab). The top chord behavior was similar to that found by Robinson et al. (1978) for joists with comparable degrees of shear connection. CSJ-5 was classified as a Case 2 joist; therefore, the bottom chord was predicted to yield. The bottom chord did yield at the panel points and throughout the majority of the middle panel length but did not reach the center, so the measured force was slightly lower than calculated.

The performance of CSJ-6 agreed with the Case 4 flexural model in that there was a net tension force in the top chord at failure. This resembled the behavior of joists with a similar and greater degree of shear connection tested by Gibbings et al. (1991). The measured tension force, however, was somewhat lower than predicted. This was probably due not only to fluctuation of the measured top chord force near failure (similar to the previous test), but also to overestimation of the calculated shear connection force. If $\Sigma Q_c$ was smaller, the predicted top chord tension force, which for the Case 4 joist is the difference between the shear connection force and the bottom chord yield force (Fig. 4.1), would also be smaller and closer to the measured value. The bottom chord yielded throughout its depth near midspan as expected.

The behavior of CSJ-7 indicates that it was misclassified, probably due to overestimating both the provided shear connection force and the available top chord force. An unreasonably high $N_{max}$ by definition overestimates the capacity of the top chord. For a Case 2 joist, the force that the top chord is expected to experience is the difference between the bottom chord yield force and the calculated shear connection force (Fig. 4.1). Therefore, overestimating the shear connection force has the added harmful effect of lowering the predicted top chord force. This joist was susceptible to top chord buckling failure because of the light top chord section and the wide shear connector placement. Were the shear connection capacity and/or the top chord capacity predictions lower, the likelihood of top chord failure would be reflected in the model. (CSJ-7 should not have been classified as Case 2. Given the configuration of this specimen, Case 1 is the appropriate classification.) Because the top chord was unable to carry the predicted force, the joist failed by top chord buckling rather than bottom chord yielding as initially predicted. Both the provided shear connection and the available top chord force must be correctly estimated to predict the behavior of the composite joist.

The classification of CSJ-8 (Case 1) presumes that the top chord will fail in compression. The top chord did fail, but at a much lower force than predicted, by buckling rather than yielding. This is an illustration of the importance of accurately selecting $N_{max}$ when the top chord is predicted to fail in compression. Also it should be noticed that this test had a higher degree of shear connection than did tests CSJ-1, 2, and 3 in which the top chord yielded. Clearly, it is unconservative to assume the top chord of an under-connected joist will reach its yield force. CSJ-8 reached 82% of the top chord yield force, while CSJ-7 (which had three fewer studs per shear span) attained only 69%. Although this discrepancy could be due in part to the difference in connector types, it is an indication of the ability of the studs to increase the top chord compression capacity by bracing. Contrary to the selected classification for this test, the bottom chord yielded near the end of the test. The predicted bottom chord force is deemed reasonable, however, because it is only slightly less than yield. This test was near the transition between Case 1 and Case 2.

### 4.4.4 Experimental Shear Connection

Whereas the experimental chord forces could be measured directly using strain gages, measuring the shear connection force in such a manner is not possible. The experimental shear connection force (i.e., shear connection force being supplied under test load) is back calculated based on the measured moment and the assumed flexural model.

The equations representing the flexural model that include the shear connection force were given previously as

$$M_c = \Sigma Q_c \cdot e \pm N_c \cdot e' \qquad [4.1]$$

$$M_c = \Sigma Q_c \cdot e_t + T_c \cdot e' \qquad [4.2]$$

Either of these equations can be used to back calculate the shear connection. Because the experimental shear connection is to be found at the applied load stage, applied load variables are substituted for the total load variables, and these equations become

$$\Sigma Q_{ae} \cdot e \pm N_a \cdot e' = M_{ae} \qquad (4.5)$$

$$\Sigma Q_{ae} \cdot e_t + T_a \cdot e' = M_{ae} \qquad (4.6)$$

Using these equations to back calculate the experimental shear connection from the experimental moment, $M_{ae}$, requires that the chord force be assumed. (The second subscript is left off the chord force because this force may be a calculated or measured value.) Having assumed a value for the chord force, unknowns $\Sigma Q_{ae}$ and $e$ remain in the first equation and unknowns $\Sigma Q_{ae}$ and $e_t$ in the second equation. Because lever arms $e$ and $e_t$ depend on the amount of shear connection, it is necessary to construct a quadratic equation or to use an iterative process to find $\Sigma Q_{ae}$. The shear connection force which is back calculated in this manner is that which must have been present under the given moment, assuming the chord force accurately corresponds to this moment. Accuracy of the back calculated shear force is predicated on accurately choosing the assumed chord force because there are an unlimited number of internal force combinations which will produce a given moment.

For a given moment in Eq. (4.6), a small variance in the bottom chord force results in a relatively large change in the shear connection force because the lever arm associated with $T_a$ ($e'$) is so much larger than that associated with $\Sigma Q_{ae}$ ($e_t$). Therefore, if the measured bottom chord force is just slightly off, the shear connection force will not be reasonable. This can be avoided by choosing a bottom chord force by trial, back calculating the shear connection, then comparing these quantities to the measured bottom chord force and predicted shear connection respectively. It should be noted that this approach is possible only if the measured chord force is available. This would not be the case in a typical design situation.

The shear connection force is less sensitive to changes in the assumed force when using Eq. (4.5) because the moment arms are more nearly equal. However, this equation can be difficult to apply to joists that are near the balanced condition. Using this equation for these joists may not be practical because the top chord response can be erratic, as described in the previous section. The top chord strains often change direction both at first yield and at failure, making it difficult to select an appropriate assumed value. As the joist approaches collapse, the experimental moment changes very little, but the top chord force (which directly influences the shear connection to be back calculated in the equation) can change significantly. Previous researchers (Cran 1971, Gibbings et al. 1991) have neglected any contribution of the top chord when predicting the composite joist moment capacity. If this procedure was adapted to back calculating the provided shear connection, zero force would be assumed for $N_a$ in Eq. (4.5).

Although theoretically either of the above equations could be used for back calculating the shear connection, Eq. (4.5) was chosen for the test joists in this series. The assumed chord force ($N_a$) was taken as the measured value ($N_{ae}$). The assumed top chord force and resulting experimental shear connection ($\Sigma Q_{ae}$) are recorded in Table 4.10.

Having assumed a chord force and computed the shear connection from the appropriate equation, the remaining chord force is found from equilibrium. For the test specimens the remaining force is the bottom chord force, listed as $T_a$ in Table 4.10. If the back calculated shear connection force is to be acceptable, the chord forces $N_a$ and $T_a$ must also be close to the actual chord forces. The assumed chord force ($N_a$), the apparent shear connection ($\Sigma Q_{ae}$), and the remaining chord forced ($T_a$) are compared to the values $N_{ae}$, $\Sigma Q_{ac}$, and $T_{ae}$ in Table 4.10. The ratio $\Sigma Q_{ae}/\Sigma Q_{ac}$ is a measure of how the provided shear connection force compares to that previously predicted.

The shear connection force for CSJ-4 was not predicted previously, but the experimental force will be examined here. The absence of slip prior to failure (depicted in the load-slip plot, Fig. 3.11) indicates that the loss of interaction and longitudinal cracking along the length of the embedded shear angle occurred simultaneously. The loss of shear connection appeared to be caused by cracking through the depth of the slab at the longitudinal shear angles. Therefore, the shear connection force measured at failure should in some way relate to the concrete strength,

$$\Sigma Q_{ae} = K\sqrt{f'_c}\,A_c$$

where $\Sigma Q_{ae}$ is the experimental shear connection expressed in pounds, $A_c$ is the longitudinal shear area through the depth of the slab, and $K$ is a coefficient to be determined. Substituting for CSJ-4,

$$179{,}600 = K\sqrt{4000}\,(432)$$

results in $K$ = 6.6, which is a reasonable value considering typical values for concrete cracking strength. It is noted that this is merely a simple explanation of the provided shear connection. A more sophisticated analysis would account for the presence of transverse reinforcement (probably by including an additional term), the difference between the solid portion and deck portion of the slab, and the interlock with the holes punched in the shear angle. Including the ability of the transverse reinforcement to increase the cracking strength would tend to decrease the coefficient $K$, while decreasing the shear contact area by the amount displaced by the metal deck would tend to increase the coefficient $K$. The bending in the top chord (with relatively small amount of vertical restraint, except that provided by the punched holes) probably contributed to the loss of bond and should also be considered in a detailed analysis of this type of shear connection.

Table 4.10 Experimental Shear Connection

| | $N_a$ (kips) | $N_{ae}$ (kips) | $T_a$ (kips) | $T_{ae}$ (kips) | $\Sigma Q_{ac}$ (kips) | $\Sigma Q_{ae}$ (kips) | $\frac{\Sigma Q_{ae}}{\Sigma Q_{ac}}$ |
|---|---|---|---|---|---|---|---|
| CSJ-1 | 36.8 | 36.8 | 82.0 | 81.8 | 41.0 | 45.2 | 1.10 |
| CSJ-2 | 40.4 | 40.4 | 83.7 | 87.5 | 41.0 | 43.3 | 1.06 |
| CSJ-3 | 243.3 | 243.3 | 380.9 | 400.5 | 134.4 | 137.6 | 1.02 |
| CSJ-4 | 0.3 | 0.3 | 179.9 | 178.7 | 179.6 | 179.6 | 1.00 |
| CSJ-5 | 0.8 | 0.8 | 89.3 | 92.4 | 85.4 | 88.5 | 1.04 |
| CSJ-6 | -11.1 | -11.1 | 59.9 | 64.6 | 81.2 | 62.0 | 0.87 |
| CSJ-7 | 17.6 | 17.6 | 54.2 | 59.0 | 39.5 | 36.6 | 0.93 |
| CSJ-8 | 21.8 | 21.8 | 54.1 | 62.3 | 33.2 | 32.3 | 0.97 |

[a] Based on nominal yield stress, $F_y$ = 50 ksi

[b] Based on nominal yield stress, $F_y$ = 36 ksi

$N_a$ Top chord force due to applied loading, assumed value for use in Eq. (4.5), kips

$N_{ae}$ Experimental top chord force due to applied load, kips

$T_a$ Bottom chord force due to applied load, found from horiz. force equil., kips

$T_{ae}$ Experimental bottom chord force due to applied load, kips

$\Sigma Q_{ac}$ Calculated shear connector capacity, kips

$\Sigma Q_{ae}$ Experimental shear connector capacity, back calculated using Eq. (4.5), kips

## CHAPTER 5

## SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

### 5.1 Summary

The objective of this study was to analyze the strength of composite joists with various degrees of shear connection. Eight full-size steel joist tests, which were from 27% to 107% composite, were tested to failure. Spans ranged from 24 ft. to 30 ft. and depths from 8 in. to 18 in. A steel deck supported slab was used for each test. Six types of shear connection were investigated.

The ultimate strength models presented by Azmi (1972) provided the basis for classifying and analyzing the test specimens. Knowledge of the shear transfer capacity, the maximum available top chord force, and the bottom chord yield force was necessary to classify the configuration of the joist. The joists were classified by how the shear connection force compared to the bottom chord yield force. The under- and over-connected joists were then further classified by including the force available from the top chord. The joists tested in this study were either Case 1, Case 2, or Case 4 according to this classification.

The test results were presented in a series of graphs for each specimen. Applied load, deflection, top and bottom chord strain, and horizontal slip were measured in each experiment. The Case 1 joists failed by a loss of shear connection followed by top chord failure. These joists had considerable top chord involvement in resisting applied loads. The Case 2 and Case 4 joists failed by bottom chord yielding followed by loss of shear connection. These joists had little top chord involvement. The Case 2 and Case 4 joists had a well-defined yield plateau; the Case 1 joists did not.

The variables related to the strength of the composite joists were the member load, the midspan moment, and the internal resisting forces (shear connection, top chord force, bottom chord force). Analysis of these variables proceeded along two paths, a series of computations to calculate the predicted values and a series to evaluate the observed values. The theoretical computations began with the predicted internal forces and finished with the predicted member load. The experimental computations began with measured member load and concluded with measured internal resisting forces. In both series, midspan moment was the intermediate variable.

Three loading stages were recognized in the evaluation. Calculated variables were computed at the dead load and total load stages. The dead load values were subtracted from the total load values to obtain the calculated applied load values. Experimental variables were measured at the dead load and applied load stages. The applied load response was superimposed on the dead load response to obtain the experimental total load values.

Comparison of each calculated and experimental variable was made at each loading stage. In most cases, the experimental results showed good agreement with the flexural model.

## 5.2 Conclusions

Based on the results of the eight composite joists tested in this study, the following conclusions can be drawn:

- Partially composite and fully composite joists can be analyzed using the flexural models proposed by Azmi (1972). Classification of the joists is based on consideration of the provided shear connection force, the maximum available top chord force, and the bottom chord yield force. Joists which are classified as Case 1 fail by a combination of loss of shear connection and top chord buckling or yielding. Those which are classified as Case 2 or Case 4 fail by yielding of the bottom chord followed by loss of shear transfer. The strength of the joist is accurately predicted by these models. (Test specimen CSJ-4 is a notable exception, as discussed in a subsequent section.)

- The horizontal shear transfer capacity must be accurately known. Classification of a composite joist as under- or over-connected depends on the provided shear connection force. This force is critical to the internal resisting couple of the composite section. The predicted shear capacity influences the magnitude of the force anticipated in the top chord.

- Knowledge of the top chord capacity is important in the analysis of composite joists. Once the joist has been determined to be under- or over-connected, the available top chord force is used to further classify the joist. The top chord capacity must be correctly estimated to select the proper flexural model.

- The shape of the load-deflection plot can be linked to the failure mode of the joist. The load-deflection plot of a joist governed by bottom chord yielding (Case 2 or Case 4) typically has a well-defined yield point. That of a partially composite joist governed by top chord failure (Case 1) has a rounded shape. Because the joist classifications are evident in the top chord strain plots (Case 1 shows considerable top chord force, Cases 2 and 4 show very little), the shape of the load-deflection plot also corresponds the performance of the top chord. This observation was made previously by Robinson et al. (1978).

- The performance of the top chord can be linked to the provided amount of shear connection. Severely under-connected joists utilize the top chord significantly to resist applied loads. The top chord of those tests with higher degrees of shear connection (approximately 80% in this study) displays little involvement in resisting applied loads. This behavior was also observed by Robinson et al. (1978) for similarly designed composite joists.

- Failure of a composite joist is marked by a unique occurrence in the top chord. Yielding or buckling of the top chord is typical of failure in Case 1 joists. An abrupt change in top chord stress, back to compression upon loss of shear connection, is typical of the behavior of Case 2 and Case 4 joists. For the test specimens, these events very nearly coincided with attaining the maximum load carried by the joist.

- The strength of severely under-connected joists is governed by the compression capacity of the top chord. This capacity must be known to correctly predict the capacity of the joist. Top chord failure can be either by yielding or buckling. It is unconservative to assume the top chord will develop the yield force in compression. The lateral and vertical restraint provided by the shear connectors and deck, the panel length, and the end restraint at the joints affect the top chord compression capacity.

- The asymmetric cross-section of CSJ-5 did not present any problems. The top chord, bottom chord, and web members performed satisfactorily in this test. Web members can safely be placed on only one side of the composite joist.

- Near failure, the top chord force of Case 1 joists is better represented by the model than the top chord force of Case 2 and Case 4 joists. Typically the Case 1 top chord force from applied load is compressive, as is the dead load force. Here the loads are merely additive. For Case 2 and 4 joists, however, the compressive dead load top chord force is released under applied load near failure (with the onset of bottom chord yielding). This superposition of loads is not handled as well by the model.

## 5.3 Design Recommendations

Based on the performance of the joists tested in this study, the following recommendations are made concerning their design:

- Top chord buckling failure causes sudden collapse of the joist and should be avoided. Sufficient shear connection should be provided to prevent this mode of failure. At a minimum, the joist should be configured such that the sum of shear connector capacity and the top chord bucking load exceeds the bottom chord yield force. In adjusting the force to be carried by the top chord, it is not sufficient to look only at the degree to which shear transfer capacity is provided. The number of connectors and their potential to brace the top chord must also be considered.

- The embedded top chord angle of CSJ-4 provided sound shear connection; however, failure was sudden and brittle. There was no provision for ductility; this type of shear connection is either "on" or "off". If this type of shear connection was to be used in design, a large factor of safety would be necessary to ensure full development of the bottom chord. Otherwise, modification to the angle would need to be made to provide for ductility in the connection.

- The effect of dead load on the ultimate capacity should be accounted for in the design of composite joists. This is most important for partially composite joists with very low degrees of shear connection. Here the top chord force under applied load is cumulative with that from dead load. This may not be as important for heavier joists because the chord force due to dead load is a smaller percentage of the total chord force.

## 5.4 Areas of Further Research

Based on the performance and evaluation of the test specimens, the following areas of further research have been identified:

- Comparison of preliminary shear connection calculations to the test results of CSJ-4 showed that analytical methods of establishing shear transfer capacity can be highly speculative. Push-out tests are essential in predicting the strength of experimental shear connection schemes and should continue to be pursued.

- Where difficulties arose in predicting the strength of the composite joists, it was due primarily to incorrectly predicting the performance of the top chord. If an under-connected joist is to be safely designed, the top chord compression capacity must be accurately known. It is unconservative to assume the top chord will develop the yield force in compression. Development of a method to quickly predict joist top chord buckling strength, incorporating the effects of member end fixity at the panel points and lateral/vertical restraint provided by stud shear connectors, could be undertaken.

- There was a distinct difference in the behavior of CSJ-4, where almost no slip occurred prior to failure, and those tests where the top chord participated throughout the test. The role of slip in altering the force in the top chord and its contribution to the moment resistance should be further investigated. The amount of slip that must be permitted/prevented, for the flexural models to hold, should be evaluated. It is interesting to note that the only test which maintained complete interaction through the majority of the loading cycle (CSJ-4), was the least accurately represented by the flexural models.

- Previous researchers (Unterkofler et al. 1989, Gibbings et al. 1991) have effectively applied methods, which account for web deformation and slip, to calculate the elastic stiffness of the composite joist section. With few exceptions, the joists evaluated in these studies were fully composite. These methods may or may not accurately predict the stiffness and deflections of a composite joist with a very low degree of shear connection. These methods should be re-evaluated before they are applied to partially composite joists.

- Evaluation should be undertaken of composite joists which are close to, and on either side of, the balanced classification in an effort to better understand the top chord behavior following yield of the bottom chord.

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# APPENDIX A

## Test Results

The results of the composite joist tests (CSJ-1 through CSJ-8) are given in the following pages. The first sheet of each test is the test summary sheet which gives information on the test configuration and instrumentation locations. Following the test summary sheet is the data collected during the tests and used to generate plots of load versus either centerline deflection, quarter span deflection, strain, or slip. Unloading/reloading cycles are indicated by shading in the tables. These load points are only plotted for the load vs. deflection plots. The plots are provided in the last section.

The deflection and strain plots start at zero load and no measured deflection or strain. For these plots, the label "Total Load per Joist" is placed on the vertical axis to represent the load per joist due to the joist, deck, concrete, load beam weight, and the hydraulic jacks. The first load point on the load vs. deflection (or strain) plots represents the noncomposite deflection (or strain) due to the weight of the joist plus the deck. The next load point corresponds to placement of the concrete. Note that the weight of the joist, deck, and concrete was calculated and not measured. Also, the measured stiffness, based on placement of the concrete, was used to back calculate the deflection of the joist due to the weight of the deck and joist. Applied loads are those due to the load beam weight and the hydraulic jacks acting on the composite specimen.

The load vs. slip plots start at zero load and zero measured slip for the composite system. The vertical axis on these plots is labeled "Applied Load per Joist" to represent the load due to the load beam weight and the hydraulic jacks.

## NUCOR COMPOSITE JOIST TEST SUMMARY SHEET

TEST DESIGNATION: CSJ-1 TEST DATE: 13 August 1991

### TEST DESCRIPTION

**Joist:** Span: 24'-3" Weight: 15 plf
Depth: 8 in. Spacing: 40 in.
Top Chord: 2L-1.50x1.50x0.170 Yield Stress: 52.2 ksi
Bottom Chord: 2L-2.50x2.50x0.250 Yield Stress: 52.7 ksi
**Deck:** Type: 1.0C Gage: 26 ga
**Slab:** Total Depth: 3.0 in. Compressive Strength: 3700 psi
**Shear Connector:** Type: Buildex 5/16 in. dia. x 2 in. long standoff screw
Quantity: 14 per half-span

### THEORETICAL CALCULATIONS

Theoretical Applied Load per Joist at Failure: 18.0 kips
Theoretical Total Load per Joist at Failure: 20.9 kips
Transformed Moment of Inertia: 168.9 in.$^4$
Theoretical Elastic Stiffness: 12.80 k/in.
Elastic Deflection at Yield: 1.84 in.

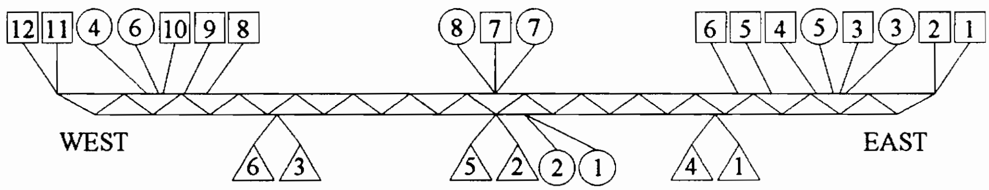
### TEST RESULTS

Applied Load per Joist at Failure: 19.5 kips
Total Load per Joist at Failure: 22.4 kips
Midspan Deflection at Failure: 5.05 in.
Maximum Slip and Location: 0.852 in., SLIP 4
Mode of Failure: yielding of the top chord

### COMPARISON OF ACTUAL TO THEORETICAL

Applied Load per Joist/Theoretical Applied Load per Joist: 1.08

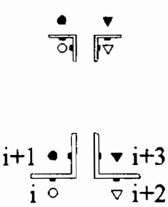
### INSTRUMENTATION LOCATIONS




(1) BC1 (N)
(2) BC2 (S)
(3) TC1 (N)
(4) TC2 (S)
(5) TC3 (N)
(6) TC4 (S)
(7) TC5 (N)
(8) TC6 (S)

△1 NEQB Defl
△2 NMB Defl
△3 NWQB Defl
△4 SEQB Defl
△5 SMB Defl
△6 SWQB Defl

[1] SLIP 1 (S)
[2] SLIP 2 (N)
[3] SLIP 3 (N)
[4] SLIP 4 (N)
[5] SLIP 5 (N)
[6] SLIP 6 (N)
[7] SLIP 7 (S)
[8] SLIP 8 (S)
[9] SLIP 9 (S)
[10] SLIP 10 (S)
[11] SLIP 11 (S)
[12] SLIP 12 (N)




Strain Gage
Locations

| TOTAL LOAD PER JOIST (kips) | CSJ-1 TEST DATA SHEET DEFLECTIONS | | | | | |
|---|---|---|---|---|---|---|
| | NEQB (in.) | NMB (in.) | NWQB (in.) | SEQB (in.) | SMB (in.) | SWQB (in.) |
| 0.00 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 0.45 | 0.103 | 0.145 | 0.104 | 0.092 | 0.134 | 0.099 |
| 2.89 | 0.661 | 0.934 | 0.672 | 0.589 | 0.859 | 0.638 |
| 4.39 | 0.767 | 1.072 | 0.768 | 0.693 | 1.008 | 0.741 |
| 6.04 | 0.840 | 1.173 | 0.809 | 0.768 | 1.110 | 0.806 |
| 7.68 | 0.932 | 1.307 | 0.896 | 0.862 | 1.235 | 0.892 |
| 9.01 | 1.019 | 1.418 | 0.978 | 0.947 | 1.338 | 0.979 |
| 10.28 | 1.142 | 1.575 | 1.092 | 1.062 | 1.495 | 1.086 |
| 11.92 | 1.316 | 1.805 | 1.266 | 1.238 | 1.732 | 1.254 |
| 13.44 | 1.463 | 2.018 | 1.407 | 1.378 | 1.941 | 1.392 |
| 9.01 | 1.225 | 1.699 | 1.184 | 1.149 | 1.621 | 1.184 |
| 4.64 | 0.941 | 1.307 | 0.932 | 0.865 | 1.240 | 0.904 |
| 7.30 | 1.096 | 1.533 | 1.065 | 1.021 | 1.458 | 1.063 |
| 10.46 | 1.298 | 1.796 | 1.252 | 1.222 | 1.718 | 1.252 |
| 13.31 | 1.490 | 2.059 | 1.444 | 1.413 | 1.988 | 1.439 |
| 14.39 | 1.614 | 2.234 | 1.567 | 1.525 | 2.155 | 1.560 |
| 14.89 | 1.682 | 2.331 | 1.631 | 1.592 | 2.253 | 1.635 |
| 15.53 | 1.802 | 2.497 | 1.754 | 1.702 | 2.424 | 1.752 |
| 16.54 | 1.943 | 2.696 | 1.900 | 1.842 | 2.624 | 1.894 |
| 17.11 | 2.030 | 2.820 | 1.987 | 1.933 | 2.750 | 1.980 |
| 17.74 | 2.154 | 2.982 | 2.101 | 2.050 | 2.907 | 2.097 |
| 18.44 | 2.269 | 3.138 | 2.215 | 2.176 | 3.075 | 2.212 |
| 19.07 | 2.420 | 3.355 | 2.362 | 2.319 | 3.284 | 2.363 |
| 19.77 | 2.566 | 3.554 | 2.512 | 2.472 | 3.483 | 2.492 |
| 20.27 | 2.726 | 3.770 | 2.658 | 2.640 | 3.702 | 2.646 |
| 20.53 | 2.781 | 3.840 | 2.704 | 2.690 | 3.771 | 2.685 |
| 14.07 | 2.443 | 3.374 | 2.394 | 2.344 | 3.302 | 2.368 |
| 9.20 | 1.998 | 2.783 | 1.955 | 1.913 | 2.708 | 1.917 |
| 4.77 | 1.367 | 1.898 | 1.343 | 1.296 | 1.835 | 1.301 |
| 9.45 | 1.889 | 2.626 | 1.823 | 1.810 | 2.550 | 1.808 |
| 14.39 | 2.365 | 3.277 | 2.302 | 2.284 | 3.209 | 2.298 |
| 20.46 | 2.882 | 3.982 | 2.814 | 2.798 | 3.920 | 2.798 |
| 21.28 | 3.116 | 4.319 | 3.042 | 3.030 | 4.259 | 3.024 |
| 21.85 | 3.303 | 4.568 | 3.202 | 3.199 | 4.491 | 3.187 |
| 21.66 | 3.477 | 4.799 | 3.348 | 3.371 | 4.724 | 3.344 |
| 22.36 | 3.715 | 5.080 | 3.526 | 3.592 | 5.011 | 3.519 |
| 21.73 | 3.958 | 5.339 | 3.654 | 3.858 | 5.281 | 3.652 |
| 21.35 | 4.205 | 5.588 | 3.768 | 4.112 | 5.532 | 3.766 |
| 20.08 | 4.260 | 5.615 | 3.768 | 4.142 | 5.541 | 3.766 |
| 19.83 | 4.530 | 5.851 | 3.868 | 4.394 | 5.745 | 3.869 |
| 19.39 | 4.824 | 6.113 | 3.996 | 4.679 | 5.982 | 3.977 |
| 18.06 | 5.098 | 6.340 | 4.092 | 5.032 | 6.252 | 4.075 |
| 17.62 | 5.474 | 6.750 | 4.270 | 5.449 | 6.628 | 4.247 |
| 17.30 | 5.785 | 7.110 | 4.439 | 5.761 | 6.907 | 4.394 |
| 16.98 | 6.220 | 7.626 | 4.686 | 6.213 | 7.352 | 4.598 |
| 11.79 | 5.758 | 7.004 | 4.266 | 5.766 | 6.749 | 4.159 |
| 8.38 | 5.204 | 6.256 | 3.768 | 5.218 | 6.024 | 3.647 |
| 4.20 | 4.443 | 5.242 | 3.092 | 4.484 | 5.030 | 2.970 |

| TOTAL LOAD PER JOIST (kips) | CSJ-1 TEST DATA SHEET TC1 2L1.50x1.50x0.170 TC1 (21) | TC1 (23) | TC1 (25) | TC1 (27) (με) | AVG MEM LOAD (kips) | CSJ-1 TEST DATA SHEET TC2 2L1.50x1.50x0.170 TC2 (42) | TC2 (44) | TC2 (46) | TC2 (48) (με) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 |
| 0.45 | -23 | -26 | -26 | -23 | -0.7 | -24 | -29 | -24 | -34 | -0.8 |
| 2.89 | -148 | -167 | -164 | -147 | -4.4 | -155 | -189 | -157 | -216 | -5.0 |
| 4.39 | -154 | -182 | -179 | -185 | -4.9 | -161 | -198 | -177 | -264 | -5.6 |
| 6.04 | -151 | -191 | -189 | -218 | -5.2 | -163 | -205 | -192 | -310 | -6.1 |
| 7.68 | -150 | -200 | -201 | -260 | -5.7 | -167 | -214 | -208 | -362 | -6.6 |
| 9.01 | -157 | -216 | -221 | -299 | -6.2 | -169 | -223 | -221 | -393 | -7.0 |
| 10.28 | -166 | -246 | -244 | -337 | -6.9 | -175 | -235 | -239 | -430 | -7.5 |
| 11.92 | -176 | -283 | -277 | -392 | -7.9 | -185 | -258 | -272 | -499 | -8.5 |
| 13.44 | -183 | -316 | -298 | -436 | -8.6 | -196 | -297 | -312 | -544 | -9.4 |
| 9.01 | -194 | -282 | -261 | -332 | -7.5 | -198 | -276 | -264 | -436 | -8.2 |
| 4.64 | -175 | -209 | -194 | -201 | -5.4 | -169 | -214 | -182 | -295 | -6.0 |
| 7.30 | -185 | -257 | -232 | -276 | -6.6 | -184 | -246 | -224 | -374 | -7.2 |
| 10.46 | -186 | -289 | -268 | -363 | -7.7 | -194 | -278 | -275 | -466 | -8.5 |
| 13.31 | -188 | -319 | -300 | -440 | -8.7 | -194 | -299 | -320 | -545 | -9.5 |
| 14.39 | -201 | -347 | -320 | -478 | -9.4 | -193 | -325 | -356 | -536 | -9.8 |
| 14.89 | -213 | -369 | -331 | -500 | -9.9 | -212 | -359 | -391 | -559 | -10.6 |
| 15.53 | -242 | -409 | -360 | -542 | -10.8 | -223 | -394 | -427 | -579 | -11.3 |
| 16.54 | -279 | -485 | -399 | -594 | -12.3 | -245 | -431 | -480 | -603 | -12.3 |
| 17.11 | -288 | -520 | -420 | -624 | -12.9 | -254 | -447 | -507 | -614 | -12.7 |
| 17.74 | -310 | -553 | -452 | -654 | -13.7 | -276 | -472 | -552 | -630 | -13.5 |
| 18.44 | -326 | -580 | -478 | -676 | -14.4 | -294 | -496 | -591 | -649 | -14.2 |
| 19.07 | -347 | -611 | -510 | -701 | -15.1 | -322 | -523 | -648 | -670 | -15.1 |
| 19.77 | -371 | -643 | -540 | -725 | -15.9 | -344 | -543 | -691 | -690 | -15.8 |
| 20.27 | -403 | -666 | -573 | -736 | -16.6 | -363 | -557 | -733 | -701 | -16.4 |
| 20.53 | -409 | -673 | -587 | -757 | -16.9 | -367 | -562 | -744 | -706 | -16.6 |
| 14.07 | -410 | -605 | -512 | -613 | -14.9 | -363 | -501 | -665 | -606 | -14.9 |
| 9.20 | -360 | -479 | -393 | -454 | -11.8 | -311 | -397 | -515 | -506 | -12.1 |
| 4.77 | -226 | -260 | -227 | -213 | -6.5 | -187 | -243 | -338 | -314 | -7.6 |
| 9.45 | -323 | -457 | -366 | -431 | -11.0 | -277 | -381 | -478 | -467 | -11.2 |
| 14.39 | -391 | -591 | -476 | -613 | -14.4 | -338 | -489 | -620 | -582 | -14.2 |
| 20.46 | -426 | -674 | -587 | -773 | -17.2 | -391 | -578 | -774 | -700 | -17.0 |
| 21.28 | -449 | -701 | -621 | -817 | -18.1 | -423 | -592 | -846 | -729 | -18.1 |
| 21.85 | -455 | -725 | -612 | -850 | -18.4 | -450 | -613 | -893 | -749 | -18.9 |
| 21.66 | -430 | -730 | -554 | -930 | -18.4 | -468 | -615 | -925 | -749 | -19.2 |
| 22.36 | -448 | -760 | -581 | -1014 | -19.6 | -478 | -623 | -947 | -758 | -19.6 |
| 21.73 | -474 | -767 | -610 | -1038 | -20.2 | -473 | -610 | -944 | -744 | -19.3 |
| 21.35 | -467 | -763 | -591 | -1010 | -19.7 | -473 | -606 | -943 | -739 | -19.3 |
| 20.08 | -514 | -766 | -607 | -976 | -20.0 | -470 | -596 | -935 | -720 | -19.0 |
| 19.83 | -543 | -770 | -634 | -974 | -20.4 | -455 | -585 | -904 | -711 | -18.5 |
| 19.39 | -510 | -746 | -600 | -923 | -19.4 | -453 | -581 | -901 | -703 | -18.4 |
| 18.06 | -523 | -750 | -611 | -911 | -19.5 | -452 | -568 | -891 | -681 | -18.1 |
| 17.62 | -528 | -729 | -617 | -934 | -19.6 | -448 | -559 | -882 | -672 | -17.9 |
| 17.30 | -527 | -722 | -623 | -904 | -19.4 | -446 | -557 | -875 | -670 | -17.8 |
| 16.98 | -528 | -744 | -628 | -872 | -19.3 | -445 | -555 | -873 | -666 | -17.7 |
| 11.79 | -359 | -512 | -459 | -620 | -13.6 | -396 | -448 | -726 | -573 | -15.0 |
| 8.38 | -233 | -329 | -325 | -418 | -9.1 | -309 | -337 | -607 | -457 | -11.9 |
| 4.20 | -78 | -108 | -161 | -165 | -3.6 | -183 | -203 | -447 | -276 | -7.7 |

| TOTAL LOAD PER JOIST (kips) | CSJ-1 TEST DATA SHEET TC3 2L1.50x1.50x0.170 | | | | AVG MEM LOAD (kips) | CSJ-1 TEST DATA SHEET TC4 2L1.50x1.50x0.170 | | | | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| | TC3 (22) | TC3 (24) | TC3 (26) | TC3 (28) | | TC4 (41) | TC4 (43) | TC4 (45) | TC4 (47) | |
| | (με) | | | | | (με) | | | | |
| 0.00 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 |
| 0.45 | -31 | -32 | -26 | -35 | -0.9 | -22 | -30 | -18 | -34 | -0.7 |
| 2.89 | -202 | -205 | -164 | -224 | -5.5 | -143 | -195 | -115 | -221 | -4.7 |
| 4.39 | -210 | -219 | -159 | -210 | -5.6 | -144 | -210 | -105 | -201 | -4.6 |
| 6.04 | -210 | -227 | -149 | -186 | -5.4 | -143 | -218 | -94 | -183 | -4.4 |
| 7.68 | -212 | -242 | -139 | -163 | -5.3 | -144 | -232 | -85 | -161 | -4.3 |
| 9.01 | -223 | -260 | -141 | -155 | -5.4 | -145 | -244 | -77 | -151 | -4.3 |
| 10.28 | -235 | -296 | -151 | -168 | -5.9 | -149 | -263 | -78 | -147 | -4.4 |
| 11.92 | -250 | -333 | -162 | -179 | -6.4 | -167 | -288 | -84 | -157 | -4.8 |
| 13.44 | -258 | -367 | -171 | -186 | -6.8 | -184 | -331 | -95 | -178 | -5.5 |
| 9.01 | -260 | -323 | -194 | -244 | -7.1 | -186 | -299 | -126 | -236 | -5.9 |
| 4.64 | -229 | -248 | -184 | -246 | -6.3 | -155 | -231 | -133 | -239 | -5.3 |
| 7.30 | -243 | -292 | -191 | -245 | -6.8 | -168 | -264 | -130 | -228 | -5.5 |
| 10.46 | -254 | -331 | -184 | -221 | -6.9 | -180 | -302 | -112 | -208 | -5.6 |
| 13.31 | -263 | -368 | -178 | -198 | -7.0 | -185 | -329 | -94 | -186 | -5.5 |
| 14.39 | -275 | -396 | -192 | -211 | -7.5 | -197 | -357 | -116 | -207 | -6.1 |
| 14.89 | -287 | -419 | -204 | -229 | -7.9 | -219 | -391 | -137 | -227 | -6.8 |
| 15.53 | -314 | -460 | -238 | -275 | -9.0 | -240 | -427 | -146 | -251 | -7.4 |
| 16.54 | -342 | -537 | -277 | -341 | -10.4 | -264 | -465 | -179 | -267 | -8.2 |
| 17.11 | -348 | -575 | -295 | -381 | -11.2 | -276 | -484 | -194 | -269 | -8.5 |
| 17.74 | -372 | -605 | -327 | -423 | -12.0 | -300 | -514 | -225 | -278 | -9.2 |
| 18.44 | -388 | -636 | -346 | -442 | -12.6 | -321 | -541 | -250 | -286 | -9.8 |
| 19.07 | -412 | -670 | -377 | -469 | -13.4 | -350 | -574 | -289 | -292 | -10.5 |
| 19.77 | -437 | -702 | -407 | -488 | -14.2 | -369 | -600 | -319 | -298 | -11.1 |
| 20.27 | -471 | -728 | -445 | -539 | -15.2 | -387 | -623 | -351 | -302 | -11.6 |
| 20.53 | -482 | -736 | -453 | -537 | -15.4 | -391 | -628 | -357 | -300 | -11.7 |
| 14.07 | -469 | -675 | -459 | -585 | -15.3 | -390 | -581 | -379 | -356 | -11.9 |
| 9.20 | -416 | -531 | -398 | -513 | -13.0 | -331 | -464 | -385 | -304 | -10.4 |
| 4.77 | -290 | -312 | -258 | -325 | -8.3 | -209 | -264 | -332 | -139 | -6.6 |
| 9.45 | -381 | -494 | -361 | -463 | -11.8 | -294 | -418 | -340 | -239 | -9.0 |
| 14.39 | -449 | -642 | -437 | -563 | -14.6 | -360 | -536 | -354 | -303 | -10.8 |
| 20.46 | -500 | -753 | -474 | -568 | -16.0 | -412 | -645 | -390 | -313 | -12.3 |
| 21.28 | -525 | -789 | -505 | -599 | -16.9 | -444 | -673 | -439 | -314 | -13.1 |
| 21.85 | -531 | -828 | -520 | -685 | -17.9 | -475 | -695 | -472 | -323 | -13.7 |
| 21.66 | -511 | -848 | -463 | -763 | -18.0 | -496 | -698 | -512 | -321 | -14.1 |
| 22.36 | -534 | -891 | -470 | -803 | -18.8 | -507 | -708 | -533 | -325 | -14.5 |
| 21.73 | -555 | -922 | -516 | -872 | -20.0 | -505 | -699 | -535 | -321 | -14.4 |
| 21.35 | -545 | -916 | -511 | -879 | -19.9 | -506 | -697 | -537 | -323 | -14.4 |
| 20.08 | -584 | -891 | -545 | -879 | -20.2 | -505 | -694 | -536 | -335 | -14.4 |
| 19.83 | -628 | -882 | -581 | -890 | -20.8 | -489 | -665 | -537 | -318 | -14.0 |
| 19.39 | -599 | -856 | -549 | -834 | -19.8 | -488 | -664 | -535 | -321 | -14.0 |
| 18.06 | -620 | -857 | -569 | -805 | -19.9 | -490 | -661 | -536 | -340 | -14.1 |
| 17.62 | -630 | -856 | -578 | -822 | -20.1 | -485 | -653 | -531 | -341 | -14.0 |
| 17.30 | -642 | -813 | -594 | -788 | -19.8 | -481 | -645 | -532 | -336 | -13.9 |
| 16.98 | -649 | -811 | -600 | -753 | -19.6 | -479 | -642 | -530 | -334 | -13.8 |
| 11.79 | -462 | -607 | -432 | -556 | -14.3 | -426 | -539 | -526 | -315 | -12.6 |
| 8.38 | -336 | -409 | -308 | -370 | -9.9 | -344 | -401 | -492 | -201 | -10.0 |
| 4.20 | -183 | -161 | -155 | -137 | -4.4 | -229 | -216 | -424 | -48 | -6.4 |

| TOTAL LOAD PER JOIST (kips) | CSJ-1 TEST DATA SHEET TC5 2L1.50x1.50x0.170 TC5 (33) | TC5 (34) (με) | TC5 (35) | TC5 (36) | AVG MEM LOAD (kips) | CSJ-1 TEST DATA SHEET TC6 2L1.50x1.50x0.170 TC6 (53) | TC6 (54) (με) | TC6 (55) | TC6 (56) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | | 0 | 0 | 0.0 | | 0 | | 0 | 0.0 |
| 0.45 | -66 | | -68 | -83 | -2.0 | | -80 | | -77 | -2.2 |
| 2.89 | -424 | | -437 | -531 | -12.9 | | -517 | | -493 | -14.1 |
| 4.39 | -409 | | -421 | -524 | -12.6 | | -514 | | -489 | -14.0 |
| 6.04 | -392 | | -404 | -516 | -12.2 | | -511 | | -482 | -13.9 |
| 7.68 | -377 | | -387 | -509 | -11.8 | | -506 | | -477 | -13.7 |
| 9.01 | -370 | | -381 | -510 | -11.7 | | -509 | | -478 | -13.8 |
| 10.28 | -372 | | -383 | -526 | -11.9 | | -522 | | -489 | -14.1 |
| 11.92 | -407 | | -424 | -589 | -13.2 | | -570 | | -533 | -15.4 |
| 13.44 | -432 | | -454 | -637 | -14.2 | | -626 | | -573 | -16.7 |
| 9.01 | -485 | | -509 | -659 | -15.4 | | -644 | | -590 | -17.2 |
| 4.64 | -511 | | -534 | -652 | -15.8 | | -625 | | -584 | -16.9 |
| 7.30 | -486 | | -508 | -642 | -15.2 | | -620 | | -579 | -16.7 |
| 10.46 | -466 | | -487 | -644 | -14.9 | | -628 | | -579 | -16.8 |
| 13.31 | -459 | | -485 | -666 | -15.0 | | -651 | | -592 | -17.3 |
| 14.39 | -488 | | -519 | -716 | -16.0 | | -713 | | -629 | -18.7 |
| 14.89 | -509 | | -543 | -749 | -16.7 | | -753 | | -659 | -19.7 |
| 15.53 | -601 | | -601 | -819 | -18.8 | | -847 | | -717 | -21.8 |
| 16.54 | -763 | | -582 | -876 | -20.7 | | -946 | | -784 | -24.1 |
| 17.11 | -944 | | -594 | -914 | -22.8 | | -1049 | | -852 | -26.5 |
| 17.74 | -1034 | | -637 | -969 | -24.6 | | -1124 | | -921 | -28.5 |
| 18.44 | -1064 | | -687 | -1018 | -25.8 | | -1174 | | -987 | -30.1 |
| 19.07 | -1190 | | -693 | -1090 | -27.7 | | -1271 | | -1069 | -32.6 |
| 19.77 | -1316 | | -895 | -1158 | -31.3 | | -1354 | | -1147 | -34.9 |
| 20.27 | -1521 | | -965 | -1246 | -34.7 | | -1439 | | -1248 | -37.5 |
| 20.53 | -1621 | | -965 | -1267 | -35.8 | | -1454 | | -1278 | -38.1 |
| 14.07 | -1953 | | -1020 | -1283 | -39.6 | | -1460 | | -1298 | -38.5 |
| 9.20 | -1994 | | -974 | -1184 | -38.6 | | -1333 | | -1195 | -35.3 |
| 4.77 | -1746 | | -702 | -864 | -30.8 | | -972 | | -886 | -25.9 |
| 9.45 | -1889 | | -853 | -1048 | -35.3 | | -1194 | | -1073 | -31.6 |
| 14.39 | -1985 | | -953 | -1190 | -38.4 | | -1373 | | -1218 | -36.2 |
| 20.46 | -2060 | | -1030 | -1320 | -41.0 | | -1515 | | -1349 | -40.0 |
| 21.28 | -2292 | | -1447 | -1415 | -47.9 | | -1620 | | -1565 | -44.4 |
| 21.85 | -2494 | | -1577 | -1472 | yield | | -1718 | | -2266 | yield |
| 21.66 | -2447 | | -1680 | -1495 | yield | | -2350 | | -3524 | yield |
| 22.36 | -2489 | | -1747 | -1518 | yield | | -2571 | | -4210 | yield |
| 21.73 | -2536 | | -1930 | -1520 | yield | | -2914 | | -5719 | yield |
| 21.35 | -2560 | | -1981 | -1525 | yield | | -2935 | | -7014 | yield |
| 20.08 | -2546 | | -2045 | -1502 | yield | | -2954 | | -7575 | yield |
| 19.83 | -2581 | | -2101 | -1485 | yield | | -2960 | | -7741 | yield |
| 19.39 | -2587 | | -2126 | -1471 | yield | | -2969 | | -7785 | yield |
| 18.06 | -2596 | | -2166 | -1449 | yield | | -2979 | | -7863 | yield |
| 17.62 | -2589 | | -2169 | -1431 | yield | | -2982 | | -7889 | yield |
| 17.30 | -2577 | | -2155 | -1403 | yield | | -2999 | | -7923 | yield |
| 16.98 | -2535 | | -2130 | -1367 | yield | | -3021 | | -7962 | yield |
| 11.79 | -2387 | | -2003 | -1216 | yield | | -2952 | | -7895 | yield |
| 8.38 | -2146 | | -1770 | -982 | yield | | -2726 | | -7639 | yield |
| 4.20 | -1755 | | -1390 | -574 | yield | | -2321 | | -7164 | yield |

| TOTAL LOAD PER JOIST (kips) | CSJ-1 TEST DATA SHEET BC1 2L2.50x2.50x0.250 BC1 (29) | BC1 (30) | BC1 (31) (με) | BC1 (32) | AVG MEM LOAD (kips) | CSJ-1 TEST DATA SHEET BC2 2L2.50x2.50x0.250 BC2 (49) | BC2 (50) | BC2 (51) (με) | BC2 (52) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 |
| 0.45 | | 22 | 45 | 24 | 2.1 | 42 | 21 | 41 | 21 | 2.1 |
| 2.89 | | 144 | 287 | 152 | 13.4 | 268 | 134 | 263 | 134 | 13.8 |
| 4.39 | | 218 | 379 | 229 | 19.0 | 358 | 209 | 354 | 209 | 19.5 |
| 6.04 | | 299 | 478 | 313 | 25.0 | 458 | 293 | 453 | 293 | 25.8 |
| 7.68 | | 378 | 576 | 396 | 31.0 | 557 | 375 | 552 | 375 | 32.0 |
| 9.01 | | 439 | 653 | 460 | 35.6 | 636 | 438 | 629 | 438 | 36.9 |
| 10.28 | | 503 | 741 | 527 | 40.7 | 722 | 507 | 716 | 504 | 42.2 |
| 11.92 | | 574 | 846 | 600 | 46.4 | 828 | 584 | 821 | 579 | 48.4 |
| 13.44 | | 642 | 944 | 671 | 51.8 | 925 | 656 | 918 | 649 | 54.2 |
| 9.01 | | 431 | 686 | 452 | 36.0 | 665 | 436 | 658 | 430 | 37.7 |
| 4.64 | | 222 | 426 | 235 | 20.3 | 401 | 219 | 396 | 213 | 21.2 |
| 7.30 | | 350 | 584 | 367 | 29.9 | 563 | 354 | 556 | 348 | 31.4 |
| 10.46 | | 500 | 771 | 523 | 41.2 | 750 | 509 | 743 | 502 | 43.1 |
| 13.31 | | 637 | 948 | 666 | 51.7 | 927 | 652 | 918 | 645 | 54.1 |
| 14.39 | | 683 | 1017 | 714 | 55.4 | 994 | 700 | 984 | 691 | 58.0 |
| 14.89 | | 706 | 1052 | 738 | 57.3 | 1028 | 722 | 1019 | 712 | 59.9 |
| 15.53 | | 732 | 1103 | 765 | 59.7 | 1078 | 751 | 1068 | 740 | 62.6 |
| 16.54 | | 771 | 1171 | 806 | 63.1 | 1147 | 796 | 1138 | 784 | 66.6 |
| 17.11 | | 790 | 1209 | 827 | 64.9 | 1184 | 816 | 1176 | 803 | 68.5 |
| 17.74 | | 815 | 1255 | 853 | 67.1 | 1227 | 837 | 1221 | 824 | 70.7 |
| 18.44 | | 842 | 1306 | 881 | 69.5 | 1278 | 865 | 1271 | 850 | 73.4 |
| 19.07 | | 864 | 1358 | 905 | 71.8 | 1329 | 891 | 1324 | 875 | 76.1 |
| 19.77 | | 892 | 1417 | 935 | 74.5 | 1385 | 919 | 1382 | 902 | 79.0 |
| 20.27 | | 909 | 1464 | 954 | 76.4 | 1422 | 926 | 1421 | 909 | 80.5 |
| 20.53 | | 920 | 1486 | 966 | 77.4 | 1445 | 937 | 1443 | 922 | 81.7 |
| 14.07 | | 621 | 1122 | 656 | 55.1 | 1079 | 630 | 1079 | 614 | 58.6 |
| 9.20 | | 400 | 825 | 423 | 37.8 | 781 | 403 | 780 | 386 | 40.5 |
| 4.77 | | 202 | 512 | 210 | 21.2 | 468 | 205 | 465 | 185 | 22.8 |
| 9.45 | | 415 | 820 | 436 | 38.4 | 779 | 425 | 775 | 404 | 41.0 |
| 14.39 | | 639 | 1132 | 672 | 56.1 | 1090 | 654 | 1086 | 634 | 59.6 |
| 20.46 | | 912 | 1502 | 959 | 77.4 | 1457 | 932 | 1454 | 913 | 81.9 |
| 21.28 | | 946 | 1577 | 994 | 80.7 | 1527 | 964 | 1521 | 942 | 85.3 |
| 21.85 | | 960 | 1622 | 1011 | 82.5 | 1579 | 985 | 1571 | 960 | 87.7 |
| 21.66 | | 947 | 1632 | 996 | 82.1 | 1593 | 968 | 1585 | 941 | 87.6 |
| 22.36 | | 972 | 1693 | 1026 | 84.7 | 1659 | 988 | 1648 | 960 | 90.5 |
| 21.73 | | 931 | 1689 | 987 | 82.8 | 1638 | 902 | 1617 | 871 | 86.6 |
| 21.35 | | 904 | 1680 | 961 | 81.4 | 1636 | 865 | 1612 | 833 | 85.1 |
| 20.08 | | 823 | 1590 | 879 | 75.6 | 1585 | 815 | 1562 | 784 | 81.7 |
| 19.83 | | 794 | 1559 | 839 | 73.3 | 1602 | 818 | 1577 | 787 | 82.4 |
| 19.39 | | 759 | 1521 | 801 | 70.8 | 1594 | 806 | 1570 | 775 | 81.7 |
| 18.06 | | 728 | 1480 | 768 | 68.3 | 1480 | 704 | 1459 | 673 | 74.3 |
| 17.62 | | 716 | 1434 | 760 | 66.8 | 1468 | 692 | 1439 | 658 | 73.3 |
| 17.30 | | 684 | 1351 | 727 | 63.4 | 1489 | 703 | 1467 | 672 | 74.6 |
| 16.98 | | 648 | 1293 | 690 | 60.4 | 1527 | 709 | 1507 | 679 | 76.1 |
| 11.79 | | 423 | 973 | 459 | 42.6 | 1190 | 446 | 1168 | 415 | 55.4 |
| 8.38 | | 277 | 732 | 303 | 30.1 | 924 | 281 | 901 | 249 | 40.6 |
| 4.20 | | 99 | 423 | 118 | 14.7 | 583 | 92 | 559 | 56 | 22.2 |

| APPLIED LOAD PER JOIST (kips) | CSJ-1 TEST DATA SHEET END SLIPS SLIP 1 (in.) | SLIP 2 (in.) | SLIP 11 (in.) | SLIP 12 (in.) |
|---|---|---|---|---|
| 0.00 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.50 | 0.002 | -0.001 | 0.000 | 0.000 |
| 3.14 | 0.002 | -0.001 | 0.000 | 0.000 |
| 4.79 | 0.003 | 0.001 | 0.001 | 0.001 |
| 6.12 | 0.007 | 0.006 | 0.004 | 0.006 |
| 7.38 | 0.014 | 0.012 | 0.010 | 0.012 |
| 9.03 | 0.025 | 0.023 | 0.020 | 0.028 |
| 10.55 | 0.032 | 0.032 | 0.032 | 0.039 |
| 6.12 | 0.032 | 0.028 | 0.030 | 0.036 |
| 1.75 | 0.022 | 0.017 | 0.018 | 0.021 |
| 4.41 | 0.024 | 0.021 | 0.023 | 0.028 |
| 7.57 | 0.030 | 0.028 | 0.029 | 0.036 |
| 10.42 | 0.036 | 0.034 | 0.037 | 0.046 |
| 11.50 | 0.042 | 0.043 | 0.048 | 0.057 |
| 12.00 | 0.047 | 0.048 | 0.056 | 0.064 |
| 12.64 | 0.053 | 0.059 | 0.072 | 0.077 |
| 13.65 | 0.063 | 0.075 | 0.086 | 0.091 |
| 14.22 | 0.069 | 0.083 | 0.094 | 0.098 |
| 14.85 | 0.080 | 0.095 | 0.106 | 0.111 |
| 15.55 | 0.092 | 0.109 | 0.116 | 0.122 |
| 16.18 | 0.103 | 0.127 | 0.133 | 0.137 |
| 16.87 | 0.116 | 0.142 | 0.146 | 0.151 |
| 17.38 | 0.138 | 0.161 | 0.158 | 0.168 |
| 17.63 | 0.144 | 0.166 | 0.161 | 0.172 |
| 11.18 | 0.149 | 0.158 | 0.162 | 0.166 |
| 6.31 | 0.125 | 0.128 | 0.131 | 0.136 |
| 1.88 | 0.072 | 0.070 | 0.068 | 0.077 |
| 6.56 | 0.110 | 0.111 | 0.110 | 0.120 |
| 11.50 | 0.135 | 0.146 | 0.146 | 0.156 |
| 17.57 | 0.157 | 0.179 | 0.177 | 0.190 |
| 18.39 | 0.173 | 0.205 | 0.199 | 0.217 |
| 18.96 | 0.181 | 0.230 | 0.214 | 0.233 |
| 18.77 | 0.184 | 0.256 | 0.228 | 0.250 |
| 19.47 | 0.185 | 0.290 | 0.234 | 0.263 |
| 18.84 | 0.205 | 0.346 | 0.234 | 0.267 |
| 18.46 | 0.228 | 0.350 | 0.234 | 0.268 |
| 17.19 | 0.233 | 0.348 | 0.234 | 0.268 |
| 16.94 | 0.257 | 0.360 | 0.238 | 0.265 |
| 16.50 | 0.297 | 0.380 | 0.238 | 0.265 |
| 15.17 | 0.361 | 0.383 | 0.238 | 0.263 |
| 14.72 | 0.384 | 0.384 | 0.238 | 0.263 |
| 14.41 | 0.399 | 0.379 | 0.238 | 0.262 |
| 14.09 | 0.451 | 0.524 | 0.238 | 0.260 |
| 8.90 | 0.470 | 0.530 | 0.237 | 0.233 |
| 5.49 | 0.484 | 0.480 | 0.195 | 0.192 |
| 1.31 | 0.449 | 0.389 | 0.135 | 0.137 |

| APPLIED LOAD PER JOIST (kips) | CSJ-1 TEST DATA SHEET INTERMEDIATE SLIPS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | SLIP 3 (in.) | SLIP 4 (in.) | SLIP 5 (in.) | SLIP 6 (in.) | SLIP 7 (in.) | SLIP 8 (in.) | SLIP 9 (in.) | SLIP 10 (in.) |
| 0.00 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.50 | 0.001 | 0.001 | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 |
| 3.14 | 0.001 | 0.001 | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 |
| 4.79 | 0.002 | 0.002 | 0.002 | 0.001 | 0.000 | 0.002 | 0.002 | 0.002 |
| 6.12 | 0.006 | 0.006 | 0.004 | 0.003 | 0.000 | 0.005 | 0.006 | 0.006 |
| 7.38 | 0.012 | 0.013 | 0.009 | 0.008 | 0.000 | 0.011 | 0.012 | 0.012 |
| 9.03 | 0.022 | 0.023 | 0.018 | 0.015 | 0.000 | 0.023 | 0.023 | 0.024 |
| 10.55 | 0.031 | 0.031 | 0.027 | 0.024 | 0.000 | 0.033 | 0.034 | 0.035 |
| 6.12 | 0.026 | 0.027 | 0.024 | 0.020 | 0.000 | 0.029 | 0.030 | 0.031 |
| 1.75 | 0.017 | 0.018 | 0.017 | 0.014 | 0.000 | 0.019 | 0.020 | 0.020 |
| 4.41 | 0.021 | 0.023 | 0.020 | 0.017 | 0.000 | 0.023 | 0.024 | 0.023 |
| 7.57 | 0.026 | 0.028 | 0.024 | 0.020 | 0.000 | 0.030 | 0.031 | 0.031 |
| 10.42 | 0.032 | 0.033 | 0.029 | 0.026 | 0.000 | 0.037 | 0.039 | 0.039 |
| 11.50 | 0.040 | 0.040 | 0.036 | 0.032 | 0.000 | 0.046 | 0.049 | 0.049 |
| 12.00 | 0.045 | 0.045 | 0.041 | 0.036 | 0.000 | 0.052 | 0.056 | 0.057 |
| 12.64 | 0.054 | 0.054 | 0.049 | 0.043 | 0.000 | 0.065 | 0.070 | 0.069 |
| 13.65 | 0.068 | 0.068 | 0.061 | 0.055 | -0.001 | 0.077 | 0.084 | 0.083 |
| 14.22 | 0.076 | 0.075 | 0.069 | 0.062 | -0.001 | 0.085 | 0.093 | 0.091 |
| 14.85 | 0.086 | 0.086 | 0.079 | 0.072 | -0.001 | 0.095 | 0.105 | 0.101 |
| 15.55 | 0.089 | 0.097 | 0.090 | 0.083 | -0.001 | 0.103 | 0.114 | 0.110 |
| 16.18 | 0.092 | 0.111 | 0.105 | 0.096 | -0.001 | 0.118 | 0.119 | 0.126 |
| 16.87 | 0.095 | 0.124 | 0.119 | 0.108 | -0.001 | 0.131 | 0.128 | 0.139 |
| 17.38 | 0.103 | 0.140 | 0.136 | 0.122 | 0.000 | 0.143 | 0.146 | 0.153 |
| 17.63 | 0.105 | 0.145 | 0.141 | 0.127 | 0.001 | 0.147 | 0.147 | 0.157 |
| 11.18 | 0.113 | 0.139 | 0.136 | 0.122 | 0.001 | 0.140 | 0.147 | 0.151 |
| 6.31 | 0.104 | 0.111 | 0.112 | 0.099 | 0.001 | 0.114 | 0.122 | 0.122 |
| 1.88 | 0.061 | 0.059 | 0.067 | 0.057 | 0.001 | 0.064 | 0.070 | 0.067 |
| 6.56 | 0.098 | 0.099 | 0.098 | 0.088 | 0.001 | 0.101 | 0.106 | 0.105 |
| 11.50 | 0.109 | 0.130 | 0.126 | 0.114 | 0.001 | 0.132 | 0.141 | 0.138 |
| 17.57 | 0.109 | 0.157 | 0.153 | 0.139 | 0.001 | 0.160 | 0.167 | 0.169 |
| 18.39 | 0.115 | 0.179 | 0.177 | 0.162 | 0.002 | 0.186 | 0.193 | 0.196 |
| 18.96 | 0.117 | 0.202 | 0.200 | 0.184 | 0.002 | 0.203 | 0.210 | 0.213 |
| 18.77 | 0.116 | 0.227 | 0.227 | 0.207 | 0.002 | 0.222 | 0.231 | 0.234 |
| 19.47 | 0.114 | 0.257 | 0.255 | 0.234 | 0.002 | 0.235 | 0.240 | 0.248 |
| 18.84 | 0.111 | 0.307 | 0.246 | 0.282 | 0.004 | 0.239 | 0.243 | 0.251 |
| 18.46 | 0.112 | 0.359 | 0.264 | 0.340 | 0.005 | 0.239 | 0.243 | 0.251 |
| 17.19 | 0.117 | 0.389 | 0.283 | 0.366 | 0.005 | 0.239 | 0.244 | 0.251 |
| 16.94 | 0.125 | 0.454 | 0.316 | 0.372 | 0.005 | 0.237 | 0.245 | 0.248 |
| 16.50 | 0.138 | 0.521 | 0.384 | 0.370 | 0.005 | 0.237 | 0.245 | 0.248 |
| 15.17 | 0.144 | 0.584 | 0.477 | 0.370 | 0.006 | 0.237 | 0.246 | 0.248 |
| 14.72 | 0.144 | 0.671 | 0.553 | 0.367 | 0.006 | 0.235 | 0.246 | 0.248 |
| 14.41 | 0.144 | 0.750 | 0.581 | 0.367 | 0.006 | 0.235 | 0.246 | 0.248 |
| 14.09 | 0.132 | 0.852 | 0.603 | 0.367 | 0.006 | 0.235 | 0.246 | 0.248 |
| 8.90 | 0.133 | 0.815 | 0.611 | 0.365 | 0.005 | 0.213 | 0.225 | 0.224 |
| 5.49 | 0.134 | 0.750 | 0.608 | 0.349 | 0.003 | 0.179 | 0.190 | 0.187 |
| 1.31 | 0.135 | 0.657 | 0.547 | 0.289 | -0.002 | 0.128 | 0.137 | 0.132 |

# CSJ-1

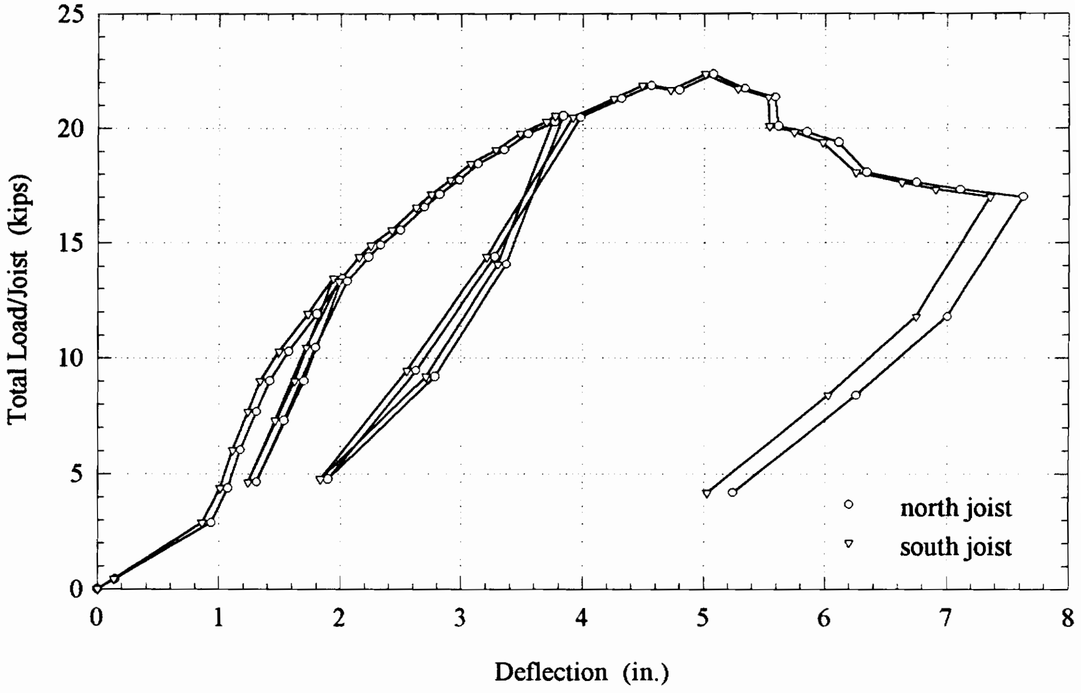



Figure A.1.1 Total Load/Joist vs. Midspan Deflection

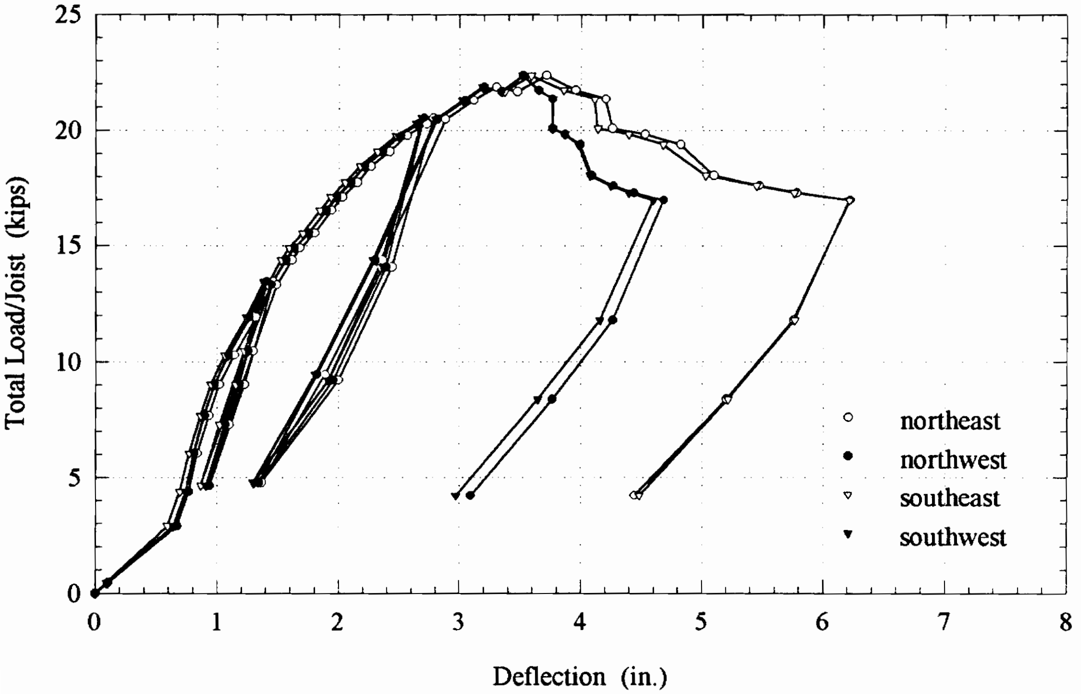



Figure A.1.2 Total Load/Joist vs. Quarter Point Deflection

# CSJ-1

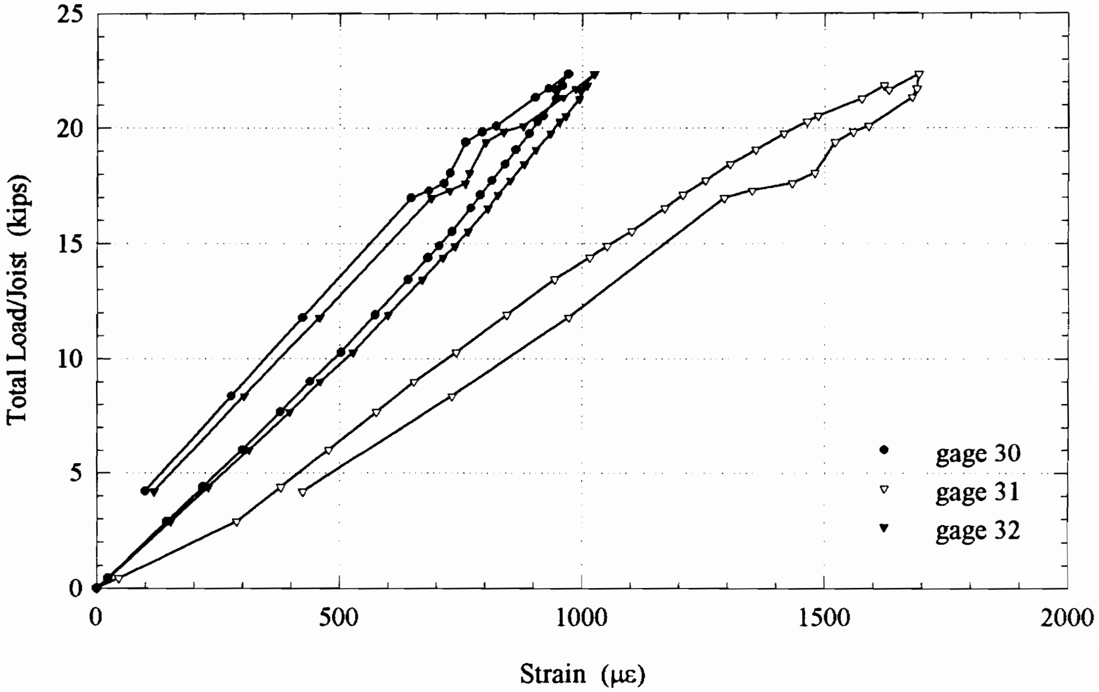



Figure A.1.3 Total Load/Joist vs. Bottom Chord Strain (BC1)

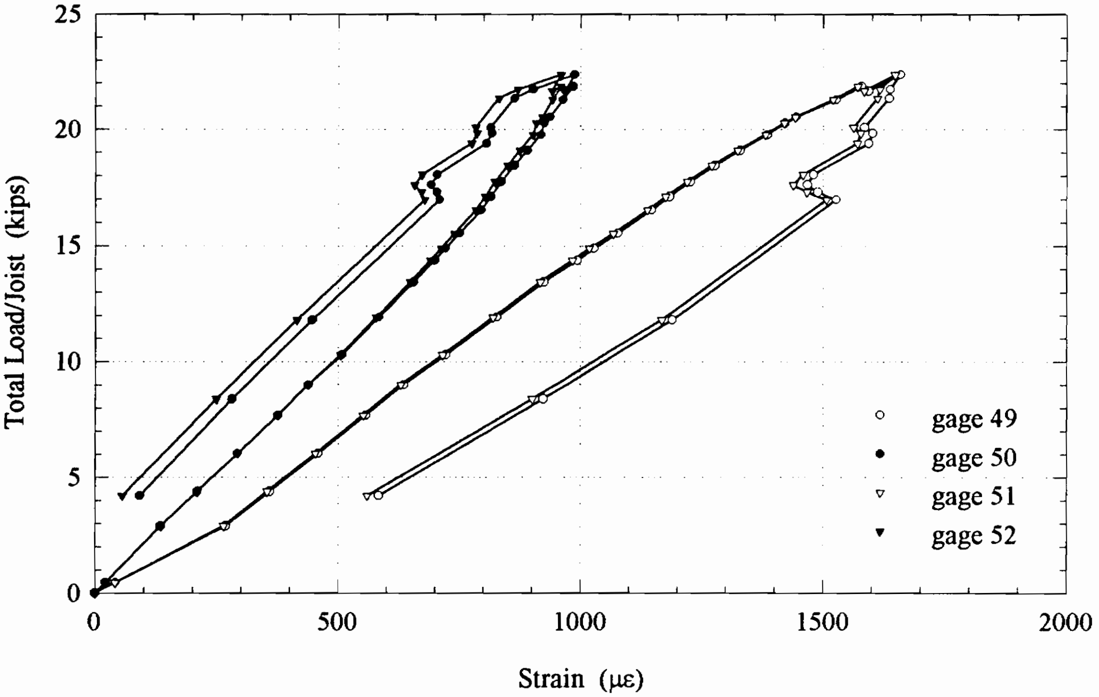



Figure A.1.4 Total Load/Joist vs. Bottom Chord Strain (BC2)

# CSJ-1

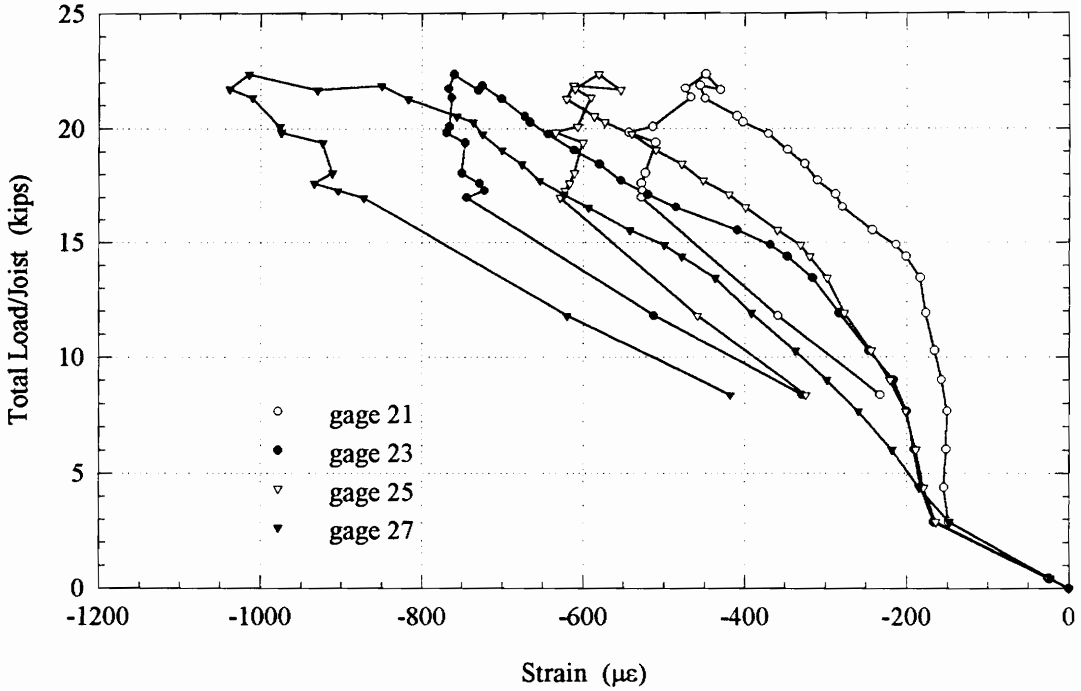



Figure A.1.5 Total Load/Joist vs. Top Chord Strain (TC1)

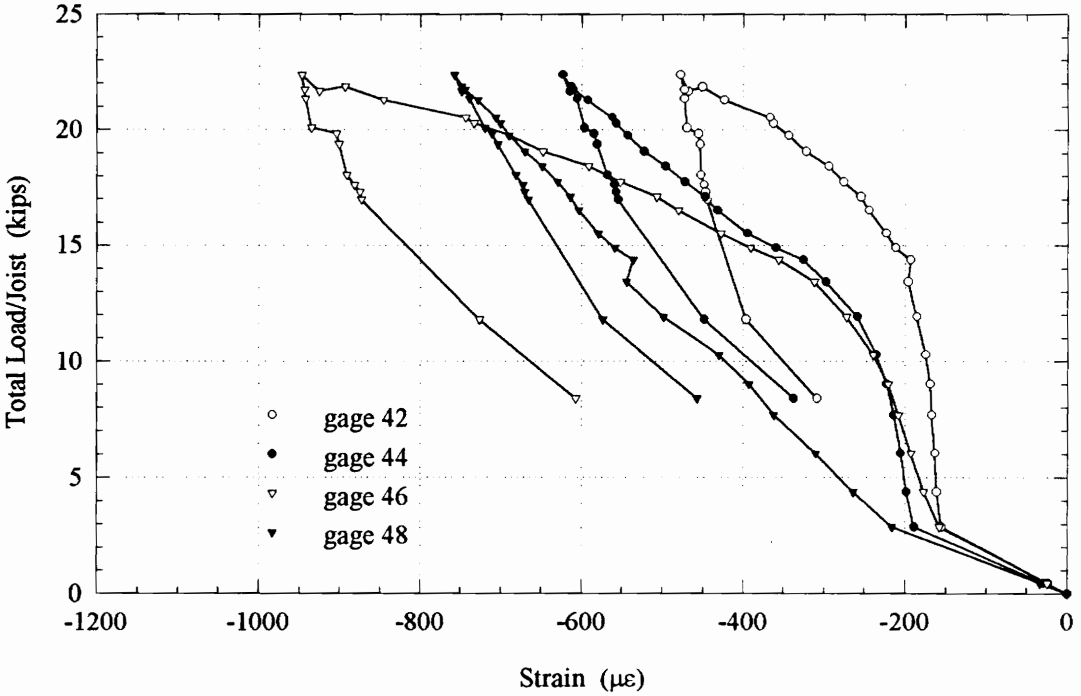



Figure A.1.6 Total Load/Joist vs. Top Chord Strain (TC2)

CSJ-1

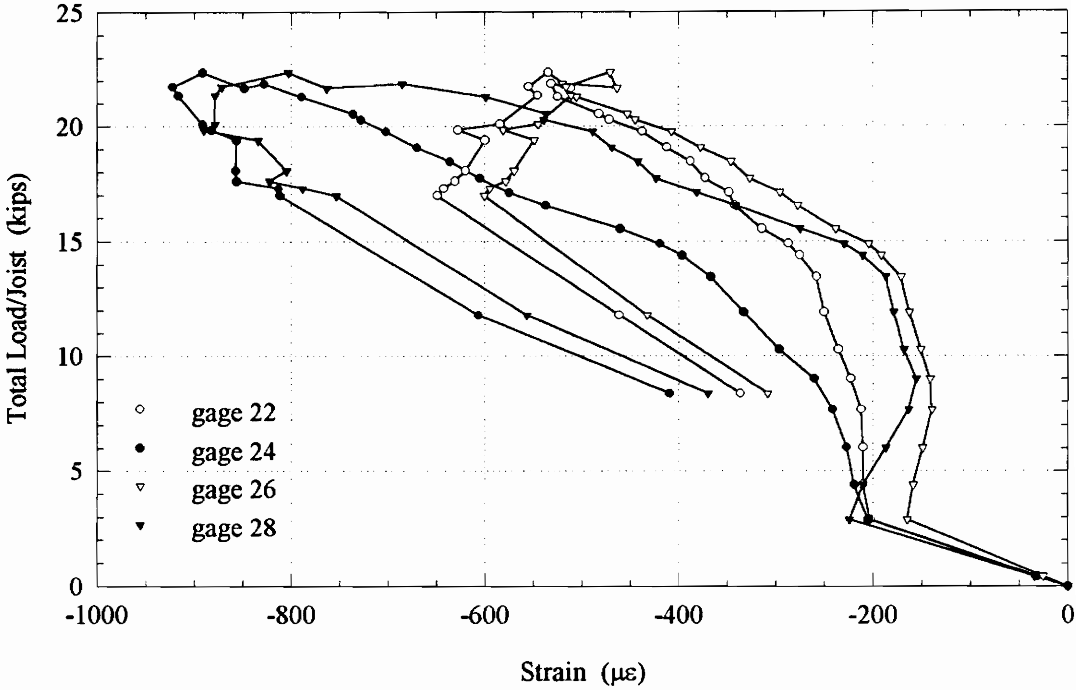



Figure A.1.7 Total Load/Joist vs. Top Chord Strain (TC3)

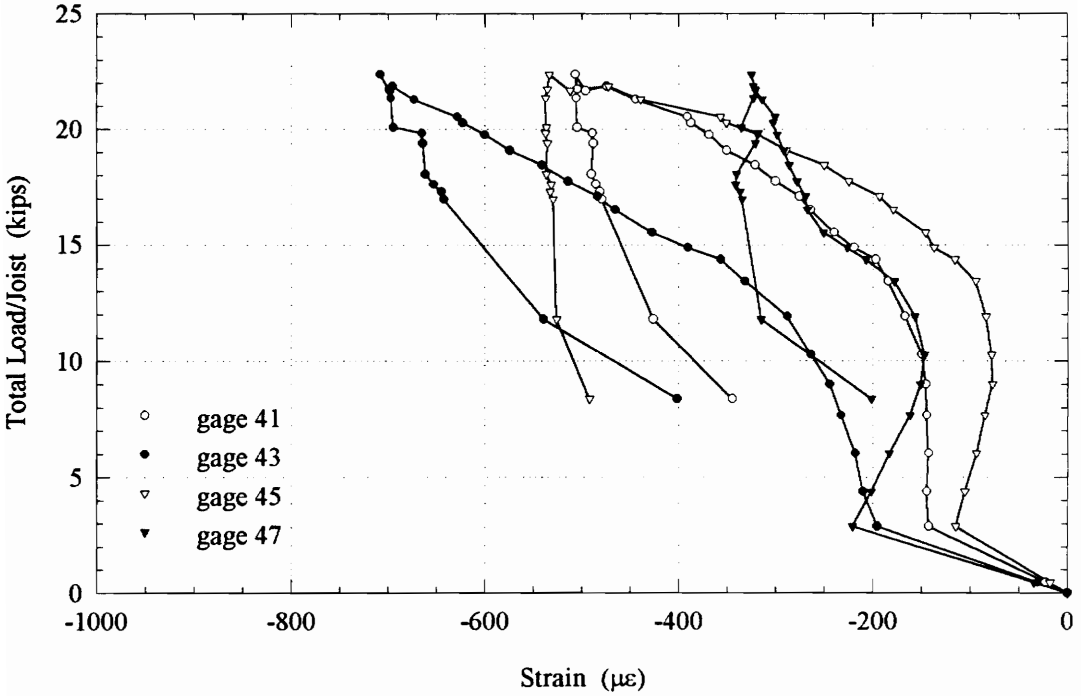



Figure A.1.8 Total Load/Joist vs. Top Chord Strain (TC4)

# CSJ-1

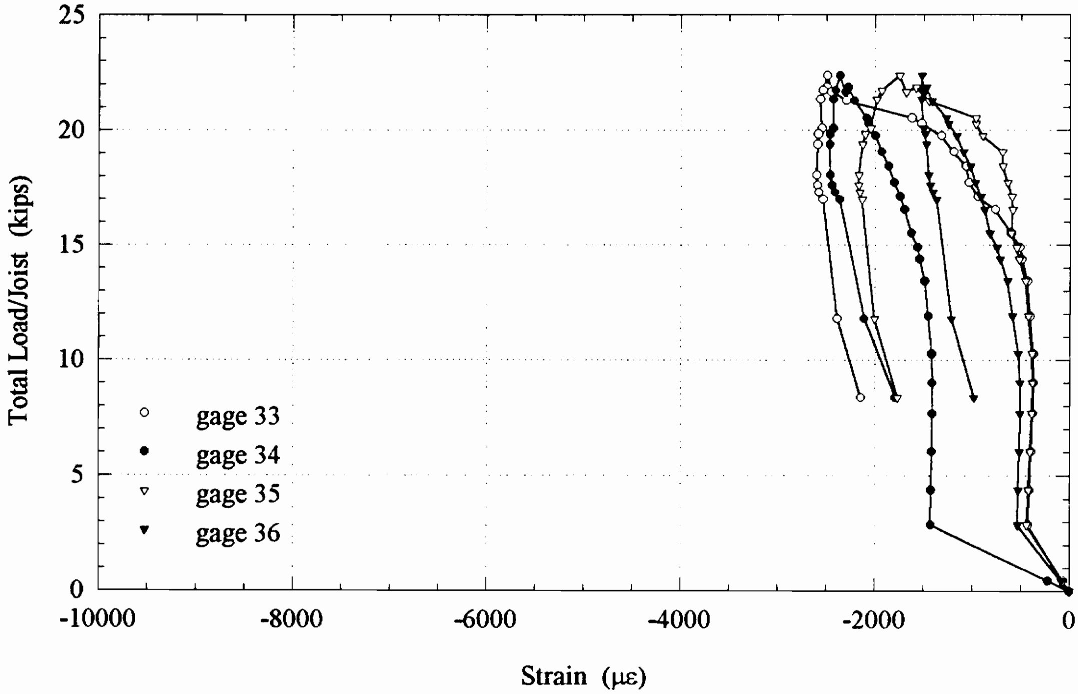



Figure A.1.9 Total Load/Joist vs. Top Chord Strain (TC5)

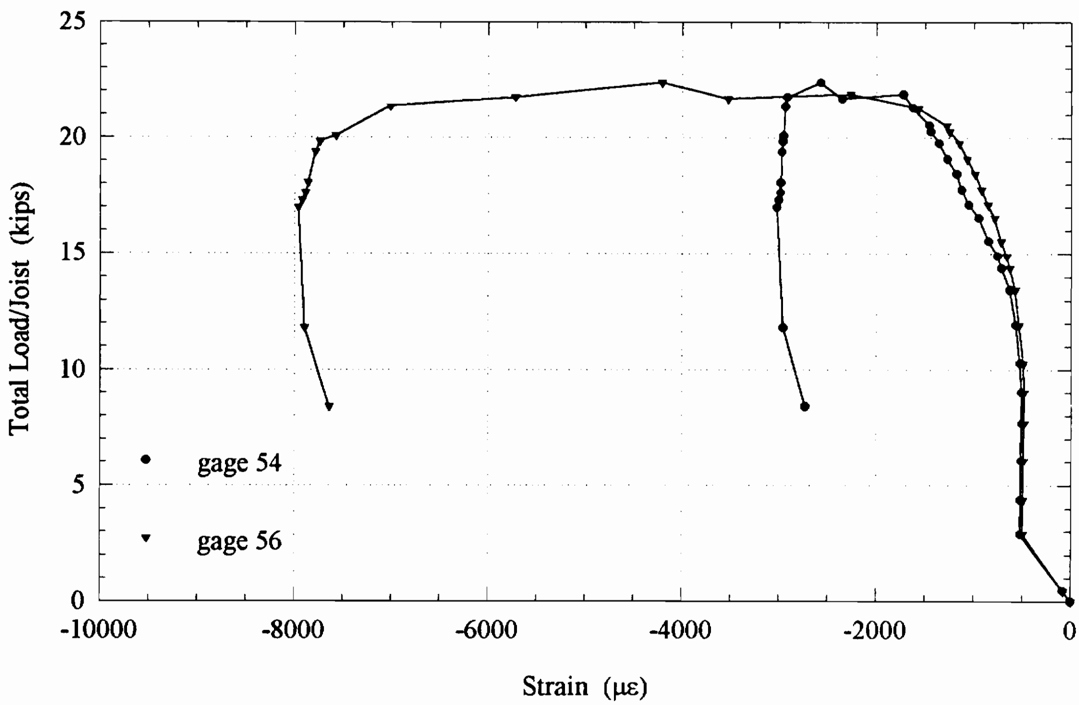



Figure A.1.10 Total Load/Joist vs. Top Chord Strain (TC6)

# CSJ-1

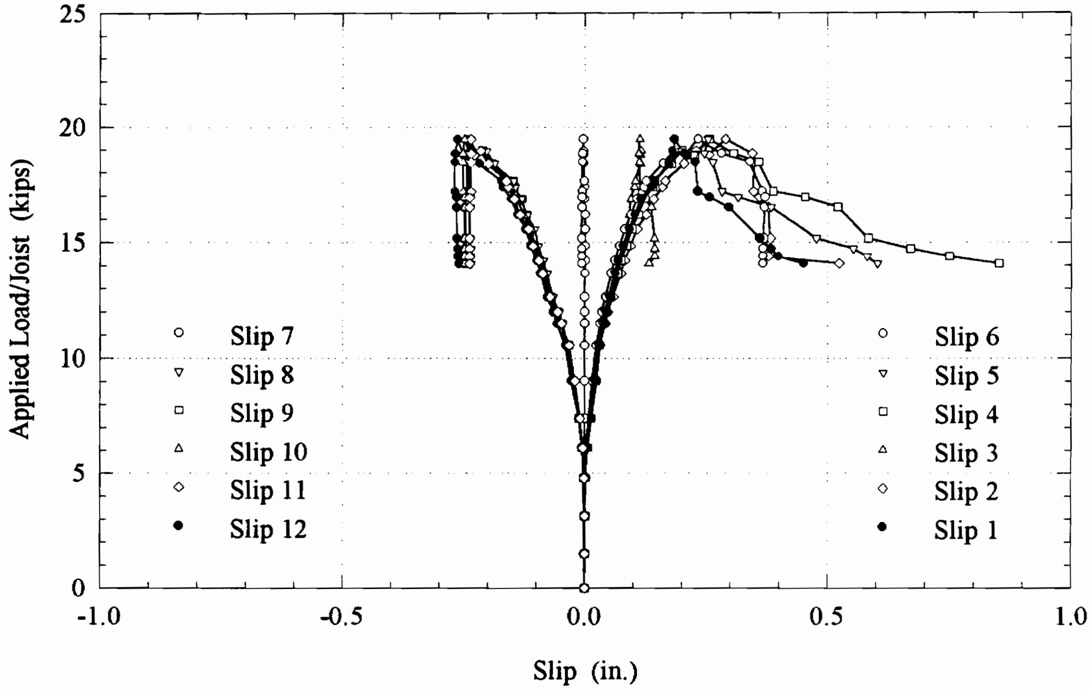



Figure A.1.11 Applied Load/Joist vs. Slip

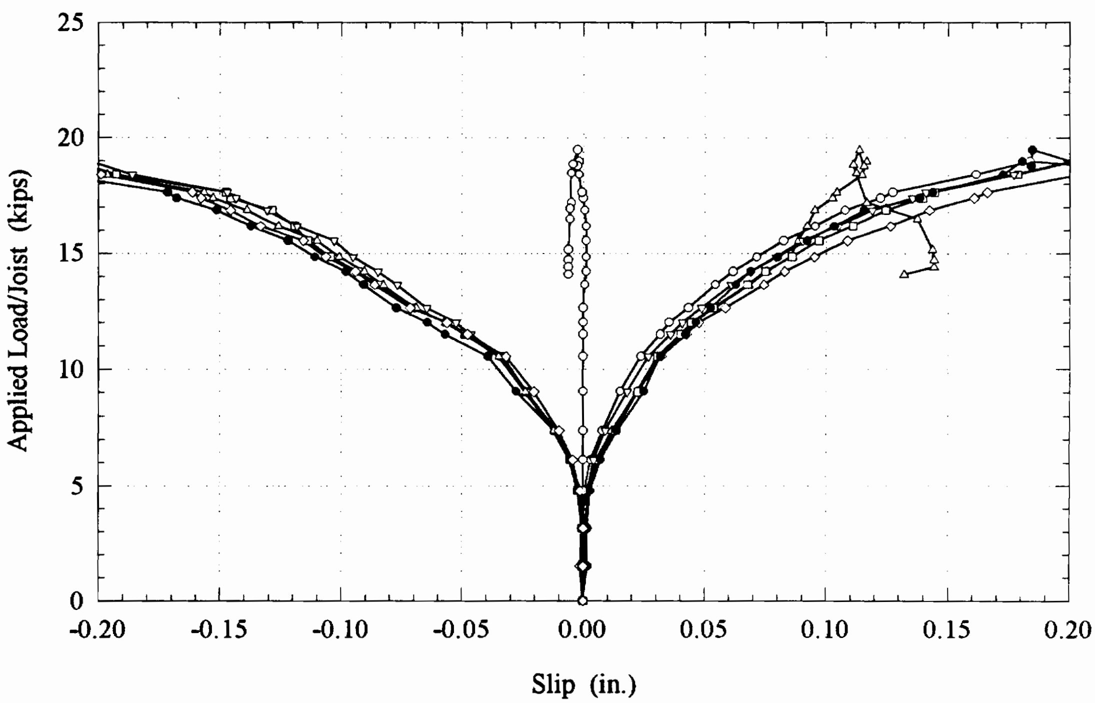



Figure A.1.12 Applied Load/Joist vs. Slip

## NUCOR COMPOSITE JOIST TEST SUMMARY SHEET

TEST DESIGNATION: CSJ-2 TEST DATE: 16 August 1991

### TEST DESCRIPTION

| | | | | |
|---|---|---|---|---|
| **Joist:** | Span: | 24'-3" | Weight: | 15 plf |
| | Depth: | 8 in. | Spacing: | 40 in. |
| | Top Chord: | 2L-1.50x1.50x0.170 | Yield Stress: | 51.9 ksi |
| | Bottom Chord: | 2L-2.50x2.50x0.250 | Yield Stress: | 54.0 ksi |
| **Deck:** | Type: | 1.5VL | Gage: | 22 ga |
| **Slab:** | Total Depth: | 3.0 in. | Compressive Strength: | 3600 psi |
| **Shear Connector:** | Type: | Buildex 5/16 in. dia. x 2 in. long standoff screw | | |
| | Quantity: | 14 per half-span | | |

### THEORETICAL CALCULATIONS

Theoretical Applied Load per Joist at Failure: 18.3 kips
Theoretical Total Load per Joist at Failure: 20.8 kips
Transformed Moment of Inertia: 164.8 in.$^4$
Theoretical Elastic Stiffness: 12.47 k/in.
Elastic Deflection at Yield: 1.73 in.

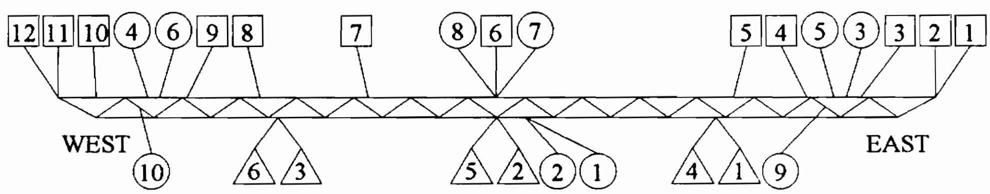
### TEST RESULTS

Applied Load per Joist at Failure: 19.7 kips
Total Load per Joist at Failure: 22.2 kips
Midspan Deflection at Failure: 5.26 in.
Maximum Slip and Location: 0.928 in., SLIP 3
Mode of Failure: yielding of the top chord

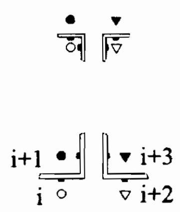
### COMPARISON OF ACTUAL TO THEORETICAL

Applied Load per Joist/Theoretical Applied Load per Joist: 1.07

### INSTRUMENTATION LOCATIONS




| | | |
|---|---|---|
| (1) BC1 (N) | △1 NEQB Defl | [1] SLIP 1 (S) |
| (2) BC2 (S) | △2 NMB Defl | [2] SLIP 2 (N) |
| (3) TC1 (N) | △3 NWQB Defl | [3] SLIP 3 (N) |
| (4) TC2 (S) | △4 SEQB Defl | [4] SLIP 4 (N) |
| (5) TC3 (N) | △5 SMB Defl | [5] SLIP 5 (N) |
| (6) TC4 (S) | △6 SWQB Defl | [6] SLIP 6 (S) |
| (7) TC5 (N) | | [7] SLIP 7 (S) |
| (8) TC6 (S) | | [8] SLIP 8 (S) |
| (9) W5 (N) | | [9] SLIP 9 (S) |
| (10) W4 (S) | | [10] SLIP 10 (S) |
| | | [11] SLIP 11 (S) |
| | | [12] SLIP 12 (N) |




Strain Gage Locations

| TOTAL LOAD PER JOIST (kips) | CSJ-2 TEST DATA SHEET DEFLECTIONS NEQB (in.) | SMB (in.) | NWQB (in.) | SEQB (in.) | SMB (in.) | SWQB (in.) |
|---|---|---|---|---|---|---|
| 0.00 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 0.51 | 0.105 | 0.146 | 0.106 | 0.112 | 0.150 | 0.111 |
| 2.49 | 0.518 | 0.717 | 0.521 | 0.551 | 0.737 | 0.544 |
| 3.99 | 0.641 | 0.924 | 0.631 | 0.672 | 0.900 | 0.661 |
| 5.26 | 0.719 | 1.040 | 0.699 | 0.752 | 1.006 | 0.738 |
| 6.97 | 0.792 | 1.150 | 0.768 | 0.835 | 1.113 | 0.798 |
| 8.29 | 0.879 | 1.270 | 0.850 | 0.917 | 1.229 | 0.885 |
| 9.50 | 0.980 | 1.409 | 0.946 | 1.018 | 1.373 | 0.990 |
| 10.13 | 1.053 | 1.506 | 1.014 | 1.090 | 1.471 | 1.060 |
| 11.20 | 1.136 | 1.630 | 1.101 | 1.179 | 1.601 | 1.146 |
| 11.96 | 1.227 | 1.755 | 1.188 | 1.271 | 1.726 | 1.247 |
| 12.47 | 1.264 | 1.810 | 1.229 | 1.310 | 1.782 | 1.282 |
| 13.04 | 1.323 | 1.884 | 1.284 | 1.362 | 1.861 | 1.342 |
| 12.85 | 1.355 | 1.935 | 1.311 | 1.397 | 1.907 | 1.370 |
| 9.81 | 1.191 | 1.695 | 1.151 | 1.227 | 1.666 | 1.198 |
| 6.78 | 1.026 | 1.464 | 1.014 | 1.060 | 1.443 | 1.036 |
| 4.12 | 0.811 | 1.164 | 0.800 | 0.837 | 1.141 | 0.829 |
| 7.22 | 1.007 | 1.446 | 0.969 | 1.037 | 1.415 | 1.020 |
| 9.88 | 1.177 | 1.676 | 1.133 | 1.218 | 1.652 | 1.193 |
| 13.10 | 1.383 | 1.967 | 1.334 | 1.422 | 1.940 | 1.408 |
| 14.49 | 1.516 | 2.161 | 1.462 | 1.560 | 2.135 | 1.543 |
| 15.95 | 1.749 | 2.488 | 1.686 | 1.801 | 2.469 | 1.777 |
| 16.96 | 1.841 | 2.626 | 1.768 | 1.895 | 2.599 | 1.865 |
| 18.16 | 2.138 | 3.028 | 2.037 | 2.197 | 3.013 | 2.136 |
| 19.18 | 2.308 | 3.254 | 2.193 | 2.372 | 3.259 | 2.328 |
| 19.37 | 2.445 | 3.438 | 2.311 | 2.507 | 3.445 | 2.433 |
| 20.13 | 2.541 | 3.572 | 2.403 | 2.603 | 3.579 | 2.526 |
| 14.12 | 2.203 | 3.106 | 2.078 | 2.250 | 3.106 | 2.197 |
| 8.93 | 1.813 | 2.576 | 1.741 | 1.853 | 2.572 | 1.821 |
| 4.18 | 1.104 | 1.589 | 1.078 | 1.145 | 1.596 | 1.125 |
| 9.05 | 1.703 | 2.414 | 1.604 | 1.752 | 2.414 | 1.707 |
| 14.81 | 2.221 | 3.129 | 2.088 | 2.282 | 3.138 | 2.230 |
| 20.06 | 2.660 | 3.733 | 2.512 | 2.720 | 3.747 | 2.659 |
| 21.45 | 3.159 | 4.435 | 2.951 | 3.190 | 4.411 | 3.079 |
| 21.96 | 3.393 | 4.757 | 3.151 | 3.420 | 4.727 | 3.275 |
| 22.15 | 3.768 | 5.279 | 3.444 | 3.782 | 5.247 | 3.567 |
| 22.09 | 4.144 | 5.777 | 3.704 | 4.165 | 5.753 | 3.836 |
| 21.58 | 4.387 | 6.086 | 3.850 | 4.401 | 6.060 | 3.976 |
| 21.08 | 4.867 | 6.676 | 4.120 | 4.858 | 6.617 | 4.230 |
| 19.87 | 5.188 | 7.022 | 4.252 | 5.076 | 6.887 | 4.340 |
| 18.35 | 5.655 | 7.566 | 4.485 | 5.489 | 7.360 | 4.536 |
| 17.47 | 6.099 | 8.069 | 4.718 | 5.885 | 7.843 | 4.739 |
| 12.53 | 5.737 | 7.557 | 4.371 | 5.548 | 7.370 | 4.394 |
| 7.85 | 5.087 | 6.667 | 3.754 | 4.924 | 6.520 | 3.789 |
| 3.87 | 4.345 | 5.657 | 3.092 | 4.216 | 5.526 | 3.093 |

| TOTAL LOAD PER JOIST (kips) | CSJ-2 TEST DATA SHEET TC1 2L1.50x1.50x0.170 TC1 (21) | TC1 (23) | TC1 (25) | TC1 (27) | AVG MEM LOAD (kips) | CSJ-2 TEST DATA SHEET TC2 2L1.50x1.50x0.170 TC2 (42) | TC2 (44) | TC2 (46) | TC2 (48) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| | (με) | | | | | (με) | | | | |
| 0.00 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 |
| 0.51 | -23 | -26 | -23 | -28 | -0.7 | -24 | -32 | -21 | -36 | -0.8 |
| 2.49 | -112 | -127 | -113 | -139 | -3.4 | -118 | -157 | -105 | -174 | -3.9 |
| 3.99 | -113 | -124 | -130 | -171 | -3.8 | -117 | -144 | -113 | -201 | -4.0 |
| 5.26 | -116 | -122 | -148 | -198 | -4.1 | -119 | -138 | -124 | -228 | -4.2 |
| 6.97 | -119 | -123 | -170 | -228 | -4.5 | -122 | -131 | -135 | -250 | -4.5 |
| 8.29 | -113 | -116 | -179 | -237 | -4.5 | -125 | -126 | -141 | -266 | -4.6 |
| 9.50 | -111 | -108 | -191 | -257 | -4.7 | -128 | -122 | -149 | -272 | -4.7 |
| 10.13 | -112 | -109 | -201 | -278 | -4.9 | -130 | -121 | -154 | -278 | -4.8 |
| 11.20 | -113 | -106 | -214 | -318 | -5.2 | -135 | -121 | -163 | -295 | -5.0 |
| 11.96 | -119 | -116 | -232 | -367 | -5.8 | -138 | -122 | -170 | -311 | -5.2 |
| 12.47 | -117 | -113 | -236 | -383 | -5.9 | -137 | -118 | -171 | -318 | -5.2 |
| 13.04 | -123 | -124 | -247 | -412 | -6.3 | -139 | -119 | -173 | -330 | -5.3 |
| 12.85 | -134 | -139 | -260 | -429 | -6.7 | -144 | -129 | -176 | -342 | -5.5 |
| 9.81 | -143 | -158 | -240 | -371 | -6.4 | -150 | -159 | -168 | -305 | -5.5 |
| 6.78 | -152 | -170 | -214 | -310 | -5.9 | -153 | -180 | -157 | -262 | -5.2 |
| 4.12 | -151 | -177 | -165 | -247 | -5.2 | -131 | -169 | -128 | -210 | -4.5 |
| 7.22 | -150 | -170 | -202 | -313 | -5.8 | -139 | -159 | -155 | -274 | -5.1 |
| 9.88 | -143 | -157 | -234 | -363 | -6.3 | -144 | -149 | -168 | -311 | -5.4 |
| 13.10 | -137 | -145 | -266 | -440 | -6.9 | -144 | -127 | -176 | -352 | -5.6 |
| 14.49 | -153 | -170 | -294 | -503 | -7.8 | -151 | -134 | -183 | -382 | -5.9 |
| 15.95 | -195 | -242 | -331 | -603 | -9.6 | -186 | -183 | -212 | -443 | -7.1 |
| 16.96 | -201 | -252 | -343 | -637 | -10.0 | -194 | -189 | -220 | -463 | -7.4 |
| 18.16 | -268 | -271 | -399 | -722 | -11.6 | -250 | -254 | -270 | -518 | -9.0 |
| 19.18 | -301 | -304 | -437 | -773 | -12.7 | -286 | -290 | -303 | -555 | -10.0 |
| 19.37 | -334 | -349 | -466 | -807 | -13.6 | -312 | -321 | -325 | -577 | -10.7 |
| 20.13 | -351 | -370 | -488 | -837 | -14.3 | -324 | -334 | -339 | -593 | -11.1 |
| 14.12 | -375 | -428 | -456 | -773 | -14.2 | -334 | -387 | -324 | -552 | -11.1 |
| 8.93 | -342 | -438 | -354 | -608 | -12.2 | -301 | -379 | -276 | -498 | -10.1 |
| 4.18 | -168 | -242 | -143 | -340 | -6.2 | -158 | -212 | -117 | -303 | -5.5 |
| 9.05 | -308 | -388 | -324 | -536 | -10.9 | -272 | -338 | -249 | -457 | -9.2 |
| 14.81 | -367 | -400 | -439 | -746 | -13.6 | -323 | -374 | -317 | -537 | -10.8 |
| 20.06 | -386 | -411 | -509 | -838 | -15.0 | -349 | -368 | -363 | -616 | -11.8 |
| 21.45 | -418 | -438 | -578 | -909 | -16.4 | -406 | -424 | -423 | -679 | -13.5 |
| 21.96 | -425 | -434 | -619 | -876 | -16.4 | -421 | -437 | -441 | -696 | -13.9 |
| 22.15 | -435 | -436 | -732 | -744 | -16.4 | -442 | -454 | -459 | -715 | -14.4 |
| 22.09 | -426 | -429 | -793 | -840 | -17.4 | -456 | -470 | -475 | -730 | -14.9 |
| 21.58 | -420 | -413 | -844 | -1042 | -19.0 | -459 | -474 | -476 | -730 | -14.9 |
| 21.08 | -424 | -377 | -934 | -1465 | -22.3 | -461 | -480 | -473 | -724 | -14.9 |
| 19.87 | -467 | -364 | -1048 | -1692 | -24.9 | -460 | -484 | -468 | -715 | -14.8 |
| 18.35 | -452 | -347 | -1129 | -1929 | -26.9 | -461 | -495 | -461 | -703 | -14.8 |
| 17.47 | -446 | -348 | -1116 | -1934 | -26.8 | -461 | -503 | -456 | -695 | -14.8 |
| 12.53 | -412 | -335 | -1001 | -1980 | -26.0 | -434 | -513 | -416 | -656 | -14.1 |
| 7.85 | -283 | -186 | -746 | -1944 | -22.0 | -310 | -373 | -286 | -500 | -10.2 |
| 3.87 | -125 | 8 | -544 | -1734 | -16.7 | -153 | -199 | -108 | -286 | -5.2 |

| TOTAL LOAD PER JOIST (kips) | CSJ-2 TEST DATA SHEET TC3 2L1.50x1.50x0.170 TC3 (9) | TC3 (10) | TC3 (11) | TC3 (12) | AVG MEM LOAD (kips) | CSJ-2 TEST DATA SHEET TC4 2L1.50x1.50x0.170 TC4 (13) | TC4 (14) | TC4 (15) | TC4 (16) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| | (με) | | | | | (με) | | | | |
| 0.00 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 |
| 0.51 | -17 | -28 | -16 | -29 | -0.6 | -21 | -33 | -20 | -33 | -0.7 |
| 2.49 | -83 | -139 | -78 | -144 | -3.1 | -104 | -160 | -99 | -160 | -3.6 |
| 3.99 | -92 | -131 | -78 | -116 | -2.9 | -101 | -151 | -85 | -118 | -3.2 |
| 5.26 | -100 | -124 | -78 | -86 | -2.7 | -102 | -148 | -78 | -91 | -2.9 |
| 6.97 | -111 | -117 | -80 | -52 | -2.5 | -104 | -144 | -69 | -61 | -2.6 |
| 8.29 | -114 | -103 | -79 | -24 | -2.2 | -105 | -142 | -54 | -32 | -2.3 |
| 9.50 | -116 | -98 | -81 | -15 | -2.2 | -104 | -142 | -48 | -4 | -2.1 |
| 10.13 | -121 | -98 | -86 | -12 | -2.2 | -104 | -146 | -48 | 8 | -2.0 |
| 11.20 | -127 | -93 | -92 | 7 | -2.1 | -105 | -149 | -46 | 25 | -1.9 |
| 11.96 | -133 | -99 | -96 | 12 | -2.2 | -105 | -153 | -50 | 36 | -1.9 |
| 12.47 | -134 | -94 | -95 | 22 | -2.1 | -103 | -150 | -46 | 45 | -1.8 |
| 13.04 | -143 | -100 | -65 | 19 | -2.0 | -103 | -152 | -46 | 50 | -1.8 |
| 12.85 | -153 | -115 | -69 | -5 | -2.4 | -108 | -163 | -59 | 34 | -2.1 |
| 9.81 | -146 | -139 | -83 | -83 | -3.1 | -118 | -184 | -91 | -38 | -3.0 |
| 6.78 | -136 | -164 | -93 | -156 | -3.8 | -126 | -198 | -115 | -103 | -3.8 |
| 4.12 | -120 | -185 | -73 | -188 | -3.9 | -110 | -180 | -117 | -139 | -3.8 |
| 7.22 | -135 | -165 | -75 | -133 | -3.5 | -113 | -179 | -106 | -79 | -3.3 |
| 9.88 | -145 | -141 | -76 | -76 | -3.1 | -114 | -175 | -87 | -32 | -2.8 |
| 13.10 | -158 | -120 | -71 | -8 | -2.5 | -106 | -161 | -57 | 32 | -2.0 |
| 14.49 | -178 | -136 | -86 | -8 | -2.8 | -109 | -168 | -60 | 41 | -2.1 |
| 15.95 | -220 | -199 | -117 | -68 | -4.2 | -143 | -219 | -92 | 14 | -3.1 |
| 16.96 | -228 | -211 | -113 | -72 | -4.3 | -149 | -226 | -95 | 17 | -3.2 |
| 18.16 | -250 | -320 | -139 | -216 | -6.4 | -195 | -296 | -150 | -39 | -4.7 |
| 19.18 | -277 | -357 | -167 | -249 | -7.3 | -227 | -334 | -180 | -65 | -5.6 |
| 19.37 | -304 | -401 | -194 | -293 | -8.3 | -250 | -366 | -209 | -98 | -6.4 |
| 20.13 | -319 | -422 | -205 | -308 | -8.8 | -261 | -378 | -218 | -101 | -6.7 |
| 14.12 | -326 | -453 | -224 | -396 | -9.8 | -278 | -421 | -280 | -233 | -8.5 |
| 8.93 | -301 | -414 | -203 | -424 | -9.4 | -252 | -407 | -292 | -294 | -8.7 |
| 4.18 | -134 | -225 | -46 | -220 | -4.4 | -129 | -227 | -158 | -167 | -4.8 |
| 9.05 | -262 | -369 | -169 | -350 | -8.0 | -228 | -367 | -255 | -258 | -7.7 |
| 14.81 | -311 | -429 | -207 | -361 | -9.1 | -270 | -410 | -269 | -219 | -8.1 |
| 20.06 | -337 | -468 | -215 | -352 | -9.6 | -284 | -415 | -255 | -155 | -7.7 |
| 21.45 | -369 | -499 | -223 | -403 | -10.4 | -340 | -472 | -312 | -198 | -9.2 |
| 21.96 | -375 | -497 | -221 | -423 | -10.6 | -355 | -485 | -330 | -210 | -9.6 |
| 22.15 | -393 | -484 | -297 | -423 | -11.1 | -375 | -501 | -353 | -234 | -10.2 |
| 22.09 | -385 | -465 | -313 | -358 | -10.6 | -391 | -517 | -372 | -250 | -10.7 |
| 21.58 | -375 | -446 | -314 | -324 | -10.2 | -394 | -520 | -376 | -259 | -10.8 |
| 21.08 | -370 | -409 | -325 | -287 | -9.7 | -397 | -525 | -379 | -270 | -11.0 |
| 19.87 | -421 | -356 | -392 | -270 | -10.0 | -398 | -528 | -384 | -286 | -11.1 |
| 18.35 | -423 | -296 | -402 | -264 | -9.7 | -401 | -535 | -394 | -313 | -11.5 |
| 17.47 | -410 | -293 | -385 | -270 | -9.5 | -404 | -542 | -402 | -332 | -11.7 |
| 12.53 | -377 | -260 | -382 | -265 | -9.0 | -386 | -543 | -425 | -408 | -12.3 |
| 7.85 | -243 | -143 | -272 | -96 | -5.3 | -277 | -399 | -329 | -326 | -9.3 |
| 3.87 | -92 | 23 | -130 | 113 | -0.6 | -136 | -209 | -171 | -144 | -4.6 |

| TOTAL LOAD PER JOIST (kips) | CSJ-2 TEST DATA SHEET TC5 2L1.50x1.50x0.170 TC5 (33) ($\mu\varepsilon$) | TC5 (34) | TC5 (35) | TC5 (36) | AVG MEM LOAD (kips) | CSJ-2 TEST DATA SHEET TC6 2L1.50x1.50x0.170 TC6 (53) ($\mu\varepsilon$) | TC6 (54) | TC6 (55) | TC6 (56) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 |
| 0.51 | -64 | -73 | -60 | -76 | -1.9 | -64 | -73 | -64 | -72 | -1.9 |
| 2.49 | -312 | -358 | -296 | -371 | -9.3 | -316 | -358 | -315 | -354 | -9.4 |
| 3.99 | -336 | -378 | -329 | -412 | -10.2 | -345 | -392 | -336 | -372 | -10.1 |
| 5.26 | -335 | -384 | -324 | -418 | -10.2 | -343 | -401 | -336 | -377 | -10.2 |
| 6.97 | -331 | -390 | -314 | -423 | -10.2 | -337 | -406 | -332 | -382 | -10.2 |
| 8.29 | -332 | -399 | -310 | -432 | -10.3 | -339 | -418 | -333 | -391 | -10.3 |
| 9.50 | -350 | -425 | -327 | -457 | -10.9 | -357 | -444 | -349 | -414 | -10.9 |
| 10.13 | -372 | -453 | -350 | -483 | -11.6 | -380 | -472 | -369 | -439 | -11.6 |
| 11.20 | -390 | -478 | -364 | -509 | -12.1 | -404 | -502 | -387 | -465 | -12.3 |
| 11.96 | -421 | -519 | -395 | -551 | -13.2 | -444 | -548 | -421 | -510 | -13.4 |
| 12.47 | -427 | -529 | -401 | -560 | -13.4 | -451 | -557 | -428 | -523 | -13.7 |
| 13.04 | -443 | -551 | -417 | -581 | -13.9 | -470 | -582 | -446 | -550 | -14.3 |
| 12.85 | -474 | -583 | -448 | -621 | -14.8 | -507 | -623 | -482 | -595 | -15.4 |
| 9.81 | -487 | -571 | -473 | -616 | -15.0 | -521 | -615 | -495 | -587 | -15.5 |
| 6.78 | -495 | -557 | -491 | -604 | -15.0 | -528 | -600 | -501 | -573 | -15.4 |
| 4.12 | -463 | -522 | -451 | -543 | -13.8 | -482 | -537 | -466 | -532 | -14.1 |
| 7.22 | -475 | -542 | -468 | -583 | -14.4 | -506 | -578 | -485 | -557 | -14.8 |
| 9.88 | -473 | -561 | -458 | -602 | -14.6 | -507 | -599 | -484 | -575 | -15.1 |
| 13.10 | -477 | -589 | -452 | -630 | -15.0 | -514 | -631 | -486 | -601 | -15.6 |
| 14.49 | -522 | -649 | -493 | -711 | -16.6 | -564 | -700 | -530 | -660 | -17.1 |
| 15.95 | -626 | -777 | -599 | -885 | -20.1 | -696 | -877 | -652 | -826 | -21.3 |
| 16.96 | -646 | -807 | -621 | -921 | -20.9 | -726 | -917 | -680 | -863 | -22.2 |
| 18.16 | -802 | -979 | -784 | -1170 | -26.1 | -939 | -1097 | -878 | -1056 | -27.7 |
| 19.18 | -881 | -1057 | -867 | -1278 | -28.5 | -1129 | -1507 | -977 | -1123 | -33.0 |
| 19.37 | -984 | -1153 | -969 | -1458 | -31.8 | -1315 | -1774 | -1101 | -1177 | -37.4 |
| 20.13 | -1022 | -1195 | -1020 | -1613 | -33.8 | -1369 | -1815 | -1142 | -1207 | -38.6 |
| 14.12 | -1070 | -1141 | -1067 | -1653 | -34.4 | -1426 | -1788 | -1195 | -1180 | -39.0 |
| 8.93 | -1036 | -1072 | -1030 | -1545 | -32.7 | -1368 | -1689 | -1150 | -1114 | -37.1 |
| 4.18 | -685 | -688 | -659 | -1028 | -21.3 | -969 | -1194 | -786 | -720 | -25.6 |
| 9.05 | -927 | -961 | -917 | -1407 | -29.4 | -1252 | -1548 | -1040 | -992 | -33.7 |
| 14.81 | -1044 | -1120 | -1036 | -1623 | -33.6 | -1399 | -1757 | -1166 | -1155 | -38.2 |
| 20.06 | -1141 | -1156 | -1123 | -2545 | -41.6 | -1520 | -1826 | -1266 | -1250 | -40.9 |
| 21.45 | -1332 | -1165 | -1378 | -6813 | yield | -2034 | -2073 | -1553 | -1198 | -47.8 |
| 21.96 | -1749 | -1161 | -1432 | -7573 | yield | -2131 | -2293 | -1563 | -1200 | yield |
| 22.15 | -1804 | -1168 | -1488 | -9559 | yield | -2353 | -2614 | -1558 | -1201 | yield |
| 22.09 | -1875 | -1149 | -1510 | -9963 | yield | -2517 | -2866 | -1568 | -1209 | yield |
| 21.58 | -1908 | -1150 | -1518 | -10048 | yield | -2626 | -2909 | -1571 | -1206 | yield |
| 21.08 | -1931 | -1156 | -1525 | -10082 | yield | -2649 | -2919 | -1575 | -1207 | yield |
| 19.87 | -1952 | -1151 | -1533 | -10092 | yield | -2651 | -2904 | -1576 | -1205 | yield |
| 18.35 | -1955 | -1127 | -1522 | -10069 | yield | -2638 | -2873 | -1565 | -1189 | yield |
| 17.47 | -1942 | -1107 | -1513 | -10036 | yield | -2627 | -2851 | -1557 | -1177 | yield |
| 12.53 | -1878 | -998 | -1460 | -9847 | yield | -2574 | -2739 | -1520 | -1101 | yield |
| 7.85 | -1610 | -681 | -1215 | -9412 | yield | -2345 | -2423 | -1307 | -830 | yield |
| 3.87 | -1213 | -248 | -826 | -8844 | yield | -1927 | -1936 | -912 | -398 | yield |

| TOTAL LOAD PER JOIST (kips) | CSJ-2 TEST DATA SHEET BC1 2L2.50x2.50x0.250 | | | | AVG MEM LOAD (kips) | CSJ-2 TEST DATA SHEET BC2 2L2.50x2.50x0.250 | | | | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| | BC1 (29) | BC1 (30) | BC1 (31) | BC1 (32) | | BC2 (49) | BC2 (50) | BC2 (51) | BC2 (52) | |
| | (με) | | | | | (με) | | | | |
| 0.00 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 |
| 0.51 | 42 | 21 | 43 | 22 | 2.2 | 41 | 21 | 43 | 21 | 2.2 |
| 2.49 | 206 | 105 | 212 | 106 | 10.8 | 204 | 102 | 213 | 105 | 10.8 |
| 3.99 | 308 | 179 | 312 | 182 | 16.9 | 308 | 179 | 317 | 182 | 17.0 |
| 5.26 | 391 | 246 | 393 | 250 | 22.0 | 393 | 245 | 404 | 250 | 22.2 |
| 6.97 | 485 | 319 | 486 | 325 | 27.8 | 485 | 318 | 499 | 323 | 28.0 |
| 8.29 | 568 | 386 | 569 | 391 | 33.0 | 570 | 384 | 585 | 390 | 33.2 |
| 9.50 | 649 | 445 | 644 | 449 | 37.7 | 652 | 443 | 669 | 450 | 38.1 |
| 10.13 | 695 | 476 | 689 | 480 | 40.3 | 700 | 476 | 717 | 483 | 40.9 |
| 11.20 | 762 | 525 | 755 | 530 | 44.3 | 769 | 526 | 787 | 532 | 45.0 |
| 11.96 | 820 | 563 | 810 | 568 | 47.6 | 828 | 564 | 846 | 569 | 48.3 |
| 12.47 | 851 | 586 | 835 | 592 | 49.3 | 860 | 587 | 879 | 592 | 50.3 |
| 13.04 | 890 | 613 | 875 | 618 | 51.6 | 900 | 614 | 919 | 618 | 52.6 |
| 12.85 | 888 | 604 | 866 | 609 | 51.1 | 897 | 605 | 916 | 608 | 52.1 |
| 9.81 | 699 | 453 | 701 | 459 | 39.8 | 705 | 454 | 720 | 454 | 40.2 |
| 6.78 | 522 | 312 | 530 | 316 | 28.9 | 524 | 311 | 535 | 310 | 28.9 |
| 4.12 | 351 | 183 | 367 | 187 | 18.7 | 352 | 186 | 363 | 183 | 18.7 |
| 7.22 | 544 | 333 | 559 | 337 | 30.5 | 547 | 333 | 560 | 333 | 30.6 |
| 9.88 | 708 | 462 | 722 | 467 | 40.6 | 713 | 464 | 730 | 464 | 40.8 |
| 13.10 | 904 | 616 | 918 | 622 | 52.7 | 914 | 619 | 935 | 621 | 53.2 |
| 14.49 | 999 | 680 | 1000 | 686 | 58.0 | 1010 | 683 | 1031 | 685 | 58.7 |
| 15.95 | 1120 | 746 | 1108 | 751 | 64.2 | 1130 | 747 | 1150 | 747 | 65.0 |
| 16.96 | 1187 | 793 | 1167 | 796 | 67.9 | 1198 | 794 | 1218 | 793 | 69.0 |
| 18.16 | 1303 | 841 | 1275 | 842 | 73.4 | 1316 | 843 | 1335 | 838 | 74.6 |
| 19.18 | 1381 | 882 | 1352 | 882 | 77.5 | 1398 | 886 | 1414 | 878 | 78.8 |
| 19.37 | 1418 | 888 | 1390 | 887 | 78.9 | 1437 | 894 | 1452 | 884 | 80.4 |
| 20.13 | 1473 | 922 | 1447 | 921 | 82.0 | 1494 | 930 | 1509 | 919 | 83.6 |
| 14.12 | 1115 | 636 | 1102 | 632 | 60.0 | 1125 | 637 | 1136 | 623 | 60.7 |
| 8.93 | 786 | 389 | 809 | 387 | 40.8 | 794 | 392 | 802 | 377 | 40.7 |
| 4.18 | 410 | 173 | 446 | 172 | 20.7 | 408 | 170 | 421 | 159 | 20.0 |
| 9.05 | 773 | 401 | 808 | 403 | 41.1 | 778 | 402 | 789 | 389 | 40.6 |
| 14.81 | 1153 | 670 | 1181 | 671 | 63.3 | 1165 | 673 | 1177 | 660 | 63.3 |
| 20.06 | 1484 | 909 | 1495 | 911 | 82.7 | 1508 | 921 | 1523 | 909 | 83.7 |
| 21.45 | 1612 | 947 | 1612 | 951 | 88.2 | 1660 | 966 | 1677 | 955 | 90.6 |
| 21.96 | 1663 | 940 | 1666 | 944 | 89.8 | 1711 | 968 | 1727 | 955 | 92.4 |
| 22.15 | 1724 | 901 | 1749 | 904 | 90.9 | 1764 | 941 | 1773 | 927 | 93.1 |
| 22.09 | 1745 | 868 | 1794 | 878 | 91.0 | 1783 | 928 | 1791 | 914 | 93.3 |
| 21.58 | 1729 | 844 | 1780 | 851 | 89.6 | 1768 | 905 | 1775 | 894 | 92.0 |
| 21.08 | 1698 | 807 | 1765 | 814 | 87.6 | 1749 | 875 | 1739 | 864 | 90.0 |
| 19.87 | 1585 | 720 | 1670 | 726 | 81.0 | 1720 | 855 | 1713 | 845 | 88.4 |
| 18.35 | 1461 | 630 | 1553 | 629 | 73.6 | 1639 | 797 | 1626 | 787 | 83.5 |
| 17.47 | 1374 | 578 | 1476 | 572 | 68.9 | 1579 | 760 | 1566 | 752 | 80.2 |
| 12.53 | 1057 | 351 | 1187 | 345 | 50.6 | 1225 | 502 | 1206 | 491 | 59.0 |
| 7.85 | 723 | 145 | 869 | 145 | 32.4 | 857 | 264 | 834 | 250 | 38.0 |
| 3.87 | 414 | -22 | 567 | -14 | 16.3 | 531 | 84 | 511 | 73 | 20.7 |

| TOTAL LOAD PER JOIST (kips) | CSJ-2 W5 0.813 DIA. BAR (με) | | AVG MEM LOAD (kips) | CSJ-2 W4 0.813 DIA. BAR (με) | | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|
| | W1 (37) | W1 (38) | | W3 (61) | W3 (62) | |
| 0.00 | 0 | 0 | 0.0 | 0 | 0 | 0.0 |
| 0.51 | -76 | -18 | -0.7 | 9 | 19 | 0.2 |
| 2.49 | -371 | -87 | -3.4 | 46 | 95 | 1.1 |
| 3.99 | -412 | -123 | -4.0 | 82 | 142 | 1.7 |
| 5.26 | -418 | -155 | -4.3 | 111 | 179 | 2.2 |
| 6.97 | -423 | -189 | -4.6 | 143 | 222 | 2.8 |
| 8.29 | -432 | -222 | -4.9 | 174 | 265 | 3.3 |
| 9.50 | -457 | -256 | -5.4 | 202 | 304 | 3.8 |
| 10.13 | -483 | -275 | -5.7 | 218 | 327 | 4.1 |
| 11.20 | -509 | -300 | -6.1 | 242 | 358 | 4.5 |
| 11.96 | -551 | -321 | -6.6 | 264 | 381 | 4.8 |
| 12.47 | -560 | -331 | -6.7 | 275 | 394 | 5.0 |
| 13.04 | -581 | -347 | -7.0 | 290 | 410 | 5.3 |
| 12.85 | -621 | -346 | -7.3 | 288 | 404 | 5.2 |
| 9.81 | -616 | -273 | -6.7 | 215 | 316 | 4.0 |
| 6.78 | -604 | -203 | -6.1 | 150 | 234 | 2.9 |
| 4.12 | -543 | -141 | -5.1 | 93 | 153 | 1.9 |
| 7.22 | -583 | -215 | -6.0 | 159 | 239 | 3.0 |
| 9.88 | -602 | -277 | -6.6 | 219 | 317 | 4.0 |
| 13.10 | -630 | -352 | -7.4 | 295 | 410 | 5.3 |
| 14.49 | -711 | -389 | -8.3 | 329 | 448 | 5.8 |
| 15.95 | -885 | -441 | -10.0 | 365 | 488 | 6.4 |
| 16.96 | -921 | -467 | -10.4 | 389 | 516 | 6.8 |
| 18.16 | -1170 | -533 | -12.8 | 423 | 555 | 7.4 |
| 19.18 | -1278 | -565 | -13.9 | 449 | 590 | 7.8 |
| 19.37 | -1458 | -580 | -15.3 | 459 | 603 | 8.0 |
| 20.13 | -1613 | -601 | -16.7 | 477 | 627 | 8.3 |
| 14.12 | -1653 | -445 | -15.8 | 334 | 457 | 6.0 |
| 8.93 | -1545 | -308 | -13.9 | 212 | 301 | 3.9 |
| 4.18 | -1028 | -154 | -8.9 | 100 | 155 | 1.9 |
| 9.05 | -1407 | -304 | -12.9 | 214 | 306 | 3.9 |
| 14.81 | -1623 | -456 | -15.6 | 350 | 478 | 6.2 |
| 20.06 | -2545 | -603 | -23.7 | 476 | 628 | 8.3 |
| 21.45 | -6813 | -651 | yield | 527 | 686 | 9.1 |
| 21.96 | -7573 | -665 | yield | 542 | 705 | 9.4 |
| 22.15 | -9559 | -673 | yield | 558 | 720 | 9.6 |
| 22.09 | -9963 | -673 | yield | 566 | 728 | 9.7 |
| 21.58 | -10048 | -659 | yield | 558 | 721 | 9.6 |
| 21.08 | -10082 | -638 | yield | 544 | 708 | 9.4 |
| 19.87 | -10092 | -569 | yield | 530 | 680 | 9.1 |
| 18.35 | -10069 | -518 | yield | 498 | 638 | 8.5 |
| 17.47 | -10036 | -478 | yield | 475 | 608 | 8.2 |
| 12.53 | -9847 | -345 | yield | 339 | 445 | 5.9 |
| 7.85 | -9412 | -215 | yield | 219 | 293 | 3.9 |
| 3.87 | -8844 | -82 | yield | 114 | 182 | 2.2 |

| APPLIED LOAD PER JOIST (kips) | CSJ-2 TEST DATA SHEET END SLIPS | | | |
|---|---|---|---|---|
| | SLIP 1 (in.) | SLIP 2 (in.) | SLIP 11 (in.) | SLIP 12 (in.) |
| 0.00 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.50 | 0.000 | 0.001 | 0.001 | 0.001 |
| 2.77 | 0.000 | 0.001 | 0.001 | 0.001 |
| 4.47 | 0.000 | 0.001 | 0.001 | 0.001 |
| 5.80 | 0.000 | 0.002 | 0.003 | 0.003 |
| 7.00 | 0.000 | 0.007 | 0.007 | 0.007 |
| 7.64 | 0.000 | 0.011 | 0.011 | 0.010 |
| 8.71 | 0.000 | 0.015 | 0.015 | 0.013 |
| 9.47 | 0.007 | 0.022 | 0.020 | 0.019 |
| 9.98 | 0.009 | 0.023 | 0.021 | 0.020 |
| 10.55 | 0.012 | 0.027 | 0.024 | 0.023 |
| 10.36 | 0.018 | 0.033 | 0.028 | 0.027 |
| 7.32 | 0.018 | 0.033 | 0.028 | 0.027 |
| 4.28 | 0.018 | 0.032 | 0.026 | 0.026 |
| 1.63 | 0.018 | 0.027 | 0.020 | 0.020 |
| 4.73 | 0.018 | 0.028 | 0.023 | 0.021 |
| 7.38 | 0.018 | 0.031 | 0.026 | 0.024 |
| 10.61 | 0.020 | 0.035 | 0.031 | 0.028 |
| 12.00 | 0.030 | 0.046 | 0.037 | 0.035 |
| 13.46 | 0.057 | 0.073 | 0.054 | 0.049 |
| 14.47 | 0.064 | 0.079 | 0.060 | 0.053 |
| 15.67 | 0.104 | 0.120 | 0.082 | 0.073 |
| 16.69 | 0.125 | 0.141 | 0.095 | 0.082 |
| 16.88 | 0.143 | 0.163 | 0.107 | 0.091 |
| 17.63 | 0.153 | 0.174 | 0.114 | 0.095 |
| 11.62 | 0.156 | 0.168 | 0.111 | 0.093 |
| 6.44 | 0.156 | 0.147 | 0.102 | 0.086 |
| 1.69 | 0.156 | 0.076 | 0.051 | 0.043 |
| 6.56 | 0.156 | 0.127 | 0.088 | 0.073 |
| 12.32 | 0.156 | 0.165 | 0.111 | 0.090 |
| 17.57 | 0.170 | 0.194 | 0.128 | 0.104 |
| 18.96 | 0.237 | 0.267 | 0.161 | 0.134 |
| 19.47 | 0.274 | 0.305 | 0.173 | 0.144 |
| 19.66 | 0.341 | 0.374 | 0.185 | 0.153 |
| 19.60 | 0.410 | 0.446 | 0.194 | 0.161 |
| 19.09 | 0.460 | 0.498 | 0.196 | 0.162 |
| 18.58 | 0.554 | 0.598 | 0.197 | 0.163 |
| 17.38 | 0.605 | 0.682 | 0.197 | 0.163 |
| 15.86 | 0.704 | 0.803 | 0.197 | 0.163 |
| 14.98 | 0.798 | 0.910 | 0.197 | 0.161 |
| 10.04 | 0.805 | 0.902 | 0.188 | 0.151 |
| 5.36 | 0.805 | 0.831 | 0.147 | 0.112 |
| 1.37 | 0.805 | 0.734 | 0.091 | 0.065 |

| APPLIED LOAD PER JOIST (kips) | CSJ-2 TEST DATA SHEET INTERMEDIATE SLIPS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | SLIP 3 (in.) | SLIP 4 (in.) | SLIP 5 (in.) | SLIP 6 (in.) | SLIP 7 (in.) | SLIP 8 (in.) | SLIP 9 (in.) | SLIP 10 (in.) |
| 0.00 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.50 | 0.001 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 |
| 2.77 | 0.001 | 0.002 | 0.000 | 0.001 | 0.000 | 0.001 | 0.001 | 0.001 |
| 4.47 | 0.002 | 0.003 | 0.001 | 0.001 | 0.000 | 0.001 | 0.001 | 0.002 |
| 5.80 | 0.003 | 0.005 | 0.002 | 0.001 | 0.001 | 0.002 | 0.002 | 0.004 |
| 7.00 | 0.009 | 0.010 | 0.005 | 0.001 | 0.002 | 0.006 | 0.006 | 0.008 |
| 7.64 | 0.013 | 0.014 | 0.009 | 0.001 | 0.004 | 0.009 | 0.009 | 0.011 |
| 8.71 | 0.017 | 0.018 | 0.012 | 0.001 | 0.005 | 0.011 | 0.012 | 0.015 |
| 9.47 | 0.023 | 0.025 | 0.018 | 0.001 | 0.007 | 0.015 | 0.018 | 0.021 |
| 9.98 | 0.024 | 0.026 | 0.020 | 0.001 | 0.007 | 0.016 | 0.019 | 0.021 |
| 10.55 | 0.028 | 0.030 | 0.022 | 0.001 | 0.009 | 0.018 | 0.022 | 0.024 |
| 10.36 | 0.033 | 0.034 | 0.026 | 0.001 | 0.010 | 0.021 | 0.025 | 0.028 |
| 7.32 | 0.032 | 0.032 | 0.024 | 0.001 | 0.010 | 0.021 | 0.025 | 0.028 |
| 4.28 | 0.031 | 0.029 | 0.024 | 0.001 | 0.010 | 0.021 | 0.025 | 0.027 |
| 1.63 | 0.025 | 0.023 | 0.020 | 0.001 | 0.009 | 0.018 | 0.020 | 0.021 |
| 4.73 | 0.027 | 0.026 | 0.020 | 0.001 | 0.009 | 0.018 | 0.020 | 0.023 |
| 7.38 | 0.031 | 0.031 | 0.023 | 0.001 | 0.009 | 0.020 | 0.024 | 0.026 |
| 10.61 | 0.036 | 0.036 | 0.027 | 0.001 | 0.010 | 0.023 | 0.027 | 0.029 |
| 12.00 | 0.046 | 0.047 | 0.036 | 0.001 | 0.013 | 0.028 | 0.033 | 0.037 |
| 13.46 | 0.074 | 0.070 | 0.056 | 0.001 | 0.018 | 0.040 | 0.048 | 0.053 |
| 14.47 | 0.081 | 0.077 | 0.060 | 0.001 | 0.019 | 0.043 | 0.052 | 0.058 |
| 15.67 | 0.122 | 0.113 | 0.083 | 0.001 | 0.026 | 0.059 | 0.072 | 0.080 |
| 16.69 | 0.143 | 0.130 | 0.098 | 0.001 | 0.029 | 0.067 | 0.083 | 0.092 |
| 16.88 | 0.164 | 0.151 | 0.115 | 0.002 | 0.032 | 0.075 | 0.092 | 0.105 |
| 17.63 | 0.175 | 0.160 | 0.123 | 0.002 | 0.034 | 0.079 | 0.097 | 0.110 |
| 11.62 | 0.168 | 0.156 | 0.121 | 0.001 | 0.034 | 0.078 | 0.095 | 0.107 |
| 6.44 | 0.147 | 0.135 | 0.110 | 0.001 | 0.032 | 0.072 | 0.084 | 0.096 |
| 1.69 | 0.080 | 0.072 | 0.063 | 0.002 | 0.018 | 0.040 | 0.040 | 0.046 |
| 6.56 | 0.129 | 0.118 | 0.097 | 0.002 | 0.026 | 0.061 | 0.072 | 0.083 |
| 12.32 | 0.165 | 0.153 | 0.119 | 0.001 | 0.032 | 0.076 | 0.092 | 0.105 |
| 17.57 | 0.194 | 0.178 | 0.138 | 0.001 | 0.038 | 0.087 | 0.107 | 0.121 |
| 18.96 | 0.268 | 0.247 | 0.202 | 0.001 | 0.047 | 0.111 | 0.133 | 0.152 |
| 19.47 | 0.306 | 0.285 | 0.236 | 0.001 | 0.051 | 0.119 | 0.143 | 0.164 |
| 19.66 | 0.377 | 0.354 | 0.301 | 0.001 | 0.054 | 0.128 | 0.152 | 0.176 |
| 19.60 | 0.450 | 0.428 | 0.373 | 0.001 | 0.057 | 0.132 | 0.159 | 0.183 |
| 19.09 | 0.502 | 0.481 | 0.426 | 0.001 | 0.058 | 0.135 | 0.161 | 0.185 |
| 18.58 | 0.603 | 0.579 | 0.528 | 0.001 | 0.058 | 0.136 | 0.163 | 0.187 |
| 17.38 | 0.691 | 0.663 | 0.616 | 0.001 | 0.059 | 0.137 | 0.163 | 0.187 |
| 15.86 | 0.819 | 0.791 | 0.749 | 0.001 | 0.059 | 0.137 | 0.163 | 0.187 |
| 14.98 | 0.928 | 0.903 | 0.867 | 0.001 | 0.059 | 0.137 | 0.163 | 0.186 |
| 10.04 | 0.914 | 0.892 | 0.862 | 0.001 | 0.058 | 0.131 | 0.154 | 0.176 |
| 5.36 | 0.842 | 0.828 | 0.807 | 0.001 | 0.047 | 0.107 | 0.118 | 0.135 |
| 1.37 | 0.745 | 0.736 | 0.725 | 0.001 | 0.033 | 0.072 | 0.070 | 0.081 |

# CSJ-2

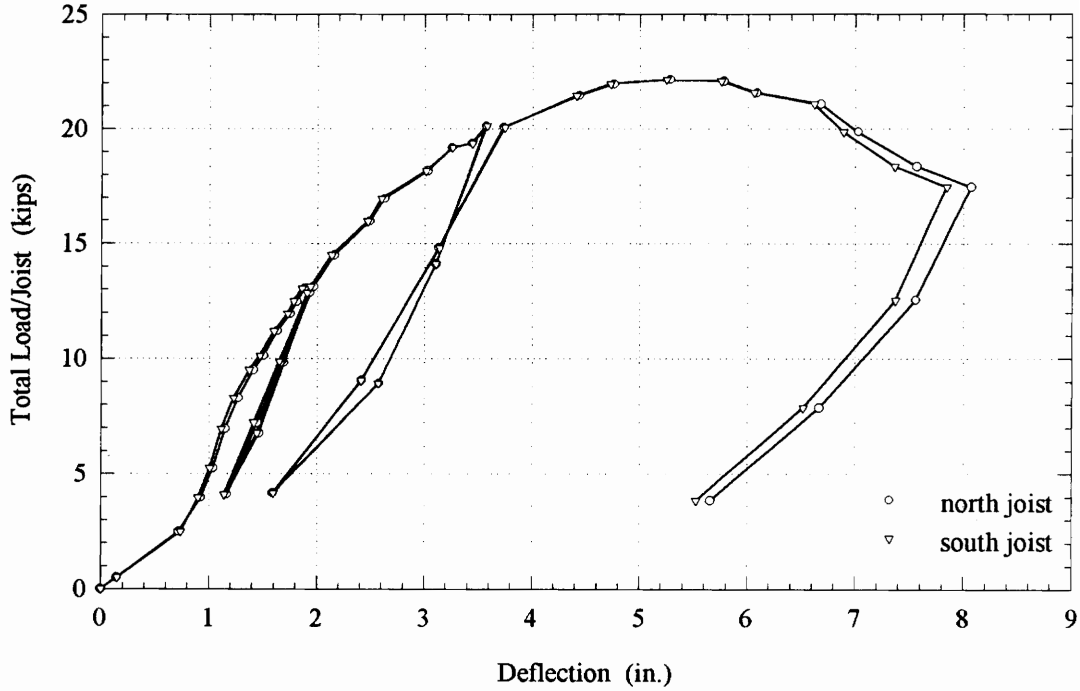



Figure A.2.1 Total Load/Joist vs. Midspan Deflection

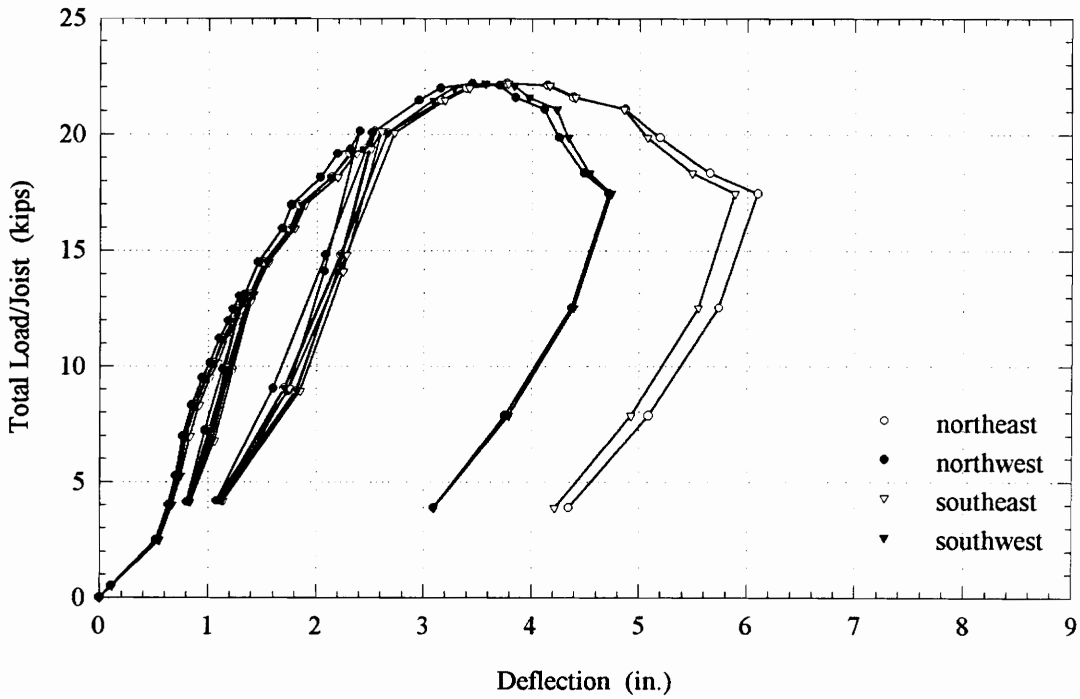



Figure A.2.2 Total Load/Joist vs. Quarter Point Deflection

CSJ-2

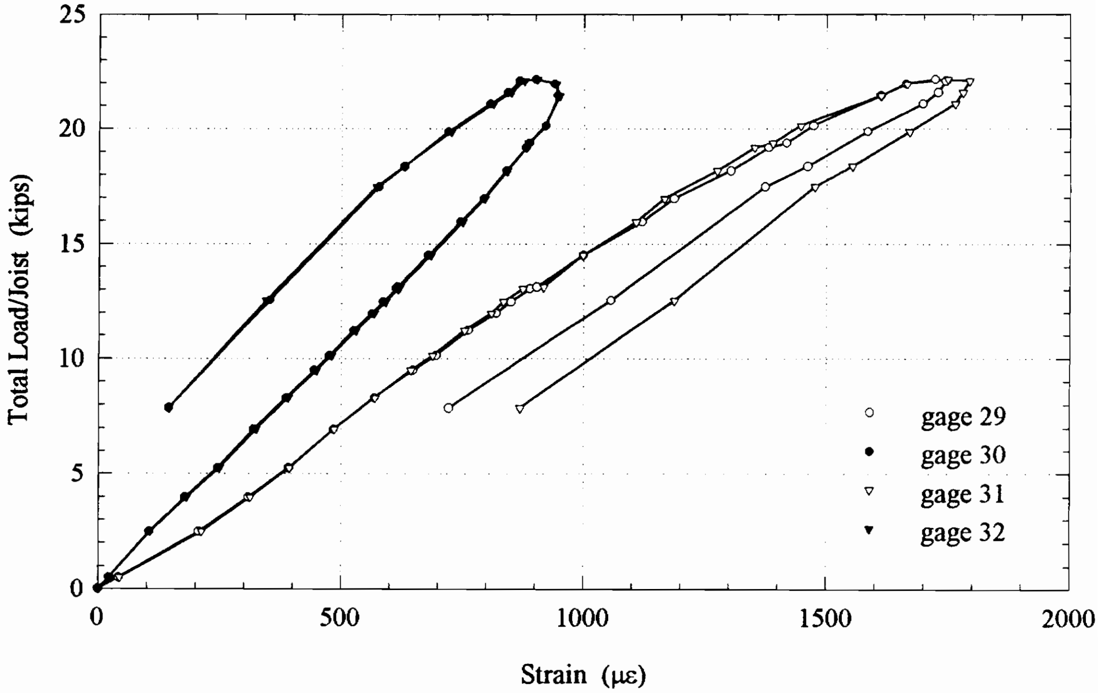



Figure A.2.3 Total Load/Joist vs. Bottom Chord Strain (BC1)

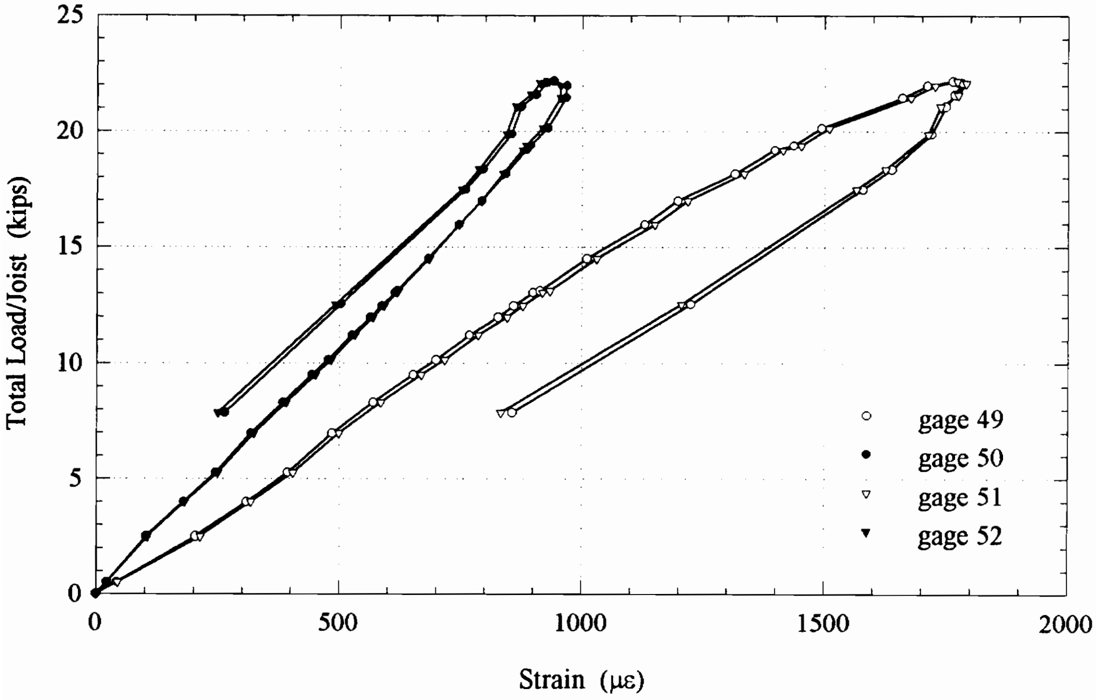



Figure A.2.4 Total Load/Joist vs. Bottom Chord Strain (BC2)

# CSJ-2

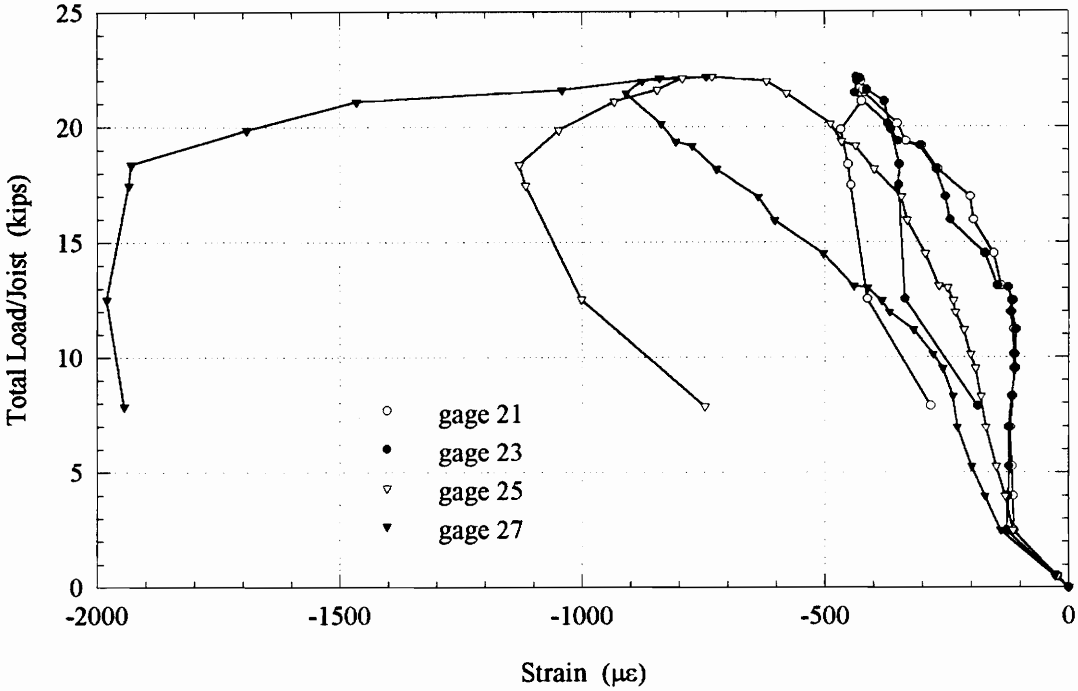



Figure A.2.5 Total Load/Joist vs. Top Chord Strain (TC1)

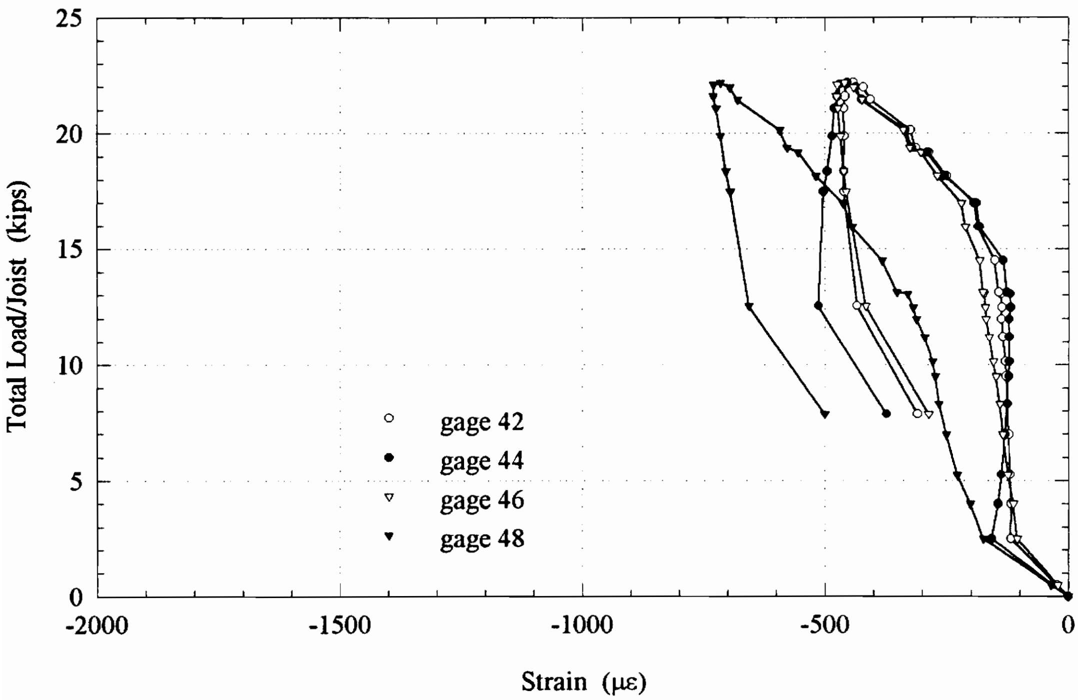



Figure A.2.6 Total Load/Joist vs. Top Chord Strain (TC2)

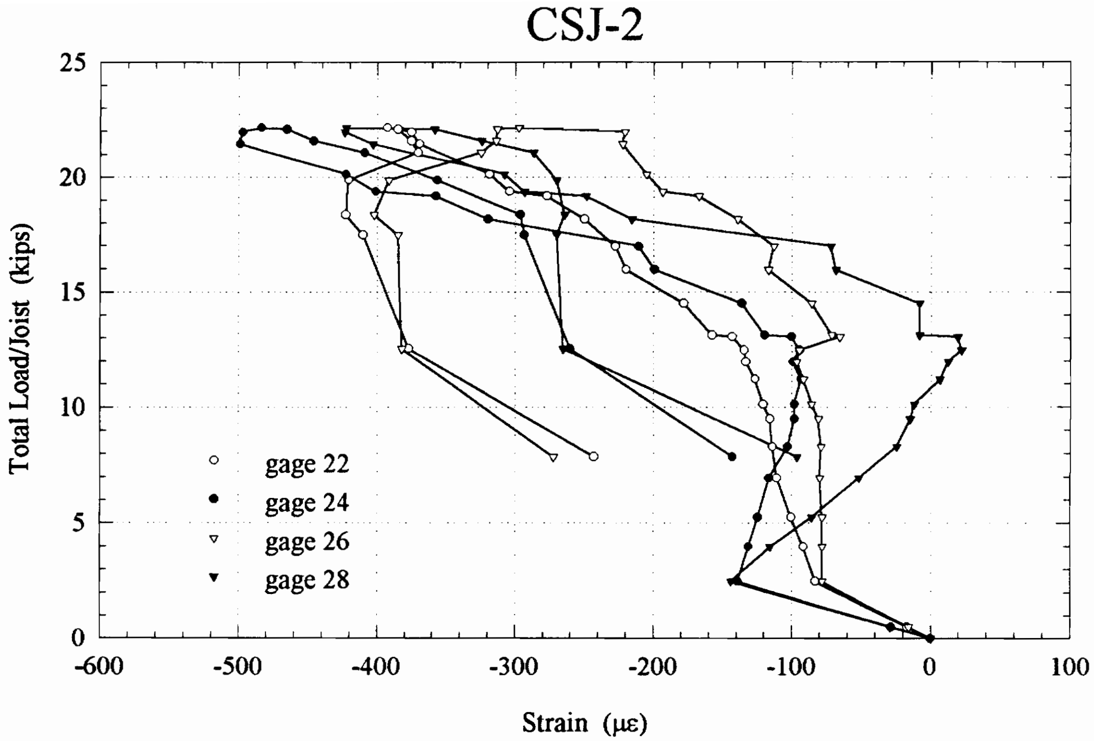



Figure A.2.7 Total Load/Joist vs. Top Chord Strain (TC3)

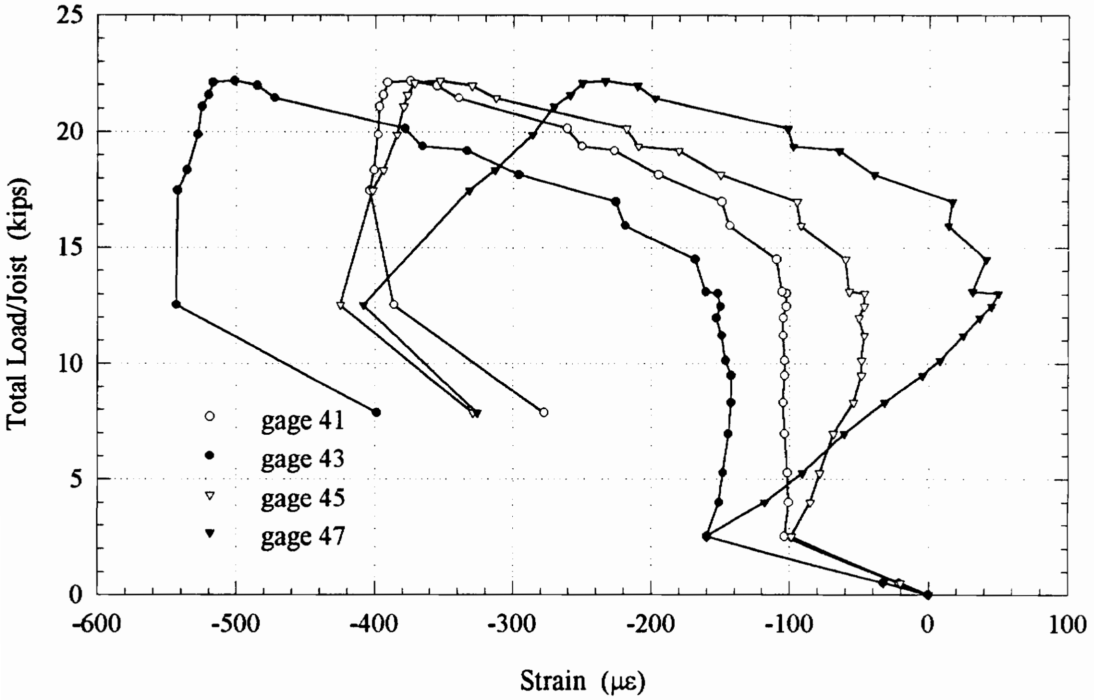



Figure A.2.8 Total Load/Joist vs. Top Chord Strain (TC4)

# CSJ-2

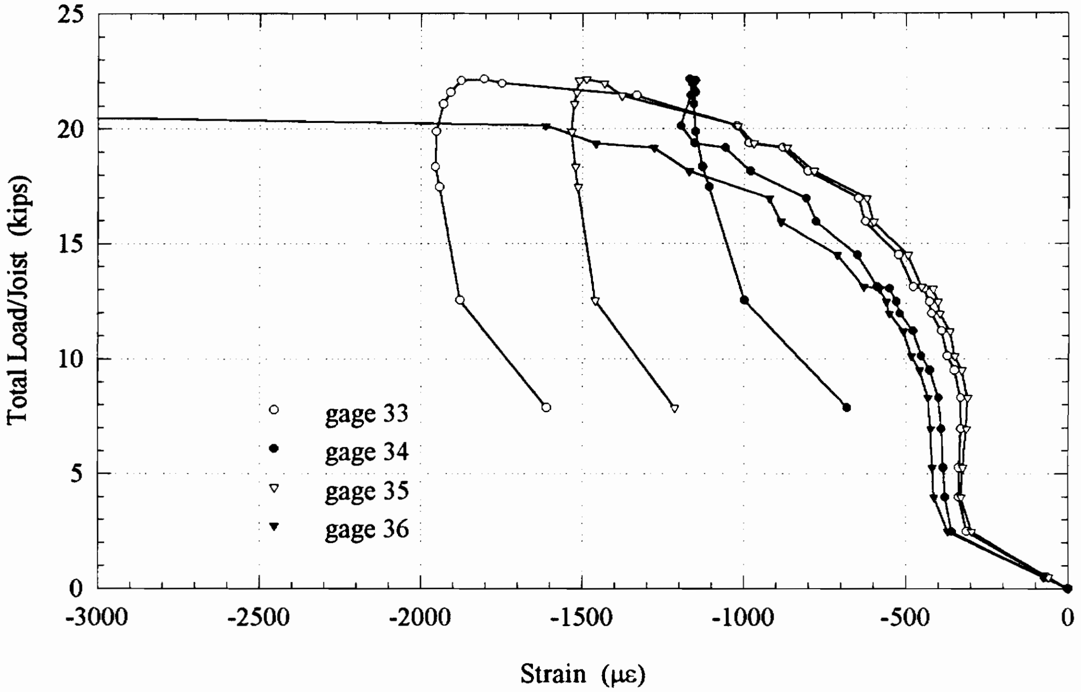



Figure A.2.9 Total Load/Joist vs. Top Chord Strain (TC5)

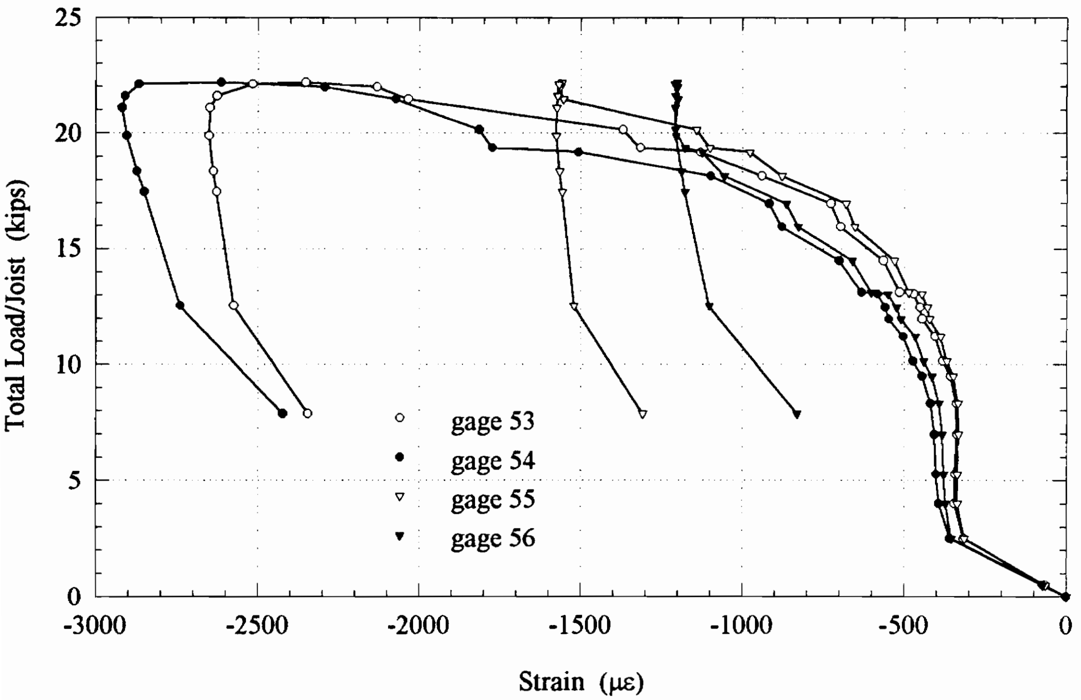



Figure A.2.10 Total Load/Joist vs. Top Chord Strain (TC6)

CSJ-2

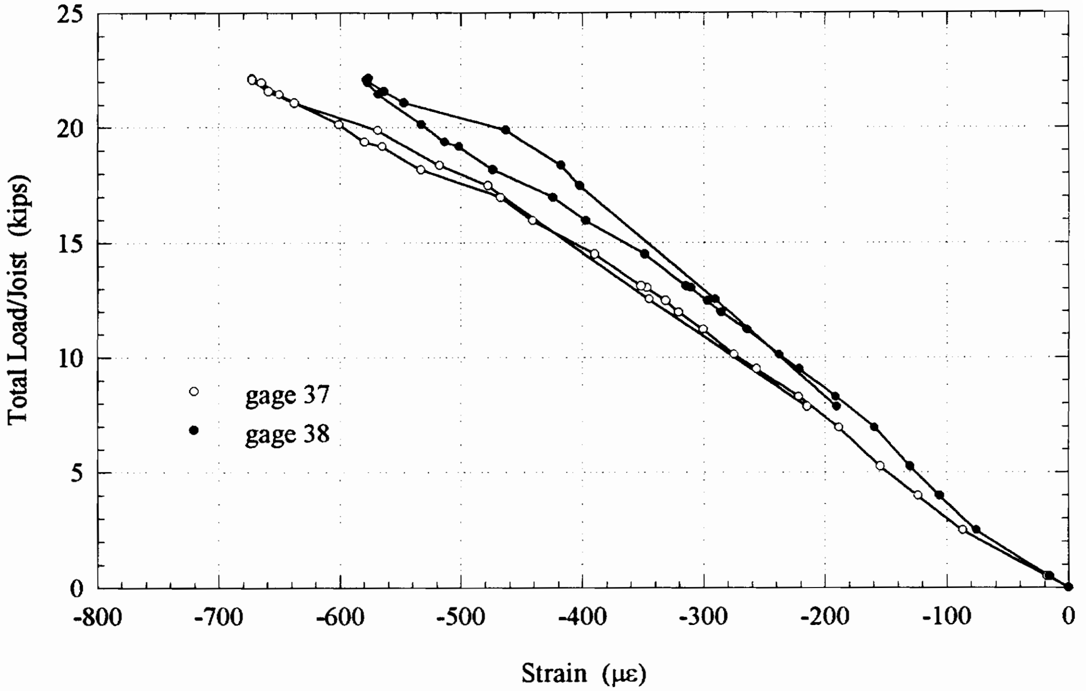



Figure A.2.11 Total Load/Joist vs. Web Strain (W5)

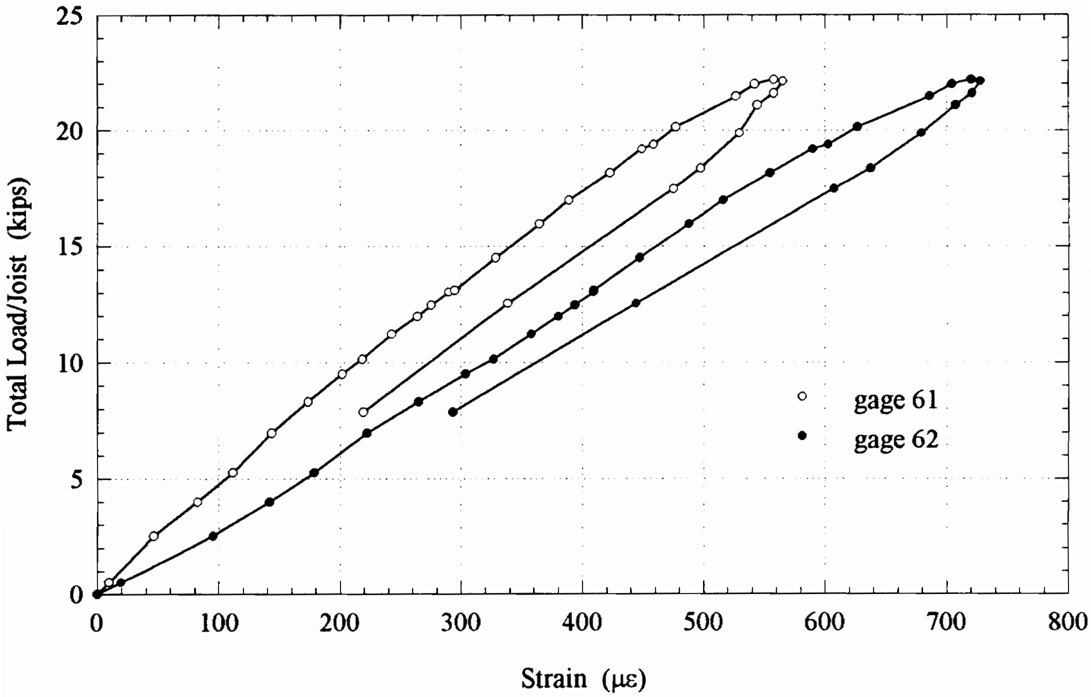



Figure A.2.12 Total Load/Joist vs. Web Strain (W4)

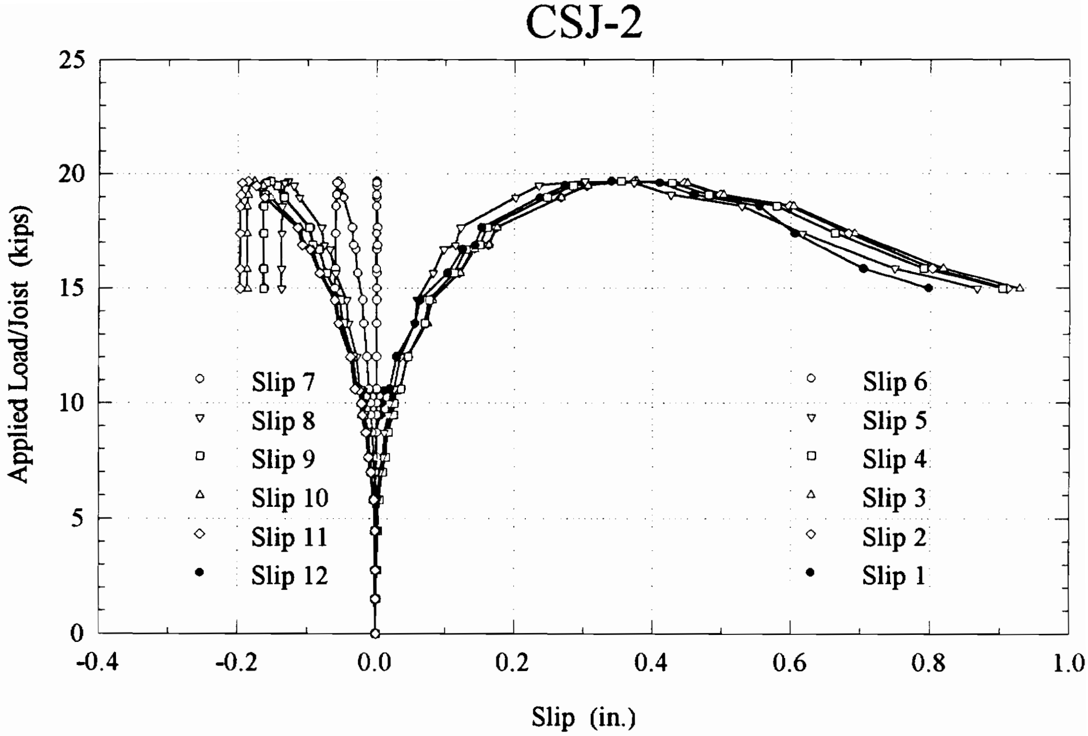



Figure A.2.13 Applied Load/Joist vs. Slip

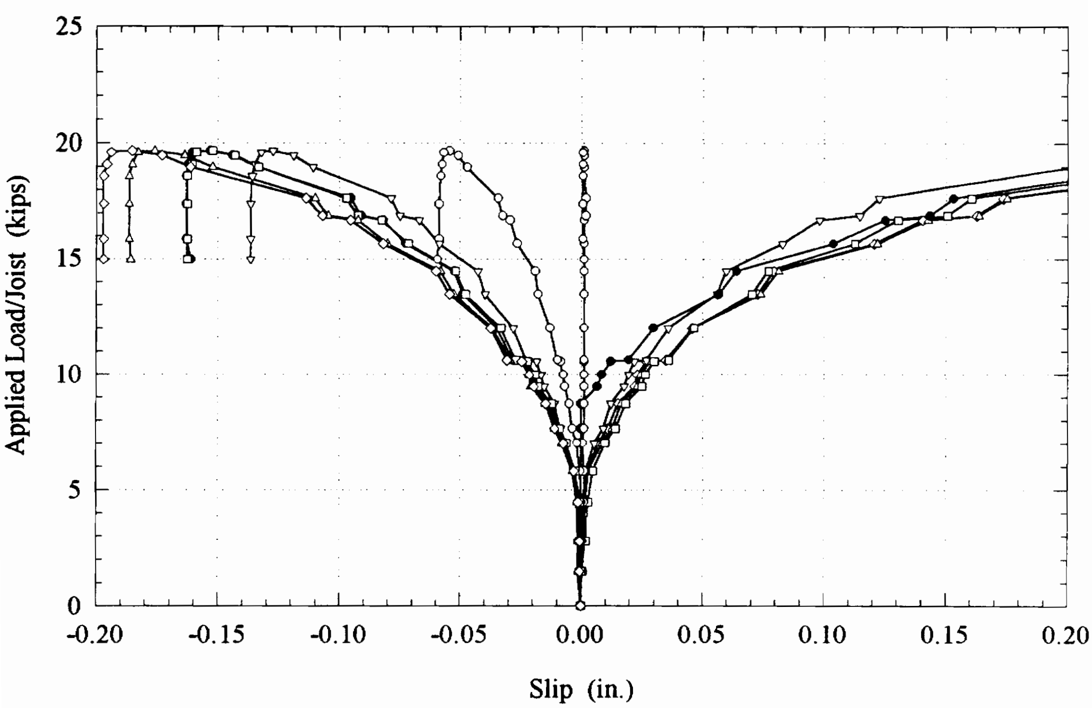



Figure A.2.14 Applied Load/Joist vs. Slip

## NUCOR COMPOSITE JOIST TEST SUMMARY SHEET

TEST DESIGNATION: CSJ-3 TEST DATE: 13 November 1991

### TEST DESCRIPTION

| | | | | |
|---|---|---|---|---|
| **Joist:** | Span: | 24'-0" | Weight: | 63 plf |
| | Depth: | 10 in. | Spacing: | 48 in. |
| | Top Chord: | 2L-3.50x3.50x0.375 | Yield Stress: | 55.0 ksi |
| | Bottom Chord: | 2L-5.00x5.00x0.500 | Yield Stress: | 51.6 ksi |
| **Deck:** | Type: | 1.5VLI | Gage: | 22 ga |
| **Slab:** | Total Depth: | 6.0 in. | Compressive Strength: | 3600 psi |
| **Shear Connector:** | Type: | L-1.25x1.25x0.133 w/ 11/16 in. dia. puddle weld | | |
| | Quantity: | 20 per half-span | | |

### THEORETICAL CALCULATIONS

Theoretical Applied Load per Joist at Failure: 102.5 kips
Theoretical Total Load per Joist at Failure: 110.0 kips
Transformed Moment of Inertia: 1114 in.$^4$
Theoretical Elastic Stiffness: 87.16 k/in.
Elastic Deflection at Yield: 0.84 in.

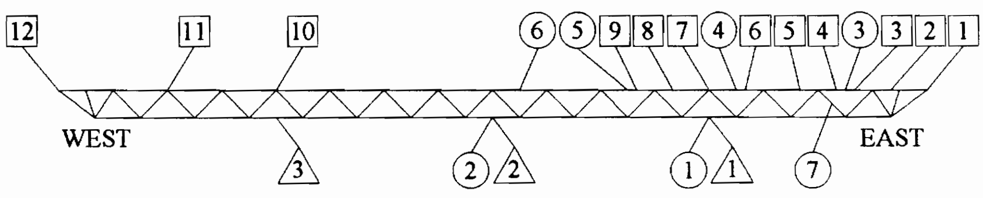
### TEST RESULTS

Applied Load per Joist at Failure: 104.9 kips
Total Load per Joist at Failure: 112.5 kips
Midspan Deflection at Failure: 6.98 in.
Maximum Slip and Location: 1.597 in., SLIP 2
Mode of Failure: yielding of the top chord

### COMPARISON OF ACTUAL TO THEORETICAL

Applied Load per Joist/Theoretical Applied Load per Joist 1.02

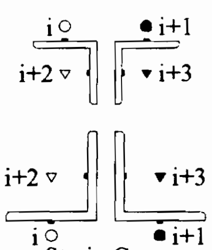
### INSTRUMENTATION LOCATIONS




1 BC1
2 BC2
3 TC1
4 TC2
5 TC3
6 TC4
7 W5

1 EQB Defl
2 MB Defl
3 WQB Defl

1 SLIP 1
2 SLIP 2
3 SLIP 3
4 SLIP 4
5 SLIP 5
6 SLIP 6
7 SLIP 7
8 SLIP 8
9 SLIP 9
10 SLIP 10
11 SLIP 11
12 SLIP 12




Strain Gage Locations

| TOTAL LOAD PER JOIST (kips) | CSJ-3 TEST DATA SHEET DEFLECTIONS EQB (in.) | MB (in.) | WQB (in.) |
|---|---|---|---|
| 0.00 | 0.000 | 0.000 | 0.000 |
| 1.68 | 0.073 | 0.090 | 0.063 |
| 7.52 | 0.324 | 0.404 | 0.282 |
| 9.48 | 0.347 | 0.436 | 0.287 |
| 12.03 | 0.366 | 0.459 | 0.310 |
| 16.76 | 0.407 | 0.510 | 0.337 |
| 19.19 | 0.416 | 0.538 | 0.360 |
| 14.97 | 0.411 | 0.506 | 0.369 |
| 12.16 | 0.393 | 0.478 | 0.351 |
| 16.51 | 0.411 | 0.515 | 0.351 |
| 19.19 | 0.430 | 0.542 | 0.365 |
| 22.38 | 0.453 | 0.575 | 0.383 |
| 28.00 | 0.498 | 0.639 | 0.428 |
| 33.36 | 0.567 | 0.718 | 0.497 |
| 35.79 | 0.599 | 0.764 | 0.529 |
| 38.09 | 0.645 | 0.810 | 0.565 |
| 39.24 | 0.668 | 0.847 | 0.593 |
| 33.36 | 0.636 | 0.796 | 0.584 |
| 21.61 | 0.530 | 0.658 | 0.483 |
| 11.65 | 0.434 | 0.529 | 0.387 |
| 17.78 | 0.476 | 0.598 | 0.410 |
| 24.42 | 0.530 | 0.672 | 0.465 |
| 29.79 | 0.585 | 0.741 | 0.515 |
| 38.73 | 0.677 | 0.852 | 0.597 |
| 41.03 | 0.709 | 0.893 | 0.634 |
| 44.22 | 0.759 | 0.967 | 0.675 |
| 45.11 | 0.778 | 0.990 | 0.698 |
| 47.16 | 0.833 | 1.054 | 0.744 |
| 49.84 | 0.888 | 1.133 | 0.798 |
| 32.34 | 0.732 | 0.925 | 0.675 |
| 19.83 | 0.590 | 0.736 | 0.543 |
| 11.52 | 0.494 | 0.602 | 0.442 |
| 19.70 | 0.558 | 0.704 | 0.492 |
| 32.09 | 0.700 | 0.888 | 0.625 |
| 39.62 | 0.787 | 1.004 | 0.702 |
| 49.97 | 0.915 | 1.174 | 0.821 |
| 52.52 | 0.952 | 1.225 | 0.858 |
| 55.33 | 1.016 | 1.317 | 0.922 |
| 57.89 | 1.094 | 1.428 | 1.004 |
| 42.17 | 0.965 | 1.234 | 0.903 |
| 31.70 | 0.842 | 1.068 | 0.780 |
| 19.95 | 0.682 | 0.852 | 0.625 |
| 11.65 | 0.558 | 0.685 | 0.502 |
| 22.12 | 0.668 | 0.842 | 0.588 |
| 34.39 | 0.824 | 1.050 | 0.744 |
| 45.62 | 0.965 | 1.239 | 0.871 |
| 55.46 | 1.080 | 1.405 | 0.990 |
| 61.85 | 1.199 | 1.562 | 1.104 |
| 63.51 | 1.254 | 1.649 | 1.164 |
| 66.83 | 1.332 | 1.760 | 1.246 |
| 69.25 | 1.405 | 1.857 | 1.319 |
| 46.01 | 1.190 | 1.539 | 1.123 |
| 36.30 | 1.062 | 1.364 | 0.995 |
| 23.27 | 0.846 | 1.068 | 0.789 |

| TOTAL LOAD PER JOIST (kips) | CSJ-3 TEST DATA SHEET DEFLECTIONS (cont.) | | |
|---|---|---|---|
| | EQB (in.) | MB (in.) | WQB (in.) |
| 11.39 | 0.640 | 0.801 | 0.584 |
| 28.26 | 0.865 | 1.114 | 0.780 |
| 39.62 | 1.030 | 1.336 | 0.944 |
| 55.33 | 1.240 | 1.622 | 1.150 |
| 66.44 | 1.400 | 1.843 | 1.310 |
| 70.53 | 1.492 | 1.968 | 1.401 |
| 73.09 | 1.552 | 2.065 | 1.470 |
| 75.64 | 1.629 | 2.161 | 1.538 |
| 77.05 | 1.689 | 2.249 | 1.607 |
| 79.35 | 1.748 | 2.341 | 1.666 |
| 82.92 | 1.886 | 2.535 | 1.803 |
| 61.72 | 1.698 | 2.258 | 1.625 |
| 43.84 | 1.442 | 1.899 | 1.374 |
| 26.21 | 1.107 | 1.419 | 1.031 |
| 11.52 | 0.805 | 1.008 | 0.734 |
| 27.49 | 1.048 | 1.359 | 0.958 |
| 45.11 | 1.341 | 1.765 | 1.250 |
| 62.61 | 1.620 | 2.148 | 1.524 |
| 79.73 | 1.890 | 2.526 | 1.798 |
| 84.20 | 2.000 | 2.678 | 1.913 |
| 87.14 | 2.110 | 2.821 | 2.008 |
| 89.57 | 2.188 | 2.941 | 2.100 |
| 53.93 | 1.771 | 2.360 | 1.698 |
| 28.26 | 1.281 | 1.654 | 1.196 |
| 11.27 | 0.892 | 1.142 | 0.830 |
| 12.29 | 0.892 | 1.142 | 0.826 |
| 29.79 | 1.194 | 1.571 | 1.109 |
| 49.97 | 1.561 | 2.069 | 1.465 |
| 69.26 | 1.881 | 2.526 | 1.789 |
| 87.14 | 2.215 | 2.969 | 2.123 |
| 90.47 | 2.307 | 3.093 | 2.209 |
| 90.86 | 2.376 | 3.190 | 2.287 |
| 95.44 | 2.486 | 3.356 | 2.392 |
| 97.49 | 2.609 | 3.522 | 2.515 |
| 99.92 | 2.751 | 3.716 | 2.657 |
| 103.49 | 2.985 | 4.057 | 2.876 |
| 106.43 | 3.195 | 4.371 | 3.091 |
| 108.87 | 3.617 | 4.966 | 3.483 |
| 110.91 | 3.992 | 5.506 | 3.835 |
| 111.30 | 4.299 | 5.939 | 4.123 |
| 111.30 | 4.633 | 6.423 | 4.410 |
| 112.46 | 5.022 | 6.977 | 4.730 |
| 110.67 | 5.361 | 7.452 | 4.981 |
| 110.80 | 5.732 | 7.959 | 5.246 |
| 108.63 | 6.089 | 8.467 | 5.502 |
| 105.43 | 6.442 | 8.965 | 5.739 |
| 102.87 | 6.854 | 9.518 | 6.022 |
| 101.34 | 7.257 | 10.077 | 6.305 |
| 98.66 | 7.513 | 10.446 | 6.479 |
| 67.85 | 7.499 | 10.404 | 6.310 |
| 49.08 | 6.964 | 9.661 | 5.785 |
| 29.54 | 6.245 | 8.707 | 5.132 |
| 11.39 | 5.526 | 7.715 | 4.474 |
| 9.10 | 5.462 | 7.614 | 4.410 |

| TOTAL LOAD PER JOIST (kips) | CSJ-3 TEST DATA SHEET TC1 2L3.50x3.50x0.375 TC1 (9) ($\mu\varepsilon$) | TC1 (10) | TC1 (11) | TC1 (12) | AVG MEM LOAD (kips) | CSJ-3 TEST DATA SHEET TC2 2L3.50x3.50x0.375 TC2 (13) ($\mu\varepsilon$) | TC2 (14) | TC2 (15) | TC2 (16) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 |
| 1.68 | -18 | -16 | -14 | -13 | -2.2 | -13 | -36 | -37 | -27 | -4.0 |
| 7.52 | -81 | -73 | -64 | -58 | -9.9 | -58 | -159 | -165 | -119 | -18.0 |
| 9.48 | -85 | -70 | -64 | -57 | -9.9 | -57 | -155 | -167 | -115 | -17.8 |
| 12.03 | -91 | -67 | -66 | -58 | -10.1 | -58 | -153 | -170 | -113 | -17.8 |
| 16.76 | -102 | -62 | -70 | -58 | -10.5 | -58 | -148 | -176 | -108 | -17.6 |
| 19.19 | -108 | -58 | -72 | -57 | -10.6 | -57 | -145 | -180 | -105 | -17.5 |
| 14.97 | -103 | -64 | -72 | -59 | -10.7 | -59 | -150 | -177 | -111 | -17.9 |
| 12.16 | -96 | -68 | -70 | -59 | -10.5 | -59 | -154 | -173 | -115 | -18.0 |
| 16.51 | -105 | -63 | -72 | -59 | -10.7 | -59 | -150 | -179 | -110 | -17.9 |
| 19.19 | -109 | -59 | -73 | -58 | -10.8 | -58 | -146 | -182 | -106 | -17.7 |
| 22.38 | -117 | -55 | -75 | -58 | -11.0 | -58 | -144 | -187 | -103 | -17.7 |
| 28.00 | -136 | -55 | -84 | -59 | -12.0 | -59 | -144 | -205 | -103 | -18.4 |
| 33.36 | -160 | -77 | -99 | -72 | -14.7 | -72 | -172 | -248 | -123 | -22.2 |
| 35.79 | -173 | -85 | -100 | -77 | -15.6 | -77 | -193 | -273 | -136 | -24.5 |
| 38.09 | -187 | -99 | -107 | -87 | -17.3 | -87 | -212 | -301 | -154 | -27.2 |
| 39.24 | -196 | -107 | -113 | -93 | -18.4 | -93 | -229 | -319 | -166 | -29.1 |
| 33.36 | -183 | -111 | -108 | -93 | -17.9 | -93 | -232 | -305 | -170 | -28.8 |
| 21.61 | -148 | -107 | -91 | -83 | -15.5 | -83 | -218 | -259 | -162 | -26.0 |
| 11.65 | -110 | -97 | -71 | -70 | -12.5 | -70 | -192 | -210 | -143 | -22.2 |
| 17.78 | -128 | -101 | -79 | -76 | -13.8 | -76 | -197 | -230 | -145 | -23.3 |
| 24.42 | -151 | -104 | -90 | -82 | -15.4 | -82 | -208 | -260 | -154 | -25.4 |
| 29.79 | -167 | -106 | -98 | -87 | -16.5 | -87 | -218 | -283 | -160 | -26.9 |
| 38.73 | -196 | -111 | -111 | -95 | -18.5 | -95 | -233 | -323 | -170 | -29.6 |
| 41.03 | -208 | -117 | -119 | -103 | -19.7 | -103 | -243 | -341 | -180 | -31.2 |
| 44.22 | -228 | -130 | -133 | -115 | -21.8 | -115 | -267 | -373 | -199 | -34.4 |
| 45.11 | -238 | -138 | -140 | -118 | -22.8 | -118 | -281 | -389 | -211 | -36.0 |
| 47.16 | -256 | -154 | -154 | -131 | -25.1 | -131 | -308 | -422 | -236 | -39.6 |
| 49.84 | -275 | -168 | -167 | -145 | -27.2 | -145 | -336 | -455 | -259 | -43.0 |
| 32.34 | -216 | -160 | -139 | -130 | -23.2 | -130 | -315 | -376 | -243 | -38.3 |
| 19.83 | -160 | -136 | -106 | -106 | -18.3 | -106 | -265 | -293 | -204 | -31.3 |
| 11.52 | -111 | -111 | -75 | -82 | -13.7 | -82 | -221 | -230 | -170 | -25.3 |
| 19.70 | -150 | -123 | -99 | -97 | -16.9 | -97 | -239 | -272 | -185 | -28.6 |
| 32.09 | -204 | -141 | -129 | -118 | -21.3 | -118 | -282 | -349 | -218 | -34.8 |
| 39.62 | -234 | -152 | -145 | -129 | -23.8 | -129 | -308 | -394 | -238 | -38.6 |
| 49.97 | -283 | -175 | -174 | -152 | -28.2 | -152 | -351 | -468 | -271 | -44.7 |
| 52.52 | -298 | -185 | -183 | -161 | -29.8 | -161 | -369 | -492 | -286 | -47.1 |
| 55.33 | -325 | -208 | -200 | -178 | -32.8 | -178 | -404 | -531 | -315 | -51.4 |
| 57.89 | -349 | -236 | -220 | -198 | -36.1 | -198 | -450 | -575 | -352 | -56.7 |
| 42.17 | -294 | -228 | -192 | -185 | -32.4 | -185 | -431 | -500 | -337 | -52.3 |
| 31.70 | -244 | -207 | -163 | -163 | -28.0 | -163 | -390 | -430 | -306 | -46.5 |
| 19.95 | -172 | -166 | -116 | -127 | -20.9 | -127 | -313 | -326 | -247 | -36.5 |
| 11.65 | -111 | -128 | -76 | -94 | -14.8 | -94 | -249 | -247 | -199 | -28.4 |
| 22.12 | -175 | -157 | -117 | -123 | -20.6 | -123 | -295 | -321 | -234 | -35.1 |
| 34.39 | -239 | -183 | -155 | -150 | -26.2 | -150 | -353 | -411 | -279 | -43.0 |
| 45.62 | -291 | -207 | -186 | -173 | -30.9 | -173 | -401 | -488 | -316 | -49.6 |
| 55.46 | -339 | -230 | -215 | -193 | -35.2 | -193 | -444 | -560 | -348 | -55.7 |
| 61.85 | -375 | -261 | -242 | -219 | -39.5 | -219 | -501 | -631 | -392 | -62.8 |
| 63.51 | -387 | -280 | -252 | -230 | -41.4 | -230 | -532 | -659 | -419 | -66.3 |
| 66.83 | -410 | -304 | -266 | -245 | -44.1 | -245 | -570 | -703 | -449 | -70.8 |
| 69.25 | -432 | -325 | -283 | -261 | -46.9 | -261 | -608 | -742 | -480 | -75.3 |
| 46.01 | -345 | -304 | -239 | -236 | -40.5 | -236 | -559 | -611 | -446 | -66.7 |
| 36.30 | -293 | -275 | -206 | -210 | -35.4 | -210 | -504 | -532 | -404 | -59.5 |
| 23.27 | -204 | -215 | -144 | -159 | -26.0 | -159 | -396 | -395 | -322 | -45.8 |

| TOTAL LOAD PER JOIST (kips) | CSJ-3 TEST DATA SHEET TC1 (cont.) 2L3.50x3.50x0.375 TC1 (9) (με) | TC1 (10) | TC1 (11) | TC1 (12) | AVG MEM LOAD (kips) | CSJ-3 TEST DATA SHEET TC2 (cont.) 2L3.50x3.50x0.375 TC2 (13) (με) | TC2 (14) | TC2 (15) | TC2 (16) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| 11.39 | -114 | -152 | -82 | -105 | -16.3 | -105 | -279 | -261 | -235 | -31.7 |
| 28.26 | -224 | -212 | -154 | -160 | -27.1 | -387 | -410 | -316 | -348 | -52.6 |
| 39.62 | -286 | -245 | -194 | -191 | -33.0 | -456 | -506 | -369 | -409 | -62.7 |
| 55.33 | -364 | -286 | -242 | -228 | -40.4 | -538 | -629 | -431 | -484 | -75.1 |
| 66.44 | -421 | -319 | -278 | -258 | -46.0 | -604 | -726 | -479 | -545 | -84.8 |
| 70.53 | -448 | -343 | -299 | -275 | -49.2 | -652 | -776 | -515 | -586 | -91.1 |
| 73.09 | -467 | -363 | -313 | -288 | -51.5 | -685 | -810 | -542 | -618 | -95.7 |
| 75.64 | -484 | -383 | -328 | -301 | -53.9 | -722 | -847 | -573 | -651 | -100.6 |
| 77.05 | -499 | -401 | -340 | -312 | -55.9 | -756 | -878 | -603 | -683 | -105.2 |
| 79.35 | -515 | -415 | -354 | -324 | -57.9 | -785 | -909 | -630 | -713 | -109.4 |
| 82.92 | -555 | -451 | -385 | -350 | -62.7 | -865 | -980 | -698 | -785 | -119.9 |
| 61.72 | -475 | -438 | -343 | -330 | -57.1 | -811 | -854 | -666 | -728 | -110.2 |
| 43.84 | -373 | -377 | -277 | -279 | -47.1 | -693 | -690 | -577 | -623 | -93.1 |
| 26.21 | -237 | -277 | -182 | -196 | -32.2 | -497 | -469 | -431 | -465 | -67.1 |
| 11.52 | -116 | -178 | -94 | -114 | -18.1 | -312 | -266 | -294 | -318 | -42.9 |
| 27.49 | -228 | -247 | -169 | -175 | -29.5 | -443 | -427 | -388 | -426 | -60.7 |
| 45.11 | -342 | -322 | -247 | -239 | -41.5 | -595 | -614 | -503 | -553 | -81.6 |
| 62.61 | -441 | -384 | -312 | -292 | -51.5 | -724 | -783 | -600 | -666 | -99.9 |
| 79.73 | -540 | -449 | -378 | -345 | -61.7 | -863 | -966 | -701 | -785 | -119.4 |
| 84.20 | -576 | -485 | -408 | -375 | -66.5 | -925 | -1030 | -755 | -844 | -128.0 |
| 87.14 | -602 | -513 | -431 | -394 | -69.9 | -970 | -1074 | -801 | -894 | -134.7 |
| 89.57 | -621 | -535 | -447 | -411 | -72.6 | -1006 | -1110 | -837 | -932 | -140.0 |
| 53.93 | -454 | -466 | -345 | -345 | -58.0 | -849 | -841 | -725 | -779 | -115.0 |
| 28.26 | -260 | -316 | -206 | -217 | -36.0 | -550 | -508 | -504 | -542 | -75.8 |
| 11.27 | -109 | -176 | -92 | -107 | -17.5 | -305 | -241 | -318 | -348 | -43.6 |
| 12.29 | -116 | -181 | -97 | -111 | -18.2 | -309 | -247 | -321 | -351 | -44.2 |
| 29.79 | -246 | -274 | -187 | -192 | -32.4 | -475 | -444 | -443 | -486 | -66.6 |
| 49.97 | -382 | -377 | -283 | -277 | -47.5 | -674 | -679 | -594 | -650 | -93.6 |
| 69.26 | -495 | -458 | -362 | -346 | -59.8 | -845 | -894 | -721 | -795 | -117.3 |
| 87.14 | -610 | -544 | -443 | -416 | -72.6 | -1015 | -1105 | -849 | -941 | -140.8 |
| 90.47 | -637 | -565 | -463 | -432 | -75.5 | -1044 | -1139 | -885 | -981 | -145.8 |
| 90.86 | -649 | -582 | -475 | -445 | -77.5 | -1066 | -1159 | -913 | -1012 | -149.5 |
| 95.44 | -683 | -608 | -500 | -464 | -81.3 | -1106 | -1210 | -959 | -1062 | -156.2 |
| 97.49 | -701 | -632 | -517 | -482 | -84.0 | -1131 | -1242 | -1002 | -1111 | -161.6 |
| 99.92 | -713 | -656 | -533 | -501 | -86.6 | -1153 | -1279 | -1052 | -1164 | -167.4 |
| 103.49 | -729 | -689 | -549 | -527 | -89.9 | -1178 | -1332 | -1128 | -1247 | -176.0 |
| 106.43 | -738 | -717 | -558 | -547 | -92.2 | -1198 | -1374 | -1194 | -1318 | -183.1 |
| 108.87 | -753 | -760 | -571 | -583 | -96.1 | -1195 | -1399 | -1305 | -1445 | -192.5 |
| 110.91 | -772 | -786 | -586 | -603 | -99.0 | -1193 | -1400 | -1375 | -1525 | -197.9 |
| 111.30 | -789 | -809 | -597 | -622 | -101.5 | -1188 | -1377 | -1425 | -1570 | -200.3 |
| 111.30 | -812 | -840 | -614 | -638 | -104.6 | -1172 | -1363 | -1460 | -1614 | -202.0 |
| 112.46 | -833 | -864 | -642 | -663 | -108.2 | -1190 | -1373 | -1509 | -1662 | -206.6 |
| 110.67 | -832 | -862 | -654 | -671 | -108.8 | -1169 | -1354 | -1514 | -1666 | -205.4 |
| 110.80 | -838 | -875 | -674 | -683 | -110.6 | -1200 | -1372 | -1541 | -1688 | -209.0 |
| 108.63 | -830 | -877 | -679 | -686 | -110.7 | -1209 | -1358 | -1540 | -1684 | -208.7 |
| 105.43 | -810 | -874 | -674 | -677 | -109.3 | -1219 | -1312 | -1528 | -1674 | -206.5 |
| 102.87 | -777 | -860 | -664 | -659 | -106.6 | -1228 | -1289 | -1512 | -1656 | -204.8 |
| 101.34 | -769 | -871 | -659 | -656 | -106.4 | -1200 | -1303 | -1507 | -1652 | -204.0 |
| 98.66 | -746 | -862 | -634 | -642 | -103.9 | -1162 | -1283 | -1491 | -1636 | -200.7 |
| 67.85 | -537 | -666 | -470 | -492 | -77.9 | -752 | -954 | -1260 | -1405 | -157.5 |
| 49.08 | -356 | -505 | -340 | -360 | -56.2 | -423 | -591 | -1021 | -1154 | -114.9 |
| 29.54 | -176 | -319 | -206 | -223 | -33.3 | -56 | -193 | -735 | -862 | -66.5 |
| 11.39 | 19 | -131 | -56 | -76 | -8.8 | 303 | 198 | -447 | -563 | -18.3 |
| 9.10 | 40 | -109 | -40 | -59 | -6.1 | 340 | 240 | -415 | -529 | -13.1 |

| TOTAL LOAD PER JOIST (kips) | CSJ-3 TEST DATA SHEET TC3 2L3.50x3.50x0.375 TC3 (17) (με) | TC3 (18) | TC3 (19) | TC3 (20) | AVG MEM LOAD (kips) | CSJ-3 TEST DATA SHEET TC4 2L3.50x3.50x0.375 TC4 (21) (με) | TC4 (22) | TC4 (23) | TC4 (24) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 |
| 1.68 | -48 | -47 | -35 | -35 | -5.9 | -53 | -50 | -38 | -38 | -6.4 |
| 7.52 | -216 | -209 | -155 | -155 | -26.5 | -239 | -224 | -168 | -169 | -28.8 |
| 9.48 | -216 | -206 | -150 | -151 | -26.1 | -239 | -224 | -164 | -164 | -28.5 |
| 12.03 | -216 | -203 | -145 | -146 | -25.6 | -237 | -222 | -158 | -158 | -27.9 |
| 16.76 | -219 | -199 | -139 | -137 | -25.0 | -236 | -220 | -147 | -148 | -27.0 |
| 19.19 | -220 | -196 | -135 | -133 | -24.6 | -235 | -220 | -141 | -143 | -26.6 |
| 14.97 | -221 | -202 | -142 | -142 | -25.5 | -238 | -222 | -152 | -152 | -27.5 |
| 12.16 | -220 | -206 | -147 | -146 | -25.9 | -239 | -224 | -159 | -159 | -28.1 |
| 16.51 | -221 | -201 | -141 | -138 | -25.2 | -237 | -221 | -148 | -148 | -27.2 |
| 19.19 | -222 | -198 | -136 | -132 | -24.8 | -235 | -220 | -141 | -143 | -26.6 |
| 22.38 | -224 | -195 | -131 | -126 | -24.4 | -234 | -219 | -135 | -136 | -26.1 |
| 28.00 | -232 | -190 | -125 | -117 | -23.9 | -232 | -218 | -121 | -123 | -25.0 |
| 33.36 | -266 | -201 | -138 | -125 | -26.3 | -233 | -223 | -113 | -115 | -24.7 |
| 35.79 | -294 | -222 | -154 | -139 | -29.1 | -237 | -232 | -114 | -116 | -25.2 |
| 38.09 | -329 | -253 | -177 | -160 | -33.1 | -244 | -247 | -119 | -124 | -26.4 |
| 39.24 | -350 | -277 | -194 | -176 | -35.9 | -253 | -266 | -129 | -137 | -28.3 |
| 33.36 | -344 | -280 | -201 | -187 | -36.4 | -258 | -270 | -144 | -151 | -29.7 |
| 21.61 | -308 | -269 | -197 | -189 | -34.7 | -259 | -263 | -164 | -170 | -30.8 |
| 11.65 | -263 | -247 | -183 | -180 | -31.5 | -254 | -250 | -175 | -179 | -30.9 |
| 17.78 | -276 | -247 | -181 | -176 | -31.7 | -253 | -250 | -164 | -168 | -30.1 |
| 24.42 | -301 | -258 | -187 | -177 | -33.3 | -254 | -256 | -153 | -158 | -29.6 |
| 29.79 | -321 | -267 | -191 | -178 | -34.5 | -254 | -261 | -145 | -151 | -29.2 |
| 38.73 | -355 | -284 | -200 | -183 | -36.8 | -256 | -271 | -133 | -142 | -28.9 |
| 41.03 | -375 | -297 | -211 | -193 | -38.8 | -266 | -287 | -139 | -149 | -30.3 |
| 44.22 | -413 | -329 | -236 | -217 | -43.0 | -288 | -319 | -156 | -170 | -33.6 |
| 45.11 | -434 | -346 | -251 | -232 | -45.5 | -298 | -334 | -165 | -180 | -35.2 |
| 47.16 | -473 | -383 | -278 | -261 | -50.2 | -329 | -375 | -192 | -209 | -39.8 |
| 49.84 | -513 | -414 | -306 | -286 | -54.7 | -357 | -409 | -212 | -232 | -43.6 |
| 32.34 | -451 | -391 | -293 | -285 | -51.2 | -347 | -384 | -235 | -249 | -43.8 |
| 19.83 | -369 | -335 | -254 | -254 | -43.7 | -320 | -338 | -230 | -238 | -40.6 |
| 11.52 | -302 | -283 | -217 | -222 | -36.9 | -294 | -298 | -218 | -221 | -37.2 |
| 19.70 | -337 | -298 | -229 | -228 | -39.3 | -299 | -309 | -209 | -215 | -37.2 |
| 32.09 | -414 | -350 | -264 | -255 | -46.2 | -326 | -354 | -214 | -226 | -40.4 |
| 39.62 | -461 | -381 | -285 | -273 | -50.4 | -343 | -381 | -217 | -232 | -42.3 |
| 49.97 | -538 | -436 | -324 | -305 | -57.7 | -377 | -430 | -230 | -250 | -46.4 |
| 52.52 | -566 | -456 | -342 | -321 | -60.7 | -395 | -451 | -242 | -264 | -48.7 |
| 55.33 | -616 | -499 | -376 | -355 | -66.5 | -434 | -494 | -271 | -293 | -53.8 |
| 57.89 | -680 | -559 | -426 | -406 | -74.6 | -488 | -553 | -317 | -339 | -61.1 |
| 42.17 | -618 | -536 | -409 | -400 | -70.7 | -471 | -524 | -330 | -348 | -60.2 |
| 31.70 | -549 | -490 | -377 | -375 | -64.6 | -442 | -484 | -324 | -338 | -57.2 |
| 19.95 | -434 | -400 | -312 | -317 | -52.7 | -382 | -405 | -292 | -299 | -49.6 |
| 11.65 | -342 | -323 | -257 | -267 | -42.8 | -327 | -338 | -260 | -262 | -42.8 |
| 22.12 | -414 | -366 | -291 | -293 | -49.2 | -354 | -378 | -267 | -272 | -45.8 |
| 34.39 | -513 | -438 | -343 | -337 | -58.7 | -407 | -444 | -289 | -301 | -51.9 |
| 45.62 | -596 | -499 | -386 | -373 | -66.8 | -451 | -500 | -306 | -322 | -56.9 |
| 55.46 | -671 | -554 | -424 | -406 | -74.0 | -488 | -550 | -321 | -342 | -61.3 |
| 61.85 | -754 | -627 | -480 | -459 | -83.6 | -551 | -617 | -365 | -386 | -69.1 |
| 63.51 | -798 | -673 | -516 | -497 | -89.5 | -589 | -660 | -401 | -422 | -74.6 |
| 66.83 | -848 | -723 | -554 | -537 | -95.9 | -632 | -707 | -435 | -457 | -80.4 |
| 69.25 | -897 | -774 | -594 | -577 | -102.4 | -678 | -754 | -473 | -496 | -86.5 |
| 46.01 | -779 | -713 | -550 | -550 | -93.4 | -628 | -688 | -477 | -492 | -82.3 |
| 36.30 | -696 | -652 | -505 | -511 | -85.1 | -583 | -633 | -456 | -467 | -77.0 |
| 23.27 | -541 | -522 | -409 | -423 | -68.3 | -482 | -517 | -396 | -400 | -64.6 |

| TOTAL LOAD PER JOIST (kips) | CSJ-3 TEST DATA SHEET TC3 (cont.) 2L3.50x3.50x0.375 TC3 (17) (με) | TC3 (18) | TC3 (19) | TC3 (20) | AVG MEM LOAD (kips) | CSJ-3 TEST DATA SHEET TC4 (cont.) 2L3.50x3.50x0.375 TC4 (21) (με) | TC4 (22) | TC4 (23) | TC4 (24) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| 11.39 | -380 | -378 | -308 | -324 | -50.1 | -364 | -385 | -320 | -318 | -50.0 |
| 28.26 | -542 | -495 | -399 | -404 | -66.3 | -458 | -496 | -370 | -374 | -61.1 |
| 39.62 | -649 | -580 | -460 | -459 | -77.4 | -528 | -575 | -406 | -414 | -69.3 |
| 55.33 | -784 | -686 | -535 | -525 | -91.1 | -614 | -675 | -448 | -463 | -79.3 |
| 66.44 | -888 | -771 | -595 | -580 | -102.1 | -683 | -755 | -485 | -505 | -87.4 |
| 70.53 | -948 | -831 | -639 | -627 | -109.7 | -736 | -809 | -528 | -548 | -94.4 |
| 73.09 | -990 | -874 | -673 | -661 | -115.2 | -773 | -849 | -560 | -580 | -99.5 |
| 75.64 | -1034 | -920 | -709 | -700 | -121.1 | -819 | -893 | -598 | -615 | -105.4 |
| 77.05 | -1074 | -963 | -746 | -738 | -126.8 | -856 | -934 | -634 | -652 | -110.8 |
| 79.35 | -1111 | -1000 | -777 | -770 | -131.8 | -889 | -968 | -664 | -683 | -115.4 |
| 82.92 | -1204 | -1099 | -862 | -857 | -144.9 | -981 | -1068 | -751 | -773 | -128.7 |
| 61.72 | -1094 | -1047 | -823 | -835 | -136.8 | -931 | -1002 | -755 | -769 | -124.5 |
| 43.84 | -923 | -912 | -724 | -745 | -119.0 | -824 | -875 | -699 | -704 | -111.8 |
| 26.21 | -662 | -677 | -553 | -580 | -89.1 | -623 | -657 | -569 | -565 | -87.0 |
| 11.52 | -420 | -449 | -393 | -421 | -60.6 | -419 | -438 | -433 | -421 | -61.7 |
| 27.49 | -602 | -595 | -503 | -522 | -80.0 | -547 | -581 | -507 | -503 | -77.0 |
| 45.11 | -813 | -774 | -635 | -646 | -103.3 | -708 | -756 | -605 | -608 | -96.4 |
| 62.61 | -999 | -929 | -746 | -751 | -123.4 | -845 | -907 | -683 | -693 | -112.7 |
| 79.73 | -1193 | -1096 | -867 | -864 | -144.8 | -986 | -1069 | -767 | -785 | -129.9 |
| 84.20 | -1271 | -1176 | -931 | -929 | -155.1 | -1054 | -1140 | -826 | -848 | -139.3 |
| 87.14 | -1327 | -1237 | -991 | -991 | -163.8 | -1114 | -1202 | -887 | -910 | -148.1 |
| 89.57 | -1371 | -1285 | -1037 | -1040 | -170.5 | -1161 | -1250 | -934 | -957 | -155.0 |
| 53.93 | -1112 | -1104 | -906 | -930 | -145.9 | -1007 | -1063 | -876 | -885 | -138.0 |
| 28.26 | -722 | -758 | -650 | -684 | -101.4 | -705 | -731 | -679 | -675 | -100.5 |
| 11.27 | -412 | -462 | -437 | -472 | -64.2 | -432 | -438 | -493 | -477 | -66.3 |
| 12.29 | -415 | -462 | -439 | -472 | -64.4 | -430 | -437 | -490 | -475 | -66.0 |
| 29.79 | -642 | -656 | -582 | -607 | -89.6 | -607 | -633 | -600 | -594 | -87.7 |
| 49.97 | -910 | -888 | -754 | -771 | -119.7 | -818 | -863 | -732 | -735 | -113.4 |
| 69.26 | -1142 | -1088 | -900 | -909 | -145.5 | -993 | -1058 | -838 | -850 | -134.7 |
| 87.14 | -1375 | -1296 | -1052 | -1056 | -172.2 | -1180 | -1265 | -959 | -981 | -157.9 |
| 90.47 | -1415 | -1339 | -1099 | -1105 | -178.6 | -1219 | -1306 | -1003 | -1026 | -164.1 |
| 90.86 | -1444 | -1363 | -1140 | -1146 | -183.5 | -1245 | -1335 | -1040 | -1062 | -168.7 |
| 95.44 | -1504 | -1408 | -1209 | -1214 | -192.2 | -1295 | -1399 | -1102 | -1125 | -177.3 |
| 97.49 | -1550 | -1423 | -1283 | -1286 | -199.7 | -1322 | -1443 | -1168 | -1192 | -184.6 |
| 99.92 | -1588 | -1435 | -1368 | -1362 | -207.2 | -1345 | -1488 | -1240 | -1265 | -192.3 |
| 103.49 | -1646 | -1444 | -1513 | -1474 | -218.9 | -1369 | -1526 | -1365 | -1375 | -203.0 |
| 106.43 | -1694 | -1437 | -1637 | -1559 | -227.9 | -1382 | -1526 | -1475 | -1469 | -210.8 |
| 108.87 | -1720 | -1393 | -1844 | -1658 | -238.3 | -1360 | -1475 | -1650 | -1552 | -217.5 |
| 110.91 | -1683 | -1396 | -1882 | -1661 | -238.6 | -1369 | -1570 | -1714 | -1546 | -223.3 |
| 111.30 | -1758 | -1413 | -1782 | -1644 | -237.7 | -1395 | -1667 | -1715 | -2476 | -261.3 |
| 111.30 | -2869 | -1426 | -1770 | -1643 | yield | -1428 | -1967 | -1699 | -3048 | yield |
| 112.46 | -9314 | -1459 | -2465 | -1676 | yield | -1478 | -1917 | -1706 | -4130 | yield |
| 110.67 | -11447 | -1440 | -3349 | -1682 | yield | -1489 | -1894 | -1705 | -5832 | yield |
| 110.80 | -13677 | -1422 | -4379 | -1707 | yield | -1529 | -1914 | -1727 | -6550 | yield |
| 108.63 | -16122 | -1388 | -5531 | -1723 | yield | -1586 | -2049 | -1726 | -6633 | yield |
| 105.43 | ## | -1390 | -7192 | -1727 | yield | -1691 | -2042 | -1673 | -6601 | yield |
| 102.87 | ## | -1396 | -9119 | -1629 | yield | -2503 | -2014 | -1999 | -6564 | yield |
| 101.34 | ## | -1432 | -10654 | -1618 | yield | -9504 | -2000 | -2832 | -6547 | yield |
| 98.66 | ## | -1454 | -11596 | -1587 | yield | -11629 | -1961 | -3905 | -6517 | yield |
| 67.85 | ## | -1293 | -13016 | -1384 | yield | -12504 | -1594 | -5287 | -6305 | yield |
| 49.08 | ## | -933 | -12607 | -1082 | yield | -12112 | -1200 | -5019 | -6043 | yield |
| 29.54 | ## | -481 | -12008 | -679 | yield | -11490 | -661 | -4588 | -5646 | yield |
| 11.39 | ## | -25 | -11273 | -241 | yield | -10778 | -127 | -4093 | -5204 | yield |
| 9.10 | ## | 24 | -11173 | -190 | yield | -10685 | -71 | -4032 | -5149 | yield |

| TOTAL LOAD PER JOIST (kips) | CSJ-3 TEST DATA SHEET BC1 2L5.00x5.00x0.500 | | | | AVG MEM LOAD (kips) | CSJ-3 TEST DATA SHEET BC2 2L5.00x5.00x0.500 | | | | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| | BC1 (1) | BC1 (2) | BC1 (3) | BC1 (4) | | BC2 (5) | BC2 (6) | BC2 (7) | BC2 (8) | |
| | (με) | | | | | (με) | | | | |
| 0.00 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 |
| 1.68 | 27 | 27 | 11 | 12 | 5.3 | 35 | 36 | 13 | 15 | 6.8 |
| 7.52 | 119 | 121 | 50 | 54 | 23.7 | 158 | 160 | 58 | 66 | 30.4 |
| 9.48 | 134 | 136 | 63 | 64 | 27.4 | 178 | 180 | 73 | 82 | 35.4 |
| 12.03 | 155 | 156 | 79 | 80 | 32.4 | 204 | 208 | 93 | 102 | 41.8 |
| 16.76 | 187 | 188 | 103 | 104 | 40.1 | 249 | 253 | 125 | 136 | 52.6 |
| 19.19 | 206 | 208 | 118 | 119 | 44.8 | 274 | 279 | 144 | 156 | 58.7 |
| 14.97 | 175 | 177 | 93 | 96 | 37.2 | 232 | 237 | 113 | 124 | 48.6 |
| 12.16 | 155 | 156 | 77 | 79 | 32.2 | 205 | 209 | 92 | 102 | 41.9 |
| 16.51 | 187 | 187 | 101 | 103 | 39.9 | 248 | 252 | 124 | 135 | 52.3 |
| 19.19 | 206 | 209 | 117 | 119 | 44.8 | 275 | 280 | 144 | 156 | 58.8 |
| 22.38 | 230 | 232 | 135 | 137 | 50.6 | 307 | 313 | 166 | 180 | 66.5 |
| 28.00 | 276 | 278 | 168 | 170 | 61.4 | 365 | 373 | 209 | 225 | 80.7 |
| 33.36 | 324 | 327 | 194 | 200 | 72.0 | 421 | 431 | 247 | 266 | 94.0 |
| 35.79 | 349 | 352 | 205 | 214 | 77.2 | 448 | 459 | 264 | 286 | 100.4 |
| 38.09 | 372 | 379 | 216 | 228 | 82.3 | 473 | 486 | 281 | 302 | 106.2 |
| 39.24 | 387 | 393 | 221 | 234 | 85.1 | 489 | 502 | 288 | 311 | 109.5 |
| 33.36 | 341 | 349 | 187 | 200 | 74.2 | 429 | 443 | 245 | 266 | 95.3 |
| 21.61 | 246 | 254 | 121 | 134 | 52.0 | 309 | 319 | 158 | 176 | 66.3 |
| 11.65 | 165 | 175 | 68 | 83 | 33.9 | 211 | 218 | 89 | 104 | 42.8 |
| 17.78 | 209 | 216 | 100 | 112 | 43.9 | 266 | 275 | 128 | 146 | 56.2 |
| 24.42 | 266 | 274 | 137 | 151 | 57.1 | 337 | 347 | 179 | 198 | 73.1 |
| 29.79 | 311 | 318 | 168 | 181 | 67.4 | 393 | 404 | 219 | 239 | 86.4 |
| 38.73 | 386 | 392 | 218 | 231 | 84.5 | 486 | 499 | 285 | 308 | 108.6 |
| 41.03 | 406 | 412 | 230 | 243 | 88.9 | 510 | 524 | 299 | 324 | 114.1 |
| 44.22 | 440 | 445 | 246 | 261 | 95.8 | 548 | 563 | 321 | 347 | 122.5 |
| 45.11 | 452 | 455 | 250 | 265 | 98.0 | 560 | 576 | 326 | 354 | 125.0 |
| 47.16 | 477 | 481 | 260 | 276 | 102.9 | 589 | 606 | 338 | 366 | 130.8 |
| 49.84 | 507 | 511 | 273 | 291 | 108.9 | 624 | 641 | 356 | 386 | 138.1 |
| 32.34 | 363 | 369 | 176 | 194 | 75.9 | 442 | 456 | 227 | 253 | 94.9 |
| 19.83 | 251 | 258 | 106 | 124 | 50.9 | 307 | 318 | 137 | 159 | 63.4 |
| 11.52 | 175 | 183 | 63 | 79 | 34.5 | 219 | 227 | 80 | 99 | 43.0 |
| 19.70 | 242 | 249 | 106 | 123 | 49.6 | 300 | 312 | 137 | 159 | 62.5 |
| 32.09 | 351 | 357 | 174 | 191 | 73.9 | 433 | 447 | 225 | 251 | 93.5 |
| 39.62 | 419 | 424 | 216 | 234 | 89.1 | 516 | 532 | 281 | 309 | 112.8 |
| 49.97 | 514 | 517 | 273 | 292 | 110.0 | 629 | 648 | 355 | 387 | 139.1 |
| 52.52 | 540 | 543 | 286 | 305 | 115.3 | 661 | 680 | 371 | 405 | 145.8 |
| 55.33 | 574 | 577 | 301 | 321 | 122.1 | 699 | 720 | 390 | 425 | 153.9 |
| 57.89 | 612 | 616 | 313 | 336 | 129.3 | 743 | 766 | 405 | 442 | 162.3 |
| 42.17 | 483 | 489 | 227 | 250 | 99.8 | 582 | 601 | 292 | 326 | 124.0 |
| 31.70 | 388 | 397 | 168 | 192 | 78.9 | 468 | 484 | 218 | 246 | 97.5 |
| 19.95 | 274 | 283 | 104 | 126 | 54.3 | 332 | 346 | 134 | 159 | 66.9 |
| 11.65 | 191 | 201 | 60 | 79 | 36.5 | 234 | 246 | 76 | 98 | 45.1 |
| 22.12 | 285 | 293 | 116 | 136 | 57.2 | 348 | 361 | 151 | 176 | 71.3 |
| 34.39 | 396 | 405 | 184 | 204 | 81.9 | 484 | 501 | 236 | 266 | 102.4 |
| 45.62 | 500 | 506 | 245 | 267 | 104.6 | 608 | 628 | 316 | 351 | 131.0 |
| 55.46 | 593 | 596 | 300 | 323 | 124.7 | 719 | 742 | 387 | 426 | 156.5 |
| 61.85 | 663 | 665 | 334 | 359 | 139.1 | 801 | 826 | 430 | 472 | 174.2 |
| 63.51 | 689 | 691 | 341 | 368 | 143.9 | 833 | 859 | 440 | 484 | 180.2 |
| 66.83 | 730 | 731 | 359 | 387 | 151.9 | 881 | 909 | 462 | 508 | 190.1 |
| 69.25 | 763 | 766 | 371 | 400 | 158.5 | 922 | 950 | 478 | 526 | 198.1 |
| 46.01 | 564 | 572 | 242 | 272 | 113.7 | 678 | 701 | 312 | 352 | 140.7 |
| 36.30 | 473 | 482 | 191 | 218 | 93.9 | 568 | 588 | 244 | 280 | 115.7 |
| 23.27 | 338 | 348 | 119 | 144 | 65.4 | 409 | 426 | 152 | 183 | 80.6 |

| TOTAL LOAD PER JOIST (kips) | CSJ-3 TEST DATA SHEET BC1 (cont.) 2L5.00x5.00x0.500 BC1 (1) | BC1 (2) | BC1 (3) | BC1 (4) | AVG MEM LOAD (kips) | CSJ-3 TEST DATA SHEET BC2 (cont.) 2L5.00x5.00x0.500 BC2 (5) | BC2 (6) | BC2 (7) | BC2 (8) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| | (με) | | | | | (με) | | | | |
| 11.39 | 211 | 222 | 55 | 78 | 39.0 | 260 | 274 | 70 | 96 | 48.2 |
| 28.26 | 373 | 382 | 145 | 169 | 73.7 | 453 | 471 | 188 | 221 | 91.7 |
| 39.62 | 486 | 493 | 209 | 234 | 98.0 | 588 | 609 | 269 | 307 | 122.1 |
| 55.33 | 635 | 640 | 296 | 323 | 130.4 | 768 | 794 | 380 | 424 | 162.9 |
| 66.44 | 745 | 748 | 357 | 386 | 154.0 | 899 | 928 | 459 | 508 | 192.4 |
| 70.53 | 796 | 796 | 379 | 409 | 163.9 | 959 | 990 | 487 | 538 | 204.8 |
| 73.09 | 830 | 830 | 393 | 424 | 170.5 | 1000 | 1033 | 504 | 557 | 213.1 |
| 75.64 | 864 | 864 | 404 | 437 | 177.0 | 1042 | 1076 | 520 | 574 | 221.2 |
| 77.05 | 892 | 891 | 412 | 446 | 181.9 | 1073 | 1108 | 528 | 586 | 226.9 |
| 79.35 | 923 | 923 | 423 | 460 | 187.9 | 1111 | 1147 | 544 | 601 | 234.4 |
| 82.92 | 985 | 985 | 442 | 480 | 199.2 | 1186 | 1222 | 566 | 627 | 248.1 |
| 61.72 | 804 | 808 | 326 | 363 | 158.5 | 965 | 997 | 416 | 468 | 196.0 |
| 43.84 | 629 | 634 | 229 | 264 | 120.9 | 757 | 783 | 290 | 336 | 149.2 |
| 26.21 | 427 | 435 | 130 | 162 | 79.4 | 519 | 541 | 165 | 202 | 98.3 |
| 11.52 | 251 | 260 | 47 | 75 | 43.6 | 309 | 329 | 61 | 92 | 54.5 |
| 27.49 | 417 | 425 | 135 | 166 | 78.8 | 509 | 531 | 175 | 213 | 98.3 |
| 45.11 | 604 | 611 | 234 | 266 | 118.1 | 733 | 760 | 299 | 345 | 147.2 |
| 62.61 | 785 | 787 | 330 | 365 | 156.2 | 948 | 980 | 423 | 476 | 194.6 |
| 79.73 | 967 | 966 | 425 | 463 | 194.3 | 1162 | 1199 | 544 | 606 | 241.9 |
| 84.20 | 1029 | 1026 | 449 | 489 | 206.1 | 1234 | 1272 | 574 | 638 | 256.1 |
| 87.14 | 1076 | 1073 | 464 | 504 | 214.7 | 1292 | 1331 | 592 | 658 | 266.7 |
| 89.57 | 1113 | 1110 | 474 | 518 | 221.4 | 1338 | 1380 | 606 | 675 | 275.4 |
| 53.93 | 784 | 784 | 279 | 320 | 149.3 | 941 | 973 | 355 | 409 | 184.4 |
| 28.26 | 485 | 488 | 135 | 169 | 88.0 | 591 | 615 | 172 | 214 | 109.7 |
| 11.27 | 269 | 276 | 39 | 69 | 45.0 | 334 | 357 | 53 | 86 | 57.2 |
| 12.29 | 277 | 284 | 44 | 75 | 46.9 | 343 | 366 | 59 | 93 | 59.4 |
| 29.79 | 469 | 473 | 142 | 176 | 86.8 | 575 | 601 | 184 | 226 | 109.2 |
| 49.97 | 696 | 695 | 256 | 292 | 133.5 | 843 | 873 | 327 | 380 | 166.9 |
| 69.26 | 904 | 900 | 363 | 401 | 176.9 | 1088 | 1124 | 463 | 525 | 220.4 |
| 87.14 | 1106 | 1098 | 463 | 504 | 218.4 | 1326 | 1368 | 589 | 659 | 271.5 |
| 90.47 | 1152 | 1143 | 479 | 523 | 227.0 | 1381 | 1426 | 610 | 684 | 282.4 |
| 90.86 | 1172 | 1164 | 481 | 527 | 230.3 | 1404 | 1450 | 611 | 686 | 285.9 |
| 95.44 | 1229 | 1220 | 501 | 550 | 241.1 | 1479 | 1529 | 641 | 717 | 300.7 |
| 97.49 | 1269 | 1262 | 508 | 559 | 247.8 | 1531 | 1584 | 650 | 728 | 309.5 |
| 99.92 | 1315 | 1309 | 516 | 569 | 255.5 | 1592 | 1651 | 660 | 741 | 319.9 |
| 103.49 | 1388 | 1383 | 527 | 584 | 267.4 | 1689 | 1770 | 673 | 759 | 336.8 |
| 106.43 | 1447 | 1444 | 534 | 593 | 276.7 | 1771 | 1870 | 677 | 768 | 350.3 |
| 108.87 | 1538 | 1536 | 526 | 588 | 288.4 | 1917 | 2156 | 655 | 754 | 377.5 |
| 110.91 | 1607 | 1609 | 521 | 583 | 297.5 | 2027 | 2560 | 625 | 732 | 409.4 |
| 111.30 | 1648 | 1649 | 508 | 571 | 301.5 | 2032 | 2646 | 592 | 703 | 411.4 |
| 111.30 | 1684 | 1678 | 493 | 557 | 303.8 | 2040 | 2768 | 554 | 664 | 415.0 |
| 112.46 | 1736 | 1726 | 482 | 548 | 309.4 | 2098 | 2987 | 526 | 644 | 430.9 |
| 110.67 | 1742 | 1734 | 458 | 529 | 307.3 | 2094 | 3217 | 498 | 621 | 442.9 |
| 110.80 | 1774 | 1754 | 448 | 518 | 309.6 | 2110 | 3298 | 493 | 613 | 448.7 |
| 108.63 | 1772 | 1738 | 430 | 497 | 305.5 | 2097 | 3341 | 459 | 585 | 446.5 |
| 105.43 | 1759 | 1707 | 406 | 469 | 299.0 | 2089 | 3343 | 410 | 540 | 439.5 |
| 102.87 | 1752 | 1679 | 387 | 446 | 293.6 | 2085 | 3352 | 362 | 496 | 433.6 |
| 101.34 | 1743 | 1655 | 374 | 430 | 289.5 | 2094 | 3368 | 325 | 460 | 430.3 |
| 98.66 | 1722 | 1623 | 358 | 411 | 283.3 | 2075 | 3350 | 292 | 426 | 423.1 |
| 67.85 | 1391 | 1265 | 180 | 218 | 210.3 | 1668 | 2933 | 53 | 169 | 332.2 |
| 49.08 | 1124 | 1010 | 70 | 102 | 158.8 | 1342 | 2594 | -76 | 27 | 267.7 |
| 29.54 | 830 | 713 | -46 | -26 | 101.3 | 960 | 2167 | -205 | -124 | 192.7 |
| 11.39 | 540 | 427 | -155 | -142 | 46.2 | 575 | 1747 | -321 | -263 | 119.7 |
| 9.10 | 509 | 396 | -166 | -155 | 40.2 | 533 | 1697 | -334 | -277 | 111.5 |

| TOTAL LOAD PER JOIST (kips) | CSJ-3 TEST DATA SHEET W5 2L2.50x2.50x0.250 W5 (25) | W5 (26) | W5 (27) (με) | W5 (28) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|
| 0.00 | 0 | 0 | 0 | 0 | 0.0 |
| 1.68 | -3 | -3 | -15 | -15 | -0.6 |
| 7.52 | -14 | -11 | -69 | -66 | -2.8 |
| 9.48 | -16 | -14 | -77 | -74 | -3.1 |
| 12.03 | -18 | -17 | -86 | -85 | -3.5 |
| 16.76 | -21 | -22 | -105 | -102 | -4.3 |
| 19.19 | -22 | -24 | -115 | -113 | -4.7 |
| 14.97 | -20 | -20 | -99 | -96 | -4.0 |
| 12.16 | -19 | -17 | -88 | -86 | -3.6 |
| 16.51 | -21 | -21 | -106 | -103 | -4.3 |
| 19.19 | -22 | -24 | -116 | -114 | -4.8 |
| 22.38 | -25 | -27 | -130 | -126 | -5.3 |
| 28.00 | -29 | -34 | -155 | -153 | -6.4 |
| 33.36 | -35 | -39 | -187 | -183 | -7.7 |
| 35.79 | -38 | -43 | -209 | -201 | -8.5 |
| 38.09 | -41 | -47 | -228 | -220 | -9.2 |
| 39.24 | -43 | -50 | -240 | -230 | -9.7 |
| 33.36 | -38 | -44 | -216 | -207 | -8.7 |
| 21.61 | -29 | -32 | -164 | -156 | -6.6 |
| 11.65 | -21 | -19 | -120 | -111 | -4.7 |
| 17.78 | -24 | -28 | -143 | -135 | -5.7 |
| 24.42 | -28 | -34 | -173 | -165 | -6.9 |
| 29.79 | -32 | -39 | -197 | -190 | -7.9 |
| 38.73 | -41 | -51 | -240 | -231 | -9.7 |
| 41.03 | -44 | -55 | -253 | -245 | -10.3 |
| 44.22 | -47 | -61 | -275 | -267 | -11.2 |
| 45.11 | -48 | -62 | -284 | -276 | -11.5 |
| 47.16 | -51 | -66 | -304 | -295 | -12.3 |
| 49.84 | -54 | -70 | -324 | -315 | -13.1 |
| 32.34 | -40 | -50 | -245 | -236 | -9.8 |
| 19.83 | -29 | -35 | -182 | -175 | -7.3 |
| 11.52 | -22 | -26 | -142 | -137 | -5.6 |
| 19.70 | -27 | -33 | -177 | -170 | -7.0 |
| 32.09 | -38 | -48 | -237 | -229 | -9.5 |
| 39.62 | -45 | -58 | -276 | -267 | -11.1 |
| 49.97 | -54 | -71 | -330 | -320 | -13.3 |
| 52.52 | -56 | -74 | -346 | -335 | -14.0 |
| 55.33 | -60 | -80 | -374 | -361 | -15.1 |
| 57.89 | -64 | -85 | -404 | -390 | -16.2 |
| 42.17 | -51 | -67 | -332 | -318 | -13.2 |
| 31.70 | -42 | -53 | -278 | -265 | -11.0 |
| 19.95 | -30 | -38 | -212 | -203 | -8.3 |
| 11.65 | -22 | -29 | -165 | -160 | -6.5 |
| 22.12 | -31 | -40 | -216 | -208 | -8.5 |
| 34.39 | -43 | -56 | -281 | -271 | -11.2 |
| 45.62 | -53 | -70 | -342 | -328 | -13.7 |
| 55.46 | -62 | -83 | -395 | -380 | -15.9 |
| 61.85 | -69 | -94 | -442 | -426 | -17.8 |
| 63.51 | -72 | -97 | -465 | -450 | -18.7 |
| 66.83 | -76 | -103 | -495 | -481 | -19.9 |
| 69.25 | -80 | -108 | -519 | -506 | -20.9 |
| 46.01 | -59 | -79 | -407 | -394 | -16.2 |
| 36.30 | -51 | -66 | -353 | -342 | -14.0 |
| 23.27 | -37 | -47 | -274 | -267 | -10.8 |

| TOTAL LOAD PER JOIST (kips) | CSJ-3 TEST DATA SHEET W5 (cont.) 2L2.50x2.50x0.250 W5 (25) | W5 (26) | W5 (27) (με) | W5 (28) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|
| 11.39 | -25 | -33 | -200 | -199 | -7.9 |
| 28.26 | -40 | -53 | -292 | -286 | -11.6 |
| 39.62 | -51 | -68 | -357 | -349 | -14.2 |
| 55.33 | -65 | -90 | -445 | -433 | -17.8 |
| 66.44 | -77 | -105 | -509 | -496 | -20.5 |
| 70.53 | -82 | -112 | -540 | -526 | -21.7 |
| 73.09 | -86 | -117 | -564 | -552 | -22.7 |
| 75.64 | -89 | -122 | -589 | -577 | -23.7 |
| 77.05 | -91 | -126 | -610 | -595 | -24.5 |
| 79.35 | -95 | -130 | -633 | -618 | -25.4 |
| 82.92 | -102 | -137 | -679 | -659 | -27.2 |
| 61.72 | -82 | -110 | -575 | -559 | -22.8 |
| 43.84 | -64 | -85 | -472 | -460 | -18.6 |
| 26.21 | -45 | -60 | -354 | -353 | -14.0 |
| 11.52 | -29 | -37 | -250 | -255 | -9.8 |
| 27.49 | -43 | -59 | -345 | -344 | -13.6 |
| 45.11 | -60 | -83 | -452 | -446 | -17.9 |
| 62.61 | -79 | -109 | -558 | -548 | -22.3 |
| 79.73 | -98 | -134 | -668 | -653 | -26.7 |
| 84.20 | -104 | -142 | -707 | -693 | -28.3 |
| 87.14 | -109 | -149 | -742 | -729 | -29.8 |
| 89.57 | -113 | -153 | -768 | -757 | -30.8 |
| 53.93 | -78 | -105 | -576 | -570 | -22.9 |
| 28.26 | -51 | -68 | -402 | -406 | -16.0 |
| 11.27 | -32 | -37 | -273 | -281 | -10.7 |
| 12.29 | -33 | -38 | -278 | -285 | -10.9 |
| 29.79 | -49 | -64 | -387 | -391 | -15.3 |
| 49.97 | -68 | -93 | -516 | -517 | -20.6 |
| 69.26 | -89 | -123 | -640 | -637 | -25.6 |
| 87.14 | -110 | -152 | -762 | -759 | -30.7 |
| 90.47 | -116 | -159 | -793 | -790 | -32.0 |
| 90.86 | -119 | -161 | -812 | -808 | -32.7 |
| 95.44 | -125 | -170 | -851 | -849 | -34.4 |
| 97.49 | -130 | -175 | -881 | -882 | -35.6 |
| 99.92 | -134 | -181 | -912 | -918 | -36.9 |
| 103.49 | -138 | -190 | -955 | -971 | -38.8 |
| 106.43 | -142 | -198 | -991 | -1019 | -40.5 |
| 108.87 | -147 | -206 | -1043 | -1078 | -42.6 |
| 110.91 | -152 | -212 | -1077 | -1115 | -44.0 |
| 111.30 | -154 | -217 | -1090 | -1137 | -44.8 |
| 111.30 | -155 | -220 | -1100 | -1150 | -45.2 |
| 112.46 | -156 | -226 | -1126 | -1172 | -46.2 |
| 110.67 | -153 | -230 | -1125 | -1173 | -46.2 |
| 110.80 | -151 | -236 | -1131 | -1183 | -46.5 |
| 108.63 | -146 | -237 | -1118 | -1173 | -46.1 |
| 105.43 | -141 | -232 | -1098 | -1153 | -45.2 |
| 102.87 | -139 | -228 | -1086 | -1138 | -44.6 |
| 101.34 | -141 | -221 | -1079 | -1124 | -44.2 |
| 98.66 | -144 | -209 | -1064 | -1098 | -43.3 |
| 67.85 | -121 | -145 | -861 | -882 | -34.6 |
| 49.08 | -98 | -106 | -708 | -729 | -28.3 |
| 29.54 | -71 | -70 | -540 | -564 | -21.5 |
| 11.39 | -46 | -31 | -375 | -398 | -14.6 |
| 9.10 | -44 | -26 | -356 | -379 | -13.9 |

| APPLIED LOAD PER JOIST (kips) | CSJ-3 END SLIPS SLIP 1 (in.) | SLIP 12 (in.) |
|---|---|---|
| 0.00 | 0.000 | 0.000 |
| 1.96 | 0.000 | 0.000 |
| 4.51 | 0.000 | 0.001 |
| 9.24 | 0.000 | 0.001 |
| 11.67 | 0.000 | 0.001 |
| 7.45 | 0.001 | 0.001 |
| 4.64 | 0.000 | 0.001 |
| 8.99 | 0.000 | 0.001 |
| 11.67 | 0.000 | 0.001 |
| 14.86 | 0.000 | 0.002 |
| 20.48 | 0.002 | 0.002 |
| 25.84 | 0.006 | 0.006 |
| 28.27 | 0.007 | 0.006 |
| 30.57 | 0.007 | 0.006 |
| 31.72 | 0.007 | 0.007 |
| 25.84 | 0.006 | 0.006 |
| 14.09 | 0.006 | 0.005 |
| 4.13 | 0.002 | 0.002 |
| 10.26 | 0.004 | 0.004 |
| 16.90 | 0.006 | 0.006 |
| 22.27 | 0.006 | 0.006 |
| 31.21 | 0.007 | 0.007 |
| 33.51 | 0.007 | 0.008 |
| 36.70 | 0.008 | 0.009 |
| 37.59 | 0.009 | 0.009 |
| 39.64 | 0.010 | 0.012 |
| 42.32 | 0.011 | 0.014 |
| 24.82 | 0.010 | 0.012 |
| 12.31 | 0.009 | 0.009 |
| 4.00 | 0.005 | 0.006 |
| 12.18 | 0.007 | 0.009 |
| 24.57 | 0.009 | 0.010 |
| 32.10 | 0.010 | 0.012 |
| 42.45 | 0.013 | 0.015 |
| 45.00 | 0.014 | 0.017 |
| 47.81 | 0.017 | 0.020 |
| 50.37 | 0.019 | 0.025 |
| 34.66 | 0.018 | 0.023 |
| 24.18 | 0.018 | 0.021 |
| 12.43 | 0.015 | 0.017 |
| 4.13 | 0.009 | 0.012 |
| 14.61 | 0.014 | 0.017 |
| 26.87 | 0.017 | 0.020 |
| 38.11 | 0.018 | 0.022 |
| 47.94 | 0.021 | 0.025 |
| 54.33 | 0.023 | 0.030 |
| 55.99 | 0.024 | 0.034 |
| 59.31 | 0.027 | 0.040 |
| 61.74 | 0.029 | 0.045 |
| 38.49 | 0.028 | 0.042 |
| 28.78 | 0.026 | 0.039 |
| 15.75 | 0.024 | 0.032 |

| APPLIED LOAD PER JOIST (kips) | CSJ-3 END SLIPS (cont.) SLIP 1 (in.) | SLIP 12 (in.) |
|---|---|---|
| 3.87 | 0.016 | 0.023 |
| 20.74 | 0.024 | 0.033 |
| 32.10 | 0.026 | 0.038 |
| 47.81 | 0.028 | 0.042 |
| 58.93 | 0.030 | 0.047 |
| 63.01 | 0.032 | 0.053 |
| 65.57 | 0.033 | 0.057 |
| 68.12 | 0.033 | 0.062 |
| 69.53 | 0.033 | 0.067 |
| 71.83 | 0.034 | 0.070 |
| 75.40 | 0.040 | 0.079 |
| 54.20 | 0.039 | 0.076 |
| 36.32 | 0.037 | 0.070 |
| 18.69 | 0.037 | 0.057 |
| 4.00 | 0.029 | 0.043 |
| 19.97 | 0.034 | 0.054 |
| 37.59 | 0.034 | 0.065 |
| 55.09 | 0.037 | 0.073 |
| 72.21 | 0.042 | 0.084 |
| 76.68 | 0.048 | 0.091 |
| 79.62 | 0.054 | 0.098 |
| 82.05 | 0.060 | 0.103 |
| 46.41 | 0.056 | 0.094 |
| 20.74 | 0.056 | 0.076 |
| 3.75 | 0.041 | 0.056 |
| 4.77 | 0.041 | 0.057 |
| 22.27 | 0.045 | 0.069 |
| 42.45 | 0.046 | 0.084 |
| 61.74 | 0.053 | 0.096 |
| 79.63 | 0.067 | 0.112 |
| 82.95 | 0.072 | 0.117 |
| 83.34 | 0.076 | 0.122 |
| 87.93 | 0.081 | 0.130 |
| 89.97 | 0.087 | 0.139 |
| 92.40 | 0.094 | 0.149 |
| 95.97 | 0.109 | 0.168 |
| 98.92 | 0.122 | 0.186 |
| 101.35 | 0.154 | 0.210 |
| 103.39 | 0.186 | 0.231 |
| 103.78 | 0.207 | 0.245 |
| 103.79 | 0.220 | 0.260 |
| 104.94 | 0.233 | 0.273 |
| 103.15 | 0.245 | 0.280 |
| 103.28 | 0.245 | 0.285 |
| 101.11 | 0.245 | 0.286 |
| 97.91 | 0.245 | 0.287 |
| 95.36 | 0.245 | 0.287 |
| 93.82 | 0.245 | 0.287 |
| 91.14 | 0.245 | 0.287 |
| 60.34 | 0.245 | 0.279 |
| 41.56 | 0.245 | 0.264 |
| 22.02 | 0.245 | 0.249 |
| 3.87 | 0.245 | 0.235 |
| 1.58 | 0.245 | 0.233 |

| APPLIED LOAD PER JOIST (kips) | CSJ-3 TEST DATA SHEET INTERMEDIATE SLIPS SLIP 2 (in.) | SLIP 3 (in.) | SLIP 4 (in.) | SLIP 5 (in.) | SLIP 6 (in.) | SLIP 7 (in.) | SLIP 8 (in.) | SLIP 9 (in.) | SLIP 10 (in.) | SLIP 11 (in.) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.96 | 0.000 | -0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | -0.001 |
| 4.51 | 0.000 | -0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | -0.001 |
| 9.24 | 0.001 | -0.001 | 0.001 | -0.001 | 0.000 | 0.001 | 0.001 | 0.001 | -0.001 | -0.001 |
| 11.67 | 0.001 | -0.001 | 0.001 | 0.000 | 0.001 | 0.001 | 0.000 | 0.001 | 0.000 | -0.001 |
| 7.45 | 0.001 | -0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.000 | 0.000 |
| 4.64 | 0.001 | -0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.000 | 0.001 | 0.000 | -0.001 |
| 8.99 | 0.001 | -0.001 | 0.001 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | -0.001 | -0.001 |
| 11.67 | 0.001 | -0.001 | 0.001 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | -0.001 | -0.001 |
| 14.86 | 0.001 | -0.001 | 0.002 | 0.001 | 0.001 | 0.002 | 0.001 | 0.001 | 0.000 | -0.001 |
| 20.48 | 0.002 | 0.001 | 0.004 | 0.001 | 0.001 | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 |
| 25.84 | 0.006 | 0.004 | 0.006 | 0.005 | 0.004 | 0.005 | 0.002 | 0.002 | 0.003 | 0.004 |
| 28.27 | 0.009 | 0.004 | 0.007 | 0.009 | 0.007 | 0.006 | 0.004 | 0.004 | 0.005 | 0.006 |
| 30.57 | 0.013 | 0.004 | 0.009 | 0.013 | 0.010 | 0.007 | 0.007 | 0.005 | 0.008 | 0.006 |
| 31.72 | 0.016 | 0.004 | 0.009 | 0.016 | 0.013 | 0.007 | 0.009 | 0.007 | 0.009 | 0.006 |
| 25.84 | 0.015 | 0.004 | 0.009 | 0.016 | 0.013 | 0.007 | 0.009 | 0.007 | 0.009 | 0.006 |
| 14.09 | 0.012 | 0.004 | 0.006 | 0.012 | 0.009 | 0.006 | 0.007 | 0.005 | 0.007 | 0.004 |
| 4.13 | 0.007 | 0.002 | 0.004 | 0.006 | 0.005 | 0.004 | 0.004 | 0.003 | 0.004 | 0.001 |
| 10.26 | 0.008 | 0.002 | 0.004 | 0.007 | 0.006 | 0.004 | 0.004 | 0.004 | 0.004 | 0.002 |
| 16.90 | 0.011 | 0.002 | 0.006 | 0.010 | 0.009 | 0.005 | 0.006 | 0.005 | 0.006 | 0.003 |
| 22.27 | 0.013 | 0.004 | 0.007 | 0.013 | 0.010 | 0.006 | 0.007 | 0.006 | 0.008 | 0.004 |
| 31.21 | 0.017 | 0.004 | 0.009 | 0.017 | 0.014 | 0.007 | 0.009 | 0.008 | 0.010 | 0.006 |
| 33.51 | 0.020 | 0.004 | 0.010 | 0.020 | 0.016 | 0.008 | 0.011 | 0.010 | 0.012 | 0.006 |
| 36.70 | 0.026 | 0.006 | 0.011 | 0.026 | 0.020 | 0.009 | 0.015 | 0.013 | 0.015 | 0.007 |
| 37.59 | 0.029 | 0.006 | 0.012 | 0.027 | 0.023 | 0.009 | 0.017 | 0.015 | 0.017 | 0.007 |
| 39.64 | 0.036 | 0.007 | 0.013 | 0.034 | 0.029 | 0.010 | 0.021 | 0.018 | 0.020 | 0.009 |
| 42.32 | 0.043 | 0.007 | 0.015 | 0.039 | 0.034 | 0.011 | 0.025 | 0.021 | 0.024 | 0.011 |
| 24.82 | 0.035 | 0.006 | 0.012 | 0.034 | 0.027 | 0.009 | 0.021 | 0.018 | 0.020 | 0.009 |
| 12.31 | 0.025 | 0.006 | 0.009 | 0.023 | 0.019 | 0.007 | 0.015 | 0.013 | 0.014 | 0.007 |
| 4.00 | 0.016 | 0.004 | 0.006 | 0.014 | 0.012 | 0.005 | 0.009 | 0.008 | 0.009 | 0.004 |
| 12.18 | 0.020 | 0.005 | 0.009 | 0.016 | 0.015 | 0.006 | 0.011 | 0.010 | 0.010 | 0.006 |
| 24.57 | 0.030 | 0.006 | 0.012 | 0.025 | 0.024 | 0.009 | 0.018 | 0.015 | 0.017 | 0.008 |
| 32.10 | 0.036 | 0.007 | 0.013 | 0.031 | 0.028 | 0.009 | 0.021 | 0.018 | 0.020 | 0.009 |
| 42.45 | 0.047 | 0.008 | 0.016 | 0.039 | 0.037 | 0.012 | 0.028 | 0.023 | 0.026 | 0.013 |
| 45.00 | 0.051 | 0.009 | 0.018 | 0.042 | 0.041 | 0.012 | 0.031 | 0.025 | 0.029 | 0.013 |
| 47.81 | 0.060 | 0.012 | 0.021 | 0.049 | 0.048 | 0.014 | 0.036 | 0.029 | 0.034 | 0.017 |
| 50.37 | 0.072 | 0.017 | 0.026 | 0.059 | 0.057 | 0.017 | 0.043 | 0.035 | 0.040 | 0.022 |
| 34.66 | 0.064 | 0.017 | 0.023 | 0.057 | 0.051 | 0.015 | 0.039 | 0.032 | 0.038 | 0.019 |
| 24.18 | 0.054 | 0.015 | 0.021 | 0.051 | 0.043 | 0.013 | 0.033 | 0.028 | 0.033 | 0.017 |
| 12.43 | 0.039 | 0.013 | 0.016 | 0.035 | 0.031 | 0.012 | 0.023 | 0.020 | 0.023 | 0.013 |
| 4.13 | 0.025 | 0.010 | 0.012 | 0.023 | 0.020 | 0.009 | 0.015 | 0.013 | 0.015 | 0.009 |
| 14.61 | 0.036 | 0.013 | 0.016 | 0.030 | 0.029 | 0.011 | 0.020 | 0.018 | 0.020 | 0.012 |
| 26.87 | 0.048 | 0.016 | 0.020 | 0.040 | 0.039 | 0.013 | 0.029 | 0.024 | 0.028 | 0.015 |
| 38.11 | 0.060 | 0.017 | 0.023 | 0.049 | 0.048 | 0.015 | 0.036 | 0.030 | 0.034 | 0.018 |
| 47.94 | 0.071 | 0.020 | 0.026 | 0.060 | 0.057 | 0.018 | 0.043 | 0.035 | 0.040 | 0.021 |
| 54.33 | 0.084 | 0.025 | 0.032 | 0.075 | 0.068 | 0.021 | 0.051 | 0.042 | 0.048 | 0.027 |
| 55.99 | 0.094 | 0.029 | 0.036 | 0.084 | 0.076 | 0.024 | 0.057 | 0.046 | 0.054 | 0.031 |
| 59.31 | 0.103 | 0.032 | 0.040 | 0.094 | 0.084 | 0.026 | 0.062 | 0.051 | 0.060 | 0.035 |
| 61.74 | 0.113 | 0.037 | 0.045 | 0.105 | 0.092 | 0.030 | 0.069 | 0.056 | 0.067 | 0.040 |
| 38.49 | 0.099 | 0.036 | 0.042 | 0.094 | 0.080 | 0.027 | 0.061 | 0.049 | 0.061 | 0.035 |
| 28.78 | 0.086 | 0.034 | 0.039 | 0.083 | 0.070 | 0.025 | 0.053 | 0.044 | 0.054 | 0.033 |
| 15.75 | 0.063 | 0.030 | 0.033 | 0.061 | 0.052 | 0.021 | 0.039 | 0.033 | 0.040 | 0.027 |

| APPLIED LOAD PER JOIST (kips) | CSJ-3 TEST DATA SHEET INTERMEDIATE SLIPS (cont.) SLIP 2 (in.) | SLIP 3 (in.) | SLIP 4 (in.) | SLIP 5 (in.) | SLIP 6 (in.) | SLIP 7 (in.) | SLIP 8 (in.) | SLIP 9 (in.) | SLIP 10 (in.) | SLIP 11 (in.) |
|---|---|---|---|---|---|---|---|---|---|---|
| 3.87 | 0.039 | 0.021 | 0.024 | 0.037 | 0.032 | 0.017 | 0.023 | 0.020 | 0.025 | 0.019 |
| 20.74 | 0.063 | 0.031 | 0.033 | 0.057 | 0.051 | 0.021 | 0.037 | 0.032 | 0.039 | 0.027 |
| 32.10 | 0.078 | 0.034 | 0.037 | 0.071 | 0.064 | 0.024 | 0.047 | 0.040 | 0.048 | 0.031 |
| 47.81 | 0.097 | 0.037 | 0.043 | 0.090 | 0.079 | 0.028 | 0.059 | 0.048 | 0.059 | 0.035 |
| 58.93 | 0.113 | 0.042 | 0.048 | 0.107 | 0.092 | 0.031 | 0.069 | 0.056 | 0.068 | 0.041 |
| 63.01 | 0.126 | 0.048 | 0.053 | 0.119 | 0.103 | 0.034 | 0.077 | 0.062 | 0.076 | 0.046 |
| 65.57 | 0.134 | 0.052 | 0.057 | 0.128 | 0.110 | 0.037 | 0.083 | 0.067 | 0.082 | 0.050 |
| 68.12 | 0.145 | 0.058 | 0.062 | 0.138 | 0.118 | 0.040 | 0.089 | 0.072 | 0.090 | 0.055 |
| 69.53 | 0.154 | 0.064 | 0.067 | 0.147 | 0.127 | 0.043 | 0.096 | 0.078 | 0.096 | 0.060 |
| 71.83 | 0.163 | 0.069 | 0.070 | 0.156 | 0.134 | 0.045 | 0.101 | 0.081 | 0.103 | 0.064 |
| 75.40 | 0.186 | 0.086 | 0.082 | 0.178 | 0.153 | 0.053 | 0.116 | 0.093 | 0.117 | 0.075 |
| 54.20 | 0.174 | 0.086 | 0.079 | 0.170 | 0.144 | 0.051 | 0.110 | 0.088 | 0.111 | 0.071 |
| 36.32 | 0.146 | 0.082 | 0.073 | 0.145 | 0.122 | 0.047 | 0.094 | 0.075 | 0.094 | 0.064 |
| 18.69 | 0.105 | 0.069 | 0.062 | 0.103 | 0.088 | 0.039 | 0.067 | 0.055 | 0.066 | 0.053 |
| 4.00 | 0.063 | 0.047 | 0.044 | 0.068 | 0.055 | 0.028 | 0.042 | 0.034 | 0.042 | 0.036 |
| 19.97 | 0.094 | 0.062 | 0.057 | 0.087 | 0.078 | 0.035 | 0.059 | 0.048 | 0.058 | 0.048 |
| 37.59 | 0.127 | 0.075 | 0.067 | 0.120 | 0.106 | 0.042 | 0.080 | 0.064 | 0.080 | 0.058 |
| 55.09 | 0.157 | 0.086 | 0.076 | 0.150 | 0.129 | 0.048 | 0.099 | 0.078 | 0.099 | 0.065 |
| 72.21 | 0.190 | 0.105 | 0.087 | 0.180 | 0.156 | 0.056 | 0.119 | 0.095 | 0.117 | 0.078 |
| 76.68 | 0.208 | 0.121 | 0.095 | 0.196 | 0.171 | 0.061 | 0.130 | 0.104 | 0.127 | 0.086 |
| 79.62 | 0.225 | 0.137 | 0.104 | 0.215 | 0.185 | 0.065 | 0.143 | 0.113 | 0.136 | 0.094 |
| 82.05 | 0.239 | 0.150 | 0.110 | 0.228 | 0.196 | 0.069 | 0.152 | 0.120 | 0.144 | 0.100 |
| 46.41 | 0.199 | 0.142 | 0.103 | 0.195 | 0.164 | 0.062 | 0.130 | 0.101 | 0.122 | 0.090 |
| 20.74 | 0.135 | 0.108 | 0.084 | 0.133 | 0.113 | 0.050 | 0.089 | 0.071 | 0.082 | 0.072 |
| 3.75 | 0.078 | 0.060 | 0.058 | 0.084 | 0.069 | 0.035 | 0.054 | 0.044 | 0.051 | 0.048 |
| 4.77 | 0.078 | 0.060 | 0.058 | 0.084 | 0.069 | 0.035 | 0.054 | 0.044 | 0.051 | 0.048 |
| 22.27 | 0.119 | 0.084 | 0.074 | 0.114 | 0.100 | 0.046 | 0.078 | 0.062 | 0.073 | 0.064 |
| 42.45 | 0.163 | 0.119 | 0.089 | 0.157 | 0.135 | 0.054 | 0.107 | 0.083 | 0.100 | 0.075 |
| 61.74 | 0.203 | 0.145 | 0.103 | 0.195 | 0.166 | 0.062 | 0.130 | 0.102 | 0.122 | 0.087 |
| 79.63 | 0.246 | 0.172 | 0.119 | 0.234 | 0.200 | 0.073 | 0.157 | 0.123 | 0.146 | 0.105 |
| 82.95 | 0.260 | 0.184 | 0.126 | 0.247 | 0.212 | 0.077 | 0.166 | 0.130 | 0.154 | 0.111 |
| 83.34 | 0.270 | 0.194 | 0.131 | 0.258 | 0.220 | 0.081 | 0.173 | 0.135 | 0.160 | 0.116 |
| 87.93 | 0.288 | 0.210 | 0.139 | 0.277 | 0.238 | 0.087 | 0.187 | 0.146 | 0.172 | 0.125 |
| 89.97 | 0.309 | 0.227 | 0.148 | 0.297 | 0.255 | 0.094 | 0.203 | 0.158 | 0.185 | 0.135 |
| 92.40 | 0.332 | 0.246 | 0.160 | 0.318 | 0.275 | 0.103 | 0.221 | 0.173 | 0.199 | 0.149 |
| 95.97 | 0.373 | 0.279 | 0.181 | 0.340 | 0.310 | 0.119 | 0.252 | 0.198 | 0.227 | 0.172 |
| 98.92 | 0.409 | 0.309 | 0.202 | 0.350 | 0.342 | 0.130 | 0.281 | 0.222 | 0.254 | 0.204 |
| 101.35 | 0.497 | 0.387 | 0.260 | 0.366 | 0.421 | 0.159 | 0.351 | 0.284 | 0.298 | 0.248 |
| 103.39 | 0.563 | 0.463 | 0.336 | 0.385 | 0.499 | 0.178 | 0.422 | 0.349 | 0.341 | 0.283 |
| 103.78 | 0.610 | 0.518 | 0.384 | 0.395 | 0.559 | 0.193 | 0.478 | 0.399 | 0.380 | 0.314 |
| 103.79 | 0.667 | 0.584 | 0.429 | 0.411 | 0.627 | 0.207 | 0.542 | 0.449 | 0.419 | 0.348 |
| 104.94 | 0.745 | 0.676 | 0.516 | 0.432 | 0.712 | 0.226 | 0.620 | 0.405 | 0.454 | 0.380 |
| 103.15 | 0.824 | 0.768 | 0.613 | 0.432 | 0.778 | 0.247 | 0.697 | 0.373 | 0.475 | 0.398 |
| 103.28 | 0.907 | 0.874 | 0.715 | 0.430 | 0.815 | 0.220 | 0.785 | 0.358 | 0.486 | 0.409 |
| 101.11 | 1.007 | 0.995 | 0.825 | 0.426 | 0.882 | 0.151 | 0.888 | 0.359 | 0.489 | 0.412 |
| 97.91 | 1.128 | 1.125 | 0.941 | 0.423 | 0.983 | 0.088 | 1.000 | 0.371 | 0.490 | 0.414 |
| 95.36 | 1.252 | 1.266 | 1.096 | 0.423 | 1.110 | 0.015 | 1.135 | 0.383 | 0.490 | 0.414 |
| 93.82 | 1.372 | 1.404 | 1.244 | 0.429 | 1.165 | -0.057 | 1.271 | 0.391 | 0.490 | 0.412 |
| 91.14 | 1.457 | 1.498 | 1.345 | 0.478 | 1.165 | -0.103 | 1.361 | 0.361 | 0.490 | 0.412 |
| 60.34 | 1.597 | 1.537 | 1.492 | 0.586 | 1.203 | -0.146 | 1.532 | 0.295 | 0.447 | 0.401 |
| 41.56 | 1.526 | 1.459 | 1.436 | 0.586 | 1.177 | -0.140 | 1.495 | 0.278 | 0.404 | 0.382 |
| 22.02 | 1.460 | 1.396 | 1.376 | 0.586 | 1.173 | -0.140 | 1.469 | 0.278 | 0.359 | 0.347 |
| 3.87 | 1.400 | 1.344 | 1.315 | 0.586 | 1.169 | -0.140 | 1.442 | 0.276 | 0.321 | 0.309 |
| 1.58 | 1.393 | 1.341 | 1.307 | 0.586 | 1.168 | -0.140 | 1.437 | 0.276 | 0.317 | 0.306 |

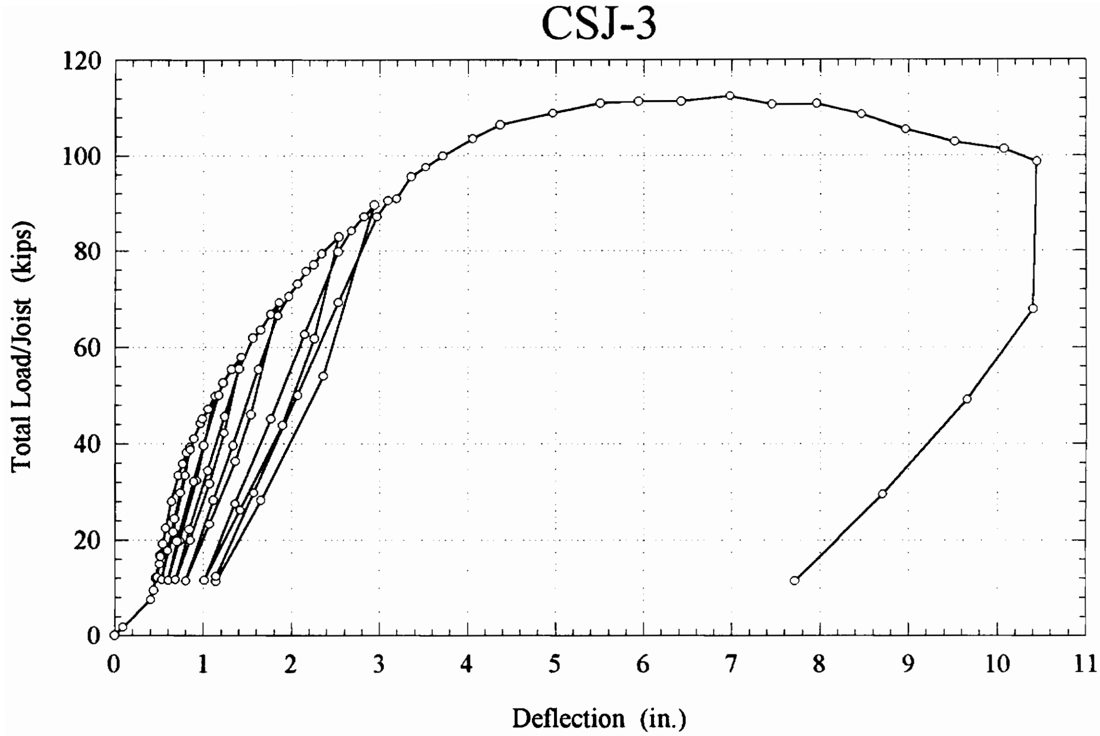



Figure A.3.1 Total Load/Joist vs. Midspan Deflection

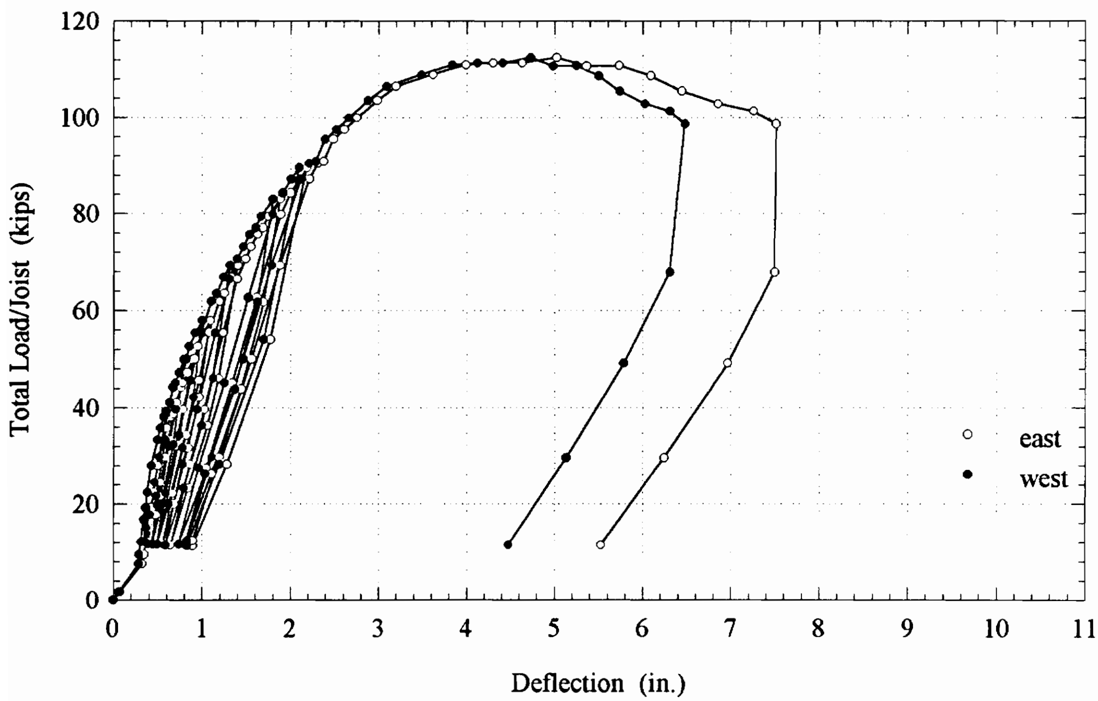



Figure A.3.2 Total Load/Joist vs. Quarter Point Deflection

# CSJ-3

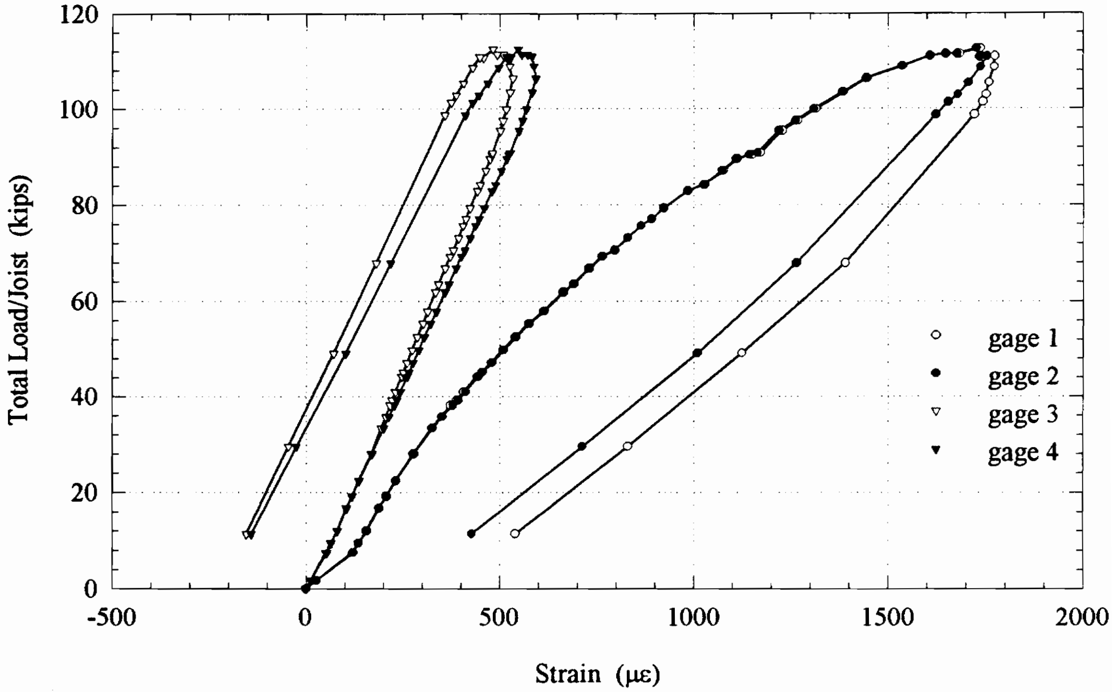



Figure A.3.3 Total Load/Joist vs. Bottom Chord Strain (BC1)

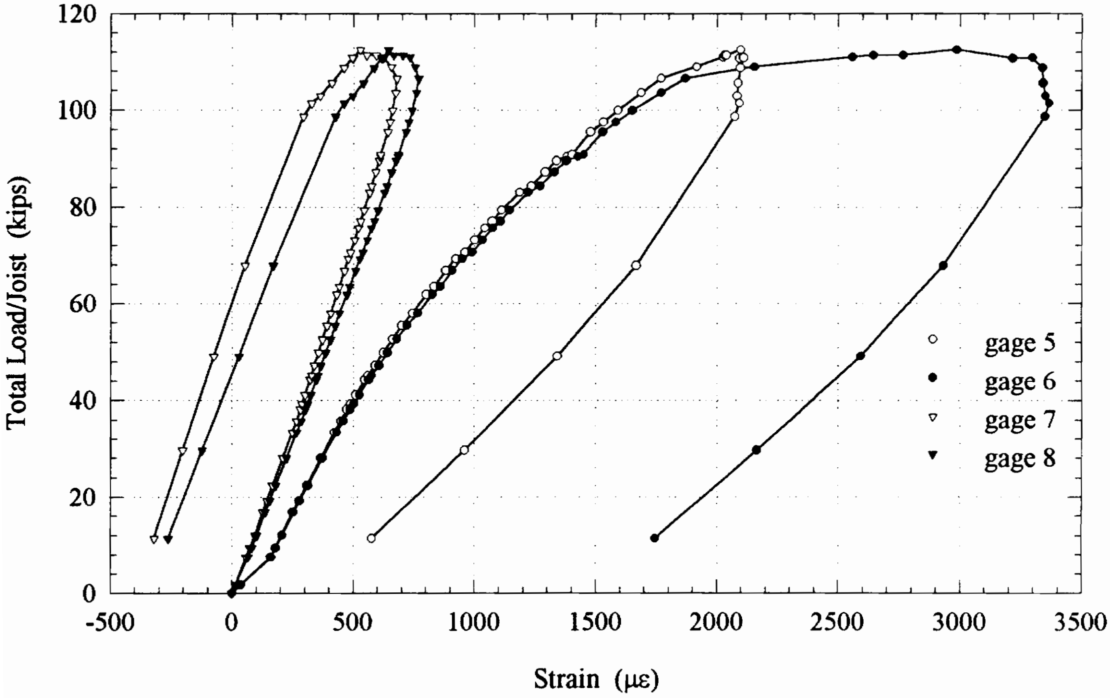



Figure A.3.4 Total Load/Joist vs. Bottom Chord Strain (BC2)

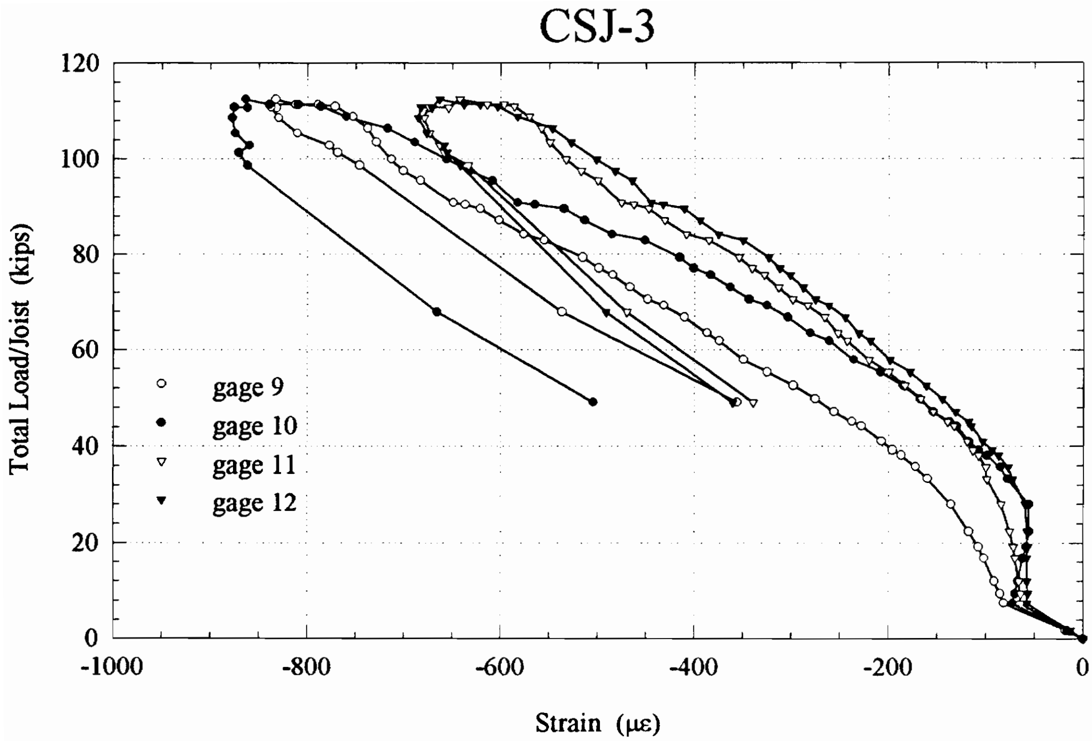



Figure A.3.5 Total Load/Joist vs. Top Chord Strain (TC1)

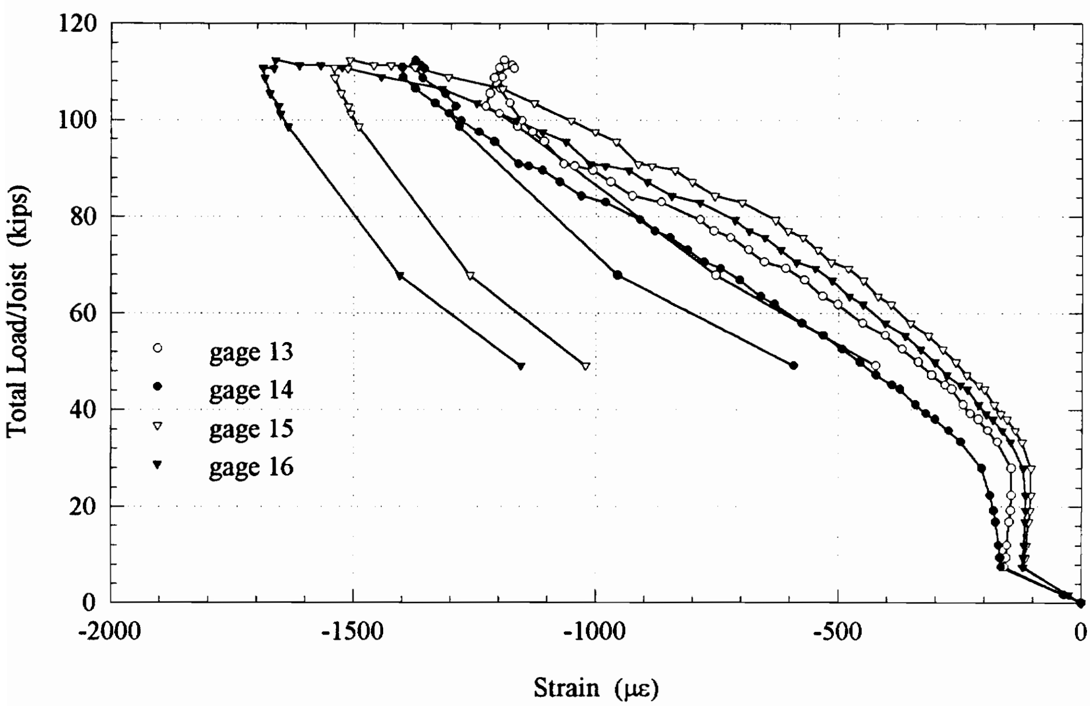



Figure A.3.6 Total Load/Joist vs. Top Chord Strain (TC2)

# CSJ-3

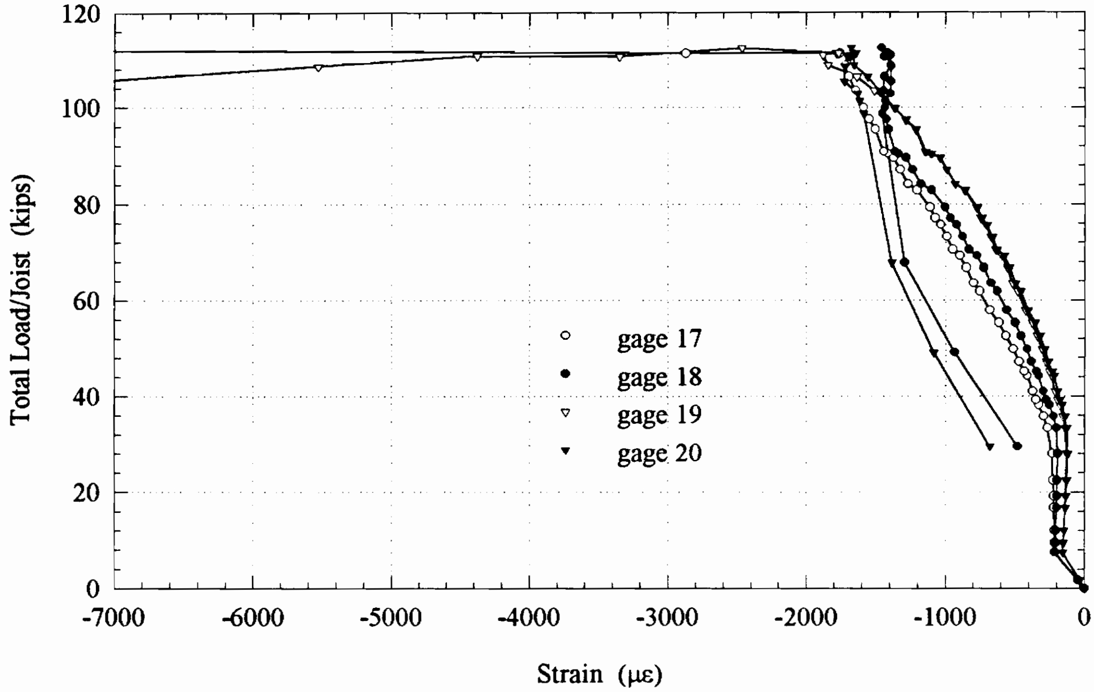



Figure A.3.7 Total Load/Joist vs. Top Chord Strain (TC3)

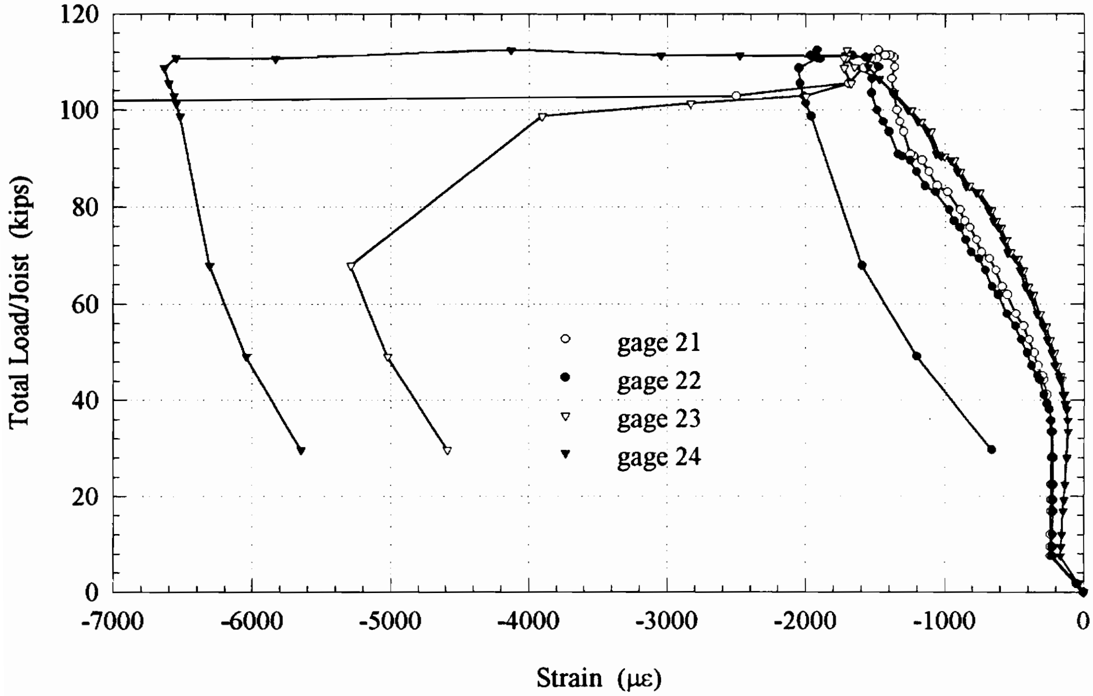



Figure A.3.8 Total Load/Joist vs. Top Chord Strain (TC4)

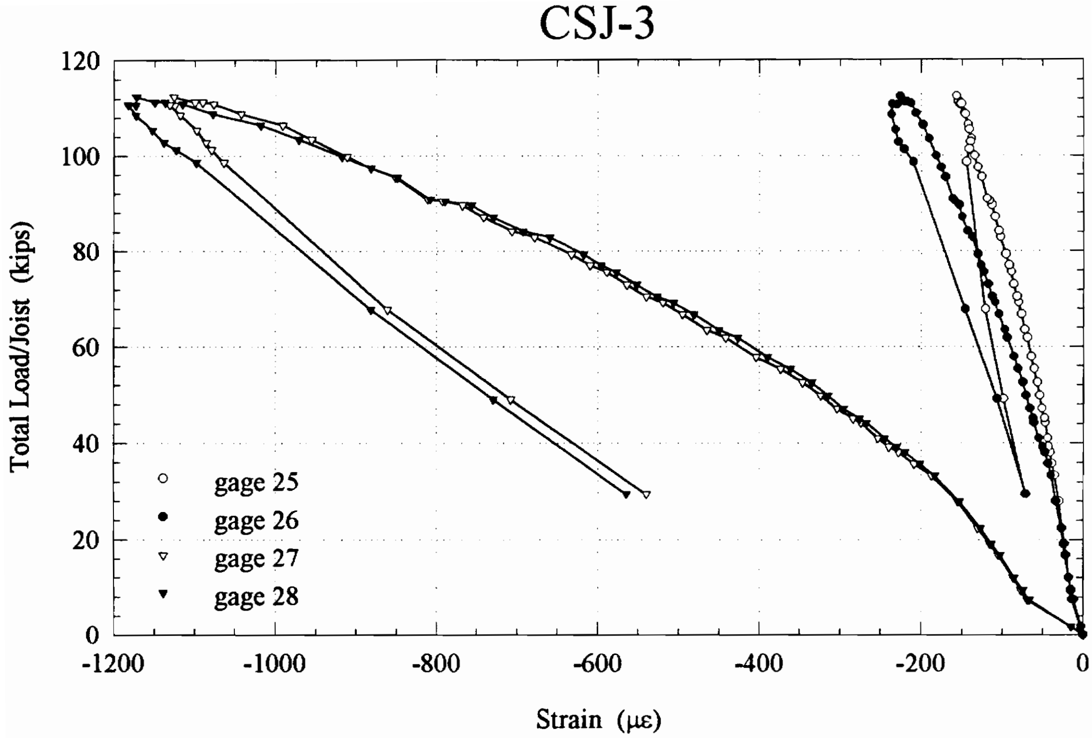



Figure A.3.9 Total Load/Joist vs. Web Strain (W5)

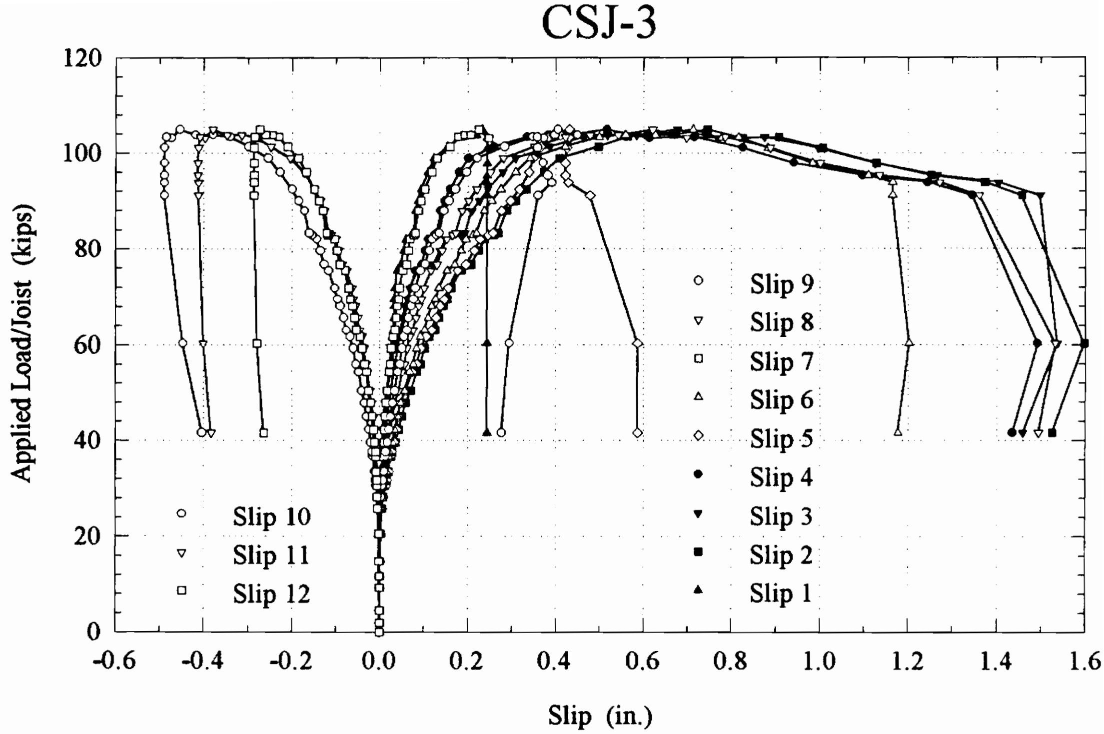



Figure A.3.10 Applied Load/Joist vs. Slip

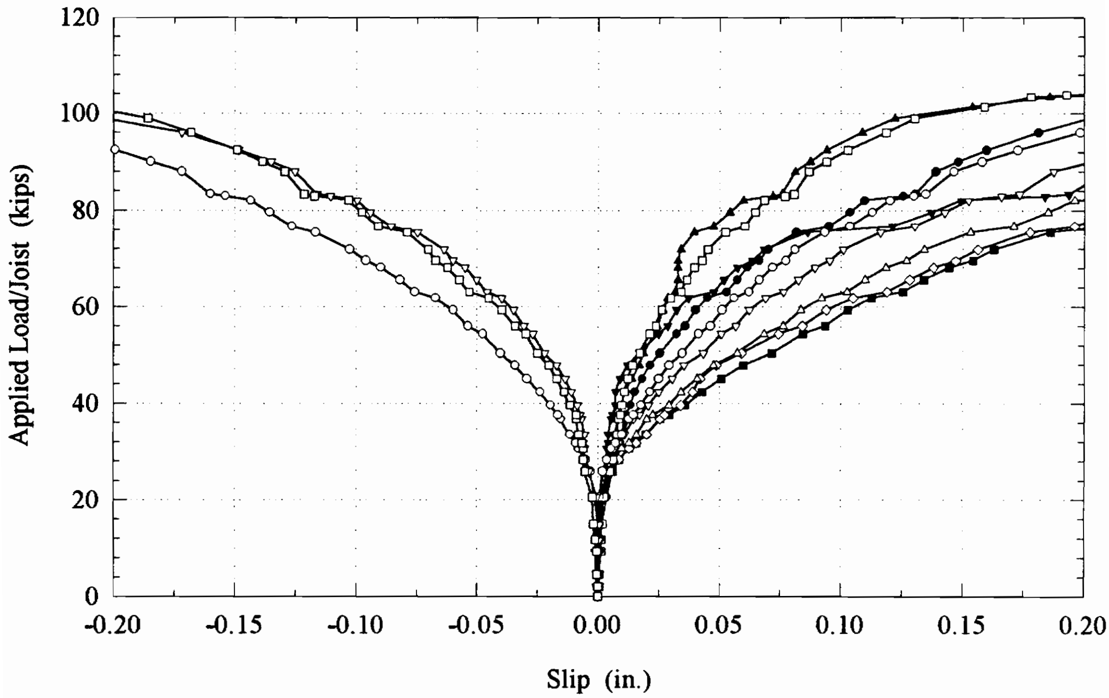



Figure A.3.11 Applied Load/Joist vs. Slip

## NUCOR COMPOSITE JOIST TEST SUMMARY SHEET

TEST DESIGNATION: CSJ-4 TEST DATE: 16 January 1992

### TEST DESCRIPTION

| | | | | |
|---|---|---|---|---|
| **Joist:** | Span: | 24'-0" | Weight: | 30 plf |
| | Depth: | 10 in. | Spacing: | 40 in. |
| | Top Chord: | 2L-2.50x2.50x0.212 | Yield Stress: | 50.0 ksi (nominal) |
| | Bottom Chord: | 2L-3.50x3.50x0.375 | Yield Stress: | 54.4 ksi |
| **Deck:** | Type: | 1.0C | Gage: | 26 ga |
| **Slab:** | Total Depth: | 3.0 in. | Compressive Strength: | 4000 psi |
| **Shear Connector:** | Type: | Longitudinal Shear Angle L-2.00x2.00x0.163 | | |
| | Quantity: | N/A | | |

### THEORETICAL CALCULATIONS

Theoretical Applied Load per Joist at Failure: 74.2 kips
Theoretical Total Load per Joist at Failure: 77.4 kips
Transformed Moment of Inertia: 410.4 $in.^4$
Theoretical Elastic Stiffness: 36.15 k/in.
Elastic Deflection at Yield: 1.77 in.

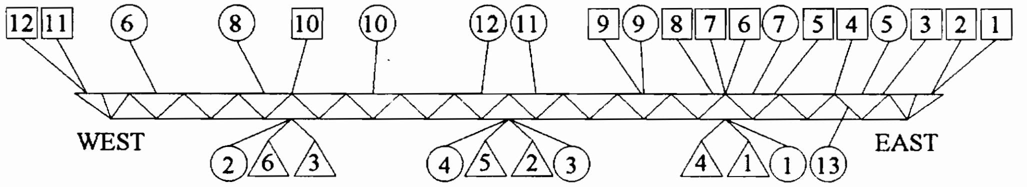
### TEST RESULTS

Applied Load per Joist at Failure: 56.6 kips
Total Load per Joist at Failure: 59.8 kips
Midspan Deflection at Failure: 2.16 in.
Maximum Slip and Location: 1.362 in., SLIP 1
Mode of Failure: loss of shear connection

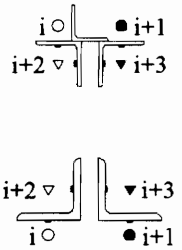
### COMPARISON OF ACTUAL TO THEORETICAL

Applied Load per Joist/Theoretical Applied Load per Joist: 0.76

### INSTRUMENTATION LOCATIONS




| | | | |
|---|---|---|---|
| (1) BC1 (N) | (9) TC5 (N) | △1 NEQB Defl | [1] SLIP 1 (S) |
| (2) BC2 (S) | (10) TC6 (S) | △2 NMB Defl | [2] SLIP 2 (N) |
| (3) BC3 (N) | (11) TC7 (N) | △3 NWQB Defl | [3] SLIP 3 (N) |
| (4) BC4 (S) | (12) TC8 (S) | △4 SEQB Defl | [4] SLIP 4 (N) |
| (5) TC1 (N) | (13) W5 (N) | △5 SMB Defl | [5] SLIP 5 (N) |
| (6) TC2 (S) | | △6 SWQB Defl | [6] SLIP 6 (N) |
| (7) TC3 (N) | | | [7] SLIP 7 (S) |
| (8) TC4 (S) | | | [8] SLIP 8 (N) |
| | | | [9] SLIP 9 (N) |
| | | | [10] SLIP 10 (S) |
| | | | [11] SLIP 11 (S) |
| | | | [12] SLIP 12 (N) |




Strain Gage Locations

| TOTAL LOAD PER JOIST (kips) | CSJ-4 TEST DATA SHEET DEFLECTIONS | | | | | |
|---|---|---|---|---|---|---|
| | NEQB (in.) | NMB (in.) | NWQB (in.) | SEQB (in.) | SMB (in.) | SWQB (in.) |
| 0.00 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 0.80 | 0.055 | 0.081 | 0.058 | 0.055 | 0.076 | 0.057 |
| 3.22 | 0.220 | 0.326 | 0.231 | 0.220 | 0.303 | 0.227 |
| 4.62 | 0.270 | 0.386 | 0.263 | 0.273 | 0.354 | 0.269 |
| 5.96 | 0.279 | 0.423 | 0.282 | 0.284 | 0.378 | 0.283 |
| 7.69 | 0.307 | 0.469 | 0.313 | 0.319 | 0.424 | 0.314 |
| 9.22 | 0.330 | 0.501 | 0.332 | 0.344 | 0.461 | 0.344 |
| 11.01 | 0.362 | 0.543 | 0.368 | 0.378 | 0.508 | 0.377 |
| 12.09 | 0.389 | 0.580 | 0.396 | 0.399 | 0.540 | 0.400 |
| 13.88 | 0.421 | 0.621 | 0.428 | 0.433 | 0.587 | 0.430 |
| 15.41 | 0.444 | 0.663 | 0.455 | 0.466 | 0.629 | 0.461 |
| 17.33 | 0.481 | 0.709 | 0.487 | 0.500 | 0.680 | 0.500 |
| 19.18 | 0.517 | 0.759 | 0.533 | 0.539 | 0.731 | 0.540 |
| 20.27 | 0.536 | 0.792 | 0.556 | 0.562 | 0.763 | 0.561 |
| 21.99 | 0.572 | 0.833 | 0.587 | 0.596 | 0.810 | 0.589 |
| 23.65 | 0.600 | 0.879 | 0.619 | 0.628 | 0.856 | 0.624 |
| 25.82 | 0.646 | 0.949 | 0.670 | 0.672 | 0.926 | 0.671 |
| 16.75 | 0.513 | 0.732 | 0.533 | 0.532 | 0.712 | 0.538 |
| 11.39 | 0.417 | 0.584 | 0.423 | 0.429 | 0.568 | 0.433 |
| 4.94 | 0.307 | 0.437 | 0.309 | 0.316 | 0.410 | 0.318 |
| 11.90 | 0.417 | 0.607 | 0.419 | 0.431 | 0.577 | 0.430 |
| 18.74 | 0.531 | 0.778 | 0.542 | 0.557 | 0.749 | 0.556 |
| 25.50 | 0.650 | 0.949 | 0.670 | 0.677 | 0.926 | 0.675 |
| 28.76 | 0.714 | 1.041 | 0.734 | 0.745 | 1.014 | 0.738 |
| 30.36 | 0.746 | 1.092 | 0.779 | 0.784 | 1.060 | 0.776 |
| 32.15 | 0.778 | 1.147 | 0.816 | 0.821 | 1.107 | 0.813 |
| 33.81 | 0.824 | 1.211 | 0.866 | 0.869 | 1.172 | 0.860 |
| 34.83 | 0.838 | 1.235 | 0.880 | 0.881 | 1.191 | 0.874 |
| 35.91 | 0.856 | 1.262 | 0.898 | 0.901 | 1.218 | 0.897 |
| 37.64 | 0.893 | 1.318 | 0.934 | 0.940 | 1.274 | 0.930 |
| 39.55 | 0.929 | 1.373 | 0.980 | 0.979 | 1.325 | 0.972 |
| 41.28 | 0.966 | 1.424 | 1.012 | 1.011 | 1.376 | 1.009 |
| 43.26 | 1.012 | 1.493 | 1.067 | 1.057 | 1.441 | 1.061 |
| 44.54 | 1.044 | 1.544 | 1.099 | 1.092 | 1.492 | 1.091 |
| 45.56 | 1.067 | 1.567 | 1.117 | 1.112 | 1.516 | 1.112 |
| 35.21 | 0.920 | 1.322 | 0.953 | 0.956 | 1.279 | 0.946 |
| 24.74 | 0.733 | 1.050 | 0.756 | 0.761 | 1.023 | 0.769 |
| 14.20 | 0.545 | 0.764 | 0.560 | 0.569 | 0.754 | 0.570 |
| 4.94 | 0.375 | 0.529 | 0.382 | 0.394 | 0.512 | 0.405 |
| 15.67 | 0.559 | 0.796 | 0.565 | 0.578 | 0.777 | 0.580 |
| 25.63 | 0.733 | 1.059 | 0.752 | 0.764 | 1.033 | 0.769 |
| 35.79 | 0.916 | 1.331 | 0.944 | 0.959 | 1.297 | 0.960 |
| 43.83 | 1.062 | 1.548 | 1.099 | 1.096 | 1.502 | 1.110 |
| 47.86 | 1.140 | 1.668 | 1.181 | 1.186 | 1.622 | 1.187 |
| 50.16 | 1.200 | 1.742 | 1.236 | 1.241 | 1.697 | 1.243 |
| 53.10 | 1.273 | 1.839 | 1.309 | 1.312 | 1.804 | 1.315 |
| 54.88 | 1.314 | 1.899 | 1.355 | 1.358 | 1.869 | 1.360 |
| 57.63 | 1.378 | 1.982 | 1.419 | 1.420 | 1.957 | 1.423 |
| 59.86 | 1.442 | 2.060 | 1.482 | 1.477 | 2.045 | 1.483 |
| 59.81 | 1.520 | 2.203 | 1.642 | 1.530 | 2.110 | 1.532 |
| 60.57 | 1.589 | 2.332 | 1.761 | 1.560 | 2.171 | 1.581 |
| 59.09 | 1.667 | 2.466 | 1.871 | 1.782 | 2.384 | 1.691 |
| 56.41 | 1.850 | 2.604 | 1.916 | 1.885 | 2.510 | 1.749 |
| 57.69 | 1.937 | 2.706 | 1.971 | 1.972 | 2.589 | 1.794 |

| TOTAL LOAD PER JOIST (kips) | CSJ-4 TEST DATA SHEET DEFLECTIONS (cont.) | | | | | |
|---|---|---|---|---|---|---|
| | NEQB (in.) | NMB (in.) | NWQB (in.) | SEQB (in.) | SMB (in.) | SWQB (in.) |
| 59.67 | 2.106 | 2.895 | 2.085 | 2.138 | 2.821 | 1.911 |
| 60.63 | 2.381 | 3.269 | 2.309 | 2.415 | 3.197 | 2.135 |
| 61.46 | 2.743 | 3.767 | 2.647 | 2.842 | 3.787 | 2.548 |
| 63.50 | 3.132 | 4.339 | 3.044 | 3.199 | 4.349 | 2.980 |
| 62.60 | 3.448 | 4.791 | 3.286 | 3.500 | 4.809 | 3.213 |
| 57.94 | 3.819 | 5.354 | 3.542 | 3.849 | 5.315 | 3.456 |
| 56.85 | 4.217 | 5.935 | 3.825 | 4.220 | 5.849 | 3.718 |
| 56.15 | 4.638 | 6.544 | 4.140 | 4.642 | 6.495 | 4.033 |
| 54.62 | 5.046 | 7.139 | 4.441 | 5.048 | 7.099 | 4.334 |
| 53.28 | 5.549 | 7.904 | 4.825 | 5.566 | 7.907 | 4.724 |
| 44.66 | 6.168 | 9.039 | 5.332 | 6.138 | 8.915 | 5.198 |
| 37.26 | 6.950 | 10.400 | 5.976 | 6.713 | 9.946 | 5.674 |
| 24.61 | 6.442 | 9.671 | 5.482 | 6.277 | 9.347 | 5.303 |
| 13.30 | 5.792 | 8.730 | 4.834 | 5.663 | 8.459 | 4.698 |
| 4.30 | 5.165 | 7.830 | 4.227 | 5.057 | 7.772 | 4.082 |

| TOTAL LOAD PER JOIST (kips) | CSJ-4 TEST DATA SHEET TC1 2L2.50x2.50x0.212 TC1 (9) | TC1 (10) | TC1 (11) | TC1 (12) | AVG MEM LOAD (kips) | CSJ-4 TEST DATA SHEET TC2 2L2.50x2.50x0.212 TC2 (39) | TC2 (40) | TC2 (41) | TC2 (42) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| | (με) | | | | | (με) | | | | |
| 0.00 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 |
| 0.80 | -13 | -13 | -11 | -12 | -0.7 | -13 | -14 | -12 | -12 | -0.7 |
| 3.22 | -53 | -53 | -44 | -49 | -2.9 | -50 | -54 | -47 | -49 | -3.0 |
| 4.62 | -56 | -54 | -39 | -40 | -2.8 | -54 | -58 | -48 | -50 | -3.1 |
| 5.96 | -57 | -55 | -39 | -40 | -2.8 | -55 | -60 | -48 | -50 | -3.1 |
| 7.69 | -58 | -56 | -39 | -39 | -2.8 | -57 | -61 | -48 | -50 | -3.2 |
| 9.22 | -60 | -57 | -39 | -39 | -2.9 | -59 | -63 | -47 | -49 | -3.2 |
| 11.01 | -62 | -59 | -39 | -38 | -2.9 | -61 | -65 | -47 | -50 | -3.3 |
| 12.09 | -63 | -60 | -39 | -38 | -2.9 | -62 | -66 | -48 | -50 | -3.3 |
| 13.88 | -65 | -61 | -39 | -38 | -3.0 | -64 | -68 | -47 | -50 | -3.4 |
| 15.41 | -67 | -63 | -39 | -38 | -3.0 | -65 | -70 | -47 | -50 | -3.4 |
| 17.33 | -69 | -65 | -40 | -38 | -3.1 | -67 | -72 | -46 | -51 | -3.5 |
| 19.18 | -71 | -67 | -40 | -38 | -3.2 | -69 | -74 | -47 | -51 | -3.5 |
| 20.27 | -72 | -69 | -40 | -38 | -3.2 | -70 | -75 | -46 | -52 | -3.6 |
| 21.99 | -73 | -71 | -40 | -38 | -3.3 | -71 | -77 | -46 | -52 | -3.6 |
| 23.65 | -75 | -72 | -40 | -38 | -3.3 | -72 | -79 | -45 | -52 | -3.6 |
| 25.82 | -77 | -74 | -40 | -38 | -3.4 | -73 | -81 | -44 | -52 | -3.7 |
| 16.75 | -70 | -69 | -40 | -39 | -3.2 | -64 | -72 | -44 | -52 | -3.4 |
| 11.39 | -65 | -64 | -39 | -39 | -3.0 | -58 | -66 | -44 | -51 | -3.2 |
| 4.94 | -57 | -57 | -38 | -39 | -2.8 | -51 | -58 | -44 | -50 | -3.0 |
| 11.90 | -64 | -63 | -39 | -38 | -3.0 | -59 | -66 | -44 | -51 | -3.2 |
| 18.74 | -72 | -70 | -40 | -38 | -3.2 | -66 | -74 | -44 | -52 | -3.5 |
| 25.50 | -78 | -75 | -41 | -38 | -3.4 | -73 | -81 | -43 | -53 | -3.7 |
| 28.76 | -82 | -80 | -41 | -38 | -3.6 | -76 | -84 | -43 | -54 | -3.8 |
| 30.36 | -83 | -81 | -40 | -38 | -3.6 | -78 | -86 | -41 | -53 | -3.8 |
| 32.15 | -86 | -84 | -40 | -38 | -3.6 | -79 | -89 | -41 | -54 | -3.9 |
| 33.81 | -89 | -87 | -41 | -38 | -3.8 | -81 | -91 | -41 | -55 | -3.9 |
| 34.83 | -91 | -89 | -42 | -39 | -3.8 | -83 | -92 | -40 | -55 | -4.0 |
| 35.91 | -92 | -91 | -42 | -39 | -3.9 | -84 | -94 | -39 | -55 | -4.0 |
| 37.64 | -94 | -93 | -42 | -39 | -3.9 | -85 | -96 | -38 | -55 | -4.0 |
| 39.55 | -98 | -97 | -42 | -40 | -4.1 | -87 | -98 | -37 | -56 | -4.1 |
| 41.28 | -102 | -100 | -43 | -41 | -4.2 | -89 | -100 | -36 | -56 | -4.1 |
| 43.26 | -110 | -107 | -46 | -46 | -4.6 | -91 | -104 | -36 | -58 | -4.3 |
| 44.54 | -118 | -114 | -49 | -49 | -4.9 | -94 | -108 | -36 | -59 | -4.4 |
| 45.56 | -121 | -117 | -50 | -50 | -5.0 | -96 | -109 | -35 | -60 | -4.4 |
| 35.21 | -115 | -111 | -51 | -53 | -4.9 | -85 | -100 | -36 | -60 | -4.1 |
| 24.74 | -103 | -100 | -48 | -52 | -4.4 | -75 | -88 | -36 | -58 | -3.8 |
| 14.20 | -87 | -87 | -43 | -49 | -3.9 | -62 | -74 | -35 | -53 | -3.3 |
| 4.94 | -64 | -68 | -29 | -38 | -2.9 | -50 | -60 | -33 | -48 | -2.8 |
| 15.67 | -76 | -79 | -31 | -38 | -3.3 | -62 | -73 | -33 | -50 | -3.2 |
| 25.63 | -90 | -94 | -36 | -41 | -3.8 | -75 | -85 | -34 | -54 | -3.7 |
| 35.79 | -104 | -109 | -40 | -45 | -4.4 | -87 | -98 | -34 | -57 | -4.1 |
| 43.83 | -113 | -121 | -43 | -48 | -4.8 | -96 | -108 | -33 | -59 | -4.4 |
| 47.86 | -117 | -126 | -42 | -48 | -4.9 | -100 | -113 | -32 | -59 | -4.5 |
| 50.16 | -119 | -130 | -39 | -45 | -4.9 | -102 | -116 | -30 | -58 | -4.5 |
| 53.10 | -120 | -133 | -34 | -41 | -4.8 | -105 | -117 | -25 | -56 | -4.5 |
| 54.88 | -120 | -134 | -31 | -39 | -4.8 | -106 | -119 | -23 | -55 | -4.5 |
| 57.63 | -122 | -138 | -27 | -36 | -4.7 | -109 | -120 | -19 | -53 | -4.4 |
| 59.86 | -129 | -144 | -26 | -34 | -4.9 | -111 | -125 | -16 | -54 | -4.5 |
| 59.81 | -134 | -148 | -27 | -34 | -5.0 | -134 | -153 | -28 | -71 | -5.7 |
| 60.57 | -138 | -149 | -27 | -35 | -5.1 | -193 | -216 | -70 | -116 | -8.8 |
| 59.09 | -223 | -238 | -88 | -91 | -9.4 | -232 | -287 | -104 | -157 | -11.5 |
| 56.41 | -347 | -337 | -165 | -128 | -14.4 | -227 | -281 | -102 | -155 | -11.3 |
| 57.69 | -374 | -370 | -196 | -161 | -16.2 | -229 | -283 | -103 | -156 | -11.3 |

| TOTAL LOAD PER JOIST (kips) | CSJ-4 TEST DATA SHEET TC1 (cont.) 2L2.50x2.50x0.212 TC1 (9) | TC1 (10) (με) | TC1 (11) | TC1 (12) | AVG MEM LOAD (kips) | CSJ-4 TEST DATA SHEET TC2 (cont.) 2L2.50x2.50x0.212 TC2 (39) | TC2 (40) (με) | TC2 (41) | TC2 (42) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| 59.67 | -443 | -441 | -257 | -220 | -20.0 | -250 | -287 | -108 | -158 | -11.8 |
| 60.63 | -575 | -513 | -374 | -305 | -26.0 | -260 | -297 | -112 | -163 | -12.2 |
| 61.46 | -622 | -572 | -443 | -366 | -29.5 | -348 | -417 | -187 | -194 | -16.9 |
| 63.50 | -646 | -618 | -478 | -414 | -31.7 | -498 | -532 | -329 | -328 | -24.8 |
| 62.60 | -632 | -643 | -478 | -436 | -32.2 | -511 | -543 | -347 | -342 | -25.6 |
| 57.94 | -583 | -587 | -427 | -384 | -29.2 | -504 | -534 | -349 | -341 | -25.4 |
| 56.85 | -582 | -586 | -426 | -382 | -29.1 | -501 | -530 | -348 | -340 | -25.3 |
| 56.15 | -582 | -576 | -424 | -379 | -28.9 | -498 | -527 | -347 | -339 | -25.2 |
| 54.62 | -566 | -564 | -416 | -370 | -28.2 | -497 | -525 | -344 | -338 | -25.1 |
| 53.28 | -546 | -553 | -400 | -361 | -27.4 | -494 | -521 | -341 | -337 | -24.9 |
| 44.66 | -427 | -484 | -318 | -283 | -22.3 | -475 | -497 | -338 | -331 | -24.1 |
| 37.26 | -363 | -447 | -283 | -252 | -19.8 | -438 | -468 | -323 | -317 | -22.8 |
| 24.61 | -309 | -404 | -255 | -227 | -17.6 | -350 | -371 | -270 | -271 | -18.6 |
| 13.30 | -169 | -272 | -145 | -118 | -10.4 | -187 | -208 | -145 | -153 | -10.2 |
| 4.30 | -28 | -141 | -35 | -11 | -3.2 | -57 | -75 | -40 | -47 | -3.2 |

| TOTAL LOAD PER JOIST (kips) | CSJ-4 TEST DATA SHEET TC3 2L2.50x2.50x0.212 TC3 (13) (με) | TC3 (14) | TC3 (15) | TC3 (16) | AVG MEM LOAD (kips) | CSJ-4 TEST DATA SHEET TC4 2L2.50x2.50x0.212 TC4 (43) (με) | TC4 (44) | TC4 (45) | TC4 (46) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 |
| 0.80 | -33 | -25 | -24 | -23 | -1.5 | -24 | -29 | -23 | -25 | -1.5 |
| 3.22 | -131 | -98 | -94 | -92 | -6.1 | -97 | -118 | -93 | -98 | -6.0 |
| 4.62 | -134 | -101 | -92 | -91 | -6.1 | -101 | -122 | -93 | -98 | -6.1 |
| 5.96 | -136 | -103 | -91 | -90 | -6.2 | -102 | -124 | -92 | -97 | -6.1 |
| 7.69 | -138 | -105 | -89 | -87 | -6.2 | -105 | -126 | -91 | -97 | -6.2 |
| 9.22 | -141 | -107 | -87 | -86 | -6.2 | -107 | -127 | -91 | -96 | -6.2 |
| 11.01 | -144 | -109 | -85 | -84 | -6.2 | -109 | -130 | -90 | -96 | -6.3 |
| 12.09 | -146 | -111 | -84 | -82 | -6.2 | -111 | -132 | -90 | -95 | -6.3 |
| 13.88 | -148 | -113 | -82 | -80 | -6.2 | -113 | -135 | -89 | -94 | -6.4 |
| 15.41 | -151 | -116 | -80 | -79 | -6.3 | -116 | -138 | -88 | -94 | -6.4 |
| 17.33 | -155 | -119 | -78 | -76 | -6.3 | -118 | -141 | -88 | -94 | -6.5 |
| 19.18 | -159 | -123 | -77 | -75 | -6.4 | -122 | -145 | -88 | -94 | -6.6 |
| 20.27 | -161 | -124 | -76 | -73 | -6.4 | -124 | -147 | -87 | -94 | -6.7 |
| 21.99 | -164 | -127 | -74 | -71 | -6.4 | -127 | -151 | -87 | -94 | -6.8 |
| 23.65 | -167 | -128 | -71 | -70 | -6.4 | -131 | -155 | -87 | -93 | -6.9 |
| 25.82 | -171 | -132 | -69 | -67 | -6.5 | -136 | -159 | -86 | -93 | -7.0 |
| 16.75 | -159 | -123 | -82 | -80 | -6.5 | -126 | -147 | -92 | -98 | -6.8 |
| 11.39 | -150 | -115 | -88 | -86 | -6.5 | -118 | -139 | -93 | -99 | -6.6 |
| 4.94 | -139 | -105 | -94 | -92 | -6.3 | -109 | -128 | -95 | -101 | -6.4 |
| 11.90 | -150 | -114 | -87 | -85 | -6.4 | -117 | -138 | -92 | -98 | -6.6 |
| 18.74 | -162 | -125 | -79 | -76 | -6.5 | -127 | -149 | -89 | -96 | -6.8 |
| 25.50 | -172 | -133 | -71 | -69 | -6.6 | -137 | -160 | -86 | -94 | -7.0 |
| 28.76 | -178 | -138 | -68 | -65 | -6.6 | -144 | -165 | -85 | -93 | -7.2 |
| 30.36 | -182 | -141 | -66 | -63 | -6.7 | -148 | -169 | -85 | -93 | -7.3 |
| 32.15 | -185 | -143 | -64 | -61 | -6.7 | -151 | -172 | -85 | -93 | -7.4 |
| 33.81 | -190 | -147 | -64 | -60 | -6.8 | -156 | -171 | -86 | -94 | -7.5 |
| 34.83 | -194 | -148 | -64 | -60 | -6.9 | -159 | -173 | -86 | -94 | -7.6 |
| 35.91 | -197 | -150 | -64 | -59 | -6.9 | -162 | -175 | -85 | -94 | -7.6 |
| 37.64 | -200 | -151 | -61 | -57 | -6.9 | -166 | -178 | -85 | -94 | -7.7 |
| 39.55 | -205 | -153 | -60 | -56 | -7.0 | -170 | -181 | -85 | -94 | -7.8 |
| 41.28 | -208 | -156 | -60 | -55 | -7.0 | -175 | -185 | -85 | -94 | -7.9 |
| 43.26 | -215 | -160 | -60 | -54 | -7.2 | -181 | -190 | -86 | -96 | -8.1 |
| 44.54 | -219 | -162 | -60 | -54 | -7.3 | -184 | -193 | -86 | -96 | -8.3 |
| 45.56 | -221 | -162 | -59 | -52 | -7.3 | -186 | -195 | -85 | -95 | -8.3 |
| 35.21 | -209 | -155 | -72 | -67 | -7.4 | -176 | -183 | -93 | -103 | -8.2 |
| 24.74 | -193 | -142 | -84 | -79 | -7.3 | -160 | -168 | -97 | -107 | -7.8 |
| 14.20 | -172 | -126 | -94 | -91 | -7.1 | -142 | -151 | -100 | -109 | -7.4 |
| 4.94 | -153 | -110 | -99 | -99 | -6.8 | -124 | -133 | -101 | -109 | -6.9 |
| 15.67 | -171 | -123 | -88 | -86 | -6.9 | -139 | -150 | -96 | -106 | -7.2 |
| 25.63 | -189 | -138 | -78 | -75 | -7.1 | -155 | -166 | -92 | -103 | -7.6 |
| 35.79 | -206 | -153 | -68 | -64 | -7.2 | -172 | -182 | -89 | -100 | -8.0 |
| 43.83 | -219 | -160 | -60 | -55 | -7.3 | -185 | -194 | -86 | -97 | -8.3 |
| 47.86 | -227 | -165 | -57 | -52 | -7.4 | -193 | -201 | -85 | -97 | -8.5 |
| 50.16 | -233 | -168 | -55 | -49 | -7.4 | -198 | -206 | -84 | -96 | -8.6 |
| 53.10 | -241 | -172 | -51 | -46 | -7.5 | -205 | -212 | -83 | -95 | -8.8 |
| 54.88 | -246 | -175 | -50 | -45 | -7.6 | -209 | -216 | -83 | -95 | -8.9 |
| 57.63 | -249 | -181 | -49 | -45 | -7.7 | -228 | -219 | -96 | -95 | -9.4 |
| 59.86 | -262 | -193 | -54 | -51 | -8.2 | -248 | -225 | -103 | -99 | -9.9 |
| 59.81 | -266 | -196 | -57 | -53 | -8.4 | -255 | -221 | -98 | -96 | -9.9 |
| 60.57 | -271 | -205 | -61 | -58 | -8.8 | -283 | -237 | -122 | -119 | -11.2 |
| 59.09 | -310 | -229 | -89 | -83 | -10.5 | -341 | -293 | -168 | -172 | -14.3 |
| 56.41 | -604 | -624 | -427 | -428 | -30.6 | -343 | -290 | -179 | -178 | -14.6 |
| 57.69 | -660 | -708 | -499 | -507 | -35.0 | -346 | -292 | -181 | -179 | -14.7 |

| TOTAL LOAD PER JOIST (kips) | CSJ-4 TEST DATA SHEET TC3 (cont.) 2L2.50x2.50x0.212 TC3 (13) (με) | TC3 (14) | TC3 (15) | TC3 (16) | AVG MEM LOAD (kips) | CSJ-4 TEST DATA SHEET TC4 (cont.) 2L2.50x2.50x0.212 TC4 (43) (με) | TC4 (44) | TC4 (45) | TC4 (46) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| 59.67 | -730 | -848 | -618 | -628 | -41.6 | -352 | -297 | -183 | -182 | -14.9 |
| 60.63 | -813 | -1061 | -776 | -809 | -50.9 | -369 | -313 | -195 | -194 | -15.8 |
| 61.46 | -899 | -1240 | -933 | -986 | -59.7 | -1273 | -664 | -530 | -542 | -44.3 |
| 63.50 | -970 | -1414 | -994 | -1105 | -66.0 | -1748 | -780 | -850 | -898 | -62.9 |
| 62.60 | -971 | -1470 | -987 | -1132 | -67.1 | -1795 | -740 | -896 | -959 | -64.6 |
| 57.94 | -863 | -1388 | -900 | -1041 | -61.7 | -1801 | -730 | -906 | -969 | -64.9 |
| 56.85 | -838 | -1389 | -882 | -1025 | -60.8 | -1799 | -725 | -904 | -968 | -64.7 |
| 56.15 | -826 | -1383 | -885 | -1030 | -60.7 | -1799 | -720 | -902 | -966 | -64.6 |
| 54.62 | -808 | -1401 | -865 | -1009 | -60.1 | -1798 | -715 | -896 | -968 | -64.4 |
| 53.28 | -793 | -1389 | -845 | -987 | -59.1 | -1796 | -710 | -894 | -967 | -64.3 |
| 44.66 | -595 | -1173 | -683 | -810 | -48.0 | -1773 | -686 | -891 | -963 | -63.5 |
| 37.26 | -503 | -1086 | -619 | -747 | -43.5 | -1744 | -659 | -884 | -953 | -62.4 |
| 24.61 | -391 | -1007 | -566 | -704 | -39.3 | -1639 | -549 | -847 | -894 | -57.8 |
| 13.30 | -120 | -774 | -369 | -542 | -26.6 | -1339 | -253 | -641 | -670 | -42.7 |
| 4.30 | 168 | -512 | -150 | -331 | -12.1 | -1064 | 8 | -428 | -452 | -28.5 |

| TOTAL TOTAL LOAD / JOIST (kips) | CSJ-4 TEST DATA SHEET TC5 2L2.50x2.50x0.212 TC5 (17) | TC5 (18) | TC5 (19) | TC5 (20) | AVG MEM LOAD (kips) | CSJ-4 TEST DATA SHEET TC6 2L2.50x2.50x0.212 TC6 (47) | TC6 (48) | TC6 (49) | TC6 (50) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| | (με) | | | | | (με) | | | | |
| 0.00 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 |
| 0.80 | -37 | -39 | -31 | -33 | -2.1 | -38 | -36 | -34 | -28 | -2.0 |
| 3.22 | -149 | -157 | -124 | -133 | -8.3 | -150 | -144 | -136 | -113 | -8.0 |
| 4.62 | -149 | -159 | -121 | -131 | -8.2 | -154 | -146 | -132 | -107 | -7.9 |
| 5.96 | -149 | -160 | -119 | -128 | -8.2 | -156 | -148 | -130 | -104 | -7.9 |
| 7.69 | -150 | -161 | -117 | -125 | -8.1 | -159 | -150 | -128 | -102 | -7.9 |
| 9.22 | -150 | -163 | -116 | -122 | -8.1 | -161 | -153 | -126 | -100 | -8.0 |
| 11.01 | -151 | -165 | -113 | -119 | -8.1 | -163 | -156 | -123 | -99 | -8.0 |
| 12.09 | -152 | -167 | -112 | -117 | -8.1 | -165 | -159 | -122 | -98 | -8.0 |
| 13.88 | -152 | -169 | -109 | -113 | -8.0 | -167 | -162 | -119 | -96 | -8.0 |
| 15.41 | -153 | -171 | -108 | -111 | -8.0 | -169 | -166 | -117 | -95 | -8.1 |
| 17.33 | -154 | -173 | -106 | -107 | -7.9 | -171 | -169 | -116 | -94 | -8.1 |
| 19.18 | -156 | -175 | -104 | -105 | -7.9 | -173 | -174 | -116 | -93 | -8.2 |
| 20.27 | -157 | -177 | -103 | -102 | -7.9 | -175 | -176 | -114 | -91 | -8.2 |
| 21.99 | -157 | -180 | -101 | -99 | -7.9 | -178 | -180 | -112 | -90 | -8.2 |
| 23.65 | -158 | -181 | -99 | -96 | -7.9 | -180 | -182 | -111 | -88 | -8.3 |
| 25.82 | -160 | -182 | -97 | -93 | -7.8 | -182 | -187 | -111 | -87 | -8.4 |
| 16.75 | -160 | -176 | -113 | -113 | -8.3 | -171 | -177 | -125 | -101 | -8.4 |
| 11.39 | -158 | -171 | -119 | -123 | -8.4 | -162 | -167 | -131 | -106 | -8.3 |
| 4.94 | -153 | -163 | -126 | -134 | -8.5 | -151 | -154 | -138 | -113 | -8.2 |
| 11.90 | -156 | -170 | -117 | -121 | -8.3 | -163 | -166 | -129 | -103 | -8.3 |
| 18.74 | -159 | -177 | -108 | -106 | -8.1 | -173 | -177 | -120 | -96 | -8.3 |
| 25.50 | -161 | -183 | -99 | -94 | -7.9 | -183 | -188 | -113 | -88 | -8.4 |
| 28.76 | -164 | -175 | -96 | -91 | -7.7 | -188 | -194 | -110 | -86 | -8.5 |
| 30.36 | -165 | -175 | -94 | -87 | -7.7 | -191 | -198 | -109 | -85 | -8.6 |
| 32.15 | -167 | -175 | -93 | -85 | -7.7 | -195 | -202 | -108 | -85 | -8.7 |
| 33.81 | -170 | -175 | -92 | -84 | -7.7 | -200 | -206 | -108 | -85 | -8.8 |
| 34.83 | -172 | -178 | -93 | -83 | -7.7 | -204 | -210 | -108 | -85 | -8.9 |
| 35.91 | -175 | -179 | -93 | -83 | -7.8 | -206 | -213 | -108 | -84 | -9.0 |
| 37.64 | -175 | -179 | -91 | -79 | -7.7 | -209 | -216 | -106 | -83 | -9.1 |
| 39.55 | -178 | -180 | -90 | -79 | -7.8 | -214 | -221 | -105 | -82 | -9.2 |
| 41.28 | -180 | -180 | -89 | -79 | -7.8 | -218 | -226 | -106 | -82 | -9.3 |
| 43.26 | -186 | -184 | -91 | -79 | -7.9 | -226 | -236 | -107 | -84 | -9.6 |
| 44.54 | -189 | -186 | -91 | -79 | -8.0 | -231 | -241 | -107 | -84 | -9.8 |
| 45.56 | -190 | -187 | -90 | -76 | -8.0 | -233 | -243 | -105 | -83 | -9.8 |
| 35.21 | -188 | -187 | -109 | -98 | -8.6 | -220 | -235 | -123 | -100 | -10.0 |
| 24.74 | -184 | -184 | -122 | -116 | -8.9 | -204 | -220 | -137 | -114 | -9.9 |
| 14.20 | -178 | -179 | -133 | -133 | -9.2 | -185 | -199 | -147 | -122 | -9.6 |
| 4.94 | -168 | -171 | -141 | -147 | -9.2 | -169 | -176 | -154 | -128 | -9.2 |
| 15.67 | -173 | -175 | -126 | -126 | -8.8 | -185 | -194 | -141 | -115 | -9.3 |
| 25.63 | -179 | -179 | -114 | -108 | -8.5 | -202 | -213 | -129 | -104 | -9.5 |
| 35.79 | -185 | -184 | -103 | -93 | -8.3 | -219 | -230 | -117 | -94 | -9.7 |
| 43.83 | -192 | -187 | -93 | -81 | -8.1 | -233 | -243 | -108 | -85 | -9.8 |
| 47.86 | -196 | -189 | -90 | -76 | -8.1 | -240 | -249 | -106 | -82 | -10.0 |
| 50.16 | -200 | -192 | -88 | -73 | -8.1 | -246 | -254 | -105 | -81 | -10.1 |
| 53.10 | -204 | -194 | -87 | -71 | -8.2 | -253 | -263 | -102 | -77 | -10.2 |
| 54.88 | -208 | -197 | -87 | -71 | -8.3 | -260 | -270 | -102 | -77 | -10.4 |
| 57.63 | -212 | -200 | -86 | -68 | -8.3 | -266 | -277 | -99 | -74 | -10.5 |
| 59.86 | -218 | -204 | -87 | -68 | -8.5 | -274 | -288 | -101 | -76 | -10.9 |
| 59.81 | -219 | -210 | -88 | -70 | -8.6 | -276 | -291 | -86 | -67 | -10.6 |
| 60.57 | -227 | -221 | -97 | -77 | -9.2 | -288 | -307 | -88 | -73 | -11.1 |
| 59.09 | -227 | -214 | -92 | -63 | -8.8 | -289 | -304 | -91 | -77 | -11.2 |
| 56.41 | -717 | -652 | -522 | -475 | -34.8 | -292 | -313 | -104 | -86 | -11.7 |
| 57.69 | -794 | -760 | -626 | -570 | -40.5 | -301 | -318 | -110 | -90 | -12.1 |

| TOTAL<br>TOTAL<br>LOAD /<br>JOIST<br>(kips) | CSJ-4 TEST DATA SHEET<br>TC5 (cont.)<br>2L2.50x2.50x0.212<br>TC5 (17) | <br><br><br>TC5 (18) | <br><br><br>TC5 (19) | <br><br><br>TC5 (20) | AVG<br>MEM<br>LOAD<br>(kips) | CSJ-4 TEST DATA SHEET<br>TC6 (cont.)<br>2L2.50x2.50x0.212<br>TC6 (47) | <br><br><br>TC6 (48) | <br><br><br>TC6 (49) | <br><br><br>TC6 (50) | AVG<br>MEM<br>LOAD<br>(kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| | (με) | | | | | (με) | | | | |
| 59.67 | -915 | -940 | -790 | -725 | -49.6 | -325 | -334 | -133 | -105 | -13.2 |
| 60.63 | -1075 | -1185 | -1050 | -971 | -63.0 | -414 | -414 | -245 | -194 | -18.6 |
| 61.46 | -1212 | -1367 | -1326 | -1243 | -75.8 | -864 | -847 | -716 | -711 | -46.2 |
| 63.50 | -1279 | -1453 | -1701 | -1517 | -87.6 | -1106 | -1163 | -1032 | -1017 | -63.6 |
| 62.60 | -1229 | -1442 | -1751 | -1615 | -88.9 | -1136 | -1218 | -1096 | -1078 | -66.6 |
| 57.94 | -969 | -1304 | -1466 | -1469 | -76.7 | -1131 | -1220 | -1112 | -1093 | -67.1 |
| 56.85 | -918 | -1301 | -1436 | -1454 | -75.2 | -1125 | -1216 | -1111 | -1093 | -66.9 |
| 56.15 | -857 | -1348 | -1426 | -1457 | -74.9 | -1122 | -1215 | -1110 | -1093 | -66.8 |
| 54.62 | -760 | -1353 | -1399 | -1436 | -72.8 | -1118 | -1211 | -1106 | -1093 | -66.6 |
| 53.28 | -660 | -1355 | -1388 | -1436 | -71.2 | -1111 | -1204 | -1101 | -1089 | -66.3 |
| 44.66 | -337 | -1150 | -1276 | -1335 | -60.3 | -1066 | -1171 | -1100 | -1086 | -65.1 |
| 37.26 | -148 | -970 | -1153 | -1227 | -51.5 | -1020 | -1141 | -1089 | -1082 | -63.8 |
| 24.61 | -27 | -758 | -989 | -1055 | -41.6 | -970 | -1077 | -1069 | -1058 | -61.4 |
| 13.30 | 246 | -341 | -652 | -697 | -21.3 | -611 | -697 | -793 | -778 | -42.4 |
| 4.30 | 531 | 51 | -330 | -357 | -1.5 | -251 | -316 | -469 | -475 | -22.2 |

| TOTAL LOAD PER JOIST (kips) | CSJ-4 TEST DATA SHEET TC7 2L2.50x2.50x0.212 TC7 (21) (με) | TC7 (22) | TC7 (23) | TC7 (24) | AVG MEM LOAD (kips) | CSJ-4 TEST DATA SHEET TC8 2L2.50x2.50x0.212 TC8 (51) (με) | TC8 (52) | TC8 (53) | TC8 (54) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 |
| 0.80 | -46 | -43 | -36 | -34 | -2.3 | -43 | -39 | -35 | -32 | -2.2 |
| 3.22 | -185 | -171 | -142 | -135 | -9.3 | -172 | -157 | -138 | -127 | -8.7 |
| 4.62 | -186 | -171 | -136 | -128 | -9.1 | -173 | -159 | -132 | -121 | -8.6 |
| 5.96 | -186 | -171 | -131 | -123 | -9.0 | -173 | -160 | -127 | -115 | -8.5 |
| 7.69 | -186 | -171 | -126 | -116 | -8.8 | -174 | -160 | -120 | -108 | -8.3 |
| 9.22 | -186 | -170 | -120 | -110 | -8.6 | -174 | -160 | -115 | -104 | -8.1 |
| 11.01 | -186 | -170 | -114 | -104 | -8.4 | -174 | -162 | -109 | -97 | -8.0 |
| 12.09 | -188 | -171 | -111 | -101 | -8.4 | -175 | -162 | -106 | -93 | -7.9 |
| 13.88 | -187 | -170 | -104 | -94 | -8.2 | -176 | -163 | -100 | -86 | -7.7 |
| 15.41 | -188 | -171 | -99 | -88 | -8.0 | -177 | -165 | -96 | -80 | -7.6 |
| 17.33 | -188 | -172 | -93 | -82 | -7.9 | -178 | -167 | -90 | -73 | -7.5 |
| 19.18 | -190 | -172 | -87 | -76 | -7.7 | -180 | -169 | -86 | -69 | -7.4 |
| 20.27 | -190 | -173 | -82 | -72 | -7.6 | -181 | -170 | -82 | -65 | -7.3 |
| 21.99 | -192 | -173 | -76 | -67 | -7.5 | -182 | -172 | -77 | -58 | -7.2 |
| 23.65 | -193 | -174 | -71 | -61 | -7.3 | -183 | -174 | -72 | -52 | -7.1 |
| 25.82 | -194 | -175 | -64 | -53 | -7.1 | -186 | -177 | -68 | -45 | -7.0 |
| 16.75 | -196 | -179 | -100 | -89 | -8.3 | -187 | -176 | -100 | -81 | -8.0 |
| 11.39 | -195 | -179 | -118 | -107 | -8.8 | -184 | -172 | -116 | -101 | -8.4 |
| 4.94 | -193 | -177 | -138 | -130 | -9.4 | -181 | -166 | -136 | -123 | -8.9 |
| 11.90 | -194 | -176 | -115 | -104 | -8.7 | -183 | -169 | -112 | -97 | -8.3 |
| 18.74 | -194 | -176 | -91 | -80 | -8.0 | -185 | -174 | -91 | -71 | -7.7 |
| 25.50 | -196 | -177 | -67 | -57 | -7.3 | -188 | -179 | -71 | -48 | -7.1 |
| 28.76 | -199 | -177 | -55 | -45 | -7.0 | -191 | -182 | -62 | -37 | -6.9 |
| 30.36 | -200 | -179 | -50 | -40 | -6.9 | -193 | -185 | -58 | -32 | -6.9 |
| 32.15 | -203 | -180 | -44 | -35 | -6.8 | -195 | -188 | -54 | -27 | -6.8 |
| 33.81 | -205 | -182 | -40 | -31 | -6.8 | -198 | -192 | -50 | -23 | -6.8 |
| 34.83 | -207 | -184 | -38 | -29 | -6.8 | -202 | -195 | -49 | -21 | -6.9 |
| 35.91 | -210 | -186 | -36 | -26 | -6.7 | -204 | -197 | -47 | -17 | -6.9 |
| 37.64 | -211 | -183 | -30 | -22 | -6.6 | -206 | -200 | -42 | -11 | -6.8 |
| 39.55 | -214 | -185 | -24 | -18 | -6.5 | -209 | -203 | -38 | -6 | -6.7 |
| 41.28 | -217 | -188 | -20 | -14 | -6.5 | -213 | -207 | -37 | -3 | -6.8 |
| 43.26 | -223 | -194 | -16 | -11 | -6.5 | -220 | -215 | -35 | 0 | -6.9 |
| 44.54 | -227 | -197 | -14 | -8 | -6.6 | -225 | -219 | -34 | 3 | -7.0 |
| 45.56 | -228 | -197 | -10 | -4 | -6.5 | -225 | -221 | -30 | 7 | -6.9 |
| 35.21 | -232 | -204 | -54 | -47 | -7.9 | -228 | -222 | -69 | -37 | -8.2 |
| 24.74 | -228 | -205 | -92 | -83 | -8.9 | -224 | -215 | -101 | -74 | -9.0 |
| 14.20 | -222 | -201 | -127 | -117 | -9.8 | -215 | -203 | -130 | -109 | -9.7 |
| 4.94 | -214 | -195 | -154 | -146 | -10.4 | -205 | -191 | -153 | -138 | -10.1 |
| 15.67 | -216 | -194 | -116 | -107 | -9.3 | -209 | -196 | -118 | -99 | -9.2 |
| 25.63 | -221 | -196 | -82 | -74 | -8.4 | -216 | -205 | -90 | -64 | -8.5 |
| 35.79 | -226 | -198 | -46 | -39 | -7.5 | -222 | -215 | -60 | -30 | -7.7 |
| 43.83 | -230 | -199 | -17 | -11 | -6.7 | -226 | -221 | -37 | -1 | -7.1 |
| 47.86 | -235 | -202 | -5 | 0 | -6.5 | -231 | -227 | -27 | 12 | -7.0 |
| 50.16 | -238 | -205 | 3 | 7 | -6.4 | -235 | -231 | -21 | 21 | -6.9 |
| 53.10 | -243 | -210 | 12 | 16 | -6.3 | -240 | -237 | -15 | 30 | -6.8 |
| 54.88 | -248 | -214 | 16 | 20 | -6.3 | -245 | -245 | -11 | 34 | -6.9 |
| 57.63 | -252 | -216 | 25 | 28 | -6.1 | -249 | -250 | -4 | 44 | -6.8 |
| 59.86 | -260 | -223 | 29 | 31 | -6.2 | -259 | -260 | -3 | 47 | -7.0 |
| 59.81 | -291 | -250 | -18 | -4 | -8.3 | -260 | -267 | 2 | 54 | -6.9 |
| 60.57 | -350 | -315 | -85 | -75 | -12.1 | -272 | -283 | -1 | 53 | -7.4 |
| 59.09 | -414 | -388 | -138 | -148 | -16.0 | -356 | -348 | -90 | -14 | -11.9 |
| 56.41 | -573 | -490 | -329 | -301 | -24.9 | -461 | -428 | -194 | -153 | -18.2 |
| 57.69 | -639 | -532 | -385 | -345 | -28.0 | -537 | -505 | -249 | -215 | -22.2 |

| TOTAL LOAD PER JOIST (kips) | CSJ-4 TEST DATA SHEET TC7 (cont.) 2L2.50x2.50x0.212 TC7 (21) (με) | TC7 (22) | TC7 (23) | TC7 (24) | AVG MEM LOAD (kips) | CSJ-4 TEST DATA SHEET TC8 (cont.) 2L2.50x2.50x0.212 TC8 (51) (με) | TC8 (52) | TC8 (53) | TC8 (54) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| 59.67 | -769 | -648 | -494 | -432 | -34.5 | -737 | -720 | -403 | -371 | -32.8 |
| 60.63 | -1056 | -1052 | -844 | -788 | -19.2 | -993 | -1014 | -737 | -682 | -50.4 |
| 61.46 | -1222 | -1192 | -1127 | -1053 | -23.6 | -1200 | -1238 | -1125 | -1037 | -67.7 |
| 63.50 | -1359 | -1304 | -1457 | -1309 | -27.9 | -1288 | -1343 | -1331 | -1221 | -76.3 |
| 62.60 | -1416 | -1338 | -1609 | -1441 | -29.8 | -1323 | -1385 | -1441 | -1305 | -80.3 |
| 57.94 | -1315 | -1218 | -1464 | -1302 | -27.2 | -1294 | -1360 | -1431 | -1279 | -78.9 |
| 56.85 | -1308 | -1181 | -1386 | -1238 | -26.2 | -1295 | -1357 | -1430 | -1276 | -78.9 |
| 56.15 | -1328 | -1149 | -1334 | -1217 | -25.8 | -1301 | -1357 | -1434 | -1276 | -79.0 |
| 54.62 | -1322 | -1087 | -1279 | -1193 | -25.1 | -1289 | -1341 | -1422 | -1260 | -78.2 |
| 53.28 | -1298 | -1006 | -1192 | -1146 | -23.8 | -1269 | -1310 | -1400 | -1224 | -76.6 |
| 44.66 | -1135 | -780 | -1004 | -1125 | -20.8 | -1204 | -1244 | -1387 | -1200 | -74.1 |
| 37.26 | -898 | -551 | -835 | -1085 | -17.3 | -1115 | -1212 | -1359 | -1184 | -71.7 |
| 24.61 | -660 | -378 | -755 | -1000 | -14.3 | -1065 | -1119 | -1321 | -1163 | -68.7 |
| 13.30 | -198 | 11 | -437 | -713 | -6.9 | -682 | -724 | -1009 | -868 | -48.3 |
| 4.30 | 198 | 402 | -112 | -353 | 0.7 | -181 | -211 | -615 | -474 | -21.8 |

| TOTAL LOAD PER JOIST (kips) | CSJ-4 TEST DATA SHEET BC1 2L3.50x3.50x0.375 | | | | AVG MEM LOAD (kips) | CSJ-4 TEST DATA SHEET BC2 2L3.50x3.50x0.375 | | | | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| | BC1 (1) | BC1 (2) | BC1 (3) | BC1 (4) | | BC2 (31) | BC2 (32) | BC2 (33) | BC2 (34) | |
| | (με) | | | | | (με) | | | | |
| 0.00 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 |
| 0.80 | 23 | 23 | 14 | 15 | 2.7 | 20 | 19 | 12 | 11 | 2.2 |
| 3.22 | 93 | 93 | 56 | 61 | 10.9 | 80 | 78 | 47 | 43 | 8.9 |
| 4.62 | 127 | 128 | 87 | 91 | 15.6 | 121 | 116 | 82 | 76 | 14.2 |
| 5.96 | 149 | 149 | 105 | 110 | 18.5 | 144 | 138 | 102 | 94 | 17.2 |
| 7.69 | 178 | 178 | 129 | 134 | 22.3 | 174 | 167 | 126 | 118 | 21.1 |
| 9.22 | 202 | 201 | 150 | 154 | 25.5 | 199 | 191 | 147 | 139 | 24.3 |
| 11.01 | 231 | 230 | 174 | 177 | 29.3 | 229 | 221 | 172 | 164 | 28.3 |
| 12.09 | 250 | 249 | 190 | 193 | 31.8 | 247 | 240 | 186 | 180 | 30.7 |
| 13.88 | 282 | 280 | 215 | 218 | 35.8 | 278 | 270 | 214 | 205 | 34.8 |
| 15.41 | 307 | 304 | 235 | 238 | 39.0 | 304 | 295 | 232 | 225 | 38.0 |
| 17.33 | 337 | 334 | 261 | 263 | 43.0 | 335 | 325 | 257 | 250 | 42.1 |
| 19.18 | 367 | 363 | 285 | 286 | 46.9 | 365 | 355 | 282 | 275 | 46.0 |
| 20.27 | 388 | 384 | 302 | 303 | 49.6 | 386 | 376 | 298 | 292 | 48.7 |
| 21.99 | 418 | 414 | 327 | 328 | 53.5 | 416 | 406 | 322 | 316 | 52.6 |
| 23.65 | 447 | 442 | 350 | 350 | 57.2 | 444 | 433 | 345 | 340 | 56.3 |
| 25.82 | 483 | 478 | 380 | 378 | 61.9 | 480 | 469 | 374 | 369 | 60.9 |
| 16.75 | 332 | 328 | 253 | 252 | 42.0 | 330 | 321 | 245 | 246 | 41.1 |
| 11.39 | 244 | 243 | 181 | 180 | 30.5 | 240 | 234 | 169 | 173 | 29.4 |
| 4.94 | 139 | 140 | 93 | 94 | 16.8 | 133 | 128 | 78 | 85 | 15.3 |
| 11.90 | 250 | 249 | 186 | 186 | 31.4 | 247 | 241 | 175 | 180 | 30.3 |
| 18.74 | 364 | 361 | 280 | 280 | 46.3 | 363 | 353 | 273 | 273 | 45.5 |
| 25.50 | 477 | 472 | 373 | 373 | 61.1 | 476 | 464 | 367 | 365 | 60.2 |
| 28.76 | 531 | 526 | 418 | 417 | 68.2 | 531 | 518 | 412 | 410 | 67.4 |
| 30.36 | 562 | 557 | 442 | 441 | 72.1 | 561 | 548 | 434 | 434 | 71.2 |
| 32.15 | 593 | 588 | 466 | 467 | 76.2 | 591 | 577 | 458 | 457 | 75.0 |
| 33.81 | 621 | 616 | 490 | 488 | 79.8 | 619 | 605 | 480 | 481 | 78.7 |
| 34.83 | 640 | 635 | 503 | 503 | 82.2 | 638 | 623 | 493 | 495 | 81.1 |
| 35.91 | 658 | 654 | 519 | 518 | 84.6 | 659 | 645 | 510 | 512 | 83.8 |
| 37.64 | 690 | 686 | 543 | 543 | 88.7 | 691 | 675 | 534 | 537 | 87.8 |
| 39.55 | 719 | 716 | 567 | 567 | 92.6 | 721 | 706 | 558 | 562 | 91.8 |
| 41.28 | 748 | 744 | 590 | 588 | 96.1 | 750 | 734 | 580 | 585 | 95.4 |
| 43.26 | 783 | 781 | 617 | 616 | 100.8 | 787 | 771 | 608 | 614 | 100.1 |
| 44.54 | 807 | 805 | 635 | 634 | 103.8 | 811 | 794 | 625 | 633 | 103.2 |
| 45.56 | 827 | 825 | 651 | 651 | 106.4 | 832 | 814 | 641 | 649 | 105.7 |
| 35.21 | 654 | 652 | 505 | 505 | 83.4 | 658 | 644 | 492 | 506 | 82.8 |
| 24.74 | 483 | 483 | 363 | 362 | 60.9 | 484 | 473 | 346 | 364 | 60.0 |
| 14.20 | 305 | 307 | 218 | 214 | 37.6 | 305 | 297 | 195 | 218 | 36.6 |
| 4.94 | 152 | 155 | 92 | 89 | 17.6 | 148 | 144 | 64 | 92 | 16.1 |
| 15.67 | 327 | 329 | 237 | 235 | 40.6 | 326 | 318 | 215 | 237 | 39.5 |
| 25.63 | 492 | 492 | 373 | 372 | 62.3 | 493 | 483 | 354 | 374 | 61.4 |
| 35.79 | 663 | 662 | 514 | 514 | 84.8 | 666 | 653 | 500 | 515 | 84.1 |
| 43.83 | 797 | 797 | 625 | 627 | 102.5 | 804 | 789 | 615 | 627 | 102.1 |
| 47.86 | 865 | 866 | 680 | 684 | 111.5 | 871 | 855 | 671 | 681 | 110.9 |
| 50.16 | 908 | 910 | 714 | 718 | 117.1 | 915 | 899 | 704 | 716 | 116.5 |
| 53.10 | 960 | 963 | 754 | 759 | 123.8 | 972 | 956 | 745 | 759 | 123.7 |
| 54.88 | 993 | 997 | 779 | 784 | 128.0 | 1008 | 991 | 771 | 786 | 128.1 |
| 57.63 | 1041 | 1046 | 816 | 822 | 134.2 | 1061 | 1043 | 810 | 827 | 134.7 |
| 59.86 | 1080 | 1085 | 844 | 850 | 139.0 | 1105 | 1085 | 839 | 858 | 140.0 |
| 59.81 | 1073 | 1076 | 834 | 838 | 137.7 | 1138 | 1135 | 869 | 893 | 145.3 |
| 60.57 | 1083 | 1084 | 839 | 844 | 138.7 | 1172 | 1175 | 892 | 919 | 149.8 |
| 59.09 | 1111 | 1098 | 857 | 857 | 141.3 | 1134 | 1145 | 853 | 884 | 144.7 |
| 56.41 | 1130 | 1124 | 781 | 786 | 137.7 | 1102 | 1110 | 825 | 857 | 140.3 |
| 57.69 | 1174 | 1169 | 796 | 803 | 142.0 | 1120 | 1128 | 841 | 872 | 142.7 |

| TOTAL LOAD PER JOIST (kips) | CSJ-4 TEST DATA SHEET BC1 (cont.) 2L3.50x3.50x0.375 BC1 (1) | BC1 (2) (με) | BC1 (3) | BC1 (4) | AVG MEM LOAD (kips) | CSJ-4 TEST DATA SHEET BC2 (cont.) 2L3.50x3.50x0.375 BC2 (31) | BC2 (32) (με) | BC2 (33) | BC2 (34) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| 59.67 | 1244 | 1240 | 824 | 830 | 149.0 | 1148 | 1157 | 866 | 896 | 146.5 |
| 60.63 | 1307 | 1300 | 831 | 838 | 154.1 | 1168 | 1176 | 884 | 917 | 149.3 |
| 61.46 | 1383 | 1382 | 845 | 857 | 160.9 | 1256 | 1261 | 856 | 889 | 153.6 |
| 63.50 | 1444 | 1450 | 859 | 875 | 166.7 | 1377 | 1379 | 878 | 907 | 163.6 |
| 62.60 | 1449 | 1450 | 845 | 861 | 165.9 | 1381 | 1380 | 866 | 896 | 162.9 |
| 57.94 | 1349 | 1346 | 771 | 785 | 153.2 | 1310 | 1310 | 805 | 836 | 153.5 |
| 56.85 | 1326 | 1323 | 754 | 769 | 150.3 | 1300 | 1298 | 796 | 827 | 152.1 |
| 56.15 | 1318 | 1318 | 748 | 765 | 149.5 | 1293 | 1291 | 791 | 821 | 151.2 |
| 54.62 | 1294 | 1296 | 735 | 751 | 146.9 | 1272 | 1269 | 775 | 805 | 148.4 |
| 53.28 | 1278 | 1288 | 731 | 750 | 145.8 | 1249 | 1246 | 755 | 785 | 145.4 |
| 44.66 | 1035 | 1083 | 589 | 624 | 120.0 | 1111 | 1117 | 644 | 682 | 128.0 |
| 37.26 | 799 | 916 | 431 | 492 | 95.0 | 1008 | 1025 | 564 | 610 | 115.5 |
| 24.61 | 589 | 689 | 265 | 315 | 67.0 | 756 | 761 | 359 | 405 | 82.2 |
| 13.30 | 357 | 449 | 108 | 153 | 38.5 | 490 | 478 | 177 | 221 | 49.2 |
| 4.30 | 150 | 241 | -21 | 22 | 14.1 | 275 | 251 | 36 | 82 | 23.2 |

| TOTAL LOAD PER JOIST (kips) | CSJ-4 TEST DATA SHEET BC3 2L3.50x3.50x0.375 | | | | AVG MEM LOAD (kips) | CSJ-4 TEST DATA SHEET BC4 2L3.50x3.50x0.375 | | | | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| | BC3 (5) | BC3 (6) | BC3 (7) | BC3 (8) | | BC4 (35) | BC4 (36) | BC4 (37) | BC4 (38) | |
| | (με) | | | | | (με) | | | | |
| 0.00 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 |
| 0.80 | 33 | 34 | 18 | 16 | 3.7 | 29 | 30 | 15 | 14 | 3.2 |
| 3.22 | 133 | 135 | 72 | 66 | 14.6 | 116 | 120 | 58 | 57 | 12.7 |
| 4.62 | 184 | 183 | 111 | 102 | 20.9 | 172 | 175 | 102 | 100 | 19.7 |
| 5.96 | 215 | 213 | 135 | 126 | 24.8 | 205 | 207 | 127 | 125 | 23.9 |
| 7.69 | 255 | 253 | 167 | 156 | 29.9 | 246 | 249 | 159 | 158 | 29.2 |
| 9.22 | 288 | 285 | 192 | 182 | 34.1 | 280 | 282 | 185 | 187 | 33.7 |
| 11.01 | 328 | 326 | 224 | 213 | 39.3 | 321 | 324 | 217 | 221 | 39.1 |
| 12.09 | 354 | 351 | 243 | 232 | 42.5 | 347 | 349 | 236 | 240 | 42.2 |
| 13.88 | 396 | 392 | 275 | 264 | 47.8 | 388 | 391 | 269 | 274 | 47.7 |
| 15.41 | 430 | 426 | 301 | 290 | 52.1 | 422 | 426 | 295 | 303 | 52.1 |
| 17.33 | 472 | 467 | 334 | 322 | 57.4 | 464 | 468 | 327 | 334 | 57.4 |
| 19.18 | 512 | 506 | 364 | 353 | 62.5 | 505 | 509 | 358 | 363 | 62.5 |
| 20.27 | 541 | 535 | 386 | 375 | 66.2 | 532 | 537 | 380 | 383 | 66.0 |
| 21.99 | 582 | 575 | 417 | 406 | 71.3 | 573 | 578 | 411 | 413 | 71.1 |
| 23.65 | 620 | 614 | 446 | 435 | 76.2 | 610 | 615 | 440 | 442 | 75.9 |
| 25.82 | 669 | 661 | 483 | 472 | 82.3 | 658 | 664 | 477 | 479 | 82.1 |
| 16.75 | 462 | 459 | 322 | 312 | 56.0 | 454 | 458 | 316 | 326 | 56.0 |
| 11.39 | 342 | 340 | 229 | 219 | 40.7 | 334 | 337 | 221 | 235 | 40.6 |
| 4.94 | 196 | 198 | 116 | 109 | 22.3 | 185 | 188 | 107 | 120 | 21.6 |
| 11.90 | 352 | 349 | 237 | 227 | 42.0 | 344 | 348 | 230 | 242 | 41.9 |
| 18.74 | 508 | 504 | 357 | 348 | 61.8 | 499 | 504 | 351 | 361 | 61.8 |
| 25.50 | 661 | 655 | 476 | 465 | 81.3 | 650 | 656 | 470 | 475 | 81.1 |
| 28.76 | 735 | 728 | 533 | 522 | 90.7 | 724 | 730 | 526 | 529 | 90.4 |
| 30.36 | 777 | 770 | 564 | 553 | 96.0 | 764 | 771 | 556 | 559 | 95.5 |
| 32.15 | 818 | 810 | 596 | 584 | 101.2 | 805 | 812 | 587 | 585 | 100.5 |
| 33.81 | 857 | 848 | 624 | 614 | 106.0 | 843 | 849 | 616 | 612 | 105.2 |
| 34.83 | 881 | 873 | 642 | 631 | 109.1 | 868 | 875 | 634 | 630 | 108.3 |
| 35.91 | 909 | 901 | 663 | 652 | 112.6 | 894 | 901 | 655 | 649 | 111.7 |
| 37.64 | 952 | 943 | 696 | 684 | 118.0 | 936 | 943 | 686 | 680 | 116.9 |
| 39.55 | 993 | 984 | 727 | 715 | 123.1 | 977 | 984 | 717 | 709 | 122.0 |
| 41.28 | 1031 | 1022 | 756 | 745 | 128.0 | 1016 | 1023 | 747 | 739 | 127.0 |
| 43.26 | 1081 | 1070 | 792 | 781 | 134.1 | 1065 | 1073 | 783 | 776 | 133.2 |
| 44.54 | 1113 | 1103 | 815 | 804 | 138.1 | 1097 | 1105 | 807 | 798 | 137.1 |
| 45.56 | 1141 | 1130 | 837 | 825 | 141.7 | 1123 | 1131 | 827 | 817 | 140.4 |
| 35.21 | 903 | 897 | 649 | 641 | 111.3 | 888 | 895 | 641 | 632 | 110.1 |
| 24.74 | 668 | 665 | 467 | 459 | 81.4 | 655 | 660 | 458 | 459 | 80.4 |
| 14.20 | 425 | 424 | 279 | 271 | 50.4 | 415 | 416 | 271 | 286 | 50.0 |
| 4.94 | 213 | 213 | 116 | 110 | 23.5 | 202 | 203 | 106 | 130 | 23.1 |
| 15.67 | 455 | 452 | 304 | 295 | 54.2 | 444 | 447 | 294 | 305 | 53.7 |
| 25.63 | 681 | 675 | 479 | 470 | 83.0 | 668 | 673 | 470 | 463 | 81.9 |
| 35.79 | 916 | 907 | 661 | 650 | 112.9 | 900 | 907 | 651 | 635 | 111.4 |
| 43.83 | 1100 | 1090 | 805 | 793 | 136.5 | 1084 | 1093 | 795 | 779 | 135.2 |
| 47.86 | 1193 | 1180 | 875 | 864 | 148.2 | 1177 | 1185 | 867 | 851 | 147.0 |
| 50.16 | 1252 | 1238 | 918 | 908 | 155.5 | 1236 | 1245 | 911 | 895 | 154.4 |
| 53.10 | 1327 | 1311 | 973 | 963 | 164.8 | 1310 | 1319 | 966 | 951 | 163.8 |
| 54.88 | 1373 | 1358 | 1007 | 997 | 170.6 | 1357 | 1366 | 1001 | 985 | 169.6 |
| 57.63 | 1440 | 1423 | 1057 | 1048 | 178.9 | 1425 | 1435 | 1052 | 1033 | 178.1 |
| 59.86 | 1495 | 1475 | 1097 | 1086 | 185.7 | 1482 | 1492 | 1093 | 1075 | 185.2 |
| 59.81 | 1468 | 1457 | 1067 | 1059 | 182.0 | 1518 | 1538 | 1125 | 1105 | 190.5 |
| 60.57 | 1493 | 1491 | 1068 | 1061 | 184.2 | 1559 | 1583 | 1154 | 1136 | 195.7 |
| 59.09 | 1525 | 1524 | 1070 | 1066 | 186.7 | 1502 | 1533 | 1095 | 1072 | 187.4 |
| 56.41 | 1454 | 1460 | 1002 | 1000 | 177.1 | 1498 | 1532 | 1063 | 1045 | 185.1 |
| 57.69 | 1492 | 1499 | 1025 | 1023 | 181.5 | 1544 | 1578 | 1083 | 1066 | 189.8 |

| TOTAL LOAD PER JOIST (kips) | CSJ-4 TEST DATA SHEET BC3 (cont.) 2L3.50x3.50x0.375 BC3 (5) (με) | BC3 (6) | BC3 (7) | BC3 (8) | AVG MEM LOAD (kips) | CSJ-4 TEST DATA SHEET BC4 (cont.) 2L3.50x3.50x0.375 BC4 (35) (με) | BC4 (36) | BC4 (37) | BC4 (38) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| 59.67 | 1565 | 1571 | 1066 | 1064 | 189.7 | 1628 | 1662 | 1106 | 1091 | 197.7 |
| 60.63 | 1677 | 1674 | 1072 | 1073 | 198.0 | 1746 | 1790 | 1116 | 1104 | 207.3 |
| 61.46 | 1814 | 1797 | 1106 | 1109 | 209.9 | 1848 | 1869 | 1128 | 1102 | 214.2 |
| 63.50 | 1876 | 1862 | 1161 | 1164 | 218.4 | 1954 | 1947 | 1229 | 1180 | 227.3 |
| 62.60 | 1859 | 1806 | 1175 | 1193 | 217.4 | 2008 | 1947 | 1250 | 1195 | 230.5 |
| 57.94 | 1754 | 1732 | 1051 | 1065 | 201.8 | 1959 | 1918 | 1162 | 1106 | 221.4 |
| 56.85 | 1766 | 1745 | 986 | 1004 | 198.2 | 1980 | 1935 | 1132 | 1073 | 220.5 |
| 56.15 | 1794 | 1772 | 951 | 967 | 197.6 | 2016 | 1961 | 1095 | 1037 | 220.1 |
| 54.62 | 1797 | 1788 | 905 | 919 | 194.9 | 2023 | 1962 | 1045 | 994 | 217.0 |
| 53.28 | 1823 | 1799 | 881 | 899 | 194.6 | 2041 | 1971 | 989 | 925 | 213.5 |
| 44.66 | 1685 | 1763 | 560 | 572 | 165.0 | 1981 | 1963 | 771 | 713 | 195.5 |
| 37.26 | 1513 | 1671 | 221 | 270 | 132.4 | 1946 | 1953 | 600 | 613 | 184.2 |
| 24.61 | 1193 | 1322 | 36 | 77 | 94.6 | 1580 | 1544 | 353 | 380 | 138.9 |
| 13.30 | 817 | 909 | -136 | -97 | 53.8 | 1182 | 1096 | 136 | 161 | 92.7 |
| 4.30 | 465 | 560 | -267 | -226 | 19.2 | 818 | 719 | -20 | 7 | 54.9 |

| TOTAL LOAD PER JOIST (kips) | CSJ-4 TEST DATA SHEET W5 2L1.50x1.50x0.170 W5 (25) | W5 (26) (με) | W5 (27) | W5 (28) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|
| 0.00 | 0 | 0 | 0 | 0 | 0.0 |
| 0.80 | -17 | -15 | -17 | -23 | -0.5 |
| 3.22 | -67 | -60 | -70 | -93 | -2.0 |
| 4.62 | -102 | -82 | -106 | -132 | -2.9 |
| 5.96 | -123 | -96 | -126 | -155 | -3.5 |
| 7.69 | -151 | -116 | -153 | -187 | -4.2 |
| 9.22 | -174 | -132 | -175 | -213 | -4.8 |
| 11.01 | -203 | -153 | -202 | -246 | -5.6 |
| 12.09 | -221 | -165 | -218 | -266 | -6.1 |
| 13.88 | -250 | -186 | -246 | -299 | -6.8 |
| 15.41 | -274 | -202 | -268 | -325 | -7.5 |
| 17.33 | -304 | -224 | -297 | -360 | -8.3 |
| 19.18 | -333 | -246 | -323 | -393 | -9.0 |
| 20.27 | -353 | -259 | -342 | -415 | -9.5 |
| 21.99 | -381 | -279 | -368 | -447 | -10.3 |
| 23.65 | -408 | -296 | -394 | -477 | -11.0 |
| 25.82 | -445 | -321 | -427 | -516 | -11.9 |
| 16.75 | -298 | -219 | -287 | -351 | -8.1 |
| 11.39 | -214 | -158 | -208 | -256 | -5.8 |
| 4.94 | -112 | -86 | -112 | -141 | -3.1 |
| 11.90 | -220 | -163 | -216 | -264 | -6.0 |
| 18.74 | -329 | -240 | -319 | -386 | -8.9 |
| 25.50 | -439 | -316 | -422 | -508 | -11.8 |
| 28.76 | -495 | -353 | -472 | -567 | -13.2 |
| 30.36 | -535 | -374 | -499 | -599 | -14.0 |
| 32.15 | -567 | -394 | -529 | -631 | -14.8 |
| 33.81 | -598 | -413 | -556 | -662 | -15.6 |
| 34.83 | -617 | -425 | -574 | -681 | -16.0 |
| 35.91 | -637 | -436 | -591 | -698 | -16.5 |
| 37.64 | -669 | -456 | -621 | -728 | -17.3 |
| 39.55 | -702 | -476 | -651 | -759 | -18.1 |
| 41.28 | -733 | -494 | -679 | -787 | -18.8 |
| 43.26 | -774 | -518 | -718 | -824 | -19.8 |
| 44.54 | -800 | -532 | -743 | -849 | -20.4 |
| 45.56 | -820 | -544 | -763 | -866 | -20.9 |
| 35.21 | -653 | -431 | -602 | -681 | -16.5 |
| 24.74 | -484 | -318 | -444 | -497 | -12.2 |
| 14.20 | -308 | -198 | -281 | -306 | -7.6 |
| 4.94 | -161 | -99 | -143 | -148 | -3.8 |
| 15.67 | -333 | -216 | -308 | -334 | -8.3 |
| 25.63 | -496 | -326 | -460 | -510 | -12.5 |
| 35.79 | -666 | -435 | -619 | -688 | -16.8 |
| 43.83 | -800 | -523 | -746 | -828 | -20.2 |
| 47.86 | -872 | -567 | -815 | -901 | -22.0 |
| 50.16 | -938 | -599 | -852 | -946 | -23.3 |
| 53.10 | -1003 | -631 | -912 | -1000 | -24.7 |
| 54.88 | -1048 | -655 | -949 | -1034 | -25.7 |
| 57.63 | -1112 | -690 | -1007 | -1085 | -27.2 |
| 59.86 | -1183 | -724 | -1064 | -1133 | -28.6 |
| 59.81 | -1187 | -715 | -1070 | -1119 | -28.5 |
| 60.57 | -1201 | -718 | -1084 | -1124 | -28.8 |
| 59.09 | -1225 | -752 | -1111 | -1181 | -29.8 |
| 56.41 | -1195 | -726 | -1108 | -1150 | -29.2 |
| 57.69 | -1226 | -748 | -1138 | -1189 | -30.0 |

| TOTAL LOAD PER JOIST (kips) | CSJ-4 TEST DATA SHEET W5 (cont.) 2L1.50x1.50x0.170 W5 (25) | W5 (26) (με) | W5 (27) | W5 (28) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|
| 59.67 | -1284 | -791 | -1196 | -1260 | -31.6 |
| 60.63 | -1352 | -827 | -1281 | -1319 | -33.3 |
| 61.46 | -1423 | -877 | -1364 | -1390 | -35.3 |
| 63.50 | -1491 | -904 | -1413 | -1432 | -36.5 |
| 62.60 | -1495 | -898 | -1413 | -1418 | -36.4 |
| 57.94 | -1402 | -823 | -1328 | -1294 | -33.8 |
| 56.85 | -1385 | -800 | -1313 | -1255 | -33.2 |
| 56.15 | -1393 | -799 | -1320 | -1251 | -33.2 |
| 54.62 | -1389 | -796 | -1315 | -1245 | -33.1 |
| 53.28 | -1376 | -801 | -1302 | -1254 | -33.0 |
| 44.66 | -1170 | -674 | -1117 | -1055 | -28.0 |
| 37.26 | -975 | -548 | -940 | -850 | -23.1 |
| 24.61 | -770 | -429 | -749 | -656 | -18.2 |
| 13.30 | -559 | -292 | -549 | -432 | -12.8 |
| 4.30 | -382 | -172 | -381 | -238 | -8.2 |

| APPLIED LOAD PER JOIST (kips) | CSJ-4 TEST DATA SHEET END SLIPS | | | |
|---|---|---|---|---|
| | SLIP 1 (in.) | SLIP 2 (in.) | SLIP 11 (in.) | SLIP 12 (in.) |
| 0.00 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.40 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.74 | 0.000 | 0.000 | 0.000 | 0.000 |
| 4.46 | 0.000 | 0.000 | 0.000 | 0.000 |
| 6.00 | 0.000 | 0.000 | 0.000 | 0.000 |
| 7.79 | 0.000 | 0.000 | 0.000 | 0.000 |
| 8.87 | -0.001 | 0.000 | 0.000 | 0.000 |
| 10.66 | -0.001 | 0.000 | 0.000 | 0.000 |
| 12.19 | -0.001 | 0.000 | 0.000 | 0.000 |
| 14.11 | -0.001 | 0.000 | 0.000 | 0.000 |
| 15.96 | -0.001 | 0.000 | 0.000 | 0.000 |
| 17.05 | -0.001 | 0.000 | 0.000 | 0.000 |
| 18.77 | -0.001 | 0.000 | 0.000 | 0.000 |
| 20.43 | -0.001 | -0.001 | -0.001 | 0.000 |
| 22.60 | -0.001 | -0.001 | 0.000 | 0.000 |
| 13.53 | -0.001 | -0.001 | -0.001 | 0.000 |
| 8.17 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.72 | 0.000 | -0.001 | 0.000 | 0.000 |
| 8.68 | 0.000 | 0.000 | 0.000 | 0.000 |
| 15.51 | -0.001 | -0.001 | 0.000 | 0.000 |
| 22.28 | -0.001 | -0.001 | 0.000 | 0.000 |
| 25.54 | -0.002 | -0.001 | -0.001 | 0.000 |
| 27.14 | -0.002 | 0.000 | 0.000 | 0.000 |
| 28.93 | -0.002 | -0.001 | -0.001 | 0.000 |
| 30.59 | -0.002 | -0.001 | -0.001 | 0.000 |
| 31.61 | -0.002 | -0.001 | -0.001 | 0.000 |
| 32.69 | -0.002 | -0.001 | -0.001 | 0.000 |
| 34.42 | -0.002 | -0.001 | -0.001 | 0.000 |
| 36.33 | -0.002 | -0.001 | -0.001 | 0.000 |
| 38.06 | -0.003 | -0.001 | -0.001 | 0.000 |
| 40.04 | -0.003 | -0.001 | -0.001 | 0.000 |
| 41.31 | -0.003 | 0.000 | -0.001 | 0.000 |
| 42.34 | -0.003 | 0.000 | -0.001 | 0.000 |
| 31.99 | -0.003 | 0.001 | -0.001 | 0.000 |
| 21.52 | -0.002 | 0.001 | -0.001 | 0.000 |
| 10.98 | -0.001 | 0.001 | -0.001 | 0.000 |
| 1.72 | -0.001 | 0.000 | -0.001 | 0.000 |
| 12.45 | -0.001 | 0.000 | -0.001 | 0.000 |
| 22.41 | -0.001 | 0.001 | -0.001 | 0.000 |
| 32.56 | -0.002 | 0.001 | -0.001 | 0.000 |
| 40.61 | -0.002 | 0.001 | -0.001 | 0.000 |
| 44.64 | -0.002 | 0.001 | -0.001 | 0.000 |
| 46.94 | -0.003 | 0.001 | -0.001 | 0.000 |
| 49.87 | -0.002 | 0.001 | -0.001 | 0.000 |
| 51.66 | -0.003 | 0.001 | -0.001 | 0.000 |
| 54.41 | -0.002 | 0.002 | -0.001 | 0.001 |
| 56.64 | -0.003 | 0.002 | -0.001 | 0.002 |
| 56.58 | -0.002 | 0.002 | 0.002 | 0.048 |
| 57.34 | -0.002 | 0.002 | 0.007 | 0.077 |
| 55.87 | 0.073 | 0.010 | 0.013 | 0.096 |
| 53.19 | 0.110 | 0.071 | 0.013 | 0.102 |
| 54.47 | 0.128 | 0.088 | 0.013 | 0.102 |

| APPLIED LOAD PER JOIST (kips) | CSJ-4 TEST DATA SHEET END SLIPS (cont.) SLIP 1 (in.) | SLIP 2 (in.) | SLIP 11 (in.) | SLIP 12 (in.) |
|---|---|---|---|---|
| 56.45 | 0.166 | 0.120 | 0.013 | 0.105 |
| 57.41 | 0.241 | 0.182 | 0.014 | 0.119 |
| 58.24 | 0.332 | 0.248 | 0.056 | 0.156 |
| 60.28 | 0.392 | 0.327 | 0.110 | 0.192 |
| 59.38 | 0.464 | 0.402 | 0.119 | 0.199 |
| 54.72 | 0.574 | 0.527 | 0.121 | 0.200 |
| 53.63 | 0.675 | 0.638 | 0.121 | 0.200 |
| 52.93 | 0.786 | 0.752 | 0.122 | 0.200 |
| 51.40 | 0.894 | 0.862 | 0.122 | 0.200 |
| 50.06 | 1.035 | 0.994 | 0.121 | 0.200 |
| 41.44 | 1.217 | 1.129 | 0.121 | 0.200 |
| 34.03 | 1.362 | 1.160 | 0.121 | 0.196 |
| 21.39 | 1.358 | 1.156 | 0.113 | 0.172 |
| 10.08 | 1.331 | 1.141 | 0.093 | 0.151 |
| 1.08 | 1.316 | 1.130 | 0.078 | 0.135 |

| APPLIED LOAD PER JOIST (kips) | CSJ-4 TEST DATA SHEET INTERMEDIATE SLIPS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | SLIP 3 (in.) | SLIP 4 (in.) | SLIP 5 (in.) | SLIP 6 (in.) | SLIP 7 (in.) | SLIP 8 (in.) | SLIP 9 (in.) | SLIP 10 (in.) |
| 0.00 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.40 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.74 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 |
| 4.46 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 |
| 6.00 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 7.79 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 8.87 | 0.000 | -0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 10.66 | 0.000 | -0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 12.19 | 0.000 | -0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| 14.11 | 0.000 | -0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| 15.96 | 0.000 | -0.001 | -0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| 17.05 | 0.000 | -0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| 18.77 | 0.000 | -0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| 20.43 | 0.000 | -0.001 | -0.001 | 0.000 | 0.000 | 0.001 | 0.000 | -0.001 |
| 22.60 | 0.000 | -0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| 13.53 | 0.000 | -0.001 | -0.001 | 0.000 | 0.000 | 0.001 | 0.000 | -0.001 |
| 8.17 | 0.000 | -0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| 1.72 | 0.000 | -0.001 | -0.001 | 0.000 | 0.000 | 0.001 | 0.000 | -0.001 |
| 8.68 | 0.000 | -0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| 15.51 | 0.000 | -0.001 | -0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| 22.28 | 0.000 | -0.001 | -0.001 | -0.001 | 0.000 | 0.001 | 0.000 | -0.001 |
| 25.54 | 0.000 | -0.001 | -0.001 | -0.001 | 0.000 | 0.001 | 0.000 | 0.000 |
| 27.14 | 0.000 | -0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| 28.93 | 0.000 | -0.001 | -0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| 30.59 | 0.000 | -0.001 | -0.001 | -0.001 | -0.001 | 0.001 | 0.000 | 0.000 |
| 31.61 | 0.000 | -0.001 | -0.001 | -0.001 | 0.000 | 0.002 | 0.000 | 0.000 |
| 32.69 | 0.000 | -0.001 | -0.001 | -0.001 | 0.000 | 0.002 | 0.000 | 0.000 |
| 34.42 | 0.000 | -0.001 | -0.001 | -0.001 | 0.000 | 0.002 | 0.000 | 0.000 |
| 36.33 | 0.000 | -0.001 | -0.001 | -0.001 | 0.000 | 0.002 | 0.000 | 0.000 |
| 38.06 | 0.000 | -0.001 | -0.001 | -0.001 | 0.000 | 0.002 | 0.000 | -0.001 |
| 40.04 | 0.001 | -0.001 | -0.001 | -0.001 | 0.000 | 0.002 | 0.000 | -0.001 |
| 41.31 | 0.001 | -0.001 | -0.001 | -0.001 | 0.000 | 0.002 | 0.000 | 0.000 |
| 42.34 | 0.001 | -0.001 | -0.001 | -0.001 | 0.000 | 0.002 | 0.001 | 0.000 |
| 31.99 | 0.001 | -0.001 | -0.001 | -0.001 | 0.000 | 0.002 | 0.000 | 0.000 |
| 21.52 | 0.001 | -0.001 | -0.001 | -0.001 | 0.000 | 0.002 | 0.000 | 0.000 |
| 10.98 | 0.001 | -0.001 | -0.001 | -0.001 | 0.000 | 0.002 | 0.000 | 0.000 |
| 1.72 | 0.001 | -0.001 | -0.001 | -0.001 | 0.000 | 0.001 | 0.000 | 0.000 |
| 12.45 | 0.001 | -0.001 | -0.001 | -0.001 | -0.001 | 0.002 | 0.000 | 0.000 |
| 22.41 | 0.001 | -0.001 | -0.001 | -0.001 | 0.000 | 0.002 | 0.000 | 0.000 |
| 32.56 | 0.001 | -0.001 | -0.001 | -0.001 | 0.000 | 0.002 | 0.000 | 0.000 |
| 40.61 | 0.001 | -0.001 | -0.001 | -0.001 | 0.000 | 0.002 | 0.001 | -0.001 |
| 44.64 | 0.001 | -0.001 | -0.001 | -0.001 | 0.000 | 0.002 | 0.001 | 0.000 |
| 46.94 | 0.001 | 0.000 | -0.001 | -0.001 | 0.000 | 0.002 | 0.001 | 0.000 |
| 49.87 | 0.001 | 0.000 | -0.001 | 0.000 | 0.000 | 0.002 | 0.001 | 0.000 |
| 51.66 | 0.002 | 0.000 | -0.001 | -0.001 | 0.000 | 0.003 | 0.001 | 0.000 |
| 54.41 | 0.002 | 0.001 | -0.001 | -0.001 | 0.000 | 0.003 | 0.001 | 0.000 |
| 56.64 | 0.004 | 0.001 | -0.001 | -0.001 | 0.000 | 0.003 | 0.001 | 0.000 |
| 56.58 | 0.004 | 0.002 | -0.001 | -0.001 | 0.001 | 0.004 | 0.001 | 0.000 |
| 57.34 | 0.004 | 0.002 | -0.001 | -0.001 | 0.002 | 0.004 | 0.001 | 0.000 |
| 55.87 | 0.010 | 0.005 | 0.001 | -0.001 | 0.050 | 0.004 | 0.001 | 0.001 |
| 53.19 | 0.069 | 0.064 | 0.053 | 0.041 | 0.072 | 0.048 | 0.021 | 0.001 |
| 54.47 | 0.087 | 0.082 | 0.067 | 0.053 | 0.084 | 0.061 | 0.029 | 0.001 |

| APPLIED LOAD PER JOIST (kips) | CSJ-4 TEST DATA SHEET INTERMEDIATE SLIPS (cont.) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | SLIP 3 (in.) | SLIP 4 (in.) | SLIP 5 (in.) | SLIP 6 (in.) | SLIP 7 (in.) | SLIP 8 (in.) | SLIP 9 (in.) | SLIP 10 (in.) |
| 56.45 | 0.117 | 0.111 | 0.093 | 0.075 | 0.113 | 0.083 | 0.045 | 0.001 |
| 57.41 | 0.178 | 0.167 | 0.141 | 0.122 | 0.172 | 0.131 | 0.081 | 0.001 |
| 58.24 | 0.241 | 0.229 | 0.196 | 0.173 | 0.248 | 0.182 | 0.118 | 0.023 |
| 60.28 | 0.318 | 0.306 | 0.266 | 0.243 | 0.300 | 0.251 | 0.164 | 0.053 |
| 59.38 | 0.394 | 0.381 | 0.340 | 0.315 | 0.368 | 0.326 | 0.225 | 0.059 |
| 54.72 | 0.517 | 0.502 | 0.468 | 0.444 | 0.484 | 0.455 | 0.353 | 0.060 |
| 53.63 | 0.628 | 0.607 | 0.578 | 0.558 | 0.584 | 0.569 | 0.466 | 0.060 |
| 52.93 | 0.731 | 0.680 | 0.692 | 0.670 | 0.694 | 0.683 | 0.578 | 0.060 |
| 51.40 | 0.825 | 0.727 | 0.803 | 0.772 | 0.803 | 0.794 | 0.687 | 0.060 |
| 50.06 | 0.928 | 0.761 | 0.933 | 0.905 | 0.946 | 0.926 | 0.818 | 0.060 |
| 41.44 | 1.008 | 0.824 | 1.076 | 1.035 | 1.135 | 1.062 | 0.974 | 0.060 |
| 34.03 | 1.009 | 0.860 | 1.109 | 1.052 | 1.278 | 1.093 | 1.013 | 0.061 |
| 21.39 | 1.009 | 0.860 | 1.109 | 1.053 | 1.278 | 1.094 | 1.014 | 0.058 |
| 10.08 | 1.007 | 0.859 | 1.109 | 1.058 | 1.274 | 1.098 | 1.030 | 0.054 |
| 1.08 | 1.007 | 0.857 | 1.109 | 1.063 | 1.273 | 1.102 | 1.047 | 0.054 |

CSJ-4

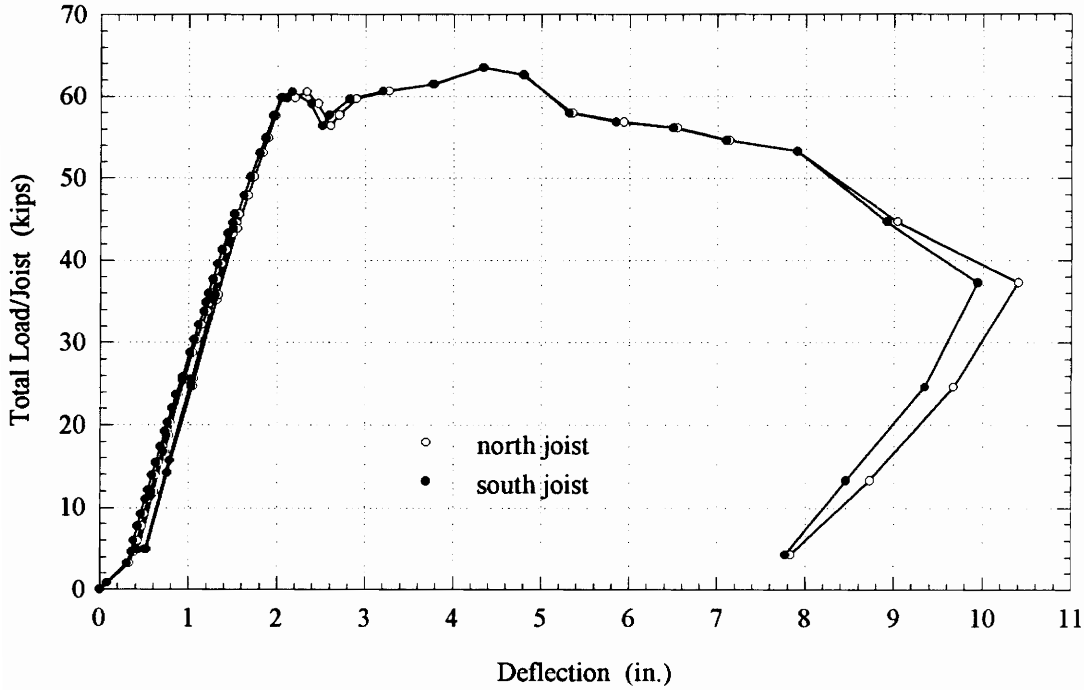



Figure A.4.1 Total Load/Joist vs. Midspan Deflection

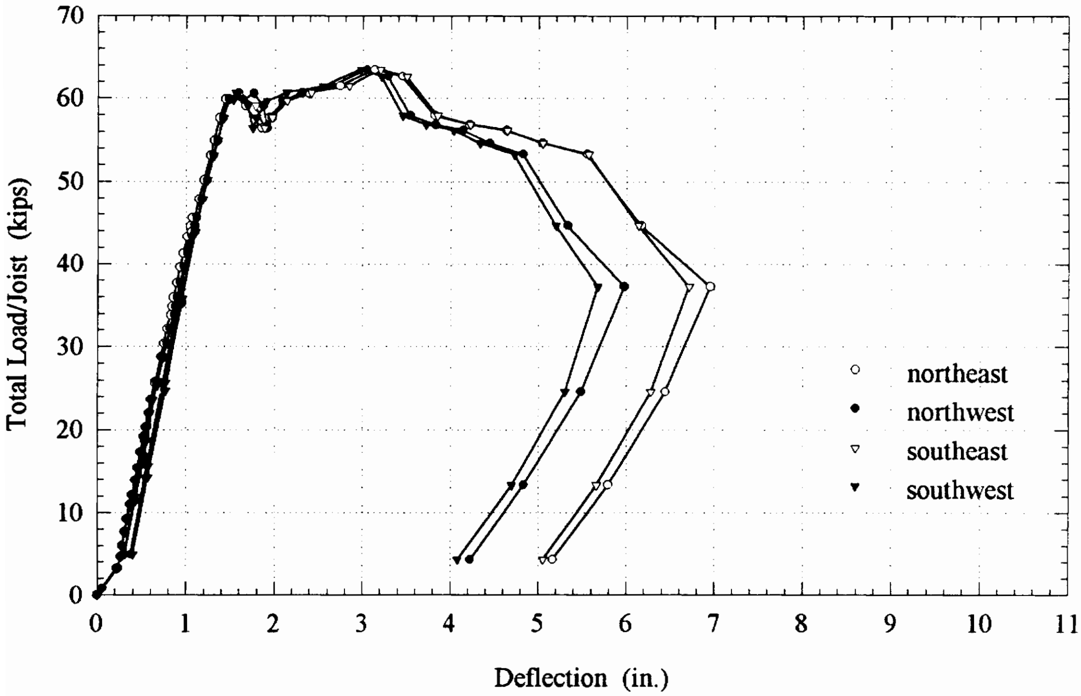



Figure A.4.2 Total Load/Joist vs. Quarter Point Deflection

CSJ-4

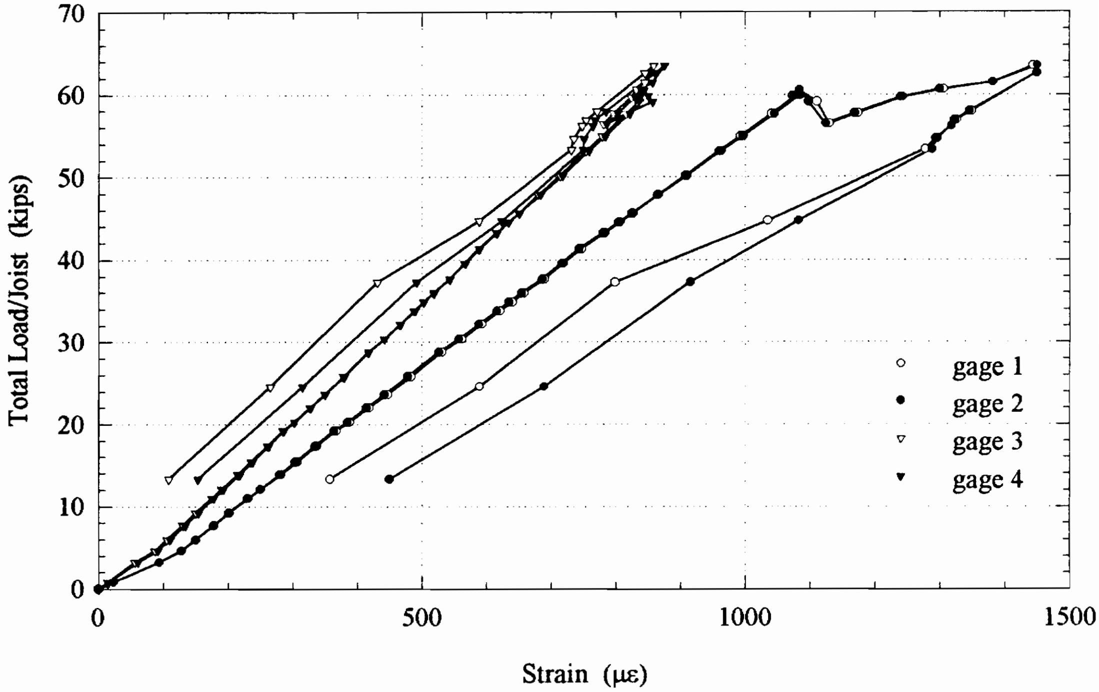



Figure A.4.3 Total Load/Joist vs. Bottom Chord Strain (BC1)

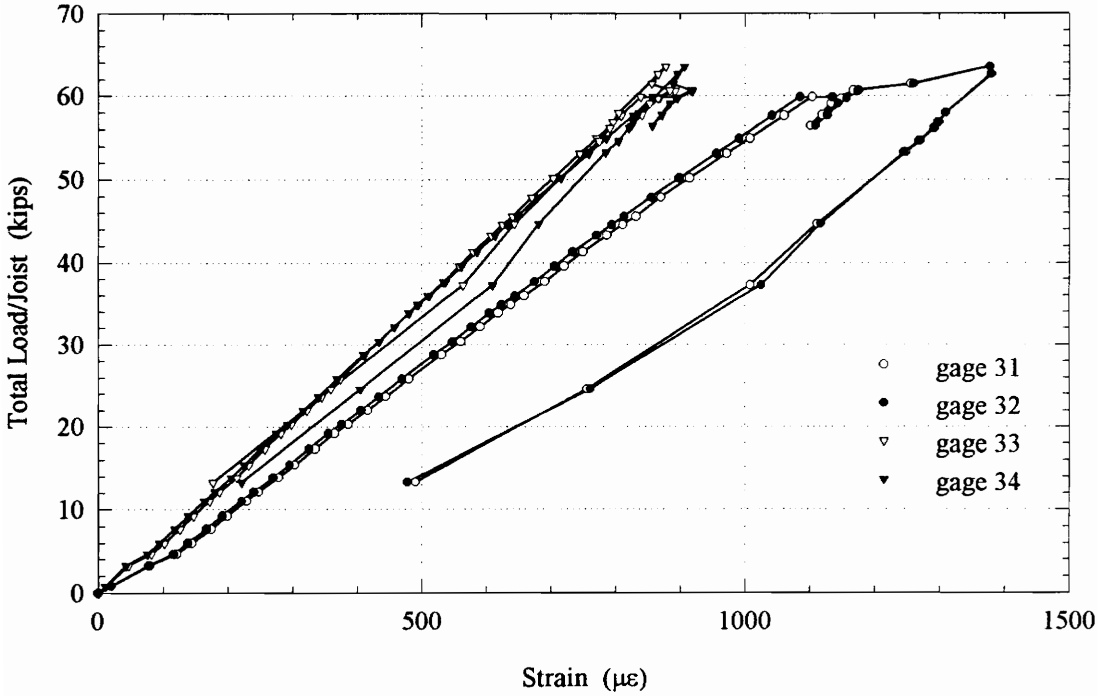



Figure A.4.4 Total Load/Joist vs. Bottom Chord Strain (BC2)

CSJ-4

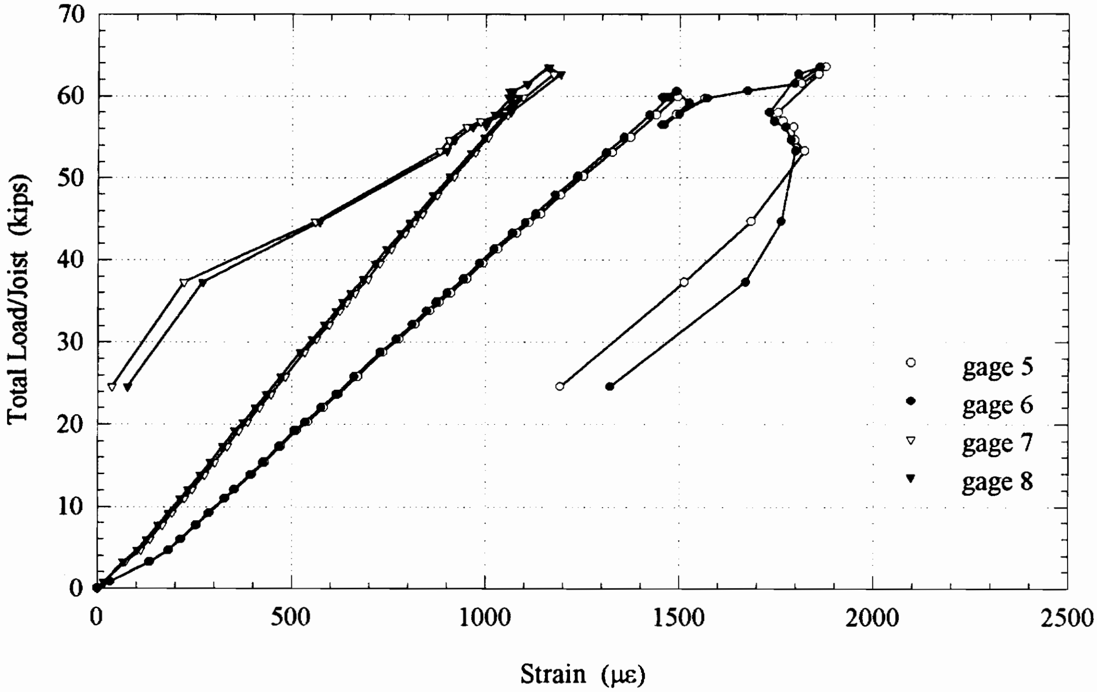



Figure A.4.5 Total Load/Joist vs. Bottom Chord Strain (BC3)

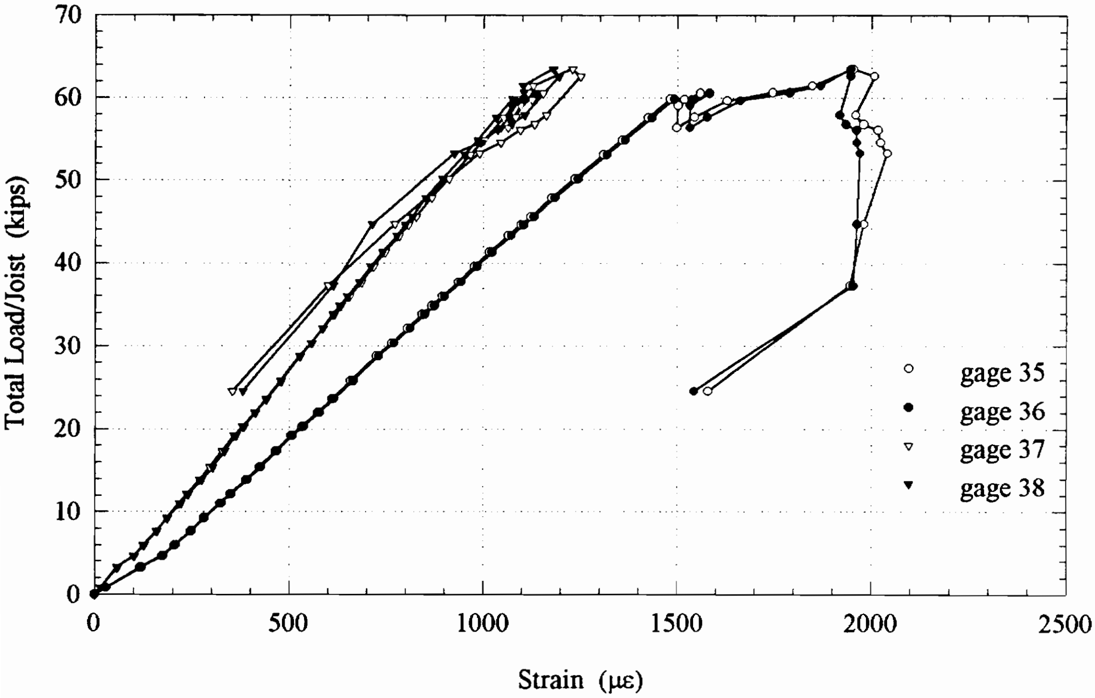



Figure A.4.6 Total Load/Joist vs. Bottom Chord Strain (BC4)

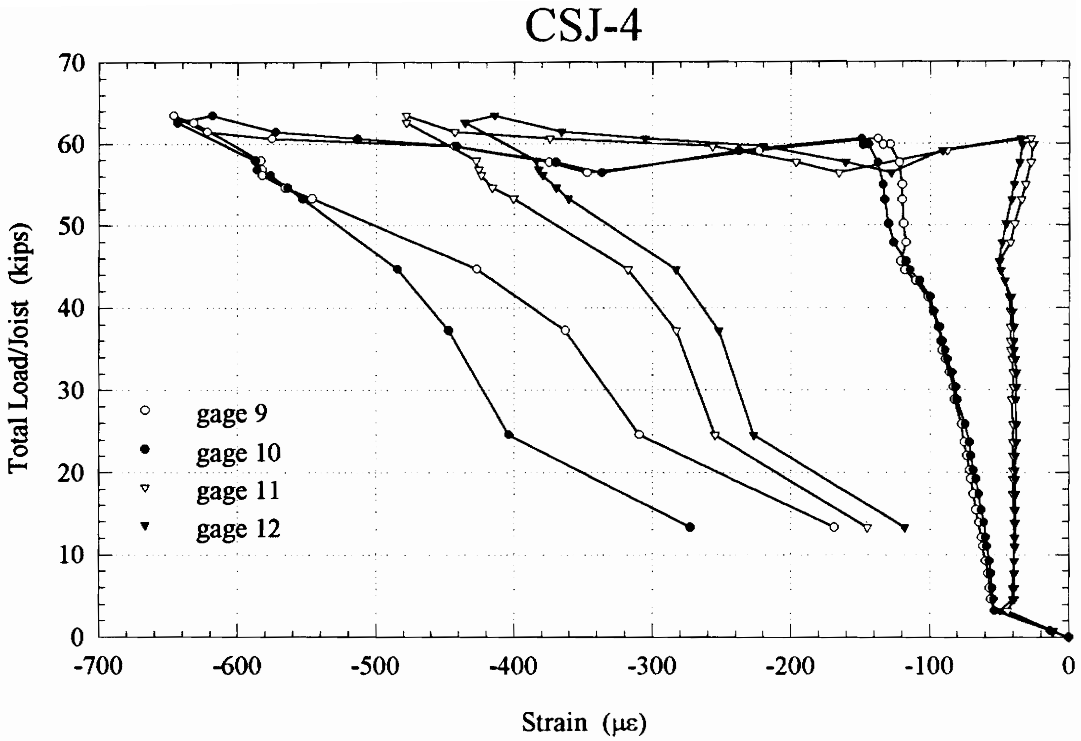



Figure A.4.7 Total Load/Joist vs. Top Chord Strain (TC1)

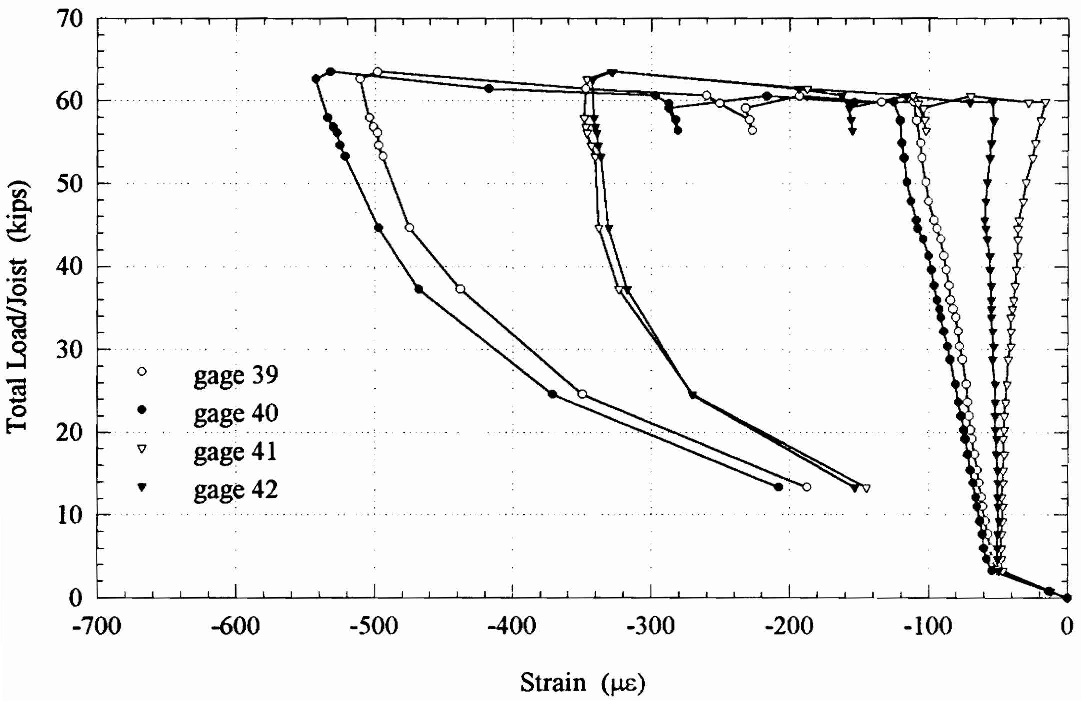



Figure A.4.8 Total Load/Joist vs. Top Chord Strain (TC2)

CSJ-4

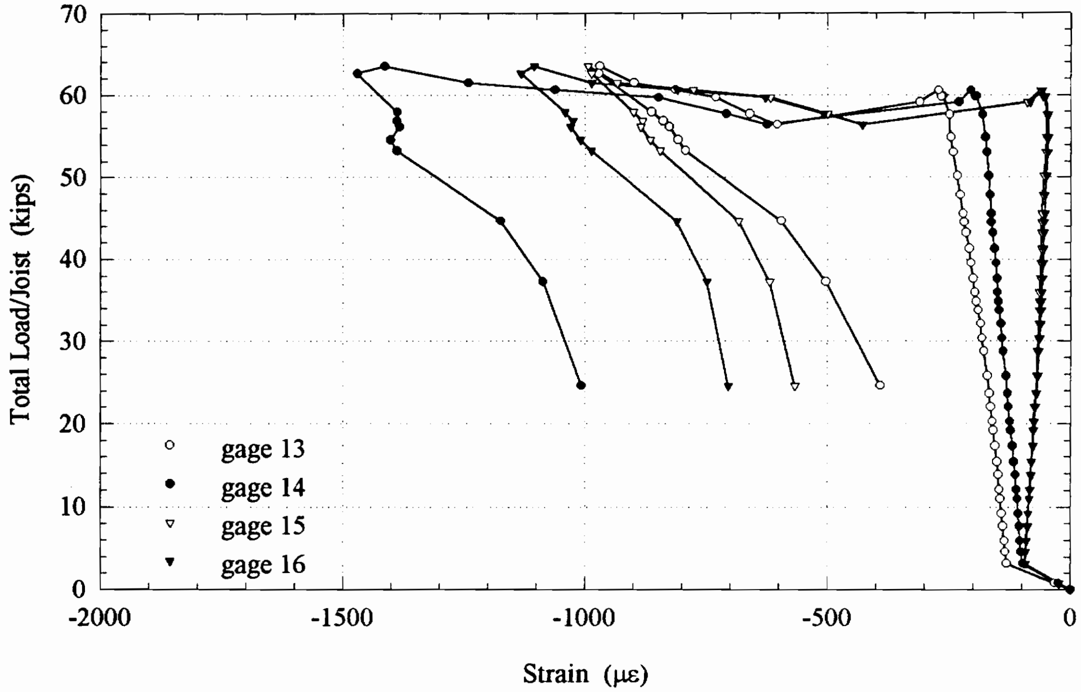



Figure A.4.9 Total Load/Joist vs. Top Chord Strain (TC3)

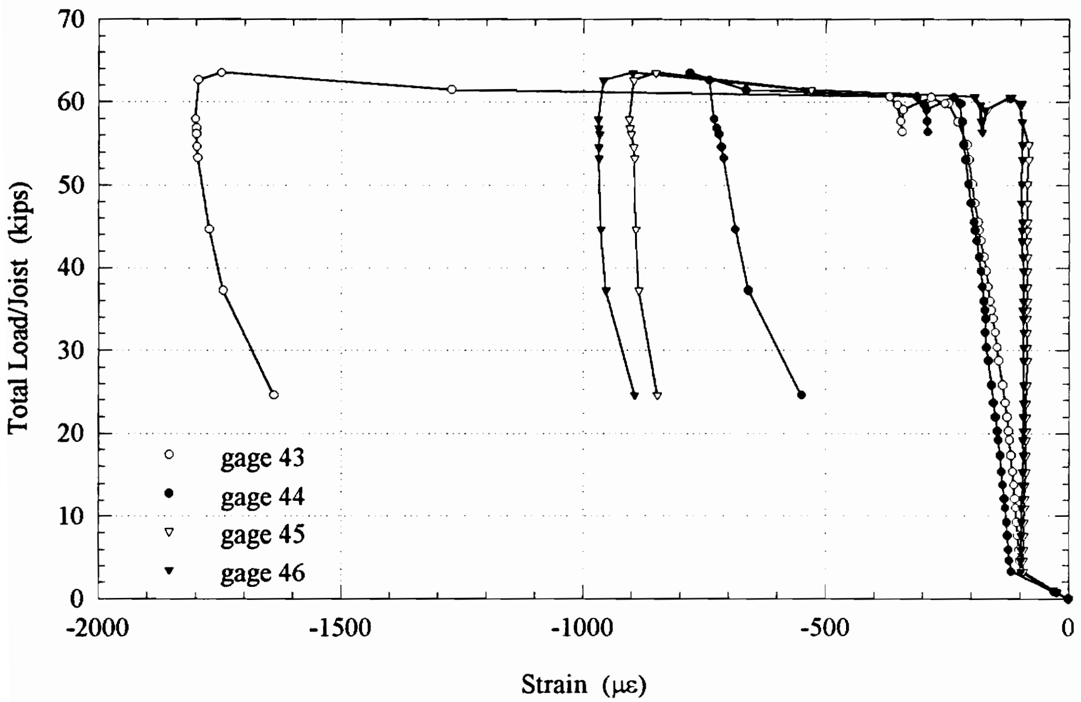



Figure A.4.10 Total Load/Joist vs. Top Chord Strain (TC4)

CSJ-4

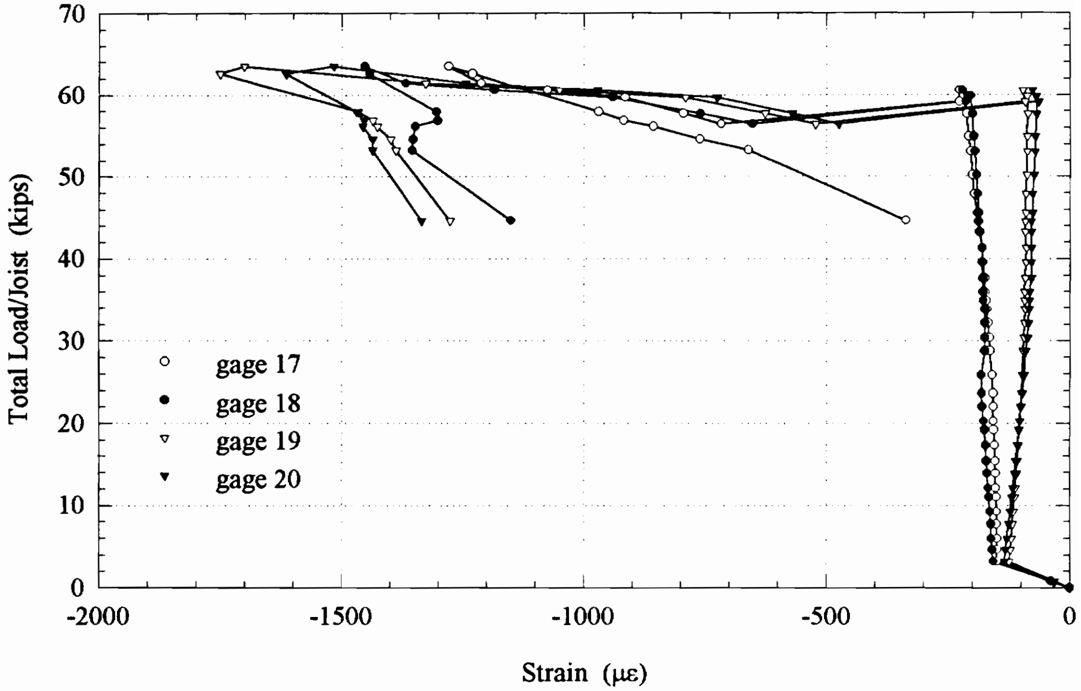



Figure A.4.11 Total Load/Joist vs. Top Chord Strain (TC5)

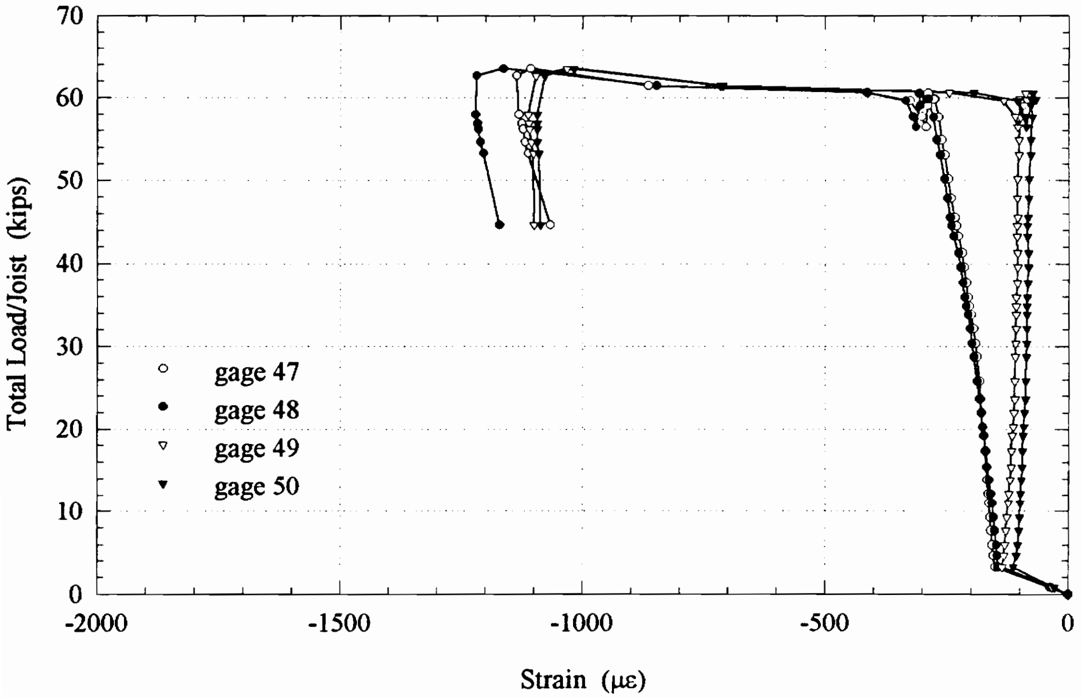



Figure A.4.12 Total Load/Joist vs. Top Chord Strain (TC6)

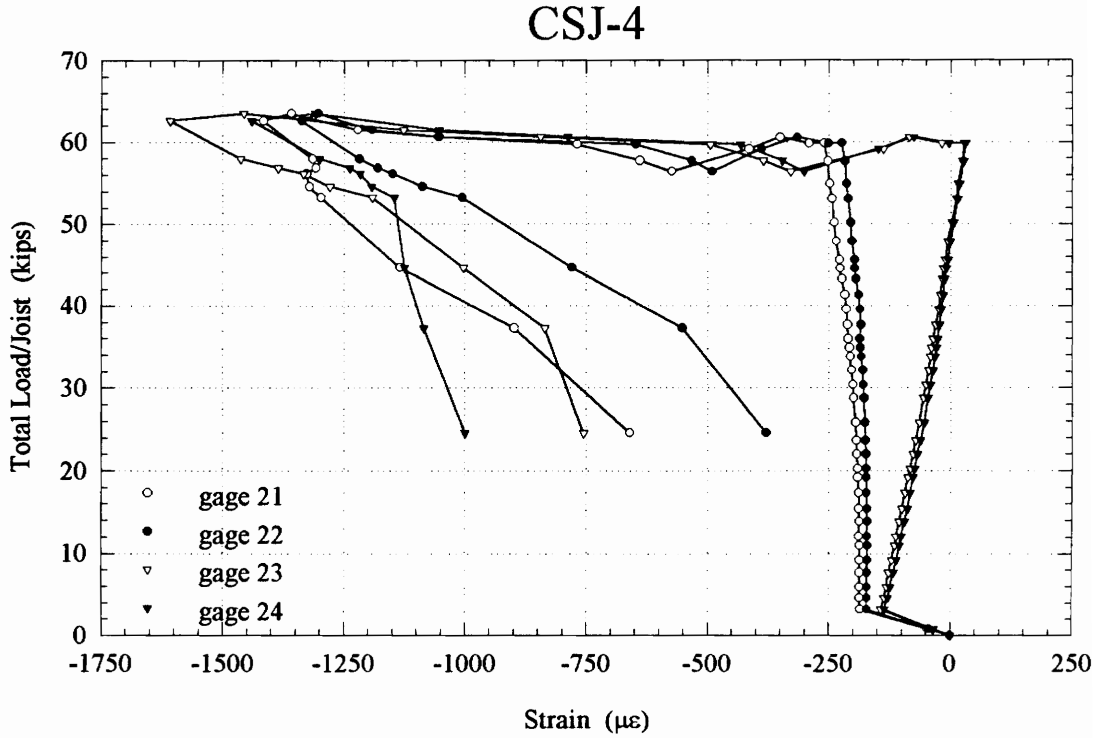



Figure A.4.13 Total Load/Joist vs. Top Chord Strain (TC7)

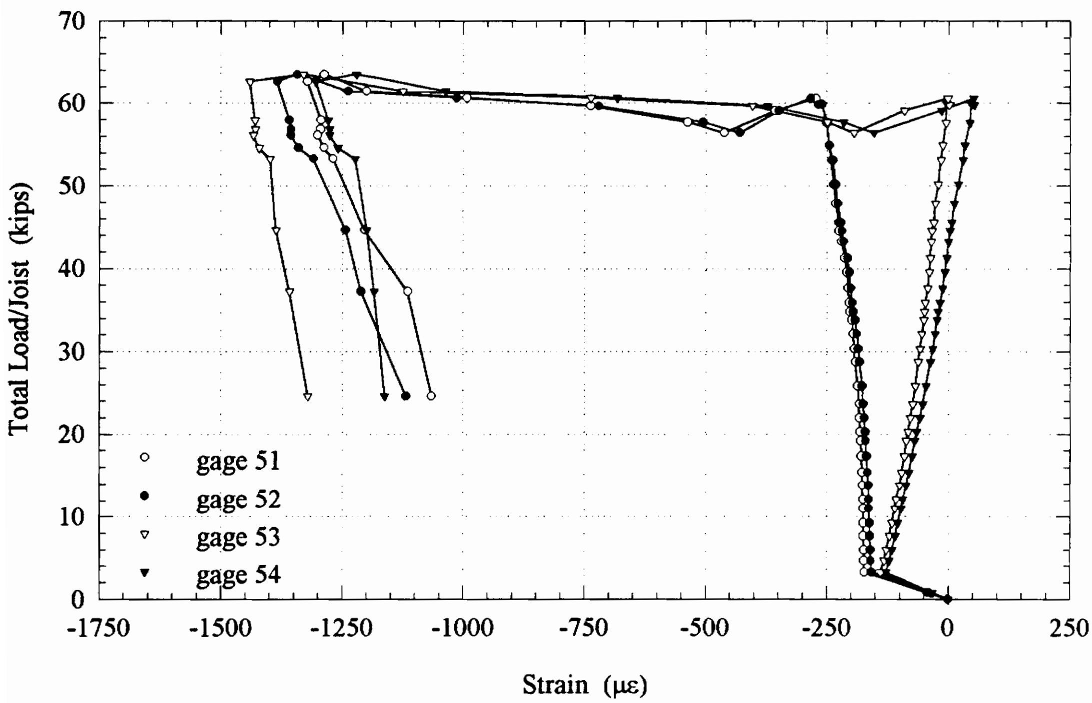



Figure A.4.14 Total Load/Joist vs. Top Chord Strain (TC8)

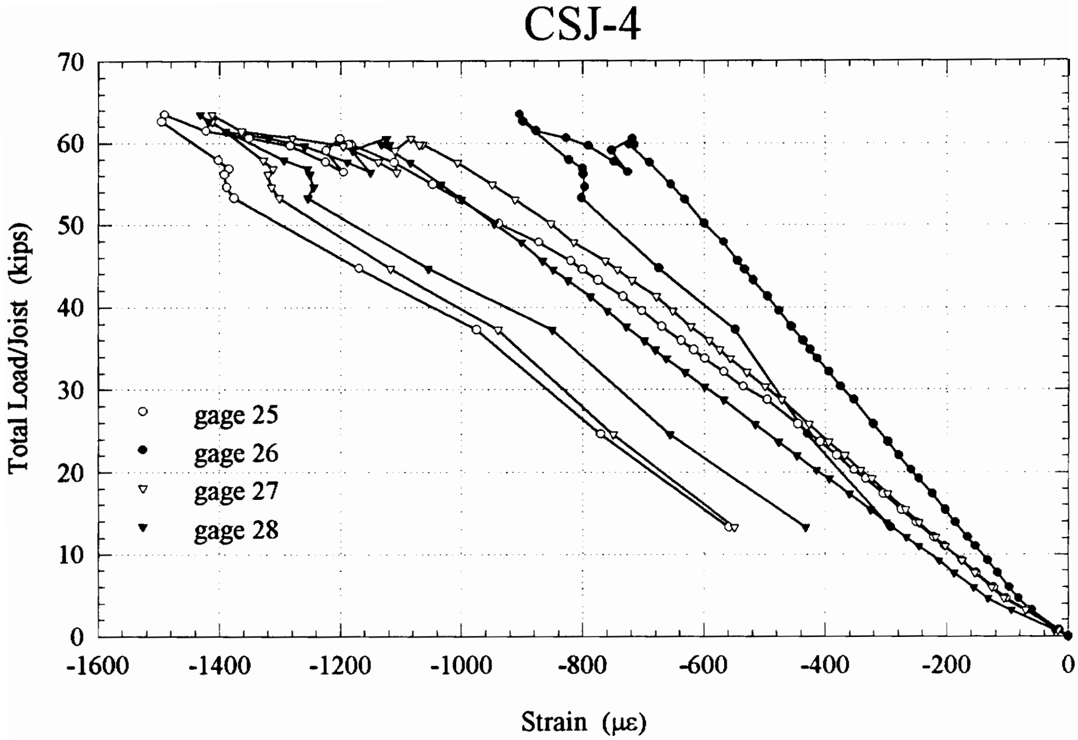



Figure A.4.15 Total Load/Joist vs. Web Strain (W5)

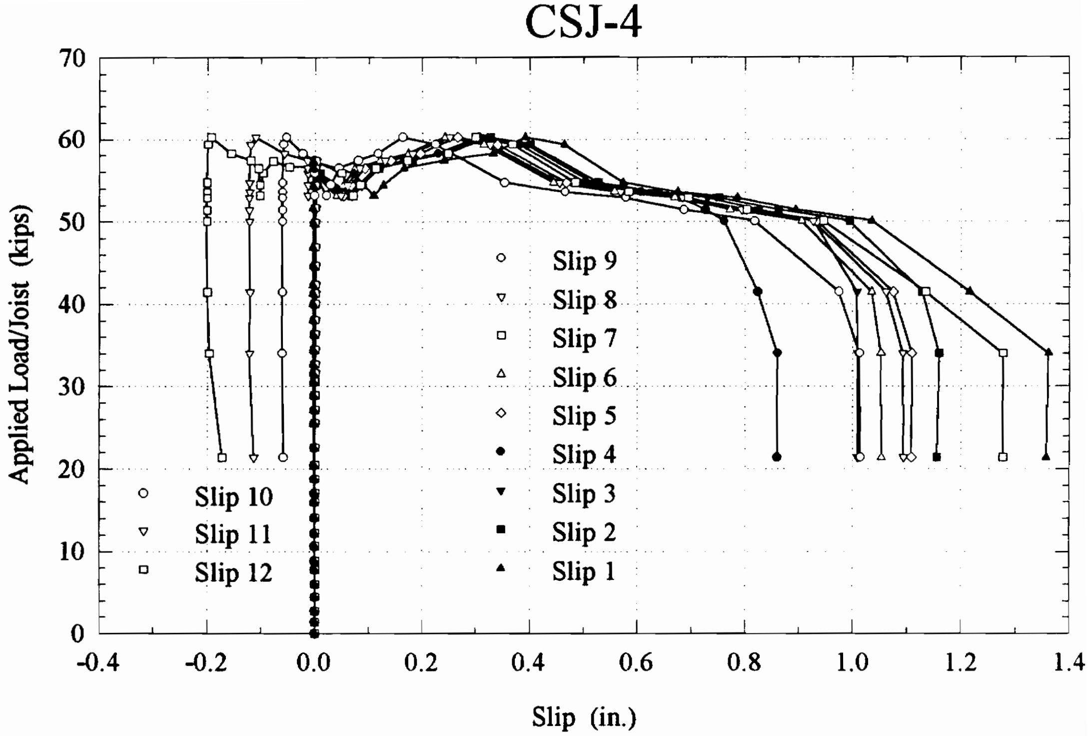



Figure A.4.16 Applied Load/Joist vs. Slip

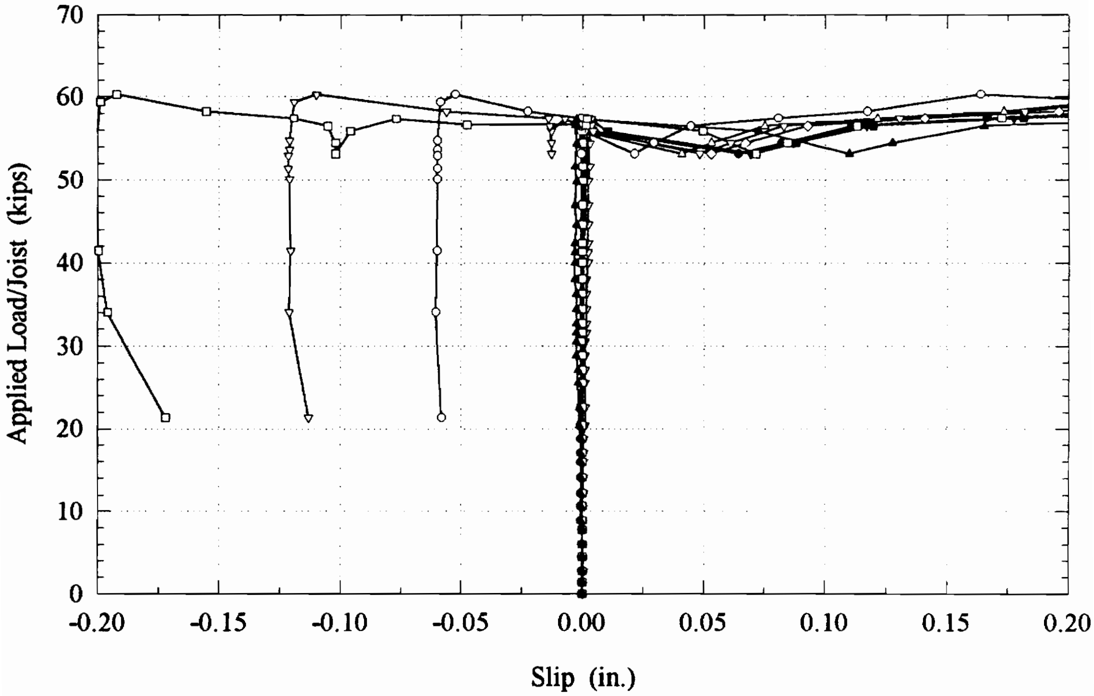



Figure A.4.17 Applied Load/Joist vs. Slip

## NUCOR COMPOSITE JOIST TEST SUMMARY SHEET

TEST DESIGNATION: CSJ-5 TEST DATE: 26 March 1992

### TEST DESCRIPTION

| | | | | |
|---|---|---|---|---|
| **Joist:** | Span: | 30'-0" | Weight: | 14 plf |
| | Depth: | 12 in. | Spacing: | 40 in. |
| | Top Chord: | ST 2x3.85 | Yield Stress: | 36.0 ksi (nominal) |
| | Bottom Chord: | 2L-2.50x2.50x0.212 | Yield Stress: | 53.5 ksi |
| **Deck:** | Type: | 1.5VLI | Gage: | 22 ga |
| **Slab:** | Total Depth: | 3.5 in. | Compressive Strength: | 4400 psi |
| **Shear Connector:** | Type: | 3/4 in. dia. x 3 in. long headed shear stud | | |
| | Quantity: | 6 per half-span | | |

### THEORETICAL CALCULATIONS

Theoretical Applied Load per Joist at Failure: 29.5 kips
Theoretical Total Load per Joist at Failure: 33.1 kips
Transformed Moment of Inertia: 328.8 $in.^4$
Theoretical Elastic Stiffness: 13.03 k/in.
Elastic Deflection at Yield: 2.85 in.

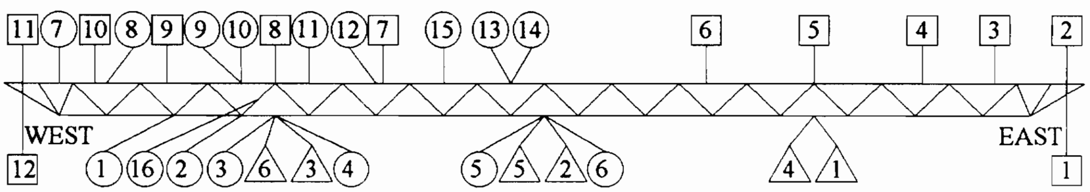
### TEST RESULTS

Applied Load per Joist at Failure: 28.7 kips
Total Load per Joist at Failure: 32.4 kips
Midspan Deflection at Failure: 8.02 in.
Maximum Slip and Location: 1.010 in., SLIP 4
Mode of Failure: yielding of the bottom chord

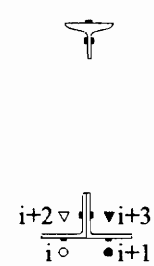
### COMPARISON OF ACTUAL TO THEORETICAL

Applied Load per Joist/Theoretical Applied Load per Joist: 0.97

### INSTRUMENTATION LOCATIONS




| | | | |
|---|---|---|---|
| (1) BC1 (N) | (9) TC3 (N) | △1 NEQB Defl | [1] SLIP 1 (S) |
| (2) BC2 (N) | (10) TC4 (S) | △2 NMB Defl | [2] SLIP 2 (N) |
| (3) BC3 (N) | (11) TC5 (N) | △3 NWQB Defl | [3] SLIP 3 (N) |
| (4) BC4 (S) | (12) TC6 (N) | △4 SEQB Defl | [4] SLIP 4 (N) |
| (5) BC5 (N) | (13) TC7 (N) | △5 SMB Defl | [5] SLIP 5 (N) |
| (6) BC6 (S) | (14) TC8 (S) | △6 SWQB Defl | [6] SLIP 6 (N) |
| (7) TC1 (N) | (15) TC9 (N) | | [7] SLIP 7 (N) |
| (8) TC2 (N) | (16) W9 (N) | | [8] SLIP 8 (N) |
| | | | [9] SLIP 9 (N) |
| | | | [10] SLIP 10 (N) |
| | | | [11] SLIP 11 (N) |
| | | | [12] SLIP 12 (S) |




Strain Gage Locations

| TOTAL LOAD PER JOIST (kips) | CSJ-5 TEST DATA SHEET DEFLECTIONS | | | | | |
|---|---|---|---|---|---|---|
| | NEQB (in.) | NMB (in.) | NWQB (in.) | SEQB (in.) | SMB (in.) | SWQB (in.) |
| 0.00 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 0.60 | 0.103 | 0.144 | 0.104 | 0.109 | 0.153 | 0.110 |
| 3.66 | 0.630 | 0.882 | 0.635 | 0.666 | 0.938 | 0.670 |
| 5.16 | 0.726 | 1.002 | 0.720 | 0.751 | 1.073 | 0.761 |
| 9.37 | 0.923 | 1.307 | 0.922 | 0.955 | 1.366 | 0.962 |
| 13.59 | 1.147 | 1.639 | 1.156 | 1.187 | 1.686 | 1.179 |
| 17.42 | 1.380 | 1.957 | 1.384 | 1.425 | 2.007 | 1.401 |
| 21.18 | 1.605 | 2.280 | 1.619 | 1.666 | 2.341 | 1.636 |
| 13.08 | 1.248 | 1.749 | 1.246 | 1.276 | 1.793 | 1.275 |
| 5.54 | 0.863 | 1.173 | 0.847 | 0.866 | 1.231 | 0.873 |
| 9.56 | 1.051 | 1.477 | 1.045 | 1.084 | 1.533 | 1.083 |
| 13.59 | 1.257 | 1.777 | 1.252 | 1.302 | 1.812 | 1.291 |
| 17.61 | 1.458 | 2.058 | 1.455 | 1.506 | 2.100 | 1.499 |
| 21.89 | 1.683 | 2.372 | 1.682 | 1.737 | 2.434 | 1.720 |
| 25.72 | 1.944 | 2.746 | 1.949 | 2.006 | 2.820 | 1.987 |
| 28.33 | 2.177 | 3.064 | 2.180 | 2.237 | 3.149 | 2.204 |
| 30.38 | 2.424 | 3.424 | 2.428 | 2.517 | 3.516 | 2.463 |
| 31.46 | 2.626 | 3.728 | 2.635 | 2.760 | 3.827 | 2.664 |
| 24.69 | 2.342 | 3.281 | 2.331 | 2.428 | 3.382 | 2.365 |
| 16.97 | 1.944 | 2.704 | 1.940 | 2.017 | 2.801 | 1.966 |
| 11.16 | 1.628 | 2.248 | 1.614 | 1.701 | 2.341 | 1.632 |
| 5.60 | 1.266 | 1.749 | 1.254 | 1.334 | 1.835 | 1.275 |
| 12.18 | 1.605 | 2.261 | 1.613 | 1.719 | 2.360 | 1.655 |
| 17.61 | 1.912 | 2.695 | 1.921 | 2.026 | 2.801 | 1.966 |
| 24.50 | 2.287 | 3.221 | 2.291 | 2.403 | 3.335 | 2.332 |
| 29.99 | 2.589 | 3.664 | 2.600 | 2.726 | 3.772 | 2.638 |
| 31.97 | 2.772 | 3.940 | 2.788 | 2.925 | 4.046 | 2.825 |
| 32.10 | 3.015 | 4.328 | 3.020 | 3.180 | 4.445 | 3.049 |
| 32.03 | 3.285 | 4.780 | 3.279 | 3.464 | 4.896 | 3.301 |
| 32.16 | 3.560 | 5.255 | 3.556 | 3.751 | 5.379 | 3.572 |
| 32.09 | 4.027 | 6.053 | 4.007 | 4.217 | 6.159 | 4.030 |
| 32.16 | 4.297 | 6.491 | 4.254 | 4.483 | 6.586 | 4.282 |
| 31.45 | 4.750 | 7.225 | 4.660 | 4.932 | 7.330 | 4.690 |
| 23.35 | 4.347 | 6.616 | 4.224 | 4.483 | 6.730 | 4.277 |
| 14.99 | 3.844 | 5.887 | 3.727 | 3.964 | 6.020 | 3.782 |
| 5.54 | 3.198 | 4.964 | 3.070 | 3.283 | 5.068 | 3.131 |
| 14.79 | 3.780 | 5.813 | 3.660 | 3.916 | 5.936 | 3.759 |
| 24.17 | 4.375 | 6.671 | 4.245 | 4.538 | 6.795 | 4.324 |
| 15.68 | 3.958 | 6.011 | 3.807 | 4.075 | 6.150 | 3.899 |
| 4.90 | 3.217 | 4.978 | 3.071 | 3.295 | 5.086 | 3.149 |
| 15.44 | 3.803 | 5.841 | 3.686 | 3.944 | 5.959 | 3.794 |
| 25.85 | 4.425 | 6.731 | 4.298 | 4.588 | 6.851 | 4.387 |
| 31.91 | 4.897 | 7.377 | 4.752 | 5.061 | 7.497 | 4.844 |
| 32.36 | 5.300 | 7.953 | 5.060 | 5.435 | 8.091 | 5.164 |
| 32.04 | 5.721 | 8.645 | 5.407 | 5.852 | 8.765 | 5.496 |
| 31.91 | 6.106 | 9.236 | 5.709 | 6.237 | 9.359 | 5.799 |
| 31.34 | 6.490 | 9.780 | 5.987 | 6.632 | 9.921 | 6.079 |
| 30.69 | 6.989 | 10.486 | 6.338 | 7.143 | 10.613 | 6.432 |
| 30.24 | 7.443 | 11.108 | 6.646 | 7.572 | 11.217 | 6.733 |
| 29.60 | 7.974 | 11.796 | 6.987 | 8.070 | 11.877 | 7.065 |
| 29.28 | 8.400 | 12.340 | 7.262 | 8.442 | 12.411 | 7.326 |
| 24.99 | 9.151 | 13.950 | 8.004 | 9.093 | 13.944 | 8.015 |
| 21.17 | 9.343 | 14.494 | 8.283 | 9.267 | 14.640 | 8.300 |
| 20.21 | 9.334 | 14.531 | 8.287 | 9.260 | 14.668 | 8.300 |
| 13.07 | 8.771 | 13.742 | 7.754 | 8.731 | 13.865 | 7.758 |
| 4.97 | 7.869 | 12.418 | 6.805 | 7.841 | 12.541 | 6.798 |

| TOTAL LOAD PER JOIST (kips) | CSJ-5 TEST DATA SHEET TC1 ST 2x3.85 TC1 (13) | TC1 (14) (με) | TC1 (15) | AVG MEM LOAD (kips) | CSJ-5 TEST DATA SHEET TC2 ST 2x3.85 TC2 (16) | TC2 (17) (με) | TC2 (18) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0.0 |
| 0.60 | -12 | -12 | -17 | -0.4 | -26 | -26 | -23 | -0.8 |
| 3.66 | -73 | -72 | -102 | -2.7 | -160 | -158 | -142 | -5.0 |
| 5.16 | -80 | -81 | -113 | -3.0 | -159 | -156 | -135 | -4.9 |
| 9.37 | -102 | -104 | -155 | -3.9 | -167 | -163 | -115 | -4.9 |
| 13.59 | -115 | -117 | -190 | -4.6 | -174 | -170 | -79 | -4.6 |
| 17.42 | -127 | -126 | -210 | -5.1 | -185 | -184 | -45 | -4.5 |
| 21.18 | -136 | -137 | -230 | -5.5 | -203 | -201 | -19 | -4.6 |
| 13.08 | -115 | -117 | -165 | -4.3 | -199 | -198 | -64 | -5.0 |
| 5.54 | -81 | -80 | -108 | -2.9 | -152 | -150 | -111 | -4.5 |
| 9.56 | -102 | -105 | -145 | -3.8 | -170 | -168 | -91 | -4.7 |
| 13.59 | -121 | -123 | -177 | -4.6 | -185 | -183 | -68 | -4.8 |
| 17.61 | -136 | -136 | -205 | -5.2 | -198 | -197 | -46 | -4.8 |
| 21.89 | -146 | -144 | -232 | -5.7 | -209 | -207 | -17 | -4.7 |
| 25.72 | -158 | -155 | -256 | -6.2 | -233 | -233 | 3 | -5.1 |
| 28.33 | -178 | -176 | -278 | -6.9 | -265 | -267 | -3 | -5.8 |
| 30.38 | -197 | -198 | -293 | -7.5 | -310 | -312 | -28 | -7.1 |
| 31.46 | -199 | -205 | -280 | -7.5 | -349 | -351 | -42 | -8.1 |
| 24.69 | -190 | -194 | -224 | -6.6 | -347 | -348 | -80 | -8.5 |
| 16.97 | -174 | -179 | -179 | -5.8 | -329 | -329 | -140 | -8.7 |
| 11.16 | -159 | -163 | -146 | -5.1 | -286 | -284 | -182 | -8.2 |
| 5.60 | -119 | -124 | -74 | -3.5 | -207 | -203 | -199 | -6.6 |
| 12.18 | -161 | -165 | -160 | -5.3 | -259 | -257 | -185 | -7.7 |
| 17.61 | -178 | -183 | -195 | -6.1 | -294 | -292 | -146 | -8.0 |
| 24.50 | -194 | -199 | -239 | -6.9 | -319 | -320 | -100 | -8.1 |
| 29.99 | -205 | -212 | -266 | -7.5 | -345 | -347 | -57 | -8.2 |
| 31.97 | -205 | -214 | -266 | -7.5 | -371 | -372 | -58 | -8.8 |
| 32.10 | -201 | -212 | -261 | -7.4 | -393 | -396 | -74 | -9.4 |
| 32.03 | -196 | -210 | -257 | -7.3 | -402 | -404 | -72 | -9.6 |
| 32.16 | -187 | -201 | -248 | -6.9 | -405 | -406 | -63 | -9.5 |
| 32.09 | -172 | -189 | -234 | -6.5 | -408 | -408 | -45 | -9.4 |
| 32.16 | -167 | -185 | -229 | -6.3 | -413 | -414 | -43 | -9.5 |
| 31.45 | -161 | -179 | -224 | -6.2 | -415 | -416 | -39 | -9.5 |
| 23.35 | -153 | -171 | -166 | -5.4 | -399 | -400 | -99 | -9.8 |
| 14.99 | -154 | -169 | -132 | -5.0 | -352 | -350 | -180 | -9.6 |
| 5.54 | -122 | -132 | -39 | -3.2 | -213 | -207 | -221 | -7.0 |
| 14.79 | -161 | -173 | -155 | -5.3 | -316 | -313 | -204 | -9.1 |
| 24.17 | -168 | -185 | -207 | -6.1 | -369 | -368 | -115 | -9.3 |
| 15.68 | -160 | -174 | -140 | -5.2 | -350 | -348 | -174 | -9.5 |
| 4.90 | -121 | -129 | -32 | -3.1 | -202 | -197 | -221 | -6.8 |
| 15.44 | -163 | -176 | -153 | -5.4 | -313 | -308 | -204 | -9.0 |
| 25.85 | -171 | -187 | -205 | -6.2 | -370 | -370 | -112 | -9.3 |
| 31.91 | -166 | -186 | -218 | -6.2 | -416 | -417 | -51 | -9.7 |
| 32.36 | -157 | -176 | -210 | -5.9 | -422 | -423 | -45 | -9.7 |
| 32.04 | -149 | -169 | -201 | -5.7 | -422 | -423 | -43 | -9.7 |
| 31.91 | -143 | -164 | -197 | -5.5 | -421 | -422 | -39 | -9.6 |
| 31.34 | -140 | -160 | -191 | -5.4 | -419 | -421 | -39 | -9.6 |
| 30.69 | -137 | -157 | -190 | -5.3 | -418 | -420 | -39 | -9.6 |
| 30.24 | -135 | -155 | -187 | -5.2 | -417 | -419 | -39 | -9.6 |
| 29.60 | -134 | -154 | -182 | -5.1 | -416 | -418 | -44 | -9.6 |
| 29.28 | -133 | -153 | -177 | -5.1 | -415 | -416 | -45 | -9.6 |
| 24.99 | -127 | -146 | -140 | -4.5 | -404 | -403 | -92 | -9.8 |
| 21.17 | -126 | -143 | -125 | -4.3 | -389 | -386 | -136 | -10.0 |
| 20.21 | -127 | -143 | -122 | -4.3 | -383 | -380 | -146 | -9.9 |
| 13.07 | -129 | -143 | -91 | -4.0 | -328 | -325 | -216 | -9.5 |
| 4.97 | -116 | -126 | -41 | -3.1 | -216 | -209 | -239 | -7.3 |

| TOTAL LOAD PER JOIST (kips) | CSJ-5 TEST DATA SHEET TC3 ST 2x3.85 TC3 (19) | TC3 (20) (με) | TC3 (21) | AVG MEM LOAD (kips) | CSJ-5 TEST DATA SHEET TC4 ST 2x3.85 TC4 (59) | TC4 (60) (με) | TC4 (61) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0.0 |
| 0.60 | -42 | -41 | -49 | -1.4 | -45 | -37 | -49 | -1.4 |
| 3.66 | -259 | -253 | -297 | -8.8 | -277 | -226 | -298 | -8.8 |
| 5.16 | -246 | -240 | -298 | -8.6 | -268 | -217 | -297 | -8.5 |
| 9.37 | -218 | -214 | -297 | -8.0 | -244 | -194 | -302 | -8.1 |
| 13.59 | -197 | -197 | -315 | -7.7 | -234 | -183 | -327 | -8.1 |
| 17.42 | -191 | -193 | -348 | -8.0 | -228 | -177 | -358 | -8.3 |
| 21.18 | -188 | -192 | -384 | -8.3 | -225 | -173 | -388 | -8.6 |
| 13.08 | -237 | -235 | -389 | -9.4 | -268 | -215 | -392 | -9.6 |
| 5.54 | -248 | -242 | -323 | -8.9 | -262 | -211 | -320 | -8.7 |
| 9.56 | -239 | -236 | -350 | -9.0 | -263 | -211 | -351 | -9.0 |
| 13.59 | -224 | -223 | -365 | -8.9 | -253 | -201 | -367 | -9.0 |
| 17.61 | -207 | -208 | -376 | -8.6 | -240 | -188 | -378 | -8.8 |
| 21.89 | -192 | -196 | -394 | -8.5 | -229 | -177 | -396 | -8.8 |
| 25.72 | -202 | -208 | -448 | -9.4 | -237 | -182 | -444 | -9.4 |
| 28.33 | -229 | -238 | -518 | -10.8 | -273 | -213 | -508 | -10.9 |
| 30.38 | -279 | -292 | -613 | -12.9 | -325 | -257 | -588 | -12.8 |
| 31.46 | -342 | -356 | -713 | -15.4 | -364 | -291 | -643 | -14.2 |
| 24.69 | -386 | -393 | -726 | -16.4 | -403 | -326 | -655 | -15.1 |
| 16.97 | -406 | -405 | -687 | -16.4 | -421 | -345 | -628 | -15.2 |
| 11.16 | -403 | -398 | -614 | -15.4 | -412 | -338 | -561 | -14.3 |
| 5.60 | -391 | -383 | -507 | -14.0 | -378 | -309 | -445 | -12.4 |
| 12.18 | -386 | -383 | -573 | -14.7 | -400 | -325 | -526 | -13.7 |
| 17.61 | -382 | -384 | -621 | -15.2 | -396 | -320 | -567 | -14.0 |
| 24.50 | -367 | -373 | -663 | -15.3 | -384 | -307 | -602 | -14.1 |
| 29.99 | -363 | -373 | -709 | -15.8 | -378 | -300 | -637 | -14.4 |
| 31.97 | -398 | -409 | -784 | -17.4 | -402 | -320 | -684 | -15.3 |
| 32.10 | -423 | -432 | -825 | -18.3 | -423 | -338 | -708 | -16.0 |
| 32.03 | -447 | -452 | -869 | -19.3 | -444 | -355 | -730 | -16.7 |
| 32.16 | -463 | -467 | -895 | -19.9 | -464 | -372 | -755 | -17.4 |
| 32.09 | -477 | -479 | -919 | -20.5 | -509 | -411 | -800 | -18.8 |
| 32.16 | -487 | -488 | -939 | -20.9 | -563 | -458 | -855 | -20.5 |
| 31.45 | -486 | -485 | -940 | -20.9 | -589 | -479 | -873 | -21.2 |
| 23.35 | -525 | -517 | -918 | -21.4 | -608 | -501 | -848 | -21.4 |
| 14.99 | -525 | -513 | -809 | -20.2 | -594 | -488 | -744 | -19.9 |
| 5.54 | -485 | -471 | -585 | -16.8 | -517 | -421 | -517 | -15.9 |
| 14.79 | -494 | -486 | -729 | -18.7 | -568 | -461 | -681 | -18.7 |
| 24.17 | -494 | -492 | -836 | -19.9 | -576 | -463 | -773 | -19.8 |
| 15.68 | -532 | -523 | -813 | -20.4 | -603 | -490 | -751 | -20.1 |
| 4.90 | -485 | -472 | -571 | -16.7 | -522 | -421 | -505 | -15.8 |
| 15.44 | -503 | -496 | -722 | -18.8 | -578 | -468 | -678 | -18.8 |
| 25.85 | -506 | -505 | -840 | -20.2 | -589 | -472 | -778 | -20.1 |
| 31.91 | -530 | -530 | -947 | -21.9 | -632 | -506 | -888 | -22.1 |
| 32.36 | -544 | -544 | -974 | -22.5 | -657 | -529 | -917 | -23.0 |
| 32.04 | -548 | -546 | -977 | -22.6 | -664 | -535 | -922 | -23.2 |
| 31.91 | -551 | -549 | -982 | -22.7 | -666 | -536 | -925 | -23.2 |
| 31.34 | -555 | -553 | -985 | -22.9 | -670 | -540 | -926 | -23.3 |
| 30.69 | -555 | -554 | -983 | -22.8 | -672 | -542 | -925 | -23.4 |
| 30.24 | -558 | -556 | -984 | -22.9 | -672 | -542 | -925 | -23.4 |
| 29.60 | -561 | -559 | -982 | -23.0 | -672 | -540 | -922 | -23.3 |
| 29.28 | -562 | -560 | -982 | -23.0 | -672 | -540 | -922 | -23.3 |
| 24.99 | -591 | -583 | -970 | -23.4 | -678 | -548 | -909 | -23.3 |
| 21.17 | -603 | -593 | -931 | -23.2 | -675 | -548 | -878 | -23.0 |
| 20.21 | -602 | -593 | -917 | -23.1 | -673 | -545 | -864 | -22.7 |
| 13.07 | -603 | -591 | -803 | -21.8 | -651 | -528 | -748 | -21.1 |
| 4.97 | -551 | -534 | -610 | -18.5 | -595 | -480 | -547 | -17.7 |

| TOTAL LOAD PER JOIST (kips) | CSJ-5 TEST DATA SHEET TC5 ST 2x3.85 TC5 (22) | TC5 (23) (με) | TC5 (24) | AVG MEM LOAD (kips) | CSJ-5 TEST DATA SHEET TC6 ST 2x3.85 TC6 (25) | TC6 (26) (με) | TC6 (27) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0.0 |
| 0.60 | -49 | -49 | -55 | -1.7 | -54 | -53 | -65 | -1.9 |
| 3.66 | -301 | -302 | -334 | -10.2 | -328 | -325 | -398 | -11.5 |
| 5.16 | -294 | -295 | -334 | -10.1 | -319 | -315 | -398 | -11.3 |
| 9.37 | -277 | -278 | -335 | -9.7 | -293 | -289 | -401 | -10.7 |
| 13.59 | -269 | -269 | -342 | -9.6 | -275 | -271 | -424 | -10.6 |
| 17.42 | -273 | -273 | -362 | -9.9 | -272 | -268 | -465 | -11.0 |
| 21.18 | -285 | -282 | -387 | -10.4 | -272 | -268 | -522 | -11.6 |
| 13.08 | -310 | -310 | -375 | -10.9 | -314 | -311 | -515 | -12.5 |
| 5.54 | -307 | -309 | -344 | -10.5 | -333 | -330 | -451 | -12.2 |
| 9.56 | -306 | -307 | -357 | -10.6 | -316 | -313 | -471 | -12.0 |
| 13.59 | -301 | -301 | -367 | -10.6 | -300 | -297 | -492 | -11.9 |
| 17.61 | -294 | -293 | -377 | -10.5 | -284 | -280 | -510 | -11.7 |
| 21.89 | -291 | -290 | -393 | -10.6 | -270 | -267 | -536 | -11.7 |
| 25.72 | -313 | -311 | -429 | -11.5 | -277 | -275 | -605 | -12.6 |
| 28.33 | -352 | -348 | -478 | -12.9 | -293 | -290 | -677 | -13.8 |
| 30.38 | -419 | -415 | -552 | -15.1 | -329 | -326 | -778 | -15.7 |
| 31.46 | -497 | -494 | -629 | -17.7 | -374 | -371 | -881 | -17.8 |
| 24.69 | -525 | -524 | -622 | -18.2 | -423 | -418 | -884 | -18.8 |
| 16.97 | -528 | -529 | -584 | -17.9 | -458 | -453 | -854 | -19.3 |
| 11.16 | -512 | -514 | -548 | -17.2 | -465 | -462 | -785 | -18.7 |
| 5.60 | -470 | -472 | -491 | -15.6 | -452 | -448 | -658 | -17.0 |
| 12.18 | -486 | -488 | -531 | -16.4 | -433 | -430 | -726 | -17.4 |
| 17.61 | -498 | -499 | -562 | -17.0 | -420 | -416 | -781 | -17.7 |
| 24.50 | -502 | -502 | -595 | -17.5 | -399 | -396 | -834 | -17.8 |
| 29.99 | -512 | -511 | -631 | -18.1 | -386 | -382 | -883 | -18.0 |
| 31.97 | -560 | -558 | -689 | -19.7 | -411 | -408 | -959 | -19.4 |
| 32.10 | -597 | -594 | -726 | -20.9 | -422 | -418 | -1020 | -20.3 |
| 32.03 | -629 | -626 | -754 | -21.9 | -428 | -425 | -1060 | -20.9 |
| 32.16 | -648 | -644 | -766 | -22.5 | -418 | -414 | -1090 | -21.0 |
| 32.09 | -674 | -667 | -774 | -23.1 | -422 | -418 | -1143 | -21.7 |
| 32.16 | -693 | -685 | -795 | -23.7 | -434 | -431 | -1188 | -22.4 |
| 31.45 | -702 | -694 | -805 | -24.0 | -455 | -450 | -1218 | -23.2 |
| 23.35 | -714 | -711 | -767 | -23.9 | -500 | -496 | -1193 | -23.9 |
| 14.99 | -685 | -683 | -699 | -22.6 | -506 | -505 | -1091 | -23.0 |
| 5.54 | -579 | -578 | -570 | -18.9 | -451 | -449 | -843 | -19.0 |
| 14.79 | -641 | -641 | -664 | -21.3 | -454 | -451 | -985 | -20.6 |
| 24.17 | -679 | -675 | -742 | -22.9 | -448 | -444 | -1108 | -21.8 |
| 15.68 | -693 | -692 | -701 | -22.8 | -500 | -498 | -1099 | -22.9 |
| 4.90 | -579 | -579 | -561 | -18.8 | -449 | -447 | -834 | -18.9 |
| 15.44 | -648 | -647 | -661 | -21.4 | -456 | -452 | -986 | -20.7 |
| 25.85 | -688 | -684 | -744 | -23.1 | -451 | -447 | -1116 | -22.0 |
| 31.91 | -740 | -735 | -814 | -25.0 | -484 | -481 | -1248 | -24.2 |
| 32.36 | -764 | -758 | -833 | -25.7 | -519 | -515 | -1277 | -25.2 |
| 32.04 | -768 | -764 | -835 | -25.9 | -529 | -526 | -1275 | -25.5 |
| 31.91 | -773 | -770 | -838 | -26.0 | -543 | -540 | -1281 | -25.8 |
| 31.34 | -780 | -777 | -842 | -26.2 | -559 | -554 | -1282 | -26.2 |
| 30.69 | -782 | -779 | -842 | -26.3 | -568 | -565 | -1281 | -26.4 |
| 30.24 | -785 | -782 | -844 | -26.3 | -578 | -575 | -1281 | -26.6 |
| 29.60 | -789 | -786 | -845 | -26.4 | -594 | -590 | -1279 | -26.9 |
| 29.28 | -791 | -789 | -845 | -26.5 | -604 | -600 | -1279 | -27.1 |
| 24.99 | -798 | -796 | -835 | -26.5 | -658 | -655 | -1267 | -28.2 |
| 21.17 | -800 | -799 | -823 | -26.4 | -706 | -708 | -1230 | -28.9 |
| 20.21 | -796 | -796 | -815 | -26.3 | -707 | -708 | -1212 | -28.7 |
| 13.07 | -765 | -766 | -765 | -25.1 | -700 | -702 | -1076 | -27.1 |
| 4.97 | -654 | -656 | -626 | -21.1 | -639 | -639 | -833 | -23.1 |

| TOTAL LOAD PER JOIST (kips) | CSJ-5 TEST DATA SHEET TC7 ST 2x3.85 TC7 (31) | TC7 (32) ($\mu\varepsilon$) | TC7 (33) | AVG MEM LOAD (kips) | CSJ-5 TEST DATA SHEET TC8 ST 2x3.85 TC8 (71) | TC8 (72) ($\mu\varepsilon$) | TC8 (73) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0.0 |
| 0.60 | -60 | -62 | -68 | -2.1 | -64 | -61 | -71 | -2.1 |
| 3.66 | -364 | -376 | -417 | -12.6 | -392 | -370 | -434 | -13.1 |
| 5.16 | -353 | -363 | -413 | -12.3 | -378 | -355 | -429 | -12.7 |
| 9.37 | -318 | -328 | -401 | -11.4 | -340 | -315 | -417 | -11.7 |
| 13.59 | -286 | -296 | -394 | -10.7 | -301 | -275 | -408 | -10.7 |
| 17.42 | -265 | -275 | -396 | -10.2 | -276 | -249 | -409 | -10.2 |
| 21.18 | -242 | -252 | -398 | -9.7 | -249 | -222 | -408 | -9.6 |
| 13.08 | -310 | -322 | -424 | -11.5 | -330 | -305 | -439 | -11.7 |
| 5.54 | -356 | -367 | -426 | -12.6 | -384 | -361 | -447 | -13.0 |
| 9.56 | -327 | -338 | -421 | -11.9 | -350 | -326 | -438 | -12.2 |
| 13.59 | -300 | -311 | -417 | -11.2 | -319 | -294 | -431 | -11.4 |
| 17.61 | -274 | -286 | -413 | -10.6 | -288 | -262 | -424 | -10.7 |
| 21.89 | -246 | -257 | -408 | -9.9 | -253 | -226 | -417 | -9.8 |
| 25.72 | -226 | -235 | -414 | -9.6 | -229 | -201 | -420 | -9.3 |
| 28.33 | -219 | -228 | -430 | -9.6 | -220 | -191 | -431 | -9.2 |
| 30.38 | -217 | -228 | -458 | -9.9 | -227 | -197 | -457 | -9.6 |
| 31.46 | -211 | -221 | -486 | -10.0 | -233 | -201 | -480 | -10.0 |
| 24.69 | -269 | -281 | -506 | -11.5 | -304 | -274 | -505 | -11.8 |
| 16.97 | -327 | -338 | -515 | -12.9 | -371 | -343 | -521 | -13.5 |
| 11.16 | -361 | -373 | -510 | -13.6 | -415 | -386 | -521 | -14.4 |
| 5.60 | -375 | -388 | -484 | -13.6 | -432 | -404 | -501 | -14.6 |
| 12.18 | -331 | -344 | -486 | -12.7 | -382 | -351 | -498 | -13.4 |
| 17.61 | -299 | -313 | -489 | -12.0 | -344 | -312 | -497 | -12.6 |
| 24.50 | -259 | -271 | -490 | -11.1 | -295 | -261 | -492 | -11.4 |
| 29.99 | -227 | -239 | -490 | -10.4 | -255 | -221 | -489 | -10.5 |
| 31.97 | -212 | -225 | -504 | -10.3 | -243 | -206 | -493 | -10.3 |
| 32.10 | -142 | -154 | -495 | -8.6 | -197 | -160 | -488 | -9.2 |
| 32.03 | -64 | -76 | -475 | -6.7 | -160 | -119 | -495 | -8.5 |
| 32.16 | 26 | 14 | -448 | -4.5 | -83 | -38 | -476 | -6.5 |
| 32.09 | 148 | 133 | -453 | -1.9 | 1 | 49 | -478 | -4.7 |
| 32.16 | 196 | 179 | -461 | -0.9 | 13 | 62 | -510 | -4.8 |
| 31.45 | 227 | 209 | -492 | -0.6 | -5 | 49 | -569 | -5.7 |
| 23.35 | 144 | 127 | -511 | -2.6 | -104 | -54 | -592 | -8.2 |
| 14.99 | 56 | 38 | -503 | -4.5 | -193 | -150 | -594 | -10.2 |
| 5.54 | 10 | -8 | -468 | -5.1 | -231 | -194 | -552 | -10.7 |
| 14.79 | 86 | 69 | -468 | -3.4 | -145 | -102 | -564 | -8.9 |
| 24.17 | 169 | 152 | -487 | -1.8 | -60 | -12 | -580 | -7.1 |
| 15.68 | 63 | 45 | -506 | -4.3 | -180 | -136 | -608 | -10.1 |
| 4.90 | 4 | -15 | -475 | -5.3 | -238 | -201 | -559 | -10.9 |
| 15.44 | 78 | 61 | -477 | -3.7 | -154 | -112 | -576 | -9.2 |
| 25.85 | 164 | 147 | -492 | -2.0 | -68 | -20 | -590 | -7.4 |
| 31.91 | 163 | 148 | -538 | -2.5 | -67 | -16 | -634 | -7.8 |
| 32.36 | 134 | 117 | -575 | -3.5 | -56 | -3 | -649 | -7.7 |
| 32.04 | 120 | 104 | -592 | -4.0 | -52 | 3 | -662 | -7.8 |
| 31.91 | 68 | 50 | -649 | -5.8 | -61 | -6 | -681 | -8.2 |
| 31.34 | 28 | 9 | -698 | -7.2 | -127 | -69 | -756 | -10.4 |
| 30.69 | -9 | -29 | -756 | -8.7 | -190 | -130 | -839 | -12.7 |
| 30.24 | -58 | -79 | -816 | -10.4 | -208 | -147 | -872 | -13.4 |
| 29.60 | -130 | -153 | -887 | -12.8 | -217 | -158 | -888 | -13.8 |
| 29.28 | -201 | -223 | -944 | -14.9 | -205 | -148 | -887 | -13.5 |
| 24.99 | -696 | -719 | -1090 | -27.4 | -639 | -589 | -1086 | -25.3 |
| 21.17 | -742 | -762 | -990 | -27.2 | -814 | -775 | -1107 | -29.4 |
| 20.21 | -735 | -756 | -960 | -26.8 | -819 | -781 | -1088 | -29.4 |
| 13.07 | -686 | -704 | -869 | -24.7 | -755 | -718 | -1010 | -27.1 |
| 4.97 | -530 | -548 | -655 | -18.9 | -595 | -561 | -814 | -21.5 |

| TOTAL LOAD PER JOIST (kips) | CSJ-5 TEST DATA SHEET TC9 ST 2x3.85 TC9 (28) | TC9 (29) (με) | TC9 (30) | AVG MEM LOAD (kips) |
|---|---|---|---|---|
| 0.00 | 0 | 0 | 0 | 0.0 |
| 0.60 | -58 | -57 | -67 | -2.0 |
| 3.66 | -352 | -351 | -412 | -12.2 |
| 5.16 | -337 | -336 | -408 | -11.8 |
| 9.37 | -297 | -296 | -399 | -10.8 |
| 13.59 | -262 | -262 | -401 | -10.1 |
| 17.42 | -238 | -238 | -413 | -9.7 |
| 21.18 | -222 | -222 | -436 | -9.6 |
| 13.08 | -293 | -293 | -450 | -11.3 |
| 5.54 | -340 | -339 | -433 | -12.2 |
| 9.56 | -310 | -310 | -434 | -11.5 |
| 13.59 | -282 | -282 | -438 | -10.9 |
| 17.61 | -254 | -253 | -441 | -10.4 |
| 21.89 | -224 | -224 | -445 | -9.8 |
| 25.72 | -214 | -216 | -480 | -9.9 |
| 28.33 | -221 | -222 | -526 | -10.6 |
| 30.38 | -240 | -243 | -576 | -11.6 |
| 31.46 | -269 | -272 | -631 | -12.8 |
| 24.69 | -333 | -335 | -644 | -14.3 |
| 16.97 | -392 | -393 | -638 | -15.6 |
| 11.16 | -422 | -420 | -615 | -15.9 |
| 5.60 | -425 | -421 | -556 | -15.3 |
| 12.18 | -387 | -385 | -575 | -14.7 |
| 17.61 | -358 | -357 | -596 | -14.3 |
| 24.50 | -318 | -318 | -615 | -13.7 |
| 29.99 | -288 | -289 | -633 | -13.2 |
| 31.97 | -298 | -301 | -672 | -13.9 |
| 32.10 | -291 | -295 | -697 | -14.0 |
| 32.03 | -275 | -279 | -709 | -13.8 |
| 32.16 | -225 | -229 | -705 | -12.7 |
| 32.09 | -172 | -178 | -723 | -11.7 |
| 32.16 | -151 | -157 | -740 | -11.5 |
| 31.45 | -146 | -152 | -772 | -11.7 |
| 23.35 | -222 | -227 | -775 | -13.4 |
| 14.99 | -271 | -275 | -742 | -14.1 |
| 5.54 | -251 | -254 | -625 | -12.3 |
| 14.79 | -225 | -228 | -669 | -12.3 |
| 24.17 | -178 | -184 | -725 | -11.9 |
| 15.68 | -262 | -267 | -733 | -13.8 |
| 4.90 | -255 | -257 | -622 | -12.4 |
| 15.44 | -230 | -234 | -671 | -12.4 |
| 25.85 | -182 | -187 | -728 | -12.0 |
| 31.91 | -185 | -192 | -803 | -12.9 |
| 32.36 | -196 | -204 | -836 | -13.5 |
| 32.04 | -191 | -199 | -844 | -13.5 |
| 31.91 | -202 | -210 | -859 | -13.9 |
| 31.34 | -216 | -223 | -871 | -14.3 |
| 30.69 | -230 | -238 | -885 | -14.8 |
| 30.24 | -252 | -258 | -901 | -15.4 |
| 29.60 | -290 | -295 | -925 | -16.5 |
| 29.28 | -323 | -328 | -946 | -17.4 |
| 24.99 | -531 | -549 | -1031 | -23.1 |
| 21.17 | -656 | -673 | -1012 | -25.6 |
| 20.21 | -657 | -674 | -996 | -25.4 |
| 13.07 | -619 | -635 | -914 | -23.7 |
| 4.97 | -509 | -525 | -749 | -19.5 |

| TOTAL LOAD PER JOIST (kips) | CSJ-5 BC1 2L2.50x2.50x0.212 | | AVG MEM LOAD (kips) | CSJ-5 BC2 2L2.50x2.50x0.212 | | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|
| | BC1 (1) (με) | BC1 (2) (με) | | BC2 (3) (με) | BC2 (4) (με) | |
| 0.00 | 0 | 0 | 0.0 | 0 | 0 | 0.0 |
| 0.60 | 29 | 22 | 1.5 | 37 | 29 | 2.0 |
| 3.66 | 178 | 137 | 9.3 | 227 | 178 | 11.9 |
| 5.16 | 229 | 177 | 11.9 | 300 | 229 | 15.6 |
| 9.37 | 386 | 295 | 20.1 | 508 | 379 | 26.1 |
| 13.59 | 571 | 416 | 29.0 | 743 | 544 | 37.9 |
| 17.42 | 745 | 528 | 37.5 | 979 | 701 | 49.4 |
| 21.18 | 924 | 641 | 46.1 | 1228 | 865 | 61.6 |
| 13.08 | 645 | 421 | 31.4 | 859 | 593 | 42.7 |
| 5.54 | 382 | 216 | 17.6 | 485 | 320 | 23.7 |
| 9.56 | 520 | 324 | 24.9 | 682 | 464 | 33.7 |
| 13.59 | 661 | 435 | 32.3 | 877 | 608 | 43.7 |
| 17.61 | 797 | 542 | 39.4 | 1061 | 743 | 53.1 |
| 21.89 | 955 | 662 | 47.6 | 1276 | 897 | 64.0 |
| 25.72 | 1164 | 781 | 57.2 | 1577 | 1074 | 78.0 |
| 28.33 | 1333 | 876 | 65.0 | 1850 | 1223 | 90.5 |
| 30.38 | 1508 | 959 | 72.6 | 2094 | 1361 | 101.7 |
| 31.46 | 1609 | 1006 | 77.0 | 2199 | 1445 | 107.3 |
| 24.69 | 1374 | 821 | 64.6 | 1893 | 1217 | 91.5 |
| 16.97 | 1103 | 611 | 50.4 | 1523 | 943 | 72.6 |
| 11.16 | 898 | 450 | 39.7 | 1227 | 727 | 57.5 |
| 5.60 | 689 | 286 | 28.7 | 919 | 507 | 42.0 |
| 12.18 | 921 | 471 | 41.0 | 1256 | 753 | 59.1 |
| 17.61 | 1115 | 625 | 51.2 | 1527 | 956 | 73.1 |
| 24.50 | 1360 | 814 | 64.0 | 1861 | 1202 | 90.2 |
| 29.99 | 1563 | 969 | 74.5 | 2134 | 1400 | 104.0 |
| 31.97 | 1659 | 1028 | 79.1 | 2240 | 1487 | yield |
| 32.10 | 1706 | 1042 | 80.9 | 2261 | 1518 | yield |
| 32.03 | 1727 | 1046 | 81.6 | 2269 | 1533 | yield |
| 32.16 | 1753 | 1055 | 82.7 | 2286 | 1553 | yield |
| 32.09 | 1789 | 1060 | 83.9 | 2293 | 1569 | yield |
| 32.16 | 1814 | 1070 | 84.9 | 2311 | 1586 | yield |
| 31.45 | 1821 | 1064 | 84.9 | 2294 | 1580 | yield |
| 23.35 | 1522 | 833 | 69.3 | 1897 | 1285 | yield |
| 14.99 | 1213 | 593 | 53.2 | 1461 | 965 | yield |
| 5.54 | 852 | 314 | 34.3 | 934 | 584 | yield |
| 14.79 | 1207 | 594 | 53.0 | 1450 | 963 | yield |
| 24.17 | 1570 | 875 | 72.0 | 1951 | 1334 | yield |
| 15.68 | 1260 | 632 | 55.7 | 1528 | 1017 | yield |
| 4.90 | 837 | 301 | 33.5 | 915 | 568 | yield |
| 15.44 | 1201 | 589 | 52.7 | 1442 | 958 | yield |
| 25.85 | 1578 | 881 | 72.4 | 1962 | 1342 | yield |
| 31.91 | 1818 | 1060 | 84.7 | 2286 | 1576 | yield |
| 32.36 | 1844 | 1076 | 85.9 | 2319 | 1598 | yield |
| 32.04 | 1838 | 1068 | 85.5 | 2310 | 1589 | yield |
| 31.91 | 1840 | 1069 | 85.6 | 2310 | 1591 | yield |
| 31.34 | 1831 | 1062 | 85.2 | 2296 | 1582 | yield |
| 30.69 | 1826 | 1058 | 84.9 | 2289 | 1578 | yield |
| 30.24 | 1821 | 1054 | 84.7 | 2282 | 1574 | yield |
| 29.60 | 1801 | 1038 | 83.6 | 2254 | 1551 | yield |
| 29.28 | 1791 | 1030 | 83.1 | 2240 | 1542 | yield |
| 24.99 | 1597 | 860 | 72.3 | 1994 | 1318 | yield |
| 21.17 | 1464 | 738 | 64.8 | 1819 | 1150 | yield |
| 20.21 | 1428 | 709 | 62.9 | 1767 | 1112 | yield |
| 13.07 | 1163 | 514 | 49.4 | 1382 | 850 | yield |
| 4.97 | 852 | 279 | 33.3 | 932 | 543 | yield |

| TOTAL LOAD PER JOIST (kips) | CSJ-5 TEST DATA SHEET BC3 2L2.50x2.50x0.212 | | | | AVG MEM LOAD (kips) | CSJ-5 TEST DATA SHEET BC4 2L2.50x2.50x0.212 | | | | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| | BC3 (5) | BC3 (6) | BC3 (7) | BC3 (8) | | BC4 (45) | BC4 (46) | BC4 (47) | BC4 (48) | |
| | (με) | | | | | (με) | | | | |
| 0.00 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 |
| 0.60 | 34 | 33 | 25 | 24 | 1.7 | 35 | 35 | 26 | 21 | 1.7 |
| 3.66 | 210 | 204 | 151 | 147 | 10.5 | 217 | 214 | 158 | 131 | 10.6 |
| 5.16 | 272 | 264 | 204 | 202 | 13.9 | 279 | 274 | 212 | 186 | 14.0 |
| 9.37 | 450 | 432 | 357 | 356 | 23.5 | 452 | 442 | 365 | 341 | 23.5 |
| 13.59 | 630 | 607 | 503 | 506 | 33.1 | 629 | 613 | 514 | 491 | 33.1 |
| 17.42 | 797 | 767 | 633 | 640 | 41.8 | 793 | 772 | 647 | 626 | 41.8 |
| 21.18 | 965 | 927 | 762 | 774 | 50.4 | 958 | 933 | 778 | 762 | 50.5 |
| 13.08 | 638 | 615 | 470 | 484 | 32.5 | 631 | 614 | 481 | 462 | 32.2 |
| 5.54 | 319 | 316 | 196 | 211 | 15.3 | 316 | 310 | 205 | 186 | 15.0 |
| 9.56 | 488 | 474 | 341 | 356 | 24.4 | 481 | 469 | 349 | 332 | 24.0 |
| 13.59 | 656 | 632 | 488 | 502 | 33.5 | 648 | 630 | 498 | 482 | 33.2 |
| 17.61 | 816 | 786 | 629 | 643 | 42.3 | 810 | 789 | 643 | 627 | 42.2 |
| 21.89 | 996 | 957 | 785 | 800 | 52.1 | 992 | 967 | 803 | 787 | 52.2 |
| 25.72 | 1167 | 1123 | 907 | 935 | 60.8 | 1158 | 1132 | 929 | 921 | 60.9 |
| 28.33 | 1300 | 1252 | 997 | 1038 | 67.5 | 1286 | 1259 | 1021 | 1022 | 67.5 |
| 30.38 | 1413 | 1364 | 1062 | 1118 | 72.9 | 1390 | 1364 | 1086 | 1099 | 72.7 |
| 31.46 | 1474 | 1427 | 1094 | 1158 | 75.8 | 1450 | 1430 | 1129 | 1147 | 75.9 |
| 24.69 | 1203 | 1167 | 850 | 915 | 60.9 | 1176 | 1163 | 877 | 896 | 60.5 |
| 16.97 | 885 | 864 | 572 | 639 | 43.6 | 857 | 854 | 590 | 616 | 42.9 |
| 11.16 | 636 | 631 | 361 | 428 | 30.3 | 609 | 617 | 372 | 403 | 29.5 |
| 5.60 | 380 | 395 | 145 | 216 | 16.7 | 358 | 377 | 157 | 192 | 16.0 |
| 12.18 | 667 | 662 | 391 | 459 | 32.1 | 640 | 648 | 402 | 437 | 31.3 |
| 17.61 | 899 | 882 | 592 | 659 | 44.6 | 872 | 871 | 606 | 640 | 44.0 |
| 24.50 | 1186 | 1153 | 841 | 908 | 60.2 | 1162 | 1148 | 864 | 892 | 59.8 |
| 29.99 | 1420 | 1376 | 1045 | 1111 | 72.9 | 1398 | 1375 | 1073 | 1097 | 72.8 |
| 31.97 | 1510 | 1463 | 1115 | 1182 | 77.6 | 1486 | 1463 | 1147 | 1172 | 77.5 |
| 32.10 | 1527 | 1481 | 1118 | 1188 | 78.2 | 1498 | 1482 | 1150 | 1183 | 78.2 |
| 32.03 | 1538 | 1490 | 1119 | 1189 | 78.5 | 1504 | 1493 | 1151 | 1186 | 78.5 |
| 32.16 | 1558 | 1505 | 1130 | 1200 | 79.4 | 1521 | 1506 | 1158 | 1194 | 79.2 |
| 32.09 | 1572 | 1513 | 1132 | 1202 | 79.8 | 1535 | 1516 | 1160 | 1195 | 79.6 |
| 32.16 | 1593 | 1530 | 1145 | 1214 | 80.7 | 1552 | 1531 | 1166 | 1201 | 80.2 |
| 31.45 | 1583 | 1519 | 1132 | 1204 | 80.0 | 1539 | 1517 | 1148 | 1184 | 79.3 |
| 23.35 | 1237 | 1185 | 825 | 896 | 61.0 | 1188 | 1175 | 830 | 870 | 59.8 |
| 14.99 | 867 | 832 | 506 | 579 | 41.0 | 817 | 816 | 503 | 552 | 39.6 |
| 5.54 | 431 | 421 | 140 | 216 | 17.8 | 391 | 405 | 136 | 195 | 16.6 |
| 14.79 | 867 | 834 | 513 | 588 | 41.3 | 822 | 823 | 511 | 566 | 40.1 |
| 24.17 | 1293 | 1241 | 883 | 957 | 64.4 | 1247 | 1236 | 889 | 934 | 63.4 |
| 15.68 | 928 | 891 | 561 | 637 | 44.4 | 878 | 876 | 555 | 603 | 42.9 |
| 4.90 | 414 | 403 | 127 | 204 | 16.9 | 373 | 388 | 121 | 178 | 15.6 |
| 15.44 | 861 | 828 | 508 | 585 | 40.9 | 814 | 816 | 503 | 557 | 39.6 |
| 25.85 | 1302 | 1251 | 892 | 967 | 64.9 | 1256 | 1244 | 895 | 940 | 63.8 |
| 31.91 | 1576 | 1514 | 1125 | 1202 | 79.7 | 1533 | 1511 | 1135 | 1174 | 78.8 |
| 32.36 | 1602 | 1539 | 1145 | 1222 | 81.1 | 1560 | 1536 | 1155 | 1191 | 80.1 |
| 32.04 | 1595 | 1530 | 1136 | 1212 | 80.6 | 1549 | 1523 | 1143 | 1179 | 79.4 |
| 31.91 | 1596 | 1531 | 1137 | 1212 | 80.6 | 1557 | 1530 | 1149 | 1185 | 79.8 |
| 31.34 | 1584 | 1522 | 1127 | 1202 | 80.0 | 1542 | 1516 | 1135 | 1169 | 78.9 |
| 30.69 | 1578 | 1516 | 1121 | 1196 | 79.6 | 1538 | 1512 | 1132 | 1166 | 78.7 |
| 30.24 | 1572 | 1511 | 1116 | 1191 | 79.3 | 1540 | 1514 | 1133 | 1167 | 78.8 |
| 29.60 | 1547 | 1486 | 1093 | 1168 | 77.9 | 1534 | 1505 | 1127 | 1159 | 78.4 |
| 29.28 | 1535 | 1475 | 1083 | 1156 | 77.3 | 1529 | 1498 | 1121 | 1153 | 78.0 |
| 24.99 | 1321 | 1229 | 873 | 940 | 64.2 | 1367 | 1314 | 966 | 996 | 68.3 |
| 21.17 | 1170 | 1042 | 725 | 785 | 54.8 | 1199 | 1138 | 809 | 841 | 58.7 |
| 20.21 | 1127 | 999 | 687 | 748 | 52.4 | 1155 | 1099 | 772 | 806 | 56.4 |
| 13.07 | 803 | 708 | 417 | 482 | 35.5 | 814 | 782 | 477 | 518 | 38.1 |
| 4.97 | 427 | 375 | 111 | 183 | 16.1 | 412 | 412 | 138 | 189 | 17.0 |

| TOTAL LOAD PER JOIST (kips) | CSJ-5 TEST DATA SHEET BC5 2L2.50x2.50x0.212 | | | | AVG MEM LOAD (kips) | CSJ-5 TEST DATA SHEET BC6 2L2.50x2.50x0.212 | | | | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| | BC5 (9) | BC5 (10) | BC5 (11) | BC5 (12) | | BC6 (49) | BC6 (50) | BC6 (51) | BC6 (52) | |
| | (με) | | | | | (με) | | | | |
| 0.00 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 |
| 0.60 | 45 | 46 | 33 | 32 | 2.3 | 50 | 45 | 36 | 34 | 2.4 |
| 3.66 | 277 | 279 | 202 | 196 | 14.0 | 304 | 276 | 218 | 208 | 14.8 |
| 5.16 | 359 | 360 | 274 | 268 | 18.6 | 387 | 357 | 291 | 281 | 19.4 |
| 9.37 | 594 | 595 | 479 | 473 | 31.5 | 620 | 586 | 498 | 486 | 32.2 |
| 13.59 | 841 | 838 | 674 | 675 | 44.6 | 856 | 822 | 693 | 690 | 45.0 |
| 17.42 | 1060 | 1060 | 843 | 852 | 56.2 | 1070 | 1040 | 862 | 879 | 56.7 |
| 21.18 | 1280 | 1284 | 1010 | 1033 | 67.8 | 1290 | 1263 | 1032 | 1071 | 68.5 |
| 13.08 | 841 | 850 | 613 | 645 | 43.4 | 849 | 830 | 632 | 679 | 44.0 |
| 5.54 | 433 | 438 | 244 | 282 | 20.5 | 434 | 427 | 258 | 315 | 21.1 |
| 9.56 | 653 | 656 | 440 | 474 | 32.7 | 653 | 638 | 455 | 507 | 33.2 |
| 13.59 | 874 | 876 | 638 | 669 | 45.0 | 875 | 856 | 656 | 704 | 45.5 |
| 17.61 | 1088 | 1087 | 829 | 856 | 56.8 | 1092 | 1067 | 852 | 895 | 57.5 |
| 21.89 | 1326 | 1325 | 1039 | 1066 | 70.0 | 1334 | 1305 | 1068 | 1109 | 70.9 |
| 25.72 | 1555 | 1559 | 1196 | 1251 | 81.8 | 1554 | 1534 | 1221 | 1301 | 82.6 |
| 28.33 | 1731 | 1744 | 1320 | 1396 | 91.1 | 1716 | 1721 | 1327 | 1457 | 91.6 |
| 30.38 | 1877 | 1917 | 1414 | 1531 | 99.2 | 1821 | 1875 | 1379 | 1599 | 98.2 |
| 31.46 | 1982 | 1981 | 1465 | 1656 | 104.3 | 1857 | 1958 | 1409 | 1712 | 102.1 |
| 24.69 | 1608 | 1615 | 1129 | 1331 | 83.7 | 1480 | 1592 | 1070 | 1383 | 81.3 |
| 16.97 | 1182 | 1202 | 749 | 959 | 60.2 | 1054 | 1180 | 686 | 1010 | 57.8 |
| 11.16 | 857 | 886 | 459 | 677 | 42.4 | 731 | 869 | 397 | 728 | 40.1 |
| 5.60 | 528 | 567 | 168 | 391 | 24.3 | 409 | 559 | 110 | 447 | 22.4 |
| 12.18 | 902 | 927 | 499 | 715 | 44.8 | 779 | 911 | 441 | 768 | 42.7 |
| 17.61 | 1208 | 1224 | 773 | 982 | 61.6 | 1083 | 1205 | 714 | 1035 | 59.4 |
| 24.50 | 1590 | 1597 | 1115 | 1316 | 82.7 | 1467 | 1576 | 1059 | 1370 | 80.5 |
| 29.99 | 1903 | 1903 | 1393 | 1589 | 99.9 | 1779 | 1879 | 1339 | 1647 | 97.8 |
| 31.97 | 2010 | 1993 | 1476 | 1723 | 106.0 | 1877 | 1951 | 1432 | 1794 | 103.8 |
| 32.10 | 1988 | 1944 | 1467 | 1831 | 106.4 | 1862 | 1901 | 1429 | 1866 | 103.9 |
| 32.03 | 1989 | 1934 | 1453 | 1814 | 105.8 | 1854 | 1902 | 1438 | 1842 | 103.5 |
| 32.16 | 2025 | 1943 | 1453 | 1816 | 106.5 | 1865 | 1901 | 1431 | 1847 | 103.7 |
| 32.09 | 2046 | 1947 | 1417 | 1796 | 106.1 | 1863 | 1899 | 1427 | 1831 | 103.3 |
| 32.16 | 2059 | 1949 | 1428 | 1812 | 106.7 | 1867 | 1918 | 1436 | 1847 | 104.0 |
| 31.45 | 2025 | 1917 | 1398 | 1801 | 105.1 | 1851 | 1885 | 1418 | 1827 | 102.7 |
| 23.35 | 1545 | 1460 | 974 | 1385 | 78.9 | 1369 | 1428 | 988 | 1409 | 76.4 |
| 14.99 | 1057 | 998 | 538 | 956 | 52.2 | 884 | 969 | 553 | 984 | 49.9 |
| 5.54 | 503 | 474 | 40 | 468 | 21.8 | 342 | 465 | 68 | 511 | 20.4 |
| 14.79 | 1074 | 1009 | 542 | 959 | 52.8 | 909 | 985 | 566 | 993 | 50.8 |
| 24.17 | 1644 | 1554 | 1050 | 1459 | 84.0 | 1475 | 1520 | 1072 | 1487 | 81.7 |
| 15.68 | 1144 | 1081 | 610 | 1026 | 56.8 | 972 | 1049 | 626 | 1055 | 54.5 |
| 4.90 | 480 | 453 | 18 | 448 | 20.6 | 323 | 445 | 48 | 493 | 19.3 |
| 15.44 | 1067 | 1003 | 534 | 951 | 52.3 | 898 | 975 | 555 | 984 | 50.2 |
| 25.85 | 1655 | 1566 | 1058 | 1468 | 84.6 | 1479 | 1524 | 1075 | 1492 | 82.0 |
| 31.91 | 2012 | 1919 | 1386 | 1790 | 104.6 | 1841 | 1878 | 1404 | 1818 | 102.2 |
| 32.36 | 2040 | 1947 | 1424 | 1823 | 106.5 | 1868 | 1901 | 1433 | 1848 | 103.8 |
| 32.04 | 2005 | 1942 | 1405 | 1818 | 105.5 | 1854 | 1897 | 1422 | 1845 | 103.3 |
| 31.91 | 2003 | 1950 | 1403 | 1828 | 105.7 | 1863 | 1907 | 1431 | 1854 | 103.8 |
| 31.34 | 1996 | 1937 | 1395 | 1819 | 105.2 | 1837 | 1890 | 1415 | 1845 | 102.8 |
| 30.69 | 1983 | 1938 | 1366 | 1821 | 104.6 | 1851 | 1897 | 1421 | 1847 | 103.2 |
| 30.24 | 2023 | 1933 | 1353 | 1817 | 104.9 | 1863 | 1897 | 1420 | 1848 | 103.4 |
| 29.60 | 1999 | 1897 | 1323 | 1781 | 103.0 | 1845 | 1904 | 1399 | 1852 | 103.0 |
| 29.28 | 1979 | 1897 | 1343 | 1767 | 102.8 | 1905 | 1892 | 1305 | 1851 | 102.3 |
| 24.99 | 2075 | 1857 | 1074 | 1394 | 94.2 | 11026 | 1927 | 1644 | 1688 | yield |
| 21.17 | 2064 | 1568 | 884 | 1099 | 82.6 | 15685 | 1868 | 1565 | 1399 | yield |
| 20.21 | 2030 | 1511 | 815 | 1023 | 79.2 | 15657 | 1821 | 1496 | 1331 | yield |
| 13.07 | 1485 | 1114 | 405 | 660 | 53.9 | 15058 | 1327 | 1065 | 936 | yield |
| 4.97 | 856 | 634 | -51 | 260 | 25.0 | 14296 | 752 | 580 | 499 | yield |

| TOTAL LOAD PER JOIST (kips) | CSJ-5 W9 L1.25x1.25x0.133 W9 (34) | W9 (35) | AVG MEM LOAD (kips) |
|---|---|---|---|
| | (με) | | |
| 0.00 | 0 | 0 | 0.0 |
| 0.60 | -36 | -14 | -0.5 |
| 3.66 | -221 | -85 | -2.8 |
| 5.16 | -293 | -113 | -3.7 |
| 9.37 | -498 | -189 | -6.3 |
| 13.59 | -711 | -255 | -8.8 |
| 17.42 | -915 | -309 | -11.2 |
| 21.18 | -1122 | -361 | -13.6 |
| 13.08 | -733 | -224 | -8.7 |
| 5.54 | -342 | -89 | -3.9 |
| 9.56 | -548 | -162 | -6.5 |
| 13.59 | -750 | -233 | -9.0 |
| 17.61 | -943 | -300 | -11.4 |
| 21.89 | -1161 | -371 | -14.0 |
| 25.72 | -1374 | -415 | -16.3 |
| 28.33 | -1538 | -444 | -18.1 |
| 30.38 | -1681 | -462 | -19.6 |
| 31.46 | -1768 | -472 | -20.5 |
| 24.69 | -1428 | -366 | -16.4 |
| 16.97 | -1027 | -240 | -11.6 |
| 11.16 | -709 | -140 | -7.8 |
| 5.60 | -379 | -34 | -3.8 |
| 12.18 | -739 | -158 | -8.2 |
| 17.61 | -1027 | -251 | -11.7 |
| 24.50 | -1389 | -364 | -16.0 |
| 29.99 | -1690 | -452 | -19.6 |
| 31.97 | -1819 | -481 | -21.0 |
| 32.10 | -1855 | -484 | -21.4 |
| 32.03 | -1887 | -491 | -21.7 |
| 32.16 | -1923 | -497 | -22.1 |
| 32.09 | -1956 | -503 | -22.5 |
| 32.16 | -1985 | -510 | -22.8 |
| 31.45 | -1976 | -510 | -22.7 |
| 23.35 | -1514 | -375 | -17.3 |
| 14.99 | -1010 | -226 | -11.3 |
| 5.54 | -422 | -47 | -4.3 |
| 14.79 | -1003 | -236 | -11.3 |
| 24.17 | -1571 | -404 | -18.0 |
| 15.68 | -1092 | -255 | -12.3 |
| 4.90 | -400 | -40 | -4.0 |
| 15.44 | -994 | -234 | -11.2 |
| 25.85 | -1581 | -408 | -18.2 |
| 31.91 | -1955 | -505 | -22.5 |
| 32.36 | -1999 | -517 | -23.0 |
| 32.04 | -1996 | -517 | -23.0 |
| 31.91 | -1999 | -518 | -23.0 |
| 31.34 | -1988 | -516 | -22.9 |
| 30.69 | -1979 | -514 | -22.8 |
| 30.24 | -1971 | -513 | -22.7 |
| 29.60 | -1934 | -502 | -22.3 |
| 29.28 | -1916 | -496 | -22.0 |
| 24.99 | -1602 | -396 | -18.3 |
| 21.17 | -1370 | -323 | -15.5 |
| 20.21 | -1305 | -305 | -14.7 |
| 13.07 | -859 | -186 | -9.5 |
| 4.97 | -397 | -49 | -4.1 |

| APPLIED LOAD PER JOIST (kips) | CSJ-5 TEST DATA SHEET END SLIPS SLIP 1 SEES (in.) | SLIP 2 NEES (in.) | SLIP 11 NWES (in.) | SLIP 12 SWES (in.) |
|---|---|---|---|---|
| 0.00 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.50 | 0.000 | 0.001 | 0.000 | 0.000 |
| 5.71 | 0.000 | 0.001 | 0.001 | 0.001 |
| 9.93 | 0.002 | 0.003 | 0.003 | 0.004 |
| 13.76 | 0.006 | 0.006 | 0.007 | 0.009 |
| 17.53 | 0.012 | 0.010 | 0.012 | 0.013 |
| 9.42 | 0.010 | 0.010 | 0.011 | 0.012 |
| 1.88 | 0.003 | 0.004 | 0.003 | 0.004 |
| 5.91 | 0.006 | 0.006 | 0.006 | 0.007 |
| 9.93 | 0.009 | 0.007 | 0.009 | 0.010 |
| 13.95 | 0.011 | 0.010 | 0.011 | 0.012 |
| 18.23 | 0.015 | 0.012 | 0.013 | 0.015 |
| 22.06 | 0.026 | 0.019 | 0.020 | 0.023 |
| 24.68 | 0.039 | 0.027 | 0.022 | 0.031 |
| 26.72 | 0.070 | 0.038 | 0.025 | 0.043 |
| 27.81 | 0.096 | 0.046 | 0.031 | 0.051 |
| 21.04 | 0.094 | 0.046 | 0.031 | 0.050 |
| 13.31 | 0.085 | 0.042 | 0.030 | 0.046 |
| 7.50 | 0.075 | 0.037 | 0.028 | 0.040 |
| 1.95 | 0.059 | 0.025 | 0.018 | 0.026 |
| 8.52 | 0.069 | 0.032 | 0.023 | 0.035 |
| 13.95 | 0.078 | 0.037 | 0.025 | 0.041 |
| 20.85 | 0.087 | 0.042 | 0.026 | 0.045 |
| 26.34 | 0.096 | 0.046 | 0.029 | 0.050 |
| 28.32 | 0.111 | 0.051 | 0.033 | 0.055 |
| 28.44 | 0.132 | 0.057 | 0.038 | 0.060 |
| 28.38 | 0.153 | 0.062 | 0.041 | 0.065 |
| 28.50 | 0.167 | 0.067 | 0.045 | 0.070 |
| 28.44 | 0.190 | 0.084 | 0.051 | 0.081 |
| 28.50 | 0.202 | 0.093 | 0.056 | 0.092 |
| 27.79 | 0.234 | 0.119 | 0.061 | 0.100 |
| 19.69 | 0.229 | 0.117 | 0.061 | 0.099 |
| 11.33 | 0.215 | 0.111 | 0.059 | 0.092 |
| 1.88 | 0.179 | 0.089 | 0.049 | 0.071 |
| 11.13 | 0.199 | 0.103 | 0.055 | 0.085 |
| 20.51 | 0.220 | 0.113 | 0.057 | 0.094 |
| 12.02 | 0.215 | 0.111 | 0.059 | 0.092 |
| 1.24 | 0.177 | 0.089 | 0.048 | 0.070 |
| 11.78 | 0.199 | 0.104 | 0.055 | 0.084 |
| 22.19 | 0.222 | 0.113 | 0.057 | 0.093 |
| 28.26 | 0.248 | 0.125 | 0.062 | 0.103 |
| 28.70 | 0.280 | 0.153 | 0.065 | 0.108 |
| 28.38 | 0.314 | 0.176 | 0.066 | 0.109 |
| 28.26 | 0.351 | 0.205 | 0.067 | 0.110 |
| 27.68 | 0.423 | 0.236 | 0.067 | 0.111 |
| 27.04 | 0.514 | 0.298 | 0.067 | 0.112 |
| 26.59 | 0.587 | 0.374 | 0.068 | 0.113 |
| 25.94 | 0.672 | 0.479 | 0.067 | 0.113 |
| 25.62 | 0.715 | 0.573 | 0.067 | 0.113 |
| 21.34 | 0.819 | 0.821 | 0.068 | 0.112 |
| 17.51 | 0.904 | 0.899 | 0.067 | 0.110 |
| 16.55 | 0.908 | 0.908 | 0.067 | 0.109 |
| 9.41 | 0.898 | 0.906 | 0.066 | 0.103 |
| 1.31 | 0.851 | 0.865 | 0.055 | 0.085 |

| APPLIED LOAD PER JOIST (kips) | CSJ-5 TEST DATA SHEET INTERMEDIATE SLIPS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | SLIP 3 NE5S (in.) | SLIP 4 NE4S (in.) | SLIP 5 NE3S (in.) | SLIP 6 NE2S (in.) | SLIP 7 NW2S (in.) | SLIP 8 NW3S (in.) | SLIP 9 NW4S (in.) | SLIP 10 NW5S (in.) |
| 0.00 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.50 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 5.71 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 |
| 9.93 | 0.001 | 0.003 | 0.001 | 0.000 | 0.001 | 0.002 | 0.003 | 0.003 |
| 13.76 | 0.003 | 0.006 | 0.002 | 0.001 | 0.002 | 0.004 | 0.007 | 0.007 |
| 17.53 | 0.007 | 0.009 | 0.005 | 0.001 | 0.004 | 0.008 | 0.012 | 0.012 |
| 9.42 | 0.007 | 0.009 | 0.004 | 0.001 | 0.004 | 0.008 | 0.011 | 0.011 |
| 1.88 | 0.004 | 0.004 | 0.002 | 0.001 | 0.002 | 0.004 | 0.005 | 0.004 |
| 5.91 | 0.004 | 0.005 | 0.002 | 0.001 | 0.002 | 0.005 | 0.007 | 0.007 |
| 9.93 | 0.005 | 0.007 | 0.004 | 0.001 | 0.003 | 0.006 | 0.009 | 0.010 |
| 13.95 | 0.007 | 0.009 | 0.004 | 0.001 | 0.004 | 0.007 | 0.011 | 0.012 |
| 18.23 | 0.009 | 0.011 | 0.006 | 0.002 | 0.005 | 0.009 | 0.013 | 0.014 |
| 22.06 | 0.015 | 0.015 | 0.010 | 0.003 | 0.007 | 0.013 | 0.018 | 0.022 |
| 24.68 | 0.023 | 0.020 | 0.013 | 0.006 | 0.010 | 0.018 | 0.021 | 0.031 |
| 26.72 | 0.035 | 0.028 | 0.020 | 0.009 | 0.012 | 0.024 | 0.026 | 0.043 |
| 27.81 | 0.044 | 0.036 | 0.024 | 0.011 | 0.016 | 0.031 | 0.033 | 0.058 |
| 21.04 | 0.045 | 0.036 | 0.024 | 0.011 | 0.016 | 0.031 | 0.034 | 0.058 |
| 13.31 | 0.043 | 0.034 | 0.023 | 0.011 | 0.015 | 0.029 | 0.032 | 0.054 |
| 7.50 | 0.037 | 0.031 | 0.021 | 0.010 | 0.014 | 0.027 | 0.029 | 0.047 |
| 1.95 | 0.027 | 0.023 | 0.016 | 0.009 | 0.012 | 0.021 | 0.021 | 0.036 |
| 8.52 | 0.030 | 0.028 | 0.018 | 0.009 | 0.012 | 0.023 | 0.025 | 0.042 |
| 13.95 | 0.035 | 0.031 | 0.021 | 0.009 | 0.013 | 0.026 | 0.028 | 0.048 |
| 20.85 | 0.040 | 0.034 | 0.023 | 0.010 | 0.015 | 0.028 | 0.030 | 0.053 |
| 26.34 | 0.045 | 0.037 | 0.025 | 0.011 | 0.016 | 0.030 | 0.032 | 0.059 |
| 28.32 | 0.049 | 0.042 | 0.028 | 0.013 | 0.018 | 0.034 | 0.037 | 0.067 |
| 28.44 | 0.055 | 0.048 | 0.032 | 0.016 | 0.021 | 0.038 | 0.042 | 0.078 |
| 28.38 | 0.060 | 0.053 | 0.037 | 0.019 | 0.023 | 0.041 | 0.049 | 0.086 |
| 28.50 | 0.065 | 0.058 | 0.040 | 0.023 | 0.025 | 0.043 | 0.056 | 0.094 |
| 28.44 | 0.081 | 0.068 | 0.052 | 0.027 | 0.030 | 0.049 | 0.071 | 0.108 |
| 28.50 | 0.091 | 0.077 | 0.061 | 0.030 | 0.032 | 0.055 | 0.080 | 0.117 |
| 27.79 | 0.117 | 0.113 | 0.089 | 0.037 | 0.035 | 0.063 | 0.088 | 0.126 |
| 19.69 | 0.117 | 0.112 | 0.089 | 0.037 | 0.035 | 0.063 | 0.088 | 0.123 |
| 11.33 | 0.114 | 0.105 | 0.086 | 0.037 | 0.035 | 0.062 | 0.085 | 0.115 |
| 1.88 | 0.095 | 0.088 | 0.078 | 0.036 | 0.032 | 0.056 | 0.072 | 0.092 |
| 11.13 | 0.103 | 0.099 | 0.081 | 0.036 | 0.033 | 0.058 | 0.078 | 0.107 |
| 20.5[illegible] | 0.110 | 0.107 | 0.086 | 0.036 | 0.035 | 0.060 | 0.083 | 0.118 |
| 12.02 | 0.113 | 0.107 | 0.086 | 0.037 | 0.035 | 0.061 | 0.084 | 0.116 |
| 1.24 | 0.095 | 0.089 | 0.078 | 0.036 | 0.032 | 0.056 | 0.072 | 0.091 |
| 11.78 | 0.104 | 0.100 | 0.082 | 0.036 | 0.033 | 0.057 | 0.078 | 0.107 |
| 22.19 | 0.112 | 0.109 | 0.087 | 0.037 | 0.035 | 0.060 | 0.085 | 0.119 |
| 28.26 | 0.126 | 0.132 | 0.101 | 0.039 | 0.036 | 0.065 | 0.094 | 0.132 |
| 28.70 | 0.154 | 0.179 | 0.136 | 0.046 | 0.037 | 0.067 | 0.098 | 0.138 |
| 28.38 | 0.177 | 0.217 | 0.168 | 0.070 | 0.038 | 0.069 | 0.100 | 0.140 |
| 28.26 | 0.226 | 0.265 | 0.209 | 0.106 | 0.038 | 0.070 | 0.100 | 0.140 |
| 27.68 | 0.274 | 0.317 | 0.250 | 0.136 | 0.038 | 0.070 | 0.102 | 0.141 |
| 27.04 | 0.341 | 0.390 | 0.311 | 0.172 | 0.038 | 0.070 | 0.102 | 0.142 |
| 26.59 | 0.410 | 0.472 | 0.384 | 0.198 | 0.038 | 0.070 | 0.102 | 0.142 |
| 25.94 | 0.483 | 0.591 | 0.495 | 0.224 | 0.038 | 0.070 | 0.102 | 0.142 |
| 25.62 | 0.544 | 0.690 | 0.581 | 0.255 | 0.038 | 0.070 | 0.102 | 0.142 |
| 21.34 | 0.666 | 0.927 | 0.801 | 0.550 | 0.037 | 0.070 | 0.101 | 0.139 |
| 17.51 | 0.713 | 1.002 | 0.877 | 0.662 | 0.035 | 0.069 | 0.099 | 0.137 |
| 16.55 | 0.721 | 1.010 | 0.888 | 0.676 | 0.035 | 0.069 | 0.099 | 0.135 |
| 9.41 | 0.720 | 0.998 | 0.888 | 0.674 | 0.034 | 0.068 | 0.095 | 0.124 |
| 1.31 | 0.696 | 0.939 | 0.850 | 0.641 | 0.032 | 0.060 | 0.081 | 0.101 |

# CSJ-5

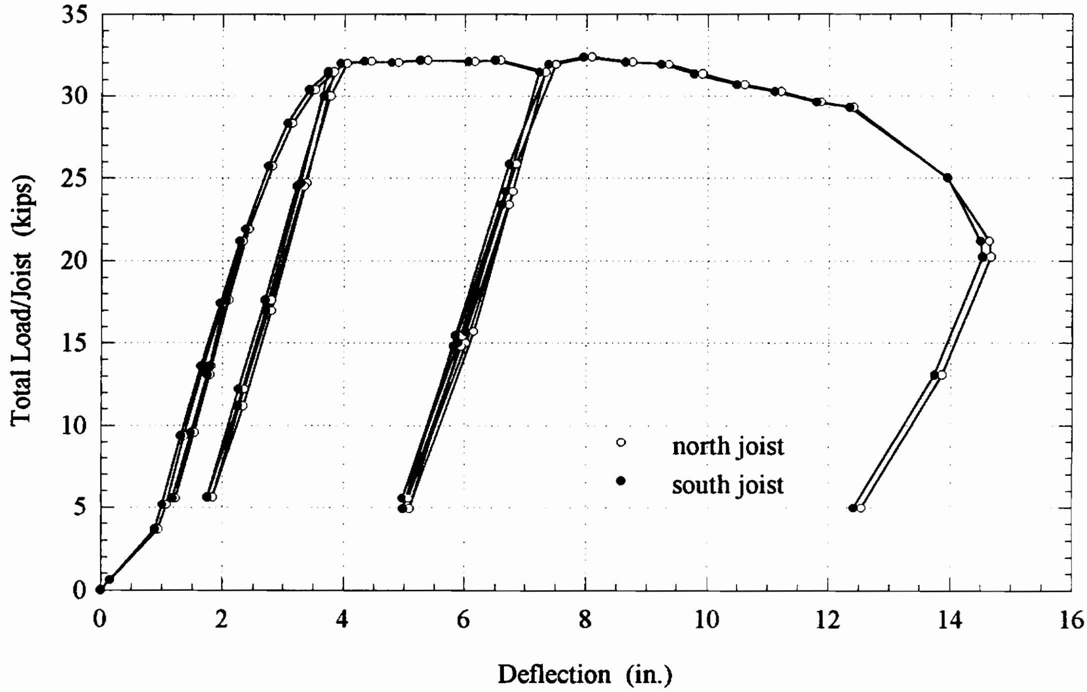



Figure A.5.1 Total Load/Joist vs. Midspan Deflection

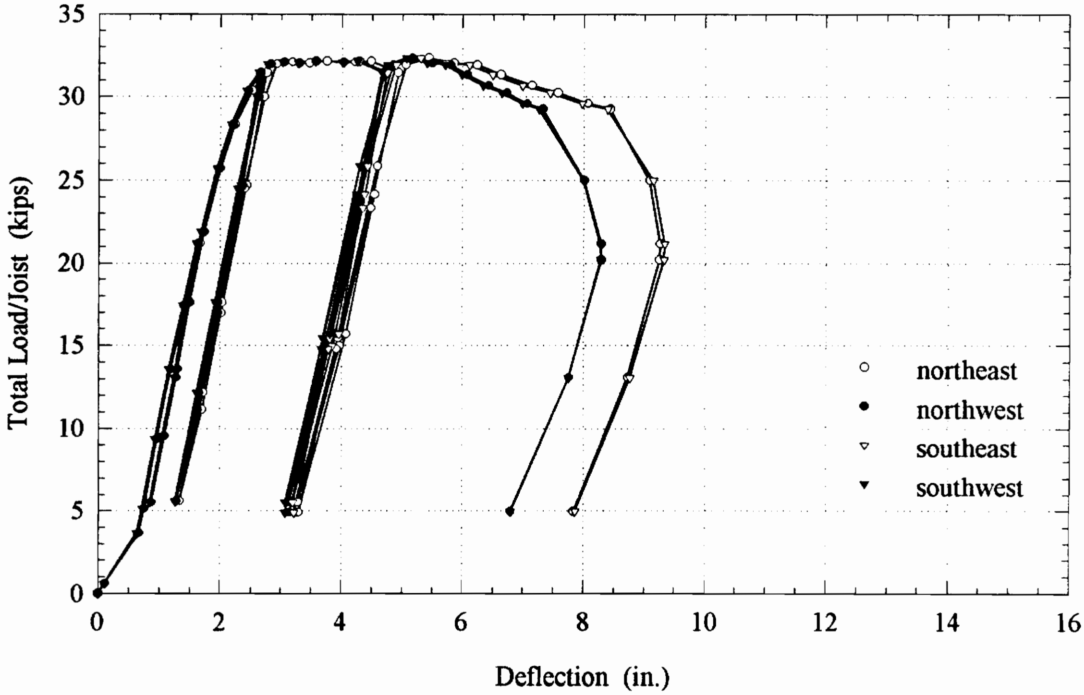



Figure A.5.2 Total Load/Joist vs. Quarter Point Deflection

# CSJ-5

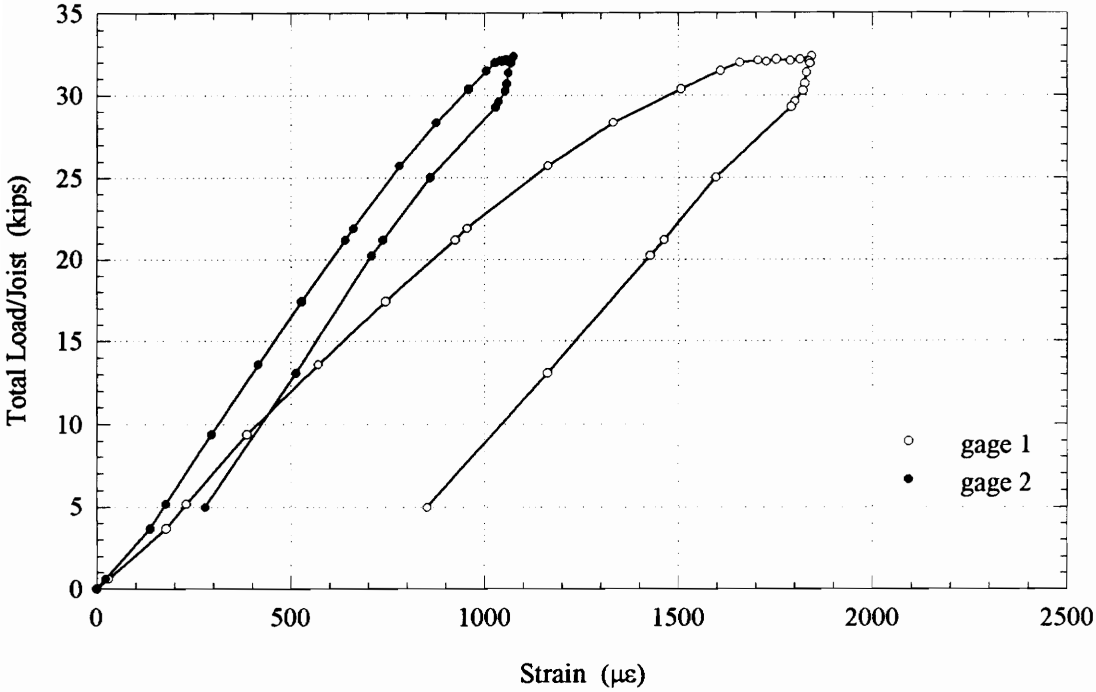



Figure A.5.3 Total Load/Joist vs. Bottom Chord Strain (BC1)

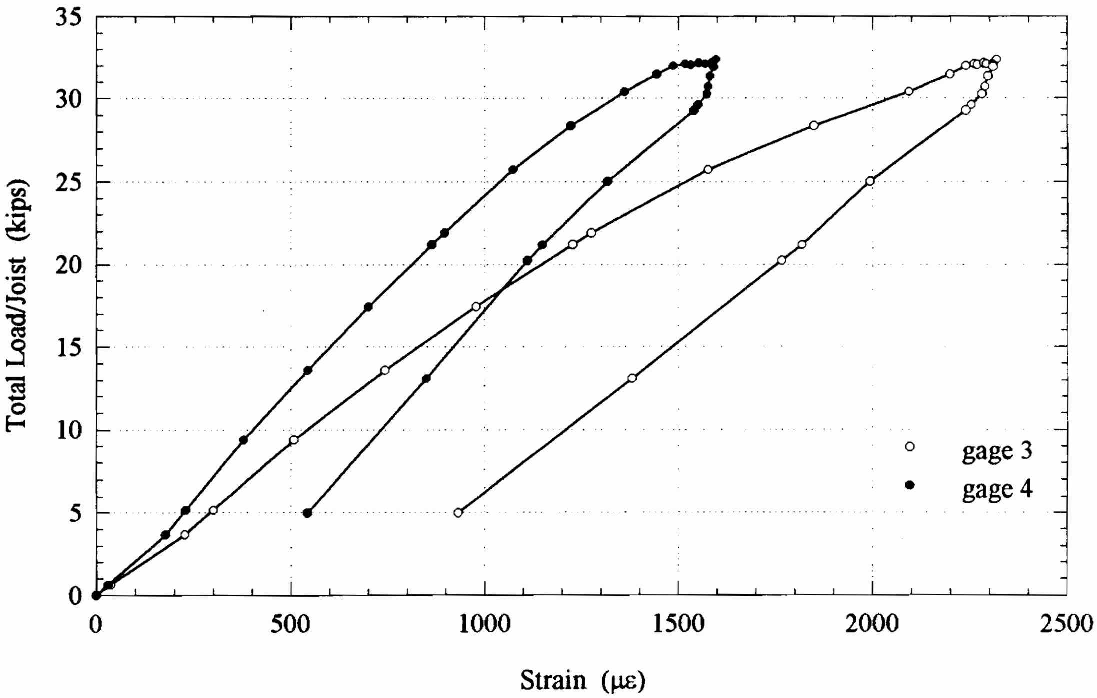



Figure A.5.4 Total Load/Joist vs. Bottom Chord Strain (BC2)

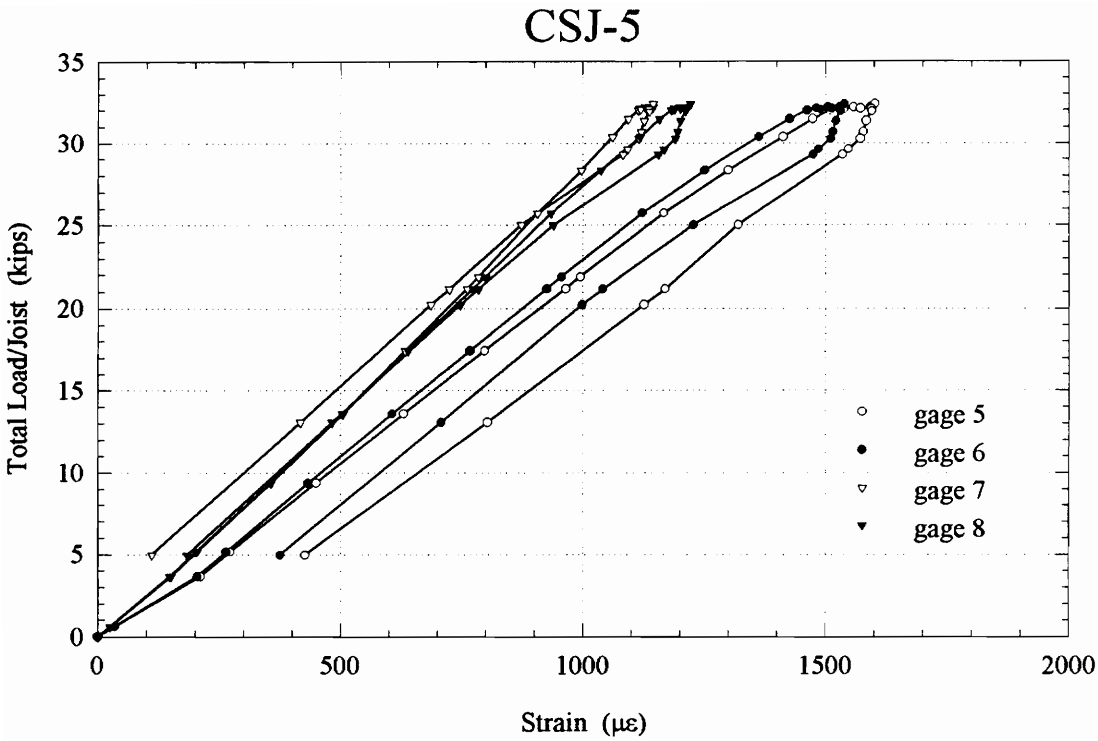



Figure A.5.5 Total Load/Joist vs. Bottom Chord Strain (BC3)

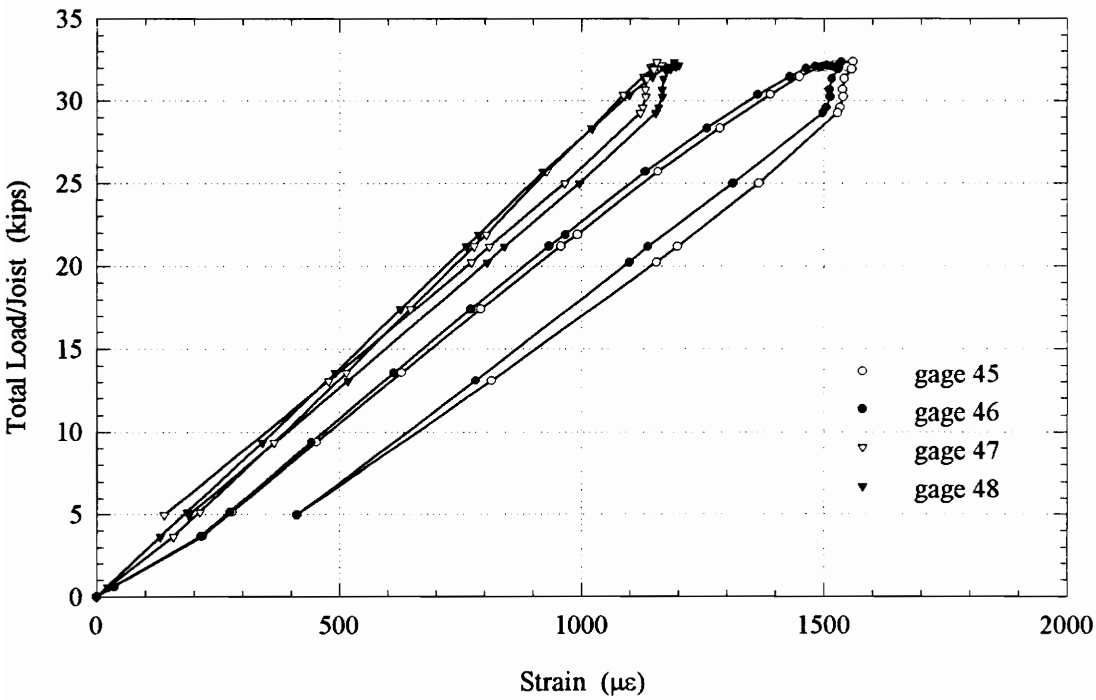



Figure A.5.6 Total Load/Joist vs. Bottom Chord Strain (BC4)

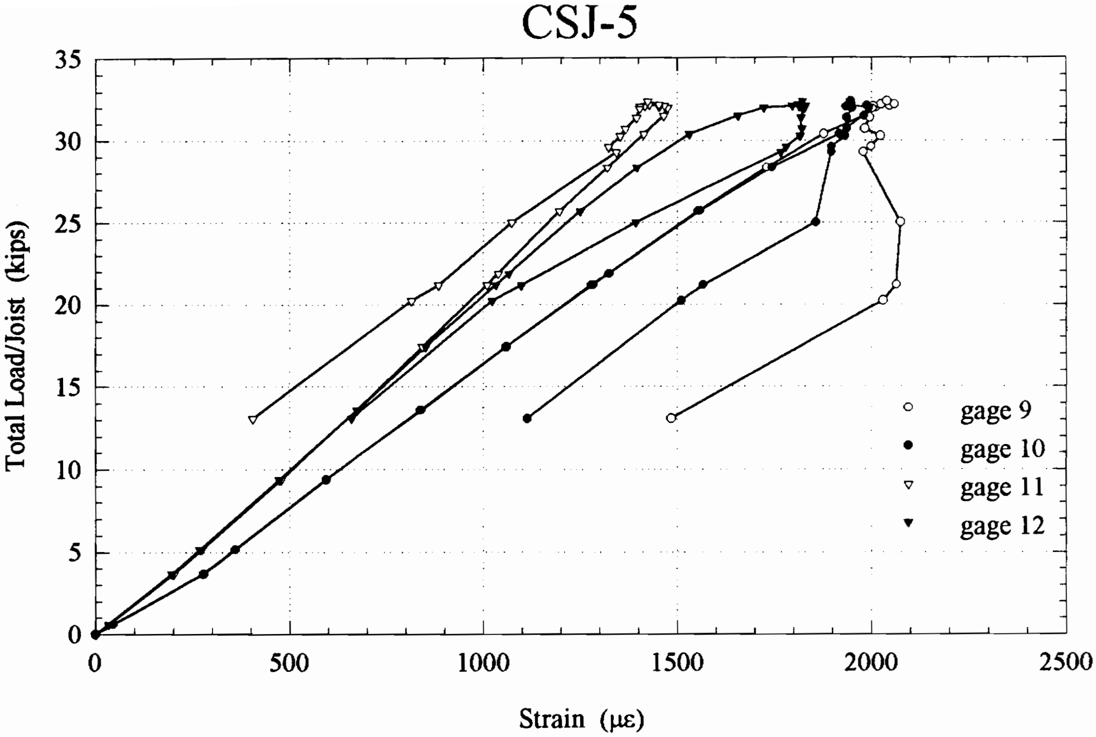



Figure A.5.7 Total Load/Joist vs. Bottom Chord Strain (BC5)

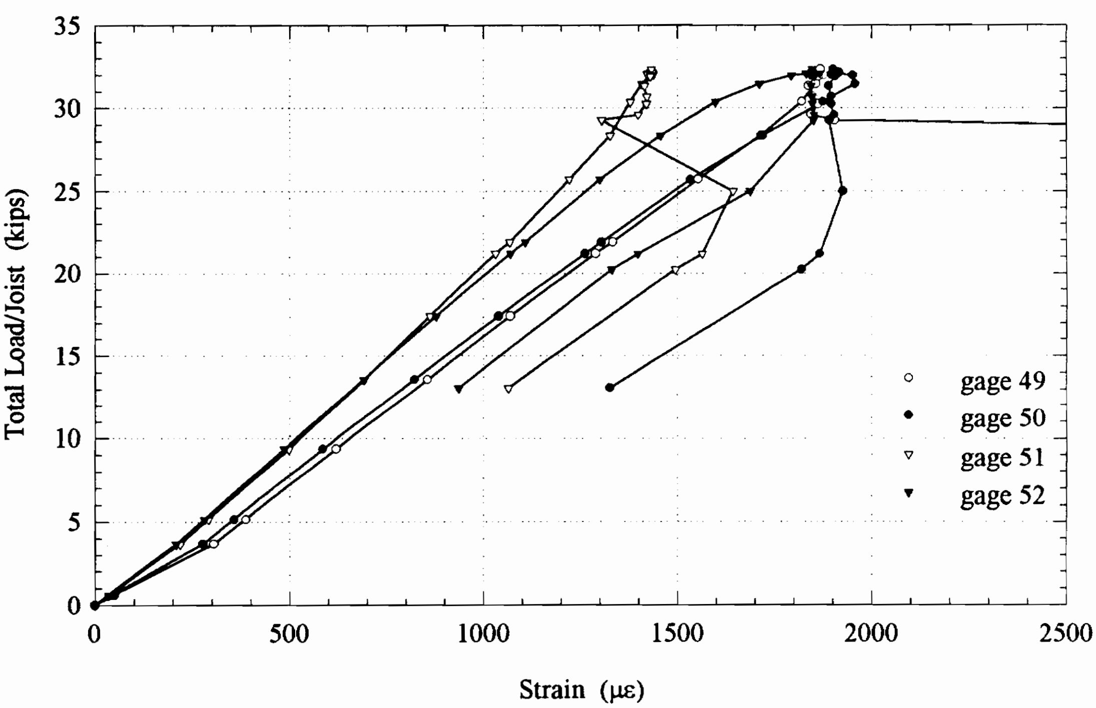



Figure A.5.8 Total Load/Joist vs. Bottom Chord Strain (BC6)

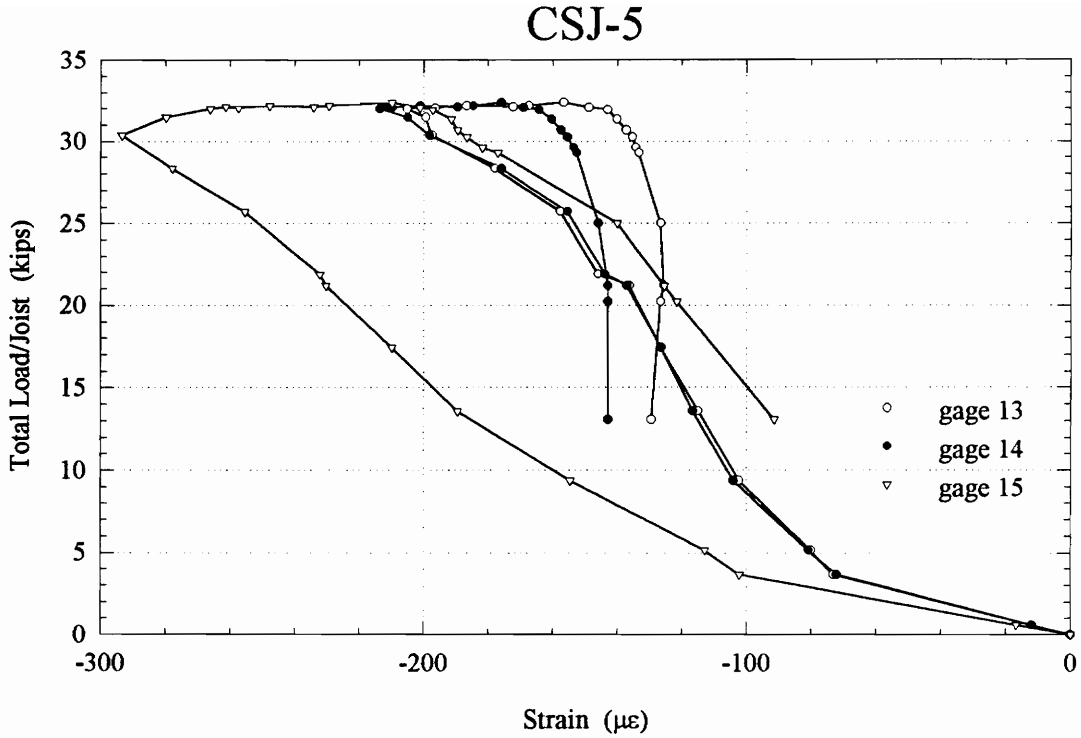



Figure A.5.9 Total Load/Joist vs. Top Chord Strain (TC1)

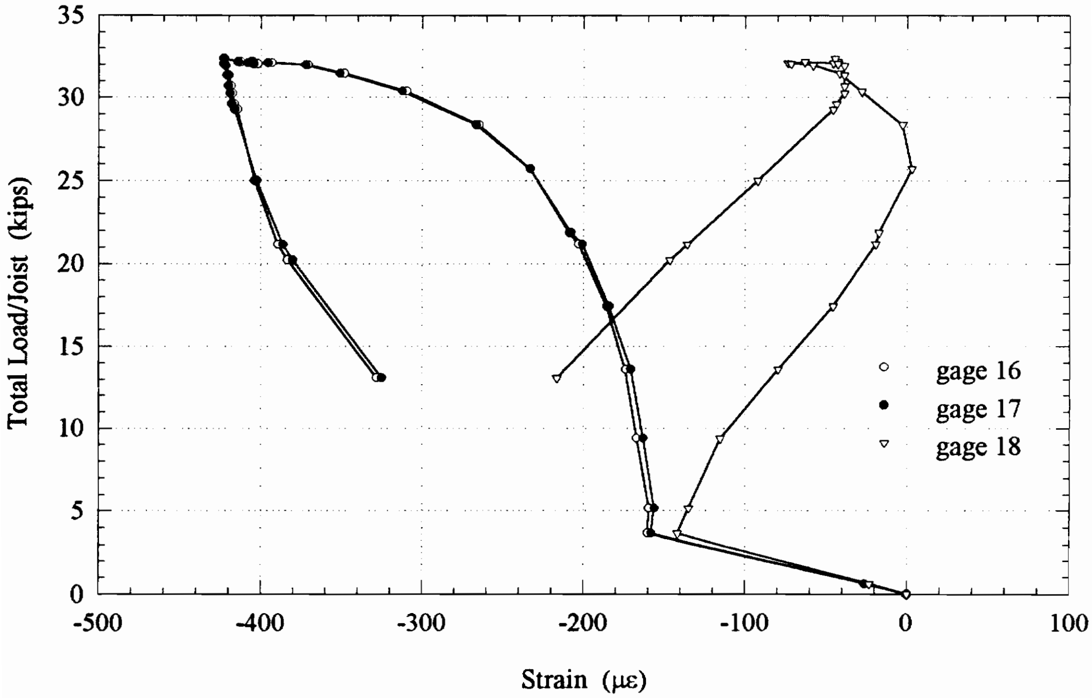



Figure A.5.10 Total Load/Joist vs. Top Chord Strain (TC2)

# CSJ-5

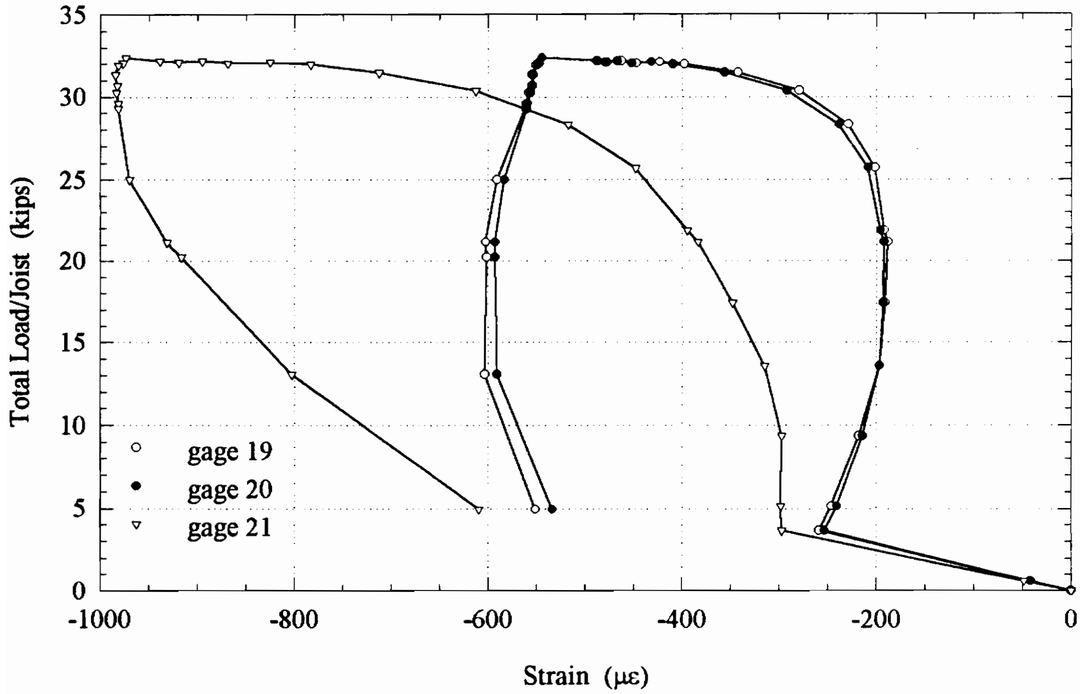



Figure A.5.11 Total Load/Joist vs. Top Chord Strain (TC3)

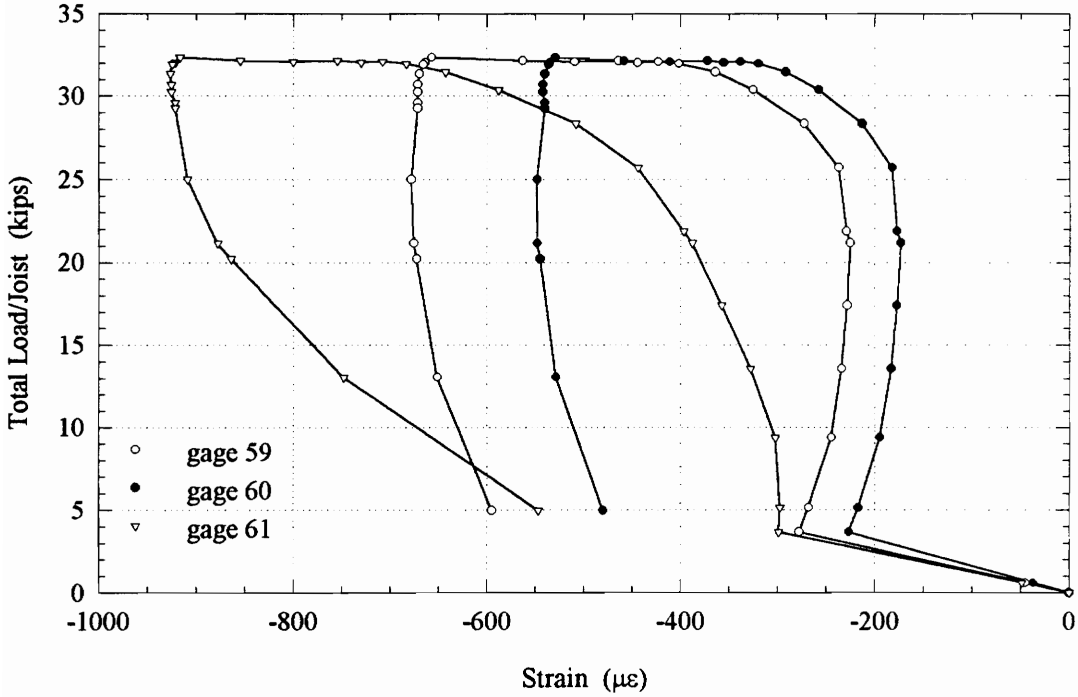



Figure A.5.12 Total Load/Joist vs. Top Chord Strain (TC4)

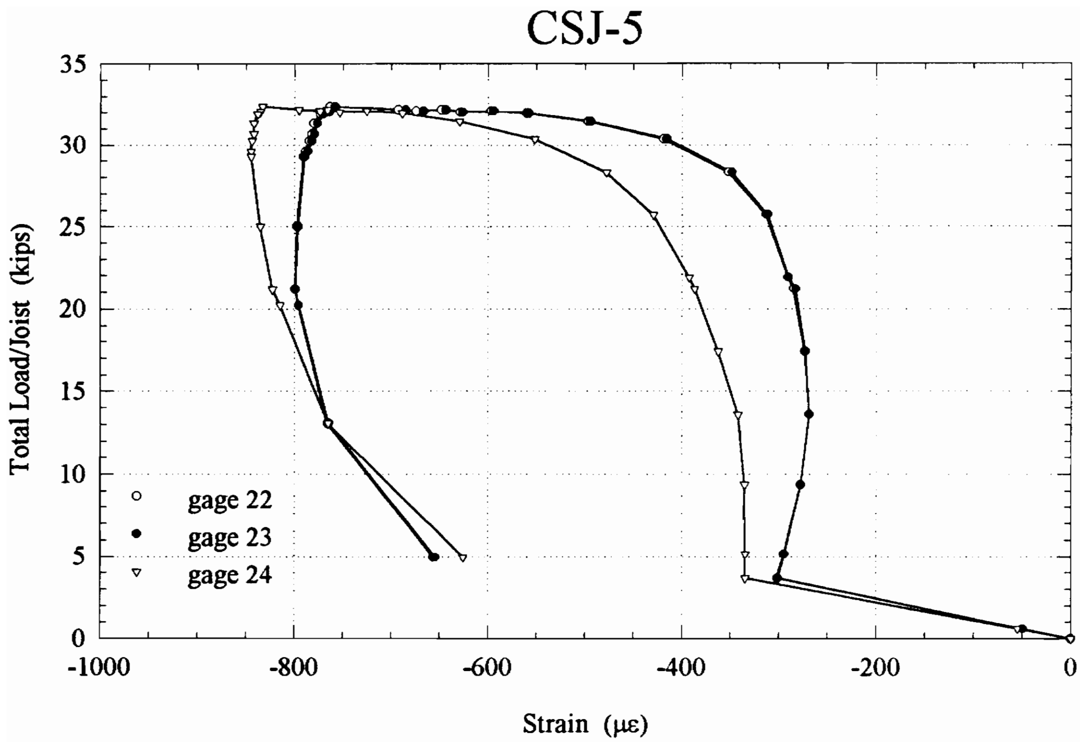



Figure A.5.13 Total Load/Joist vs. Top Chord Strain (TC5)

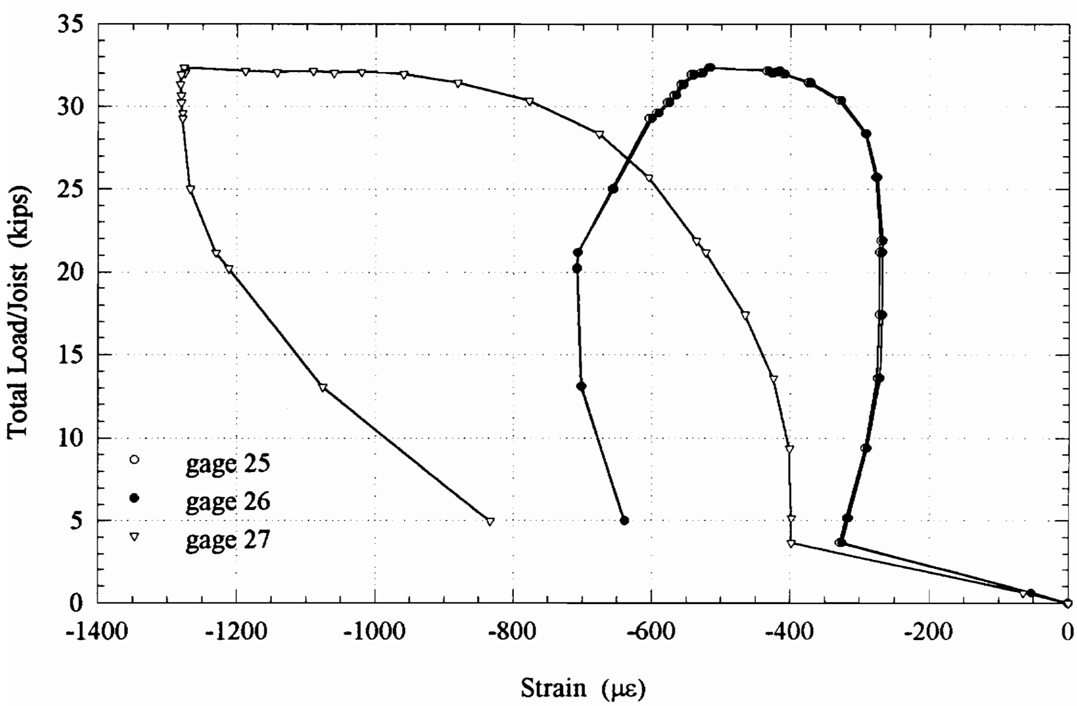



Figure A.5.14 Total Load/Joist vs. Top Chord Strain (TC6)

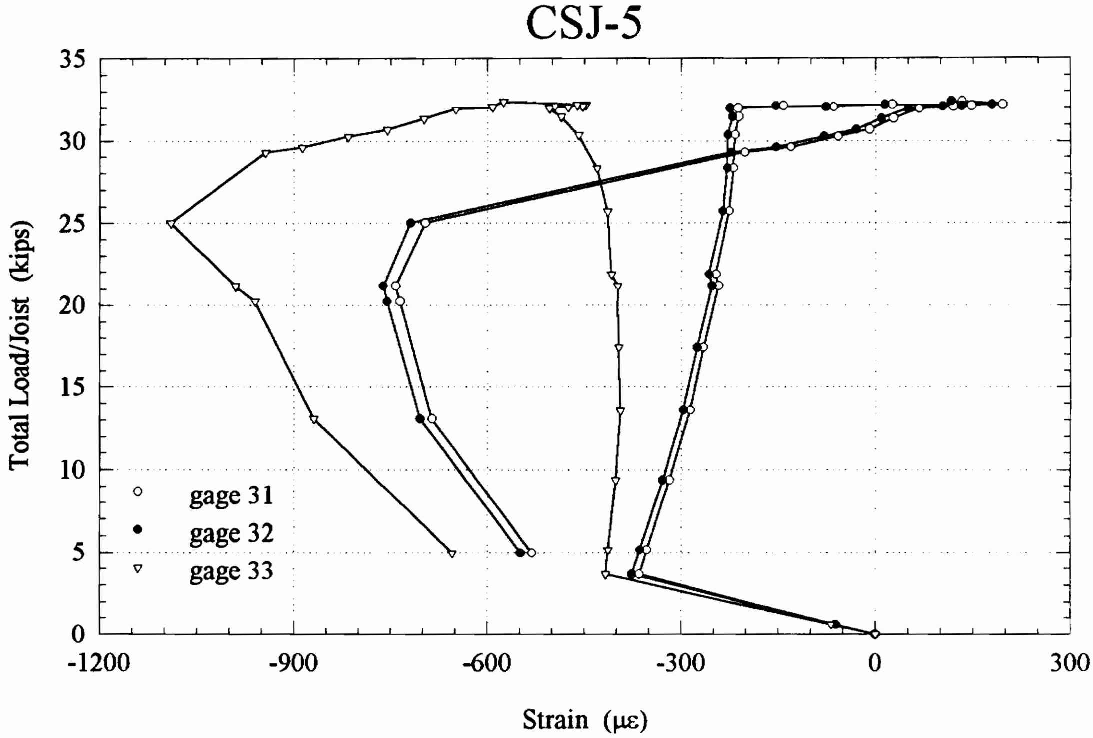



Figure A.5.15 Total Load/Joist vs. Top Chord Strain (TC7)

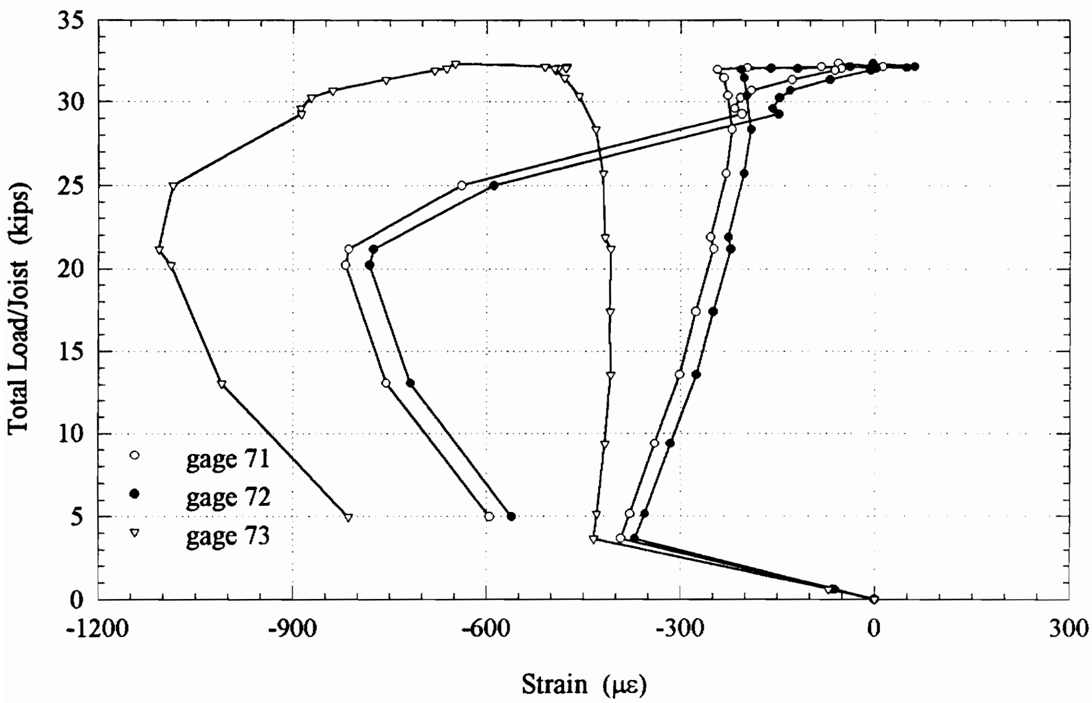



Figure A.5.16 Total Load/Joist vs. Top Chord Strain (TC8)

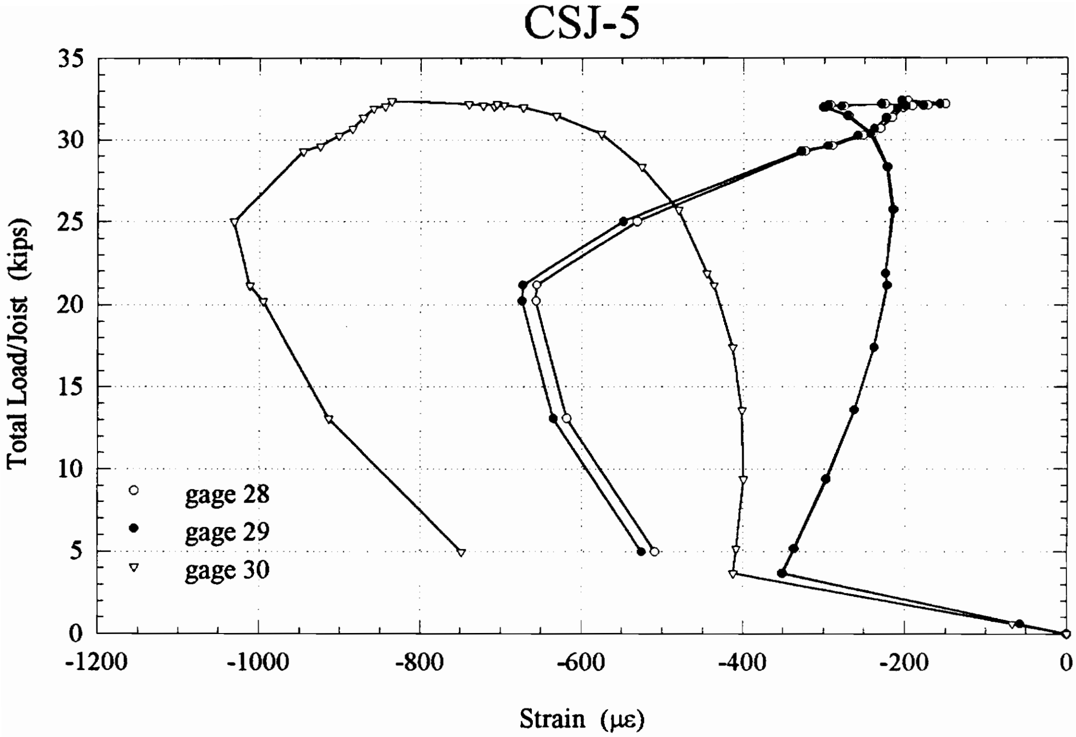



Figure A.5.17 Total Load/Joist vs. Top Chord Strain (TC9)

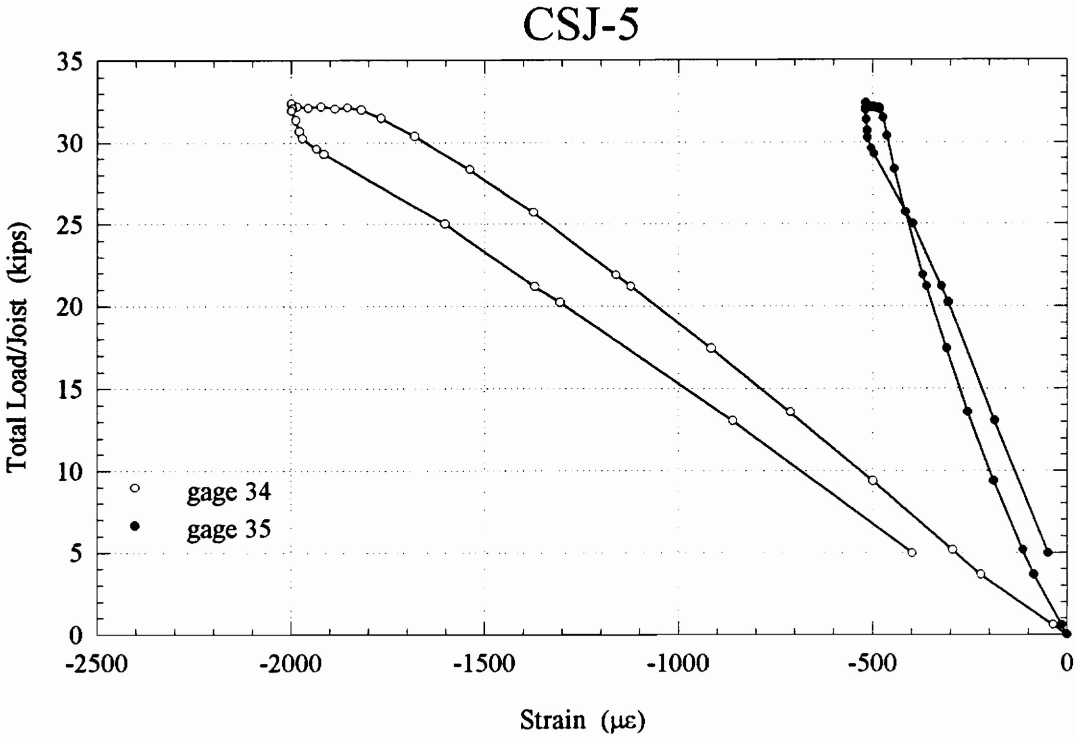



Figure A.5.18 Total Load/Joist vs. Web Strain (W9)

# CSJ-5

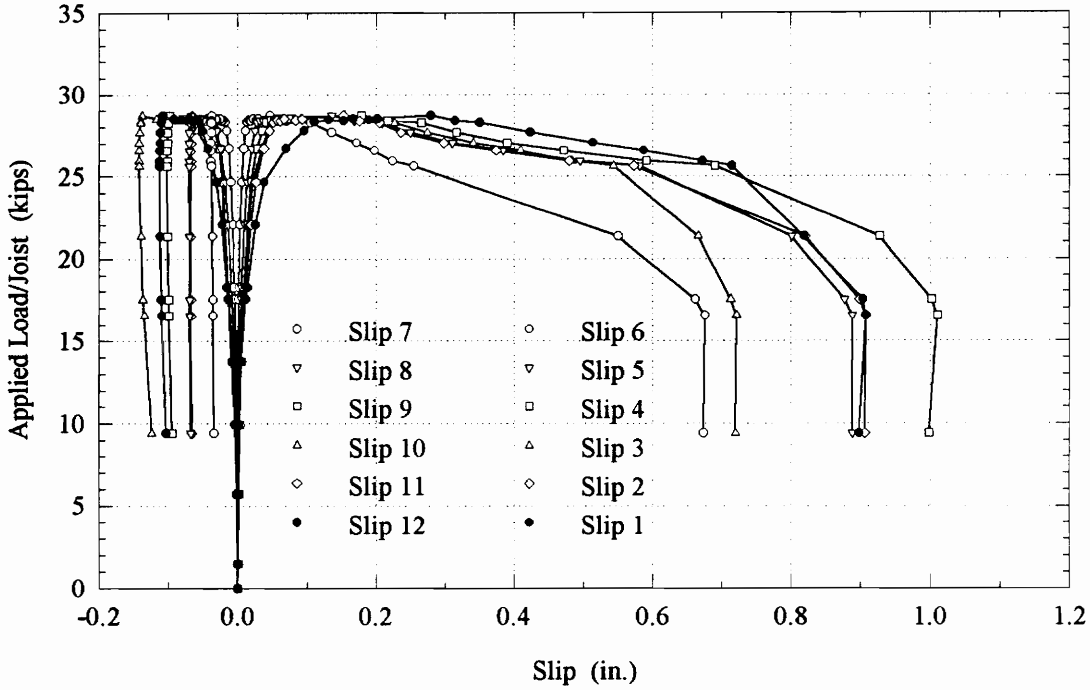



Figure A.5.19 Applied Load/Joist vs. Slip

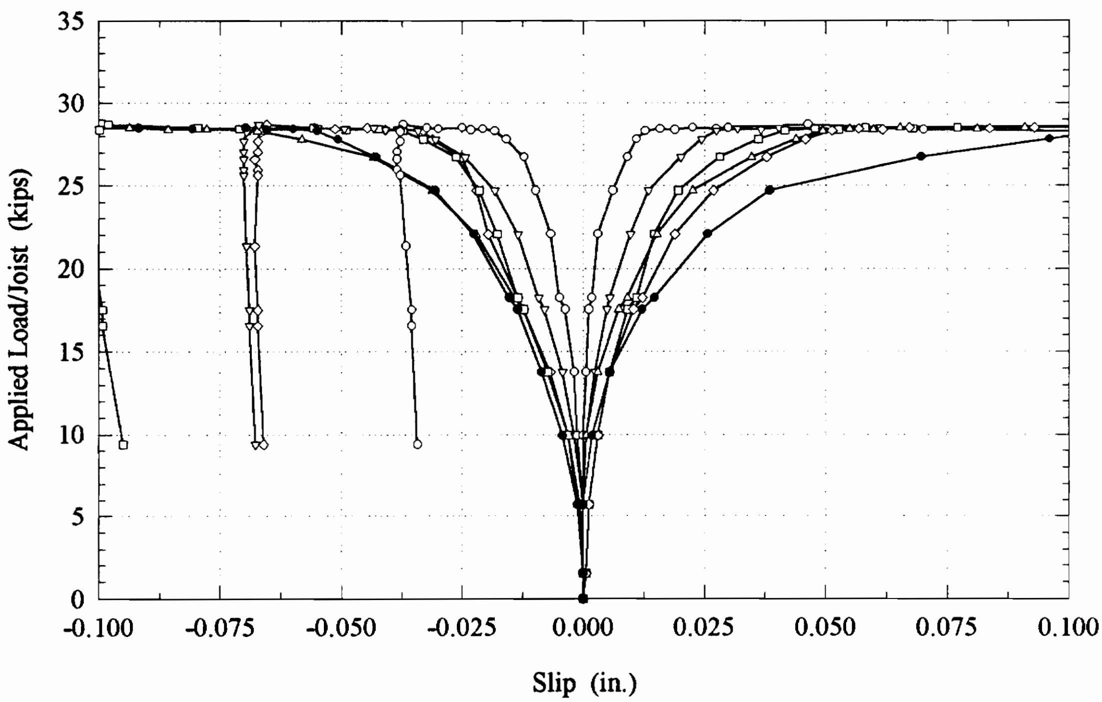



Figure A.5.20 Applied Load/Joist vs. Slip

## NUCOR COMPOSITE JOIST TEST SUMMARY SHEET

TEST DESIGNATION: CSJ-6 TEST DATE: 09 July 1992

### TEST DESCRIPTION

| | | | | |
|---|---|---|---|---|
| **Joist:** | Span: | 29'-7½" | Weight: | 11 plf |
| | Depth: | 18" | Spacing: | 40" |
| | Top Chord: | 2L-1.50x1.50x0.123 | Yield Strength: | 60.0 ksi |
| | Bottom Chord: | 2L-2.00x2.00x0.163 | Yield Strength: | 60.6 ksi |
| **Deck:** | Type: | 1.0C | Gage: | 26 ga |
| **Slab:** | Total Depth: | 4.0" | Compressive Strength: | 4200 psi |
| **Shear Connector:** | Type: | 1/2 in. dia. x 3 in. long welded headed shear stud | | |
| | Quantity: | 11 per half-span | | |

### THEORETICAL CALCULATIONS

Theoretical Applied Load per Joist at Failure: 32.2 kips
Theoretical Total Load per Joist at Failure: 36.6 kips
Transformed Moment of Inertia: $360.0\ in.^4$
Theoretical Elastic Stiffness: 17.86 k/in.
Elastic Deflection at Yield: 2.47 in.

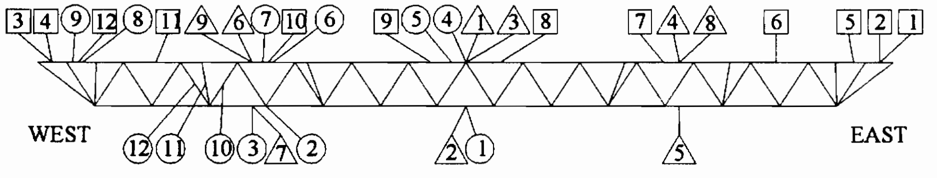
### TEST RESULTS

Applied Load per Joist at Failure: 29.6 kips
Total Load per Joist at Failure: 34.0 kips
Midspan Deflection at Failure: 5.42 in.
Maximum Slip and Location: 0.624 in. at stud SW11
Mode of Failure: yielding of the bottom chord

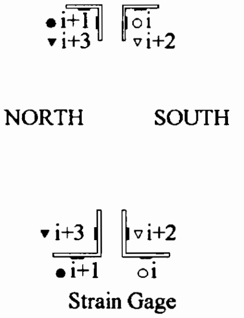
### COMPARISON OF ACTUAL TO THEORETICAL

Applied Load per Joist/Theoretical Applied Load per Joist: 0.92

### INSTRUMENTATION LOCATIONS




| Strain gages | Deflection | Slip |
|---|---|---|
| (1) BC1 | △1 NMT Defl | [1] SE End Slip |
| (2) BC2 | △2 NMB Defl | [2] NE End Slip |
| (3) BC3 | △3 SMT Defl | [3] SW End Slip |
| (4) TC1 | △4 NEQT Defl | [4] NW End Slip |
| (5) TC2 | △5 NEQB Defl | [5] NE9 Slip |
| (6) TC3 | △6 NWQT Defl | [6] NE7 Slip |
| (7) TC4 | △7 NWQB Defl | [7] NE4 Slip |
| (8) TC5 | △8 SEQT Defl | [8] NE1 Slip |
| (9) TC6 | △9 SWQT Defl | [9] NW1 Slip |
| (10) W1 | | [10] NW4 Slip |
| (11) W2 | | [11] NW7 Slip |
| (12) W3 | | [12] NW9 Slip |



Strain Gage Locations

| TOTAL LOAD PER JOIST (kips) | CSJ-6 TEST DATA SHEET DEFLECTIONS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | SWQT (in.) | SMT (in.) | SEQT (in.) | NWQT (in.) | NWQB (in.) | NMT (in.) | NMB (in.) | NEQT (in.) | NEQB (in.) |
| 0.00 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 0.27 | 0.034 | 0.045 | 0.035 | 0.031 | 0.031 | 0.040 | 0.040 | 0.031 | 0.031 |
| 4.44 | 0.556 | 0.742 | 0.574 | 0.520 | 0.520 | 0.667 | 0.667 | 0.522 | 0.522 |
| 5.94 | 0.616 | 0.812 | 0.639 | 0.584 | 0.587 | 0.751 | 0.745 | 0.588 | 0.584 |
| 6.90 | 0.648 | 0.863 | 0.676 | 0.621 | 0.622 | 0.805 | 0.797 | 0.629 | 0.623 |
| 7.67 | 0.678 | 0.905 | 0.708 | 0.650 | 0.652 | 0.847 | 0.838 | 0.658 | 0.652 |
| 8.31 | 0.703 | 0.932 | 0.731 | 0.674 | 0.672 | 0.879 | 0.870 | 0.683 | 0.676 |
| 5.94 | 0.616 | 0.812 | 0.639 | 0.585 | 0.585 | 0.751 | 0.745 | 0.588 | 0.584 |
| 7.92 | 0.694 | 0.918 | 0.713 | 0.669 | 0.665 | 0.862 | 0.846 | 0.669 | 0.661 |
| 9.90 | 0.761 | 1.021 | 0.791 | 0.742 | 0.728 | 0.965 | 0.952 | 0.745 | 0.738 |
| 12.01 | 0.836 | 1.123 | 0.865 | 0.818 | 0.808 | 1.077 | 1.054 | 0.827 | 0.818 |
| 14.25 | 0.926 | 1.248 | 0.952 | 0.904 | 0.891 | 1.197 | 1.173 | 0.916 | 0.905 |
| 16.04 | 0.999 | 1.360 | 1.031 | 0.981 | 0.967 | 1.304 | 1.276 | 0.996 | 0.982 |
| 18.27 | 1.091 | 1.485 | 1.123 | 1.071 | 1.053 | 1.429 | 1.395 | 1.091 | 1.075 |
| 19.36 | 1.144 | 1.550 | 1.178 | 1.122 | 1.101 | 1.496 | 1.464 | 1.144 | 1.126 |
| 16.04 | 1.022 | 1.392 | 1.068 | 1.013 | 0.995 | 1.334 | 1.309 | 1.025 | 1.008 |
| 10.80 | 0.827 | 1.118 | 0.869 | 0.814 | 0.800 | 1.060 | 1.041 | 0.820 | 0.812 |
| 6.46 | 0.657 | 0.881 | 0.694 | 0.642 | 0.635 | 0.819 | 0.805 | 0.642 | 0.637 |
| 10.42 | 0.802 | 1.086 | 0.846 | 0.791 | 0.780 | 1.031 | 1.013 | 0.795 | 0.788 |
| 15.08 | 0.983 | 1.336 | 1.026 | 0.968 | 0.952 | 1.281 | 1.248 | 0.978 | 0.968 |
| 19.55 | 1.153 | 1.573 | 1.192 | 1.134 | 1.110 | 1.509 | 1.477 | 1.156 | 1.137 |
| 21.14 | 1.219 | 1.657 | 1.252 | 1.198 | 1.175 | 1.595 | 1.566 | 1.222 | 1.201 |
| 23.12 | 1.304 | 1.778 | 1.344 | 1.290 | 1.261 | 1.718 | 1.684 | 1.317 | 1.292 |
| 25.10 | 1.405 | 1.917 | 1.446 | 1.387 | 1.359 | 1.848 | 1.818 | 1.417 | 1.389 |
| 27.15 | 1.504 | 2.042 | 1.543 | 1.485 | 1.454 | 1.980 | 1.952 | 1.521 | 1.485 |
| 29.19 | 1.616 | 2.196 | 1.663 | 1.600 | 1.563 | 2.129 | 2.108 | 1.634 | 1.596 |
| 30.85 | 1.726 | 2.340 | 1.783 | 1.711 | 1.673 | 2.283 | 2.263 | 1.749 | 1.705 |
| 31.36 | 1.793 | 2.433 | 1.852 | 1.781 | 1.740 | 2.384 | 2.362 | 1.820 | 1.775 |
| 32.51 | 1.868 | 2.539 | 1.926 | 1.853 | 1.816 | 2.499 | 2.477 | 1.892 | 1.847 |
| 25.36 | 1.623 | 2.228 | 1.690 | 1.612 | 1.578 | 2.167 | 2.133 | 1.647 | 1.602 |
| 18.91 | 1.373 | 1.889 | 1.432 | 1.367 | 1.326 | 1.832 | 1.792 | 1.389 | 1.355 |
| 12.08 | 1.066 | 1.476 | 1.132 | 1.057 | 1.032 | 1.424 | 1.382 | 1.076 | 1.056 |
| 18.21 | 1.313 | 1.815 | 1.372 | 1.305 | 1.270 | 1.758 | 1.717 | 1.331 | 1.299 |
| 25.36 | 1.595 | 2.196 | 1.658 | 1.588 | 1.556 | 2.140 | 2.108 | 1.622 | 1.582 |
| 32.06 | 1.878 | 2.558 | 1.939 | 1.864 | 1.829 | 2.516 | 2.490 | 1.904 | 1.858 |
| 33.21 | 2.128 | 2.976 | 2.189 | 2.113 | 2.074 | 2.941 | 2.907 | 2.157 | 2.105 |
| 32.96 | 2.270 | 3.231 | 2.341 | 2.258 | 2.217 | 3.207 | 3.161 | 2.303 | 2.249 |
| 33.53 | 2.419 | 3.506 | 2.484 | 2.407 | 2.367 | 3.470 | 3.410 | 2.451 | 2.394 |
| 33.34 | 2.575 | 3.803 | 2.650 | 2.573 | 2.525 | 3.761 | 3.695 | 2.615 | 2.553 |
| 33.40 | 2.747 | 4.095 | 2.816 | 2.731 | 2.677 | 4.041 | 3.975 | 2.772 | 2.706 |
| 33.53 | 2.878 | 4.332 | 2.945 | 2.865 | 2.804 | 4.278 | 4.204 | 2.905 | 2.836 |
| 33.40 | 3.045 | 4.620 | 3.116 | 3.029 | 2.967 | 4.571 | 4.500 | 3.069 | 2.998 |
| 33.40 | 3.297 | 5.080 | 3.365 | 3.285 | 3.218 | 5.030 | 4.949 | 3.323 | 3.248 |
| 25.68 | 3.011 | 4.685 | 3.079 | 3.001 | 2.939 | 4.624 | 4.561 | 3.024 | 2.957 |
| 18.91 | 2.722 | 4.295 | 2.793 | 2.713 | 2.661 | 4.234 | 4.159 | 2.727 | 2.671 |
| 11.50 | 2.387 | 3.845 | 2.451 | 2.379 | 2.345 | 3.788 | 3.708 | 2.387 | 2.351 |
| 5.88 | 2.114 | 3.468 | 2.165 | 2.102 | 2.074 | 3.413 | 3.336 | 2.106 | 2.081 |
| 13.03 | 2.405 | 3.872 | 2.470 | 2.393 | 2.367 | 3.813 | 3.734 | 2.407 | 2.371 |
| 20.19 | 2.715 | 4.277 | 2.774 | 2.697 | 2.648 | 4.216 | 4.142 | 2.716 | 2.664 |
| 27.27 | 3.011 | 4.676 | 3.079 | 2.996 | 2.932 | 4.623 | 4.552 | 3.023 | 2.959 |
| 33.59 | 3.304 | 5.094 | 3.360 | 3.291 | 3.218 | 5.038 | 4.962 | 3.326 | 3.252 |
| 34.04 | 3.506 | 5.447 | 3.554 | 3.495 | 3.418 | 5.388 | 5.299 | 3.525 | 3.444 |
| 33.66 | 3.735 | 5.846 | 3.780 | 3.723 | 3.641 | 5.786 | 5.675 | 3.743 | 3.658 |
| 33.78 | 4.011 | 6.325 | 4.047 | 3.991 | 3.905 | 6.250 | 6.139 | 4.005 | 3.917 |

| TOTAL LOAD PER JOIST (kips) | CSJ-6 TEST DATA SHEET DEFLECTIONS (cont.) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | SWQT (in.) | SMT (in.) | SEQT (in.) | NWQT (in.) | NWQB (in.) | NMT (in.) | NMB (in.) | NEQT (in.) | NEQB (in.) |
| 33.78 | 4.378 | 6.943 | 4.430 | 4.361 | 4.267 | 6.873 | 6.763 | 4.377 | 4.282 |
| 33.90 | 4.726 | 7.519 | 4.808 | 4.714 | 4.601 | 7.448 | 7.314 | 4.733 | 4.632 |
| 33.84 | 5.082 | 8.048 | 5.150 | 5.053 | 4.920 | 7.952 | 7.804 | 5.050 | 4.941 |
| 33.77 | 5.506 | 8.652 | 5.514 | 5.479 | 5.327 | 8.555 | 8.409 | 5.415 | 5.299 |
| 33.33 | 5.898 | 9.191 | 5.832 | 5.864 | 5.702 | 9.096 | 8.955 | 5.732 | 5.607 |
| 33.39 | 6.485 | 9.971 | 6.289 | 6.454 | 6.287 | 9.873 | 9.722 | 6.171 | 6.038 |
| 33.14 | 6.903 | 10.505 | 6.580 | 6.847 | 6.656 | 10.397 | 10.240 | 6.462 | 6.326 |
| 32.89 | 7.286 | 11.053 | 6.935 | 7.219 | 7.009 | 10.955 | 10.788 | 6.799 | 6.659 |
| 32.70 | 7.694 | 11.722 | 7.350 | 7.624 | 7.397 | 11.625 | 11.456 | 7.208 | 7.055 |
| 32.39 | 8.116 | 12.493 | 7.811 | 8.078 | 7.826 | 12.385 | 12.186 | 7.686 | 7.512 |
| 32.27 | 8.811 | 13.631 | 8.480 | 8.774 | 8.521 | 13.526 | 13.315 | 8.355 | 8.160 |
| 24.86 | 8.444 | 13.162 | 8.134 | 8.418 | 8.181 | 13.048 | 12.846 | 8.002 | 7.818 |
| 19.24 | 8.107 | 12.702 | 7.816 | 8.079 | 7.845 | 12.592 | 12.395 | 7.673 | 7.509 |
| 12.15 | 7.566 | 12.024 | 7.359 | 7.567 | 7.369 | 11.921 | 11.743 | 7.202 | 7.068 |
| 5.94 | 7.052 | 11.369 | 6.884 | 7.058 | 6.894 | 11.270 | 11.106 | 6.748 | 6.635 |

| TOTAL LOAD PER JOIST (kips) | CSJ-6 TEST DATA SHEET TC1 2L1.50x1.50x0.123 | | | | AVG MEM LOAD (kips) | CSJ-6 TEST DATA SHEET TC2 2L1.50x1.50x0.123 | | | | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| | TC1 (1) | TC1 (2) | TC1 (3) | TC1 (4) | | TC2 (5) | TC2 (6) | TC2 (7) | TC2 (8) | |
| | (με) | | | | | (με) | | | | |
| 0.00 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 |
| 0.27 | 0 | -25 | -22 | -21 | -0.3 | -30 | -29 | -28 | -28 | -0.6 |
| 4.44 | 6 | -412 | -361 | -355 | -5.8 | -496 | -475 | -472 | -466 | -9.8 |
| 5.94 | 29 | -402 | -356 | -352 | -5.5 | -489 | -469 | -460 | -453 | -9.6 |
| 6.90 | 40 | -397 | -352 | -350 | -5.4 | -485 | -465 | -454 | -446 | -9.5 |
| 7.67 | 47 | -393 | -349 | -349 | -5.4 | -481 | -463 | -448 | -440 | -9.4 |
| 8.31 | 54 | -390 | -347 | -348 | -5.3 | -478 | -460 | -444 | -436 | -9.3 |
| 5.94 | 29 | -402 | -356 | -353 | -5.6 | -489 | -469 | -460 | -453 | -9.6 |
| 7.92 | 50 | -393 | -348 | -349 | -5.3 | -480 | -462 | -446 | -439 | -9.4 |
| 9.90 | 68 | -384 | -342 | -346 | -5.2 | -473 | -456 | -433 | -425 | -9.2 |
| 12.01 | 89 | -374 | -336 | -342 | -4.9 | -466 | -450 | -421 | -413 | -9.0 |
| 14.25 | 110 | -365 | -330 | -338 | -4.7 | -459 | -444 | -408 | -399 | -8.8 |
| 16.04 | 129 | -357 | -325 | -336 | -4.6 | -452 | -441 | -396 | -389 | -8.6 |
| 18.27 | 151 | -349 | -320 | -334 | -4.4 | -448 | -439 | -386 | -380 | -8.5 |
| 19.36 | 161 | -347 | -319 | -334 | -4.3 | -447 | -439 | -382 | -377 | -8.4 |
| 16.04 | 129 | -362 | -332 | -344 | -4.7 | -462 | -453 | -405 | -399 | -8.8 |
| 10.80 | 80 | -385 | -350 | -356 | -5.2 | -482 | -469 | -440 | -431 | -9.4 |
| 6.46 | 36 | -404 | -361 | -359 | -5.6 | -494 | -478 | -464 | -456 | -9.7 |
| 10.42 | 79 | -385 | -346 | -353 | -5.2 | -478 | -465 | -437 | -428 | -9.3 |
| 15.08 | 124 | -365 | -331 | -344 | -4.7 | -461 | -452 | -408 | -401 | -8.8 |
| 19.55 | 165 | -347 | -318 | -333 | -4.3 | -445 | -439 | -380 | -376 | -8.4 |
| 21.14 | 181 | -341 | -314 | -331 | -4.1 | -441 | -437 | -371 | -369 | -8.3 |
| 23.12 | 204 | -348 | -314 | -337 | -4.1 | -447 | -451 | -370 | -379 | -8.5 |
| 25.10 | 225 | -353 | -318 | -342 | -4.0 | -452 | -461 | -368 | -382 | -8.5 |
| 27.15 | 249 | -357 | -319 | -347 | -4.0 | -457 | -469 | -365 | -386 | -8.6 |
| 29.19 | 269 | -362 | -320 | -352 | -3.9 | -464 | -481 | -364 | -392 | -8.7 |
| 30.85 | 285 | -370 | -319 | -356 | -3.9 | -475 | -495 | -366 | -400 | -8.9 |
| 31.36 | 278 | -370 | -308 | -347 | -3.8 | -473 | -492 | -356 | -392 | -8.8 |
| 32.51 | 250 | -357 | -281 | -322 | -3.6 | -449 | -468 | -322 | -361 | -8.2 |
| 25.36 | 119 | -400 | -305 | -339 | -4.7 | -485 | -492 | -371 | -405 | -9.0 |
| 18.91 | 18 | -434 | -324 | -344 | -5.6 | -511 | -506 | -410 | -440 | -9.6 |
| 12.08 | -23 | -413 | -315 | -315 | -5.5 | -492 | -476 | -407 | -419 | -9.2 |
| 18.21 | 34 | -400 | -305 | -319 | -5.1 | -481 | -475 | -384 | -404 | -9.0 |
| 25.36 | 119 | -380 | -291 | -320 | -4.5 | -467 | -473 | -352 | -380 | -8.6 |
| 32.06 | 217 | -368 | -279 | -318 | -3.8 | -459 | -474 | -325 | -363 | -8.3 |
| 33.21 | 140 | -319 | -187 | -223 | -3.0 | -400 | -399 | -214 | -253 | -6.5 |
| 32.96 | 114 | -295 | -139 | -171 | -2.5 | -378 | -366 | -150 | -189 | -5.6 |
| 33.53 | 154 | -251 | -89 | -120 | -1.6 | -330 | -318 | -69 | -113 | -4.3 |
| 33.34 | 233 | -207 | -42 | -77 | -0.5 | -288 | -277 | 7 | -38 | -3.1 |
| 33.40 | 272 | -169 | 2 | -36 | 0.4 | -251 | -244 | 79 | 27 | -2.0 |
| 33.53 | 323 | -133 | 46 | 3 | 1.2 | -214 | -209 | 146 | 91 | -1.0 |
| 33.40 | 368 | -90 | 86 | 39 | 2.1 | -175 | -173 | 217 | 156 | 0.1 |
| 33.40 | 492 | -28 | 148 | 93 | 3.6 | -119 | -123 | 321 | 253 | 1.7 |
| 25.68 | 318 | -88 | 127 | 82 | 2.3 | -161 | -163 | 269 | 199 | 0.7 |
| 18.91 | 177 | -136 | 131 | 100 | 1.4 | -178 | -180 | 236 | 171 | 0.2 |
| 11.50 | 138 | -216 | 131 | 124 | 0.9 | -168 | -198 | 219 | 150 | 0.0 |
| 5.88 | 91 | -244 | 158 | 168 | 0.9 | -160 | -177 | 223 | 162 | 0.2 |
| 13.03 | 202 | -173 | 140 | 133 | 1.6 | -137 | -164 | 246 | 182 | 0.7 |
| 20.19 | 292 | -110 | 131 | 100 | 2.1 | -120 | -154 | 273 | 202 | 1.0 |
| 27.27 | 508 | -63 | 130 | 81 | 3.4 | -108 | -146 | 301 | 226 | 1.4 |
| 33.59 | 637 | -47 | 127 | 61 | 4.0 | -115 | -160 | 308 | 227 | 1.3 |
| 34.04 | 665 | -5 | 166 | 99 | 4.7 | -80 | -121 | 379 | 293 | 2.4 |
| 33.66 | 683 | 31 | 206 | 136 | 5.4 | -55 | -90 | 447 | 360 | 3.4 |
| 33.78 | 636 | 59 | 273 | 201 | 6.0 | -30 | -62 | 546 | 453 | 4.7 |

| TOTAL LOAD PER JOIST (kips) | CSJ-6 TEST DATA SHEET TC1 (cont.) 2L1.50x1.50x0.123 TC1 (1) | TC1 (2) | TC1 (3) | TC1 (4) | AVG MEM LOAD (kips) | CSJ-6 TEST DATA SHEET TC2 (cont.) 2L1.50x1.50x0.123 TC2 (5) | TC2 (6) | TC2 (7) | TC2 (8) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| | (με) | | | | | (με) | | | | |
| 33.78 | 676 | 43 | 261 | 168 | 5.9 | -94 | -114 | 523 | 426 | 3.8 |
| 33.90 | 609 | -2 | 219 | 116 | 4.8 | -165 | -180 | 471 | 373 | 2.6 |
| 33.84 | 400 | -81 | 167 | 41 | 2.7 | -263 | -281 | 396 | 287 | 0.7 |
| 33.77 | 68 | -188 | 112 | -44 | -0.3 | -378 | -410 | 313 | 191 | -1.5 |
| 33.33 | -425 | -347 | 28 | -171 | -4.7 | -540 | -593 | 176 | 31 | -4.7 |
| 33.39 | -1021 | -545 | -84 | -328 | -10.2 | -720 | -813 | 7 | -178 | -8.7 |
| 33.14 | -1320 | -676 | -166 | -424 | -13.3 | -829 | -946 | -112 | -324 | -11.3 |
| 32.89 | -1657 | -798 | -243 | -527 | -16.6 | -921 | -1067 | -215 | -463 | -13.7 |
| 32.70 | -1813 | -879 | -257 | -569 | -18.1 | -969 | -1146 | -227 | -513 | -14.7 |
| 32.39 | -2147 | -973 | -320 | -708 | -21.3 | -1031 | -1234 | -312 | -646 | -16.5 |
| 32.27 | -2571 | -1071 | -409 | -998 | -25.9 | -1091 | -1321 | -421 | -818 | -18.7 |
| 24.86 | -2568 | -1075 | -433 | -1013 | -26.1 | -1085 | -1299 | -447 | -825 | -18.8 |
| 19.24 | -2329 | -1036 | -409 | -952 | -24.3 | -1009 | -1228 | -398 | -757 | -17.4 |
| 12.15 | -1791 | -919 | -332 | -810 | -19.8 | -849 | -1075 | -267 | -584 | -14.2 |
| 5.94 | -1203 | -734 | -174 | -553 | -13.7 | -617 | -863 | -11 | -270 | -9.0 |

| TOTAL LOAD PER JOIST (kips) | CSJ-6 TEST DATA SHEET TC3 2L1.50x1.50x0.123 | | | | AVG MEM LOAD (kips) | CSJ-6 TEST DATA SHEET TC4 2L1.50x1.50x0.123 | | | | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| | TC3 (9) | TC3 (10) | TC3 (11) | TC3 (12) | | TC4 (13) | TC4 (14) | TC4 (15) | TC4 (16) | |
| | (με) | | | | | (με) | | | | |
| 0.00 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 |
| 0.27 | -25 | -24 | -21 | -21 | -0.5 | -24 | -24 | -21 | -21 | -0.5 |
| 4.44 | -407 | -401 | -346 | -347 | -7.7 | -396 | -403 | -345 | -345 | -7.6 |
| 5.94 | -387 | -391 | -333 | -334 | -7.4 | xxx | -396 | -338 | -336 | -7.3 |
| 6.90 | -378 | -385 | -328 | -328 | -7.3 | xxx | -392 | -334 | -330 | -7.2 |
| 7.67 | -369 | -381 | -322 | -323 | -7.2 | xxx | -390 | -331 | -327 | -7.2 |
| 8.31 | -362 | -379 | -318 | -319 | -7.1 | xxx | -388 | -330 | -324 | -7.1 |
| 5.94 | -387 | -392 | -333 | -334 | -7.4 | xxx | -396 | -338 | -337 | -7.3 |
| 7.92 | -367 | -379 | -321 | -321 | -7.1 | xxx | -390 | -332 | -324 | -7.2 |
| 9.90 | -345 | -370 | -308 | -308 | -6.8 | xxx | -384 | -328 | -314 | -7.0 |
| 12.01 | -321 | -359 | -295 | -294 | -6.5 | xxx | -379 | -322 | -302 | -6.9 |
| 14.25 | -296 | -349 | -282 | -280 | -6.2 | xxx | -373 | -318 | -291 | -6.7 |
| 16.04 | -284 | -356 | -282 | -279 | -6.2 | xxx | -381 | -324 | -299 | -6.9 |
| 18.27 | -255 | -357 | -265 | -272 | -5.9 | xxx | -382 | -325 | -296 | -6.9 |
| 19.36 | -248 | -363 | -261 | -272 | -5.9 | xxx | -385 | -330 | -297 | -6.9 |
| 16.04 | -275 | -377 | -279 | -292 | -6.3 | xxx | -391 | -339 | -315 | -7.2 |
| 10.80 | -340 | -396 | -313 | -321 | -7.0 | xxx | -404 | -355 | -335 | -7.5 |
| 6.46 | -390 | -400 | -335 | -338 | -7.5 | xxx | -404 | -356 | -343 | -7.5 |
| 10.42 | -354 | -388 | -315 | -319 | -7.1 | xxx | -400 | -350 | -328 | -7.4 |
| 15.08 | -300 | -375 | -286 | -297 | -6.5 | xxx | -394 | -341 | -313 | -7.2 |
| 19.55 | -249 | -364 | -260 | -274 | -5.9 | xxx | -388 | -331 | -297 | -7.0 |
| 21.14 | -237 | -371 | -254 | -271 | -5.8 | xxx | -393 | -335 | -298 | -7.0 |
| 23.12 | -220 | -376 | -239 | -263 | -5.6 | xxx | -395 | -338 | -297 | -7.0 |
| 25.10 | -215 | -393 | -232 | -265 | -5.7 | xxx | -409 | -350 | -305 | -7.3 |
| 27.15 | -198 | -407 | -226 | -264 | -5.6 | xxx | -422 | -363 | -314 | -7.5 |
| 29.19 | -181 | -422 | -227 | -261 | -5.6 | xxx | -436 | -385 | -321 | -7.8 |
| 30.85 | -155 | -432 | -222 | -258 | -5.5 | xxx | -444 | -407 | -330 | -8.1 |
| 31.36 | -157 | -447 | -238 | -266 | -5.7 | xxx | -457 | -430 | -343 | -8.4 |
| 32.51 | -143 | -449 | -235 | -263 | -5.6 | xxx | -460 | -434 | -345 | -8.5 |
| 25.36 | -208 | -474 | -272 | -303 | -6.5 | xxx | -459 | -456 | -376 | -8.8 |
| 18.91 | -289 | -482 | -314 | -334 | -7.3 | xxx | -464 | -473 | -392 | -9.1 |
| 12.08 | -411 | -460 | -341 | -339 | -8.0 | xxx | -452 | -434 | -365 | -8.6 |
| 18.21 | -340 | -472 | -322 | -325 | -7.5 | xxx | -466 | -452 | -369 | -8.8 |
| 25.36 | -245 | -468 | -282 | -296 | -6.6 | xxx | -466 | -451 | -361 | -8.7 |
| 32.06 | -158 | -464 | -251 | -269 | -5.9 | xxx | -469 | -459 | -356 | -8.8 |
| 33.21 | -109 | -445 | -219 | -247 | -5.2 | xxx | -452 | -470 | -343 | -8.7 |
| 32.96 | -81 | -422 | -199 | -225 | -4.8 | xxx | -432 | -482 | -321 | -8.5 |
| 33.53 | -40 | -402 | -174 | -204 | -4.2 | xxx | -417 | -482 | -303 | -8.2 |
| 33.34 | 3 | -368 | -141 | -168 | -3.5 | xxx | -387 | -486 | -269 | -7.8 |
| 33.40 | 46 | -346 | -116 | -143 | -2.9 | xxx | -369 | -497 | -246 | -7.6 |
| 33.53 | 82 | -325 | -93 | -119 | -2.3 | xxx | -351 | -504 | -224 | -7.4 |
| 33.40 | 120 | -296 | -66 | -86 | -1.7 | xxx | -325 | -509 | -192 | -7.0 |
| 33.40 | 181 | -256 | -29 | -38 | -0.7 | xxx | -286 | -525 | -151 | -6.6 |
| 25.68 | 103 | -277 | -70 | -92 | -1.7 | xxx | -277 | -554 | -192 | -7.0 |
| 18.91 | 4 | -285 | -121 | -132 | -2.7 | xxx | -274 | -575 | -215 | -7.3 |
| 11.50 | -122 | -283 | -161 | -154 | -3.7 | xxx | -257 | -560 | -217 | -7.1 |
| 5.88 | -201 | -246 | -144 | -138 | -3.7 | xxx | -212 | -466 | -182 | -5.9 |
| 13.03 | -146 | -278 | -154 | -132 | -3.6 | xxx | -276 | -523 | -191 | -6.8 |
| 20.19 | -43 | -281 | -126 | -109 | -2.9 | xxx | -293 | -543 | -184 | -7.0 |
| 27.27 | 71 | -271 | -77 | -73 | -1.8 | xxx | -294 | -538 | -165 | -6.8 |
| 33.59 | 177 | -268 | -46 | -46 | -0.9 | xxx | -300 | -566 | -158 | -7.0 |
| 34.04 | 222 | -247 | -26 | -15 | -0.3 | xxx | -279 | -594 | -136 | -6.9 |
| 33.66 | 266 | -220 | -12 | 19 | 0.3 | xxx | -245 | -645 | -110 | -6.8 |
| 33.78 | 313 | -200 | -4 | 43 | 0.8 | xxx | -219 | -708 | -95 | -7.0 |

| TOTAL LOAD PER JOIST (kips) | CSJ-6 TEST DATA SHEET TC3 (cont.) 2L1.50x1.50x0.123 | | | | AVG MEM LOAD (kips) | CSJ-6 TEST DATA SHEET TC4 (cont.) 2L1.50x1.50x0.123 | | | | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| | TC3 (9) | TC3 (10) | TC3 (11) | TC3 (12) | | TC4 (13) | TC4 (14) | TC4 (15) | TC4 (16) | |
| | (με) | | | | | (με) | | | | |
| 33.78 | 317 | -228 | -50 | 32 | 0.4 | xxx | -228 | -891 | -119 | -8.5 |
| 33.90 | 307 | -274 | -117 | 1 | -0.4 | xxx | -252 | -1130 | -166 | -10.6 |
| 33.84 | 259 | -334 | -194 | -45 | -1.6 | xxx | -285 | -1539 | -231 | -14.1 |
| 33.77 | 163 | -402 | -283 | -106 | -3.2 | xxx | -319 | -2022 | -312 | -18.2 |
| 33.33 | -19 | -533 | -443 | -238 | -6.3 | xxx | -425 | -2573 | -457 | -23.6 |
| 33.39 | -353 | -676 | -529 | -380 | -9.9 | xxx | -551 | -2608 | -580 | -25.6 |
| 33.14 | -565 | -817 | -646 | -508 | -13.0 | xxx | -685 | -2808 | -707 | -28.8 |
| 32.89 | -732 | -944 | -758 | -613 | -15.6 | xxx | -802 | -3244 | -822 | -33.3 |
| 32.70 | -775 | -967 | -779 | -629 | -16.2 | xxx | -830 | -3358 | -842 | -34.4 |
| 32.39 | -820 | -1000 | -814 | -662 | -16.9 | xxx | -911 | -3582 | -863 | -36.7 |
| 32.27 | -884 | -1044 | -866 | -700 | -17.9 | xxx | -917 | -3842 | -912 | -38.8 |
| 24.86 | -923 | -1021 | -864 | -690 | -18.0 | xxx | -866 | -3831 | -897 | -38.3 |
| 19.24 | -932 | -952 | -844 | -660 | -17.4 | xxx | -787 | -3773 | -854 | -37.1 |
| 12.15 | -794 | -737 | -732 | -530 | -14.3 | xxx | -583 | -3561 | -696 | -33.1 |
| 5.94 | -552 | -453 | -534 | -329 | -9.6 | xxx | -333 | -3256 | -463 | -27.7 |

| TOTAL LOAD PER JOIST (kips) | CSJ-6 TEST DATA SHEET TC5 2L1.50x1.50x0.123 | | | | AVG MEM LOAD (kips) | CSJ-6 TEST DATA SHEET TC6 2L1.50x1.50x0.123 | | | | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| | TC5 (17) | TC5 (18) | TC5 (19) | TC5 (20) | | TC6 (21) | TC6 (22) | TC6 (23) | TC6 (24) | |
| | (με) | | | | | (με) | | | | |
| 0.00 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 |
| 0.27 | -8 | -5 | -6 | -6 | -0.1 | 1 | -8 | -5 | -5 | -0.1 |
| 4.44 | -139 | -85 | -95 | -95 | -2.1 | 12 | -139 | -88 | -77 | -1.5 |
| 5.94 | -136 | -93 | -99 | -100 | -2.2 | -17 | -145 | -100 | -79 | -1.8 |
| 6.90 | -135 | -95 | -103 | -101 | -2.2 | -34 | -149 | -108 | -81 | -1.9 |
| 7.67 | -134 | -100 | -105 | -104 | -2.3 | -48 | -152 | -115 | -82 | -2.0 |
| 8.31 | -133 | -103 | -108 | -106 | -2.3 | -60 | -154 | -121 | -83 | -2.1 |
| 5.94 | -136 | -93 | -99 | -100 | -2.2 | -17 | -146 | -100 | -79 | -1.8 |
| 7.92 | -135 | -104 | -107 | -107 | -2.3 | -55 | -156 | -118 | -85 | -2.1 |
| 9.90 | -134 | -113 | -114 | -113 | -2.4 | -93 | -161 | -136 | -87 | -2.5 |
| 12.01 | -132 | -123 | -121 | -117 | -2.5 | -139 | -167 | -156 | -86 | -2.8 |
| 14.25 | -129 | -141 | -129 | -128 | -2.7 | -195 | -184 | -182 | -90 | -3.3 |
| 16.04 | -125 | -158 | -136 | -136 | -2.8 | -244 | -201 | -202 | -91 | -3.8 |
| 18.27 | -114 | -177 | -133 | -138 | -2.9 | -294 | -221 | -214 | -90 | -4.2 |
| 19.36 | -108 | -183 | -132 | -138 | -2.9 | -323 | -230 | -221 | -89 | -4.4 |
| 16.04 | -111 | -169 | -121 | -127 | -2.7 | -268 | -215 | -197 | -85 | -3.9 |
| 10.80 | -112 | -134 | -101 | -101 | -2.3 | -159 | -176 | -149 | -75 | -2.9 |
| 6.46 | -114 | -90 | -79 | -80 | -1.9 | -58 | -136 | -105 | -58 | -1.8 |
| 10.42 | -127 | -130 | -105 | -109 | -2.4 | -139 | -177 | -146 | -82 | -2.8 |
| 15.08 | -120 | -162 | -119 | -128 | -2.7 | -237 | -209 | -187 | -89 | -3.7 |
| 19.55 | -108 | -188 | -131 | -143 | -2.9 | -328 | -236 | -221 | -93 | -4.5 |
| 21.14 | -100 | -200 | -129 | -147 | -3.0 | -365 | -249 | -230 | -95 | -4.8 |
| 23.12 | -81 | -214 | -121 | -151 | -2.9 | -418 | -272 | -241 | -94 | -5.3 |
| 25.10 | -64 | -224 | -115 | -157 | -2.9 | -473 | -294 | -258 | -92 | -5.7 |
| 27.15 | -45 | -239 | -112 | -167 | -2.9 | -529 | -317 | -278 | -96 | -6.3 |
| 29.19 | -39 | -263 | -113 | -185 | -3.1 | -585 | -362 | -301 | -102 | -6.9 |
| 30.85 | -32 | -293 | -117 | -209 | -3.3 | -646 | -414 | -331 | -112 | -7.7 |
| 31.36 | -28 | -295 | -117 | -210 | -3.3 | -661 | -423 | -337 | -111 | -7.9 |
| 32.51 | -22 | -309 | -117 | -219 | -3.4 | -687 | -438 | -348 | -115 | -8.2 |
| 25.36 | -41 | -274 | -101 | -192 | -3.1 | -559 | -394 | -289 | -110 | -6.9 |
| 18.91 | -55 | -221 | -82 | -153 | -2.6 | -410 | -326 | -220 | -89 | -5.4 |
| 12.08 | -116 | -146 | -88 | -110 | -2.4 | -216 | -218 | -156 | -71 | -3.4 |
| 18.21 | -97 | -204 | -103 | -153 | -2.9 | -364 | -301 | -217 | -93 | -5.0 |
| 25.36 | -64 | -262 | -112 | -193 | -3.2 | -532 | -378 | -285 | -110 | -6.7 |
| 32.06 | -23 | -320 | -119 | -224 | -3.5 | -676 | -440 | -342 | -129 | -8.1 |
| 33.21 | -16 | -329 | -119 | -226 | -3.5 | -707 | -458 | -354 | -130 | -8.5 |
| 32.96 | -11 | -323 | -114 | -217 | -3.4 | -704 | -453 | -353 | -123 | -8.4 |
| 33.53 | -3 | -329 | -112 | -221 | -3.4 | -721 | -464 | -359 | -126 | -8.6 |
| 33.34 | 9 | -322 | -101 | -211 | -3.2 | -717 | -456 | -355 | -116 | -8.4 |
| 33.40 | 18 | -325 | -95 | -206 | -3.1 | -724 | -458 | -357 | -114 | -8.5 |
| 33.53 | 28 | -323 | -87 | -201 | -3.0 | -726 | -458 | -355 | -110 | -8.5 |
| 33.40 | 43 | -315 | -76 | -190 | -2.8 | -724 | -449 | -352 | -100 | -8.3 |
| 33.40 | 68 | -306 | -57 | -175 | -2.4 | -724 | -442 | -348 | -88 | -8.2 |
| 25.68 | 48 | -272 | -39 | -147 | -2.1 | -587 | -401 | -286 | -74 | -6.9 |
| 18.91 | 14 | -217 | -30 | -110 | -1.8 | -429 | -332 | -217 | -53 | -5.3 |
| 11.50 | -47 | -140 | -31 | -63 | -1.4 | -241 | -231 | -152 | -23 | -3.3 |
| 5.88 | -75 | -71 | -24 | -23 | -1.0 | -91 | -129 | -99 | 0 | -1.6 |
| 13.03 | -60 | -138 | -46 | -71 | -1.6 | -255 | -224 | -162 | -36 | -3.5 |
| 20.19 | -19 | -201 | -50 | -113 | -2.0 | -419 | -307 | -225 | -60 | -5.2 |
| 27.27 | 27 | -258 | -51 | -150 | -2.2 | -570 | -380 | -285 | -80 | -6.8 |
| 33.59 | 77 | -304 | -47 | -175 | -2.3 | -702 | -441 | -341 | -91 | -8.1 |
| 34.04 | 96 | -303 | -34 | -165 | -2.1 | -714 | -444 | -344 | -81 | -8.1 |
| 33.66 | 120 | -288 | -14 | -147 | -1.7 | -707 | -433 | -341 | -64 | -7.9 |
| 33.78 | 147 | -281 | 6 | -133 | -1.3 | -715 | -432 | -343 | -52 | -7.9 |

| TOTAL LOAD PER JOIST (kips) | CSJ-6 TEST DATA SHEET TC5 (cont.) 2L1.50x1.50x0.123 | | | | AVG MEM LOAD (kips) | CSJ-6 TEST DATA SHEET TC6 (cont.) 2L1.50x1.50x0.123 | | | | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| | TC5 (17) | TC5 (18) | TC5 (19) | TC5 (20) | | TC6 (21) | TC6 (22) | TC6 (23) | TC6 (24) | |
| | (με) | | | | | (με) | | | | |
| 33.78 | 168 | -279 | 18 | -127 | -1.1 | -722 | -445 | -363 | -46 | -8.1 |
| 33.90 | 173 | -283 | 10 | -135 | -1.2 | -724 | -464 | -389 | -50 | -8.4 |
| 33.84 | 163 | -278 | -18 | -145 | -1.4 | -742 | -476 | -439 | -54 | -8.8 |
| 33.77 | 161 | -267 | -58 | -174 | -1.7 | -749 | -484 | -516 | -78 | -9.4 |
| 33.33 | 148 | -231 | -82 | -180 | -1.8 | -765 | -469 | -592 | -82 | -9.8 |
| 33.39 | 83 | -179 | -93 | -153 | -1.8 | -763 | -423 | -613 | -60 | -9.5 |
| 33.14 | 13 | -144 | -108 | -127 | -1.9 | -750 | -387 | -590 | -44 | -9.1 |
| 32.89 | -32 | -145 | -113 | -141 | -2.2 | -754 | -403 | -590 | -48 | -9.2 |
| 32.70 | -35 | -105 | -105 | -111 | -1.8 | -743 | -358 | -565 | -24 | -8.7 |
| 32.39 | -42 | -81 | -115 | -91 | -1.7 | -727 | -321 | -560 | -21 | -8.4 |
| 32.27 | -39 | -87 | -127 | -87 | -1.7 | -729 | -287 | -559 | -86 | -8.5 |
| 24.86 | -89 | -85 | -155 | -97 | -2.2 | -560 | -271 | -522 | -90 | -7.4 |
| 19.24 | -135 | -69 | -195 | -108 | -2.6 | -395 | -240 | -484 | -109 | -6.3 |
| 12.15 | -119 | -7 | -196 | -88 | -2.1 | -201 | -137 | -395 | -111 | -4.3 |
| 5.94 | -53 | 67 | -157 | -58 | -1.0 | -39 | -31 | -305 | -83 | -2.4 |

| TOTAL LOAD PER JOIST (kips) | CSJ-6 TEST DATA SHEET BC1 2L2.00x2.00x0.163 BC1 (25) (με) | BC1 (26) | BC1 (27) | BC1 (28) | AVG MEM LOAD (kips) | CSJ-6 TEST DATA SHEET BC2 2L2.00x2.00x0.163 BC2 (29) (με) | BC2 (30) | BC2 (31) | BC2 (32) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 |
| 0.27 | 18 | 22 | 15 | 18 | 0.7 | 18 | 17 | 12 | 13 | 0.5 |
| 4.44 | 302 | 358 | 242 | 298 | 10.9 | 292 | 284 | 195 | 211 | 8.9 |
| 5.94 | 386 | 455 | 312 | 388 | 14.0 | 370 | 360 | 253 | 273 | 11.4 |
| 6.90 | 440 | 517 | 357 | 445 | 16.0 | 421 | 409 | 290 | 313 | 13.0 |
| 7.67 | 484 | 564 | 393 | 490 | 17.5 | 460 | 448 | 319 | 344 | 14.3 |
| 8.31 | 521 | 606 | 424 | 528 | 18.9 | 495 | 482 | 348 | 371 | 15.4 |
| 5.94 | 385 | 454 | 311 | 388 | 14.0 | 369 | 359 | 253 | 273 | 11.4 |
| 7.92 | 503 | 586 | 412 | 508 | 18.2 | 476 | 464 | 331 | 357 | 14.8 |
| 9.90 | 613 | 709 | 503 | 623 | 22.2 | 579 | 568 | 411 | 435 | 18.1 |
| 12.01 | 730 | 839 | 600 | 744 | 26.4 | 689 | 680 | 496 | 526 | 21.7 |
| 14.25 | 852 | 977 | 701 | 871 | 30.9 | 807 | 800 | 590 | 623 | 25.6 |
| 16.04 | 958 | 1095 | 788 | 982 | 34.7 | 911 | 904 | 672 | 706 | 29.0 |
| 18.27 | 1082 | 1236 | 890 | 1111 | 39.2 | 1031 | 1027 | 767 | 808 | 33.0 |
| 19.36 | 1140 | 1305 | 938 | 1176 | 41.4 | 1093 | 1090 | 817 | 861 | 35.0 |
| 16.04 | 959 | 1107 | 781 | 990 | 34.8 | 932 | 928 | 697 | 733 | 29.9 |
| 10.80 | 667 | 782 | 536 | 688 | 24.3 | 667 | 666 | 501 | 523 | 21.4 |
| 6.46 | 424 | 509 | 338 | 432 | 15.5 | 441 | 443 | 334 | 346 | 14.2 |
| 10.42 | 644 | 755 | 526 | 659 | 23.5 | 641 | 639 | 481 | 503 | 20.6 |
| 15.08 | 908 | 1047 | 747 | 932 | 33.0 | 881 | 878 | 658 | 693 | 28.2 |
| 19.55 | 1159 | 1323 | 955 | 1191 | 42.0 | 1108 | 1104 | 827 | 873 | 35.5 |
| 21.14 | 1246 | 1425 | 1027 | 1282 | 45.2 | 1192 | 1189 | 889 | 938 | 38.2 |
| 23.12 | 1358 | 1553 | 1116 | 1398 | 49.2 | 1308 | 1303 | 974 | 1029 | 41.9 |
| 25.10 | 1474 | 1683 | 1211 | 1518 | 53.4 | 1434 | 1422 | 1058 | 1121 | 45.7 |
| 27.15 | 1600 | 1826 | 1311 | 1642 | 57.9 | 1563 | 1541 | 1144 | 1216 | 49.6 |
| 29.19 | 1738 | 2015 | 1418 | 1788 | 63.2 | 1704 | 1673 | 1229 | 1319 | 53.8 |
| 30.85 | 1853 | 2120 | 1516 | 1989 | 67.9 | 1839 | 1799 | 1302 | 1409 | 57.6 |
| 31.36 | 1879 | 2109 | 1594 | 2042 | 69.2 | 1893 | 1848 | 1327 | 1442 | 59.1 |
| 32.51 | 1917 | 2140 | 1618 | 2085 | 70.4 | 1955 | 1905 | 1371 | 1487 | 61.0 |
| 25.36 | 1513 | 1691 | 1267 | 1669 | 55.7 | 1597 | 1543 | 1099 | 1202 | 49.4 |
| 18.91 | 1152 | 1291 | 968 | 1294 | 42.7 | 1268 | 1212 | 854 | 941 | 38.8 |
| 12.08 | 768 | 851 | 660 | 882 | 28.7 | 903 | 850 | 584 | 650 | 27.1 |
| 18.21 | 1105 | 1229 | 942 | 1235 | 40.9 | 1216 | 1162 | 815 | 898 | 37.1 |
| 25.36 | 1513 | 1686 | 1281 | 1662 | 55.7 | 1589 | 1537 | 1092 | 1196 | 49.1 |
| 32.06 | 1898 | 2121 | 1597 | 2064 | 69.7 | 1942 | 1893 | 1354 | 1477 | 60.5 |
| 33.21 | 1891 | 2118 | 1575 | 2097 | 69.7 | 2033 | 1986 | 1395 | 1534 | 63.1 |
| 32.96 | 1874 | 2091 | 1553 | 2059 | 68.8 | 2033 | 1986 | 1384 | 1532 | 62.9 |
| 33.53 | 1895 | 2111 | 1575 | 2094 | 69.7 | 2071 | 2023 | 1407 | 1561 | 64.1 |
| 33.34 | 1875 | 2105 | 1565 | 2085 | 69.3 | 2072 | 2025 | 1402 | 1562 | 64.1 |
| 33.40 | 1876 | 2101 | 1559 | 2090 | 69.2 | 2078 | 2034 | 1405 | 1569 | 64.3 |
| 33.53 | 1905 | 2149 | 1518 | 2070 | 69.4 | 2087 | 2040 | 1410 | 1575 | 64.6 |
| 33.40 | 1940 | 4224 | 1442 | 2111 | yield | 2084 | 2039 | 1407 | 1575 | 64.5 |
| 33.40 | 11602 | 2789 | 1160 | 12449 | yield | 2097 | 2052 | 1416 | 1586 | 64.9 |
| 25.68 | 11016 | 2673 | 1127 | 6815 | yield | 1688 | 1642 | 1112 | 1262 | 51.8 |
| 18.91 | 10582 | 2619 | 1113 | 6502 | yield | 1321 | 1276 | 840 | 971 | 40.0 |
| 11.50 | 10110 | 2579 | 1092 | 6307 | yield | 919 | 873 | 543 | 649 | 27.1 |
| 5.88 | 9740 | 2551 | 1080 | 6154 | yield | 612 | 568 | 319 | 405 | 17.3 |
| 13.03 | 10115 | 2577 | 1108 | 6256 | yield | 983 | 938 | 590 | 698 | 29.1 |
| 20.19 | 10506 | 2592 | 1120 | 6386 | yield | 1357 | 1311 | 867 | 998 | 41.2 |
| 27.27 | 10918 | 2601 | 1131 | 6515 | yield | 1732 | 1686 | 1146 | 1297 | 53.2 |
| 33.59 | 11345 | 2604 | 1131 | 6524 | yield | 2076 | 2031 | 1399 | 1569 | 64.2 |
| 34.04 | 12145 | 2589 | 1134 | 6489 | yield | 2107 | 2066 | 1420 | 1595 | 65.2 |
| 33.66 | 12194 | 2566 | 1120 | 6019 | yield | 2095 | 2052 | 1410 | 1588 | 64.9 |
| 33.78 | 12091 | 2550 | 1116 | 5750 | yield | 2121 | 2078 | 1427 | 1610 | 65.7 |

| TOTAL LOAD PER JOIST (kips) | CSJ-6 TEST DATA SHEET BC1 (cont.) 2L2.00x2.00x0.163 BC1 (25) | BC1 (26) | BC1 (27) | BC1 (28) | AVG MEM LOAD (kips) | CSJ-6 TEST DATA SHEET BC2 (cont.) 2L2.00x2.00x0.163 BC2 (29) | BC2 (30) | BC2 (31) | BC2 (32) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| | (με) | | | | | (με) | | | | |
| 33.78 | 8506 | 2547 | 1113 | 5450 | yield | 2149 | 2092 | 1428 | 1613 | 66.1 |
| 33.90 | 8197 | 2552 | 1115 | 5098 | yield | 2188 | 2125 | 1441 | 1632 | 67.0 |
| 33.84 | 7751 | 2543 | 1109 | 4772 | yield | 2207 | 2146 | 1450 | 1645 | 67.6 |
| 33.77 | 7298 | 2555 | 1115 | 4699 | yield | 2216 | 2154 | 1446 | 1640 | 67.7 |
| 33.33 | 6218 | 2553 | 1116 | 4459 | yield | 2217 | 2148 | 1438 | 1628 | 67.5 |
| 33.39 | 5274 | 2607 | 1114 | 4015 | yield | 2240 | 2168 | 1455 | 1640 | 68.1 |
| 33.14 | 5192 | 2616 | 1119 | 3992 | yield | 2300 | 2242 | 1456 | 1654 | 69.5 |
| 32.89 | 4910 | 2654 | 1127 | 3952 | yield | 2419 | 2414 | 1523 | 1670 | 72.9 |
| 32.70 | 5186 | 2666 | 1124 | 3971 | yield | 2454 | 2623 | 1582 | 1657 | 75.5 |
| 32.39 | 5002 | 2662 | 1107 | 4039 | yield | 2457 | 3038 | 1603 | 1640 | yield |
| 32.27 | 4529 | 2645 | 1109 | 4032 | yield | 2472 | 3594 | 1618 | 1689 | yield |
| 24.86 | 3834 | 2611 | 1107 | 4075 | yield | 2028 | 3146 | 1292 | 1337 | 70.8 |
| 19.24 | 3801 | 2603 | 1116 | 4076 | yield | 1664 | 2771 | 1023 | 1044 | 59.0 |
| 12.15 | 3731 | 2596 | 1114 | 4111 | yield | 1214 | 2301 | 695 | 686 | 44.4 |
| 5.94 | 3665 | 2593 | 1106 | 4123 | yield | 823 | 1893 | 418 | 385 | 31.9 |

| TOTAL LOAD PER JOIST (kips) | CSJ-6 TEST DATA SHEET BC3 2L2.00x2.00x0.163 BC3 (33) | BC3 (34) | BC3 (35) | BC3 (36) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|
| | (με) | | | | |
| 0.00 | 0 | 0 | 0 | 0 | 0.0 |
| 0.27 | 14 | 14 | 13 | 13 | 0.5 |
| 4.44 | 230 | 225 | 216 | 208 | 8.0 |
| 5.94 | 317 | 286 | 281 | 268 | 10.5 |
| 6.90 | 357 | 326 | 322 | 308 | 11.9 |
| 7.67 | 388 | 356 | 353 | 340 | 13.0 |
| 8.31 | 414 | 382 | 379 | 368 | 14.0 |
| 5.94 | 317 | 285 | 280 | 268 | 10.4 |
| 7.92 | 400 | 369 | 366 | 353 | 13.5 |
| 9.90 | 480 | 448 | 446 | 435 | 16.4 |
| 12.01 | 564 | 531 | 532 | 523 | 19.5 |
| 14.25 | 653 | 620 | 621 | 613 | 22.8 |
| 16.04 | 729 | 697 | 694 | 689 | 25.5 |
| 18.27 | 817 | 786 | 781 | 779 | 28.7 |
| 19.36 | 861 | 832 | 823 | 826 | 30.3 |
| 16.04 | 732 | 702 | 691 | 696 | 25.6 |
| 10.80 | 524 | 491 | 487 | 485 | 18.0 |
| 6.46 | 349 | 315 | 312 | 310 | 11.7 |
| 10.42 | 505 | 471 | 472 | 467 | 17.4 |
| 15.08 | 694 | 661 | 659 | 660 | 24.3 |
| 19.55 | 875 | 843 | 836 | 842 | 30.8 |
| 21.14 | 937 | 907 | 896 | 908 | 33.1 |
| 23.12 | 1018 | 988 | 976 | 988 | 36.0 |
| 25.10 | 1099 | 1071 | 1057 | 1072 | 39.0 |
| 27.15 | 1182 | 1155 | 1141 | 1159 | 42.1 |
| 29.19 | 1271 | 1245 | 1230 | 1252 | 45.4 |
| 30.85 | 1345 | 1319 | 1307 | 1332 | 48.1 |
| 31.36 | 1370 | 1345 | 1332 | 1358 | 49.1 |
| 32.51 | 1413 | 1386 | 1377 | 1401 | 50.6 |
| 25.36 | 1121 | 1092 | 1088 | 1112 | 40.0 |
| 18.91 | 860 | 827 | 836 | 849 | 30.6 |
| 12.08 | 576 | 536 | 552 | 557 | 20.2 |
| 18.21 | 823 | 786 | 798 | 813 | 29.2 |
| 25.36 | 1119 | 1087 | 1085 | 1114 | 40.0 |
| 32.06 | 1400 | 1371 | 1363 | 1392 | 50.2 |
| 33.21 | 1448 | 1420 | 1415 | 1446 | 52.0 |
| 32.96 | 1438 | 1413 | 1410 | 1440 | 51.7 |
| 33.53 | 1463 | 1439 | 1437 | 1466 | 52.7 |
| 33.34 | 1459 | 1436 | 1437 | 1465 | 52.6 |
| 33.40 | 1460 | 1441 | 1441 | 1470 | 52.7 |
| 33.53 | 1463 | 1445 | 1448 | 1477 | 52.9 |
| 33.40 | 1460 | 1443 | 1446 | 1477 | 52.9 |
| 33.40 | 1466 | 1450 | 1458 | 1488 | 53.2 |
| 25.68 | 1139 | 1120 | 1137 | 1158 | 41.3 |
| 18.91 | 850 | 827 | 855 | 860 | 30.8 |
| 11.50 | 539 | 507 | 538 | 536 | 19.2 |
| 5.88 | 304 | 265 | 298 | 292 | 10.5 |
| 13.03 | 592 | 559 | 592 | 587 | 21.1 |
| 20.19 | 884 | 858 | 888 | 899 | 32.0 |
| 27.27 | 1180 | 1159 | 1177 | 1203 | 42.8 |
| 33.59 | 1454 | 1434 | 1443 | 1478 | 52.7 |
| 34.04 | 1475 | 1457 | 1467 | 1501 | 53.6 |
| 33.66 | 1461 | 1448 | 1460 | 1494 | 53.2 |
| 33.78 | 1479 | 1467 | 1481 | 1514 | 53.9 |

| TOTAL LOAD PER JOIST (kips) | CSJ-6 TEST DATA SHEET BC3 (cont.) 2L2.00x2.00x0.163 BC3 (33) | BC3 (34) | BC3 (35) | BC3 (36) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|
| | (με) | | | | |
| 33.78 | 1493 | 1474 | 1492 | 1521 | 54.3 |
| 33.90 | 1515 | 1496 | 1512 | 1543 | 55.1 |
| 33.84 | 1528 | 1513 | 1524 | 1555 | 55.6 |
| 33.77 | 1533 | 1513 | 1521 | 1550 | 55.5 |
| 33.33 | 1528 | 1500 | 1513 | 1537 | 55.2 |
| 33.39 | 1542 | 1505 | 1530 | 1547 | 55.6 |
| 33.14 | 1554 | 1525 | 1549 | 1569 | 56.2 |
| 32.89 | 1546 | 1534 | 1635 | 1649 | 57.8 |
| 32.70 | 1550 | 1533 | 1656 | 1679 | 58.2 |
| 32.39 | 1541 | 1520 | 1657 | 1686 | 58.1 |
| 32.27 | 1538 | 1507 | 1661 | 1693 | 58.1 |
| 24.86 | 1186 | 1146 | 1319 | 1339 | 45.3 |
| 19.24 | 898 | 848 | 1043 | 1034 | 34.7 |
| 12.15 | 549 | 480 | 696 | 674 | 21.8 |
| 5.94 | 249 | 168 | 402 | 374 | 10.8 |

| TOTAL LOAD PER JOIST (kips) | CSJ-6 W1 0.875 DIA. BAR W1 (37) (με) | W1 (38) | AVG MEM LOAD (kips) | CSJ-6 W2 2L1.00x1.00x0.109 W2 (39) (με) | W2 (40) | W2 (41) | W2 (42) | AVG MEM LOAD (kips) | CSJ-6 W3 0.875 DIA. BAR W3 (43) (με) | W3 (44) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0.0 |
| 0.27 | -7 | -5 | -0.1 | 0 | 0 | 0 | 0 | 0.0 | 7 | 6 | 0.1 |
| 4.44 | -110 | -75 | -1.6 | -5 | -5 | -3 | -4 | -0.1 | 120 | 92 | 1.8 |
| 5.94 | -140 | -103 | -2.1 | -9 | -7 | -8 | -5 | -0.1 | 157 | 129 | 2.5 |
| 6.90 | -160 | -121 | -2.5 | -11 | -8 | -12 | -7 | -0.1 | 178 | 152 | 2.9 |
| 7.67 | -175 | -135 | -2.7 | -12 | -8 | -15 | -9 | -0.1 | 195 | 169 | 3.2 |
| 8.31 | -188 | -147 | -2.9 | -14 | -9 | -17 | -10 | -0.1 | 209 | 183 | 3.4 |
| 5.94 | -141 | -103 | -2.1 | -9 | -7 | -8 | -5 | -0.1 | 157 | 129 | 2.5 |
| 7.92 | -182 | -141 | -2.8 | -13 | -9 | -17 | -9 | -0.1 | 202 | 176 | 3.3 |
| 9.90 | -222 | -177 | -3.5 | -16 | -12 | -24 | -14 | -0.2 | 245 | 220 | 4.1 |
| 12.01 | -265 | -215 | -4.2 | -20 | -14 | -32 | -20 | -0.3 | 291 | 268 | 4.9 |
| 14.25 | -310 | -255 | -4.9 | -25 | -17 | -41 | -25 | -0.3 | 339 | 316 | 5.7 |
| 16.04 | -347 | -287 | -5.5 | -29 | -20 | -50 | -31 | -0.4 | 382 | 359 | 6.5 |
| 18.27 | -393 | -325 | -6.3 | -35 | -23 | -60 | -38 | -0.5 | 431 | 407 | 7.3 |
| 19.36 | -415 | -343 | -6.6 | -38 | -25 | -68 | -42 | -0.5 | 457 | 431 | 7.7 |
| 16.04 | -348 | -282 | -5.5 | -32 | -22 | -56 | -35 | -0.4 | 388 | 359 | 6.5 |
| 10.80 | -241 | -188 | -3.7 | -23 | -16 | -33 | -25 | -0.3 | 272 | 241 | 4.5 |
| 6.46 | -151 | -111 | -2.3 | -13 | -10 | -14 | -15 | -0.2 | 175 | 145 | 2.8 |
| 10.42 | -231 | -182 | -3.6 | -21 | -15 | -31 | -23 | -0.3 | 263 | 232 | 4.3 |
| 15.08 | -328 | -268 | -5.2 | -30 | -20 | -51 | -32 | -0.4 | 365 | 337 | 6.1 |
| 19.55 | -420 | -347 | -6.7 | -38 | -25 | -69 | -42 | -0.5 | 464 | 435 | 7.8 |
| 21.14 | -452 | -374 | -7.2 | -43 | -27 | -80 | -47 | -0.6 | 498 | 469 | 8.4 |
| 23.12 | -491 | -405 | -7.8 | -50 | -28 | -96 | -55 | -0.7 | 544 | 510 | 9.2 |
| 25.10 | -530 | -433 | -8.4 | -57 | -32 | -116 | -66 | -0.8 | 591 | 554 | 10.0 |
| 27.15 | -567 | -461 | -9.0 | -64 | -38 | -133 | -79 | -0.9 | 637 | 600 | 10.8 |
| 29.19 | -608 | -493 | -9.6 | -71 | -41 | -149 | -89 | -1.0 | 684 | 646 | 11.6 |
| 30.85 | -641 | -520 | -10.1 | -77 | -44 | -162 | -96 | -1.1 | 723 | 685 | 12.3 |
| 31.36 | -650 | -528 | -10.3 | -79 | -45 | -166 | -99 | -1.2 | 735 | 696 | 12.5 |
| 32.51 | -672 | -545 | -10.6 | -81 | -47 | -172 | -103 | -1.2 | 758 | 717 | 12.9 |
| 25.36 | -522 | -413 | -8.2 | -67 | -39 | -136 | -87 | -1.0 | 601 | 559 | 10.1 |
| 18.91 | -391 | -306 | -6.1 | -53 | -31 | -98 | -66 | -0.7 | 455 | 414 | 7.6 |
| 12.08 | -247 | -193 | -3.8 | -33 | -22 | -56 | -38 | -0.4 | 293 | 254 | 4.8 |
| 18.21 | -372 | -296 | -5.8 | -49 | -28 | -90 | -57 | -0.7 | 431 | 389 | 7.2 |
| 25.36 | -522 | -422 | -8.2 | -65 | -36 | -133 | -78 | -0.9 | 597 | 553 | 10.0 |
| 32.06 | -665 | -541 | -10.5 | -81 | -44 | -170 | -96 | -1.2 | 747 | 705 | 12.7 |
| 33.21 | -688 | -560 | -10.9 | -84 | -43 | -176 | -102 | -1.2 | 772 | 729 | 13.1 |
| 32.96 | -683 | -555 | -10.8 | -85 | -45 | -175 | -106 | -1.2 | 768 | 724 | 13.0 |
| 33.53 | -697 | -564 | -11.0 | -87 | -46 | -179 | -108 | -1.3 | 783 | 739 | 13.3 |
| 33.34 | -696 | -561 | -11.0 | -88 | -46 | -179 | -110 | -1.3 | 782 | 739 | 13.3 |
| 33.40 | -699 | -561 | -11.0 | -90 | -47 | -179 | -112 | -1.3 | 784 | 740 | 13.3 |
| 33.53 | -703 | -561 | -11.0 | -92 | -48 | -178 | -112 | -1.3 | 787 | 743 | 13.3 |
| 33.40 | -704 | -559 | -11.0 | -93 | -48 | -177 | -113 | -1.3 | 785 | 741 | 13.3 |
| 33.40 | -710 | -561 | -11.1 | -95 | -49 | -174 | -113 | -1.3 | 789 | 746 | 13.4 |
| 25.68 | -543 | -420 | -8.4 | -78 | -39 | -130 | -90 | -1.0 | 611 | 569 | 10.3 |
| 18.91 | -397 | -308 | -6.1 | -61 | -30 | -89 | -68 | -0.7 | 449 | 413 | 7.5 |
| 11.50 | -236 | -184 | -3.7 | -41 | -23 | -48 | -51 | -0.5 | 274 | 242 | 4.5 |
| 5.88 | -114 | -87 | -1.8 | -24 | -18 | -19 | -37 | -0.3 | 139 | 110 | 2.2 |
| 13.03 | -260 | -203 | -4.0 | -43 | -25 | -58 | -52 | -0.5 | 303 | 266 | 5.0 |
| 20.19 | -409 | -319 | -6.3 | -62 | -33 | -98 | -71 | -0.8 | 466 | 425 | 7.8 |
| 27.27 | -559 | -438 | -8.7 | -80 | -41 | -138 | -92 | -1.0 | 630 | 585 | 10.6 |
| 33.59 | -699 | -553 | -10.9 | -95 | -48 | -170 | -109 | -1.3 | 776 | 733 | 13.2 |
| 34.04 | -710 | -561 | -11.1 | -98 | -50 | -171 | -111 | -1.3 | 788 | 744 | 13.4 |
| 33.66 | -706 | -550 | -10.9 | -98 | -50 | -162 | -112 | -1.3 | 780 | 740 | 13.2 |
| 33.78 | -716 | -549 | -11.0 | -101 | -50 | -155 | -114 | -1.3 | 790 | 749 | 13.4 |

| TOTAL LOAD PER JOIST (kips) | CSJ-6 W1 (cont.) 0.875 DIA. BAR W1 (37) (με) | W1 (38) | AVG MEM LOAD (kips) | CSJ-6 W2 (cont.) 2L1.00x1.00x0.109 W2 (39) (με) | W2 (40) | W2 (41) | W2 (42) | AVG MEM LOAD (kips) | CSJ-6 W3 (cont.) 0.875 DIA. BAR W3 (43) (με) | W3 (44) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 33.78 | -716 | -541 | -11.0 | -102 | -50 | -140 | -118 | -1.2 | 791 | 749 | 13.4 |
| 33.90 | -723 | -546 | -11.1 | -105 | -51 | -128 | -121 | -1.2 | 800 | 756 | 13.6 |
| 33.84 | -727 | -552 | -11.2 | -106 | -52 | -117 | -124 | -1.2 | 804 | 757 | 13.6 |
| 33.77 | -725 | -550 | -11.1 | -105 | -54 | -96 | -127 | -1.1 | 798 | 745 | 13.5 |
| 33.33 | -723 | -526 | -10.9 | -101 | -60 | -55 | -141 | -1.1 | 786 | 722 | 13.1 |
| 33.39 | -744 | -506 | -10.9 | -95 | -63 | 3 | -146 | -0.9 | 779 | 705 | 12.9 |
| 33.14 | -774 | -502 | -11.1 | -93 | -61 | 19 | -150 | -0.8 | 792 | 713 | 13.1 |
| 32.89 | -807 | -516 | -11.5 | -90 | -61 | 15 | -158 | -0.9 | 817 | 732 | 13.5 |
| 32.70 | -817 | -513 | -11.6 | -87 | -61 | 17 | -160 | -0.9 | 824 | 739 | 13.6 |
| 32.39 | -825 | -511 | -11.7 | -82 | -61 | 21 | -155 | -0.8 | 826 | 740 | 13.7 |
| 32.27 | -836 | -514 | -11.8 | -74 | -60 | 26 | -149 | -0.8 | 822 | 728 | 13.5 |
| 24.86 | -635 | -360 | -8.7 | -60 | -55 | 42 | -148 | -0.7 | 636 | 541 | 10.3 |
| 19.24 | -476 | -249 | -6.3 | -43 | -49 | 56 | -142 | -0.5 | 482 | 388 | 7.6 |
| 12.15 | -284 | -130 | -3.6 | -24 | -39 | 63 | -125 | -0.4 | 292 | 202 | 4.3 |
| 5.94 | -123 | -29 | -1.3 | -8 | -32 | 66 | -113 | -0.3 | 127 | 43 | 1.5 |

| APPLIED LOAD PER JOIST (kips) | CSJ-6 TEST DATA SHEET END SLIPS NEES (in.) | NWES (in.) | SEES (in.) | SWES (in.) |
|---|---|---|---|---|
| 0.00 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.50 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.46 | 0.000 | 0.000 | 0.001 | 0.000 |
| 3.23 | 0.000 | 0.000 | 0.001 | 0.000 |
| 3.86 | 0.000 | 0.000 | 0.001 | 0.000 |
| 1.50 | 0.000 | -0.001 | 0.000 | -0.001 |
| 3.48 | -0.001 | -0.001 | 0.000 | -0.001 |
| 5.46 | 0.000 | -0.001 | 0.000 | -0.001 |
| 7.57 | 0.000 | -0.001 | 0.000 | -0.001 |
| 9.80 | 0.000 | -0.001 | 0.001 | -0.002 |
| 11.59 | 0.001 | -0.001 | 0.003 | -0.003 |
| 13.83 | 0.001 | -0.001 | 0.004 | -0.005 |
| 14.91 | 0.002 | -0.001 | 0.006 | -0.006 |
| 11.59 | 0.002 | -0.001 | 0.006 | -0.006 |
| 6.35 | 0.002 | -0.001 | 0.004 | -0.004 |
| 2.01 | 0.000 | 0.000 | 0.003 | -0.001 |
| 5.97 | 0.001 | -0.001 | 0.003 | -0.002 |
| 10.63 | 0.002 | -0.001 | 0.004 | -0.004 |
| 15.10 | 0.002 | -0.001 | 0.006 | -0.007 |
| 16.70 | 0.004 | -0.001 | 0.007 | -0.007 |
| 18.68 | 0.006 | -0.001 | 0.009 | -0.010 |
| 20.66 | 0.010 | -0.004 | 0.012 | -0.014 |
| 22.70 | 0.013 | -0.006 | 0.015 | -0.018 |
| 24.75 | 0.017 | -0.010 | 0.021 | -0.021 |
| 26.41 | 0.020 | -0.015 | 0.026 | -0.026 |
| 26.92 | 0.022 | -0.017 | 0.029 | -0.030 |
| 28.07 | 0.023 | -0.019 | 0.032 | -0.032 |
| 20.91 | 0.023 | -0.019 | 0.032 | -0.032 |
| 14.47 | 0.021 | -0.019 | 0.029 | -0.027 |
| 7.63 | 0.012 | -0.009 | 0.020 | -0.014 |
| 13.76 | 0.016 | -0.013 | 0.024 | -0.021 |
| 20.91 | 0.020 | -0.016 | 0.029 | -0.027 |
| 27.62 | 0.024 | -0.020 | 0.034 | -0.034 |
| 28.77 | 0.028 | -0.023 | 0.038 | -0.039 |
| 28.51 | 0.029 | -0.024 | 0.040 | -0.041 |
| 29.09 | 0.031 | -0.026 | 0.041 | -0.043 |
| 28.90 | 0.032 | -0.027 | 0.042 | -0.045 |
| 28.96 | 0.034 | -0.029 | 0.044 | -0.046 |
| 29.09 | 0.034 | -0.030 | 0.045 | -0.049 |
| 28.96 | 0.035 | -0.032 | 0.046 | -0.051 |
| 28.96 | 0.036 | -0.035 | 0.048 | -0.056 |
| 21.23 | 0.036 | -0.035 | 0.048 | -0.057 |
| 14.47 | 0.035 | -0.035 | 0.045 | -0.051 |
| 7.06 | 0.028 | -0.032 | 0.038 | -0.041 |
| 1.44 | 0.016 | -0.021 | 0.027 | -0.026 |
| 8.59 | 0.023 | -0.024 | 0.033 | -0.035 |
| 15.74 | 0.029 | -0.030 | 0.040 | -0.044 |
| 22.83 | 0.034 | -0.034 | 0.045 | -0.051 |
| 29.15 | 0.039 | -0.039 | 0.051 | -0.060 |
| 29.60 | 0.043 | -0.043 | 0.055 | -0.067 |
| 29.21 | 0.045 | -0.049 | 0.059 | -0.075 |
| 29.34 | 0.049 | -0.057 | 0.062 | -0.084 |

| APPLIED LOAD PER JOIST (kips) | CSJ-6 TEST DATA SHEET END SLIPS (cont.) NEES (in.) | NWES (in.) | SEES (in.) | SWES (in.) |
|---|---|---|---|---|
| 29.34 | 0.057 | -0.075 | 0.072 | -0.104 |
| 29.46 | 0.075 | -0.095 | 0.092 | -0.128 |
| 29.40 | 0.085 | -0.122 | 0.105 | -0.155 |
| 29.33 | 0.095 | -0.162 | 0.118 | -0.196 |
| 28.88 | 0.101 | -0.214 | 0.124 | -0.256 |
| 28.95 | 0.106 | -0.286 | 0.129 | -0.340 |
| 28.69 | 0.107 | -0.337 | 0.131 | -0.398 |
| 28.45 | 0.109 | -0.388 | 0.133 | -0.475 |
| 28.26 | 0.111 | -0.426 | 0.133 | -0.513 |
| 27.95 | 0.113 | -0.474 | 0.135 | -0.560 |
| 27.82 | 0.125 | -0.548 | 0.142 | -0.624 |
| 20.42 | 0.125 | -0.547 | 0.142 | -0.623 |
| 14.79 | 0.122 | -0.538 | 0.139 | -0.609 |
| 7.70 | 0.109 | -0.498 | 0.129 | -0.569 |
| 1.50 | 0.089 | -0.447 | 0.109 | -0.518 |

| APPLIED LOAD PER JOIST (kips) | CSJ-6 TEST DATA SHEET INTERMEDIATE SLIPS NE9S (in.) | NE7S (in.) | NE4S (in.) | NE1S (in.) | NW1S (in.) | NW4S (in.) | NW7S (in.) | NW9S (in.) |
|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.50 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.46 | 0.000 | 0.000 | -0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 3.23 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | -0.001 | 0.000 | 0.000 |
| 3.86 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | -0.001 | 0.000 | 0.000 |
| 1.50 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | -0.001 | -0.001 |
| 3.48 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | -0.001 | 0.000 | -0.001 |
| 5.46 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 | -0.001 | 0.000 | -0.001 |
| 7.57 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 | -0.001 | -0.001 | -0.001 |
| 9.80 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 | -0.001 | -0.001 | -0.002 |
| 11.59 | 0.001 | 0.000 | 0.002 | 0.000 | 0.001 | -0.001 | -0.001 | -0.002 |
| 13.83 | 0.001 | 0.001 | 0.003 | 0.000 | 0.001 | -0.002 | -0.003 | -0.004 |
| 14.91 | 0.001 | 0.002 | 0.004 | 0.000 | 0.001 | -0.003 | -0.004 | -0.004 |
| 11.59 | 0.001 | 0.001 | 0.003 | 0.000 | 0.001 | -0.003 | -0.004 | -0.004 |
| 6.35 | 0.001 | 0.001 | 0.002 | 0.000 | 0.001 | -0.003 | -0.004 | -0.004 |
| 2.01 | 0.001 | 0.001 | 0.001 | 0.000 | 0.001 | -0.002 | -0.002 | -0.003 |
| 5.97 | 0.001 | 0.001 | 0.001 | 0.000 | 0.001 | -0.002 | -0.002 | -0.003 |
| 10.63 | 0.001 | 0.001 | 0.002 | 0.000 | 0.001 | -0.002 | -0.003 | -0.003 |
| 15.10 | 0.001 | 0.002 | 0.004 | 0.000 | 0.001 | -0.004 | -0.004 | -0.005 |
| 16.70 | 0.001 | 0.003 | 0.004 | 0.000 | 0.001 | -0.004 | -0.005 | -0.006 |
| 18.68 | 0.001 | 0.005 | 0.007 | 0.000 | 0.001 | -0.007 | -0.007 | -0.008 |
| 20.66 | 0.001 | 0.007 | 0.009 | 0.000 | 0.001 | -0.009 | -0.010 | -0.010 |
| 22.70 | 0.002 | 0.009 | 0.010 | 0.001 | 0.000 | -0.012 | -0.013 | -0.012 |
| 24.75 | 0.005 | 0.012 | 0.013 | 0.001 | -0.001 | -0.015 | -0.016 | -0.016 |
| 26.41 | 0.008 | 0.014 | 0.015 | 0.001 | -0.001 | -0.017 | -0.020 | -0.020 |
| 26.92 | 0.010 | 0.015 | 0.016 | 0.001 | -0.002 | -0.019 | -0.021 | -0.022 |
| 28.07 | 0.010 | 0.017 | 0.017 | 0.001 | -0.002 | -0.020 | -0.023 | -0.023 |
| 20.91 | 0.011 | 0.017 | 0.016 | 0.001 | -0.003 | -0.020 | -0.023 | -0.023 |
| 14.47 | 0.010 | 0.017 | 0.014 | 0.001 | -0.003 | -0.018 | -0.021 | -0.021 |
| 7.63 | 0.001 | 0.010 | 0.009 | 0.001 | -0.002 | -0.008 | -0.011 | -0.011 |
| 13.76 | 0.004 | 0.013 | 0.011 | 0.001 | -0.002 | -0.012 | -0.016 | -0.016 |
| 20.91 | 0.008 | 0.015 | 0.014 | 0.001 | -0.002 | -0.016 | -0.020 | -0.020 |
| 27.62 | 0.012 | 0.017 | 0.018 | 0.001 | -0.003 | -0.020 | -0.024 | -0.024 |
| 28.77 | 0.015 | 0.020 | 0.020 | 0.001 | -0.006 | -0.025 | -0.027 | -0.027 |
| 28.51 | 0.017 | 0.021 | 0.021 | 0.002 | -0.007 | -0.028 | -0.029 | -0.029 |
| 29.09 | 0.018 | 0.023 | 0.023 | 0.002 | -0.009 | -0.030 | -0.031 | -0.030 |
| 28.90 | 0.019 | 0.025 | 0.025 | 0.004 | -0.010 | -0.034 | -0.032 | -0.032 |
| 28.96 | 0.021 | 0.026 | 0.027 | 0.004 | -0.013 | -0.039 | -0.036 | -0.034 |
| 29.09 | 0.021 | 0.027 | 0.028 | 0.006 | -0.014 | -0.042 | -0.037 | -0.035 |
| 28.96 | 0.023 | 0.028 | 0.031 | 0.006 | -0.016 | -0.047 | -0.040 | -0.037 |
| 28.96 | 0.024 | 0.030 | 0.034 | 0.008 | -0.018 | -0.055 | -0.045 | -0.041 |
| 21.23 | 0.024 | 0.031 | 0.033 | 0.009 | -0.018 | -0.055 | -0.045 | -0.042 |
| 14.47 | 0.021 | 0.029 | 0.030 | 0.009 | -0.018 | -0.051 | -0.043 | -0.039 |
| 7.06 | 0.016 | 0.025 | 0.024 | 0.003 | -0.018 | -0.045 | -0.036 | -0.032 |
| 1.44 | 0.007 | 0.018 | 0.018 | 0.000 | -0.018 | -0.036 | -0.026 | -0.021 |
| 8.59 | 0.011 | 0.020 | 0.022 | 0.002 | -0.018 | -0.040 | -0.032 | -0.028 |
| 15.74 | 0.017 | 0.025 | 0.027 | 0.007 | -0.018 | -0.046 | -0.037 | -0.034 |
| 22.83 | 0.021 | 0.028 | 0.031 | 0.009 | -0.018 | -0.051 | -0.042 | -0.038 |
| 29.15 | 0.026 | 0.033 | 0.035 | 0.009 | -0.019 | -0.059 | -0.049 | -0.044 |
| 29.60 | 0.029 | 0.036 | 0.039 | 0.010 | -0.020 | -0.065 | -0.055 | -0.048 |
| 29.21 | 0.031 | 0.039 | 0.042 | 0.011 | -0.023 | -0.073 | -0.062 | -0.054 |
| 29.34 | 0.034 | 0.042 | 0.046 | 0.012 | -0.026 | -0.083 | -0.071 | -0.062 |

| APPLIED LOAD PER JOIST (kips) | CSJ-6 TEST DATA SHEET INTERMEDIATE SLIPS (cont.) NE9S (in.) | NE7S (in.) | NE4S (in.) | NE1S (in.) | NW1S (in.) | NW4S (in.) | NW7S (in.) | NW9S (in.) |
|---|---|---|---|---|---|---|---|---|
| 29.34 | 0.042 | 0.051 | 0.060 | 0.014 | -0.031 | -0.098 | -0.089 | -0.078 |
| 29.46 | 0.058 | 0.068 | 0.077 | 0.015 | -0.034 | -0.115 | -0.109 | -0.096 |
| 29.40 | 0.066 | 0.077 | 0.087 | 0.014 | -0.039 | -0.136 | -0.135 | -0.121 |
| 29.33 | 0.075 | 0.085 | 0.095 | 0.014 | -0.048 | -0.168 | -0.173 | -0.157 |
| 28.88 | 0.079 | 0.090 | 0.100 | 0.014 | -0.061 | -0.208 | -0.222 | -0.206 |
| 28.95 | 0.083 | 0.094 | 0.102 | 0.011 | -0.078 | -0.265 | -0.296 | -0.274 |
| 28.69 | 0.085 | 0.095 | 0.104 | 0.010 | -0.088 | -0.308 | -0.346 | -0.323 |
| 28.45 | 0.087 | 0.097 | 0.105 | 0.006 | -0.102 | -0.350 | -0.394 | -0.371 |
| 28.26 | 0.087 | 0.099 | 0.108 | 0.003 | -0.117 | -0.386 | -0.431 | -0.408 |
| 27.95 | 0.091 | 0.102 | 0.113 | -0.001 | -0.136 | -0.429 | -0.476 | -0.455 |
| 27.82 | 0.100 | 0.112 | 0.123 | -0.006 | -0.158 | -0.497 | -0.549 | -0.529 |
| 20.42 | 0.100 | 0.113 | 0.121 | -0.009 | -0.157 | -0.499 | -0.549 | -0.525 |
| 14.79 | 0.095 | 0.108 | 0.115 | -0.011 | -0.157 | -0.499 | -0.539 | -0.513 |
| 7.70 | 0.085 | 0.098 | 0.105 | -0.013 | -0.157 | -0.473 | -0.505 | -0.477 |
| 1.50 | 0.069 | 0.084 | 0.092 | -0.015 | -0.139 | -0.436 | -0.458 | -0.428 |

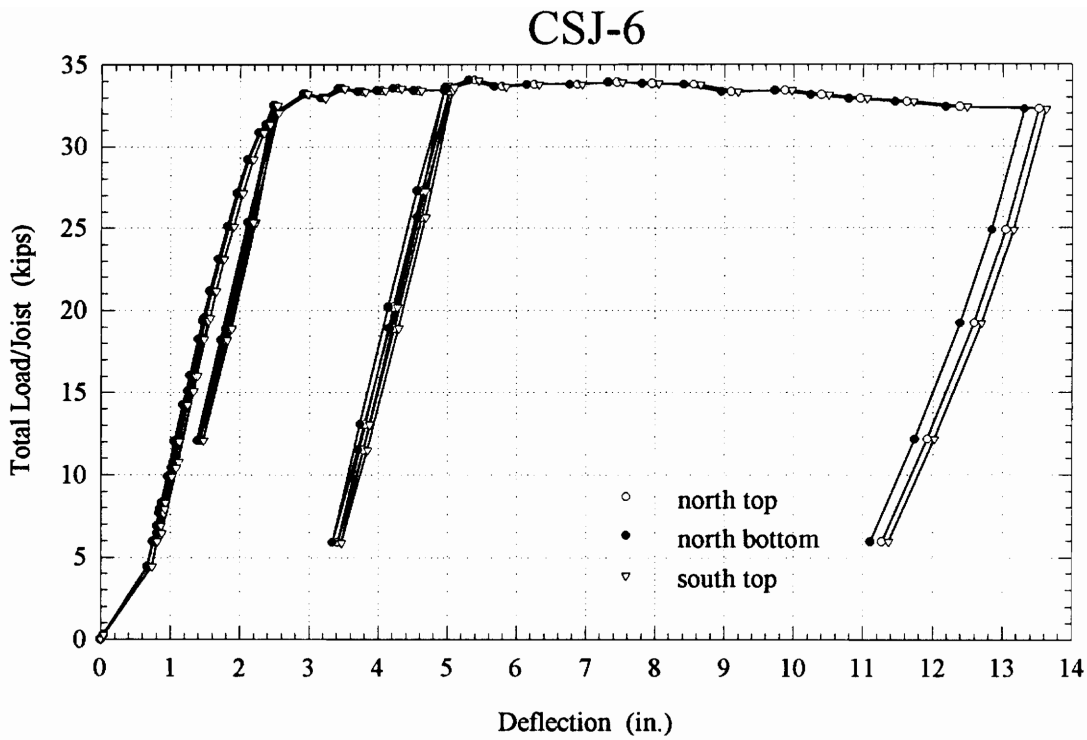


Figure A.6.1 Total Load/Joist vs. Midspan Deflection

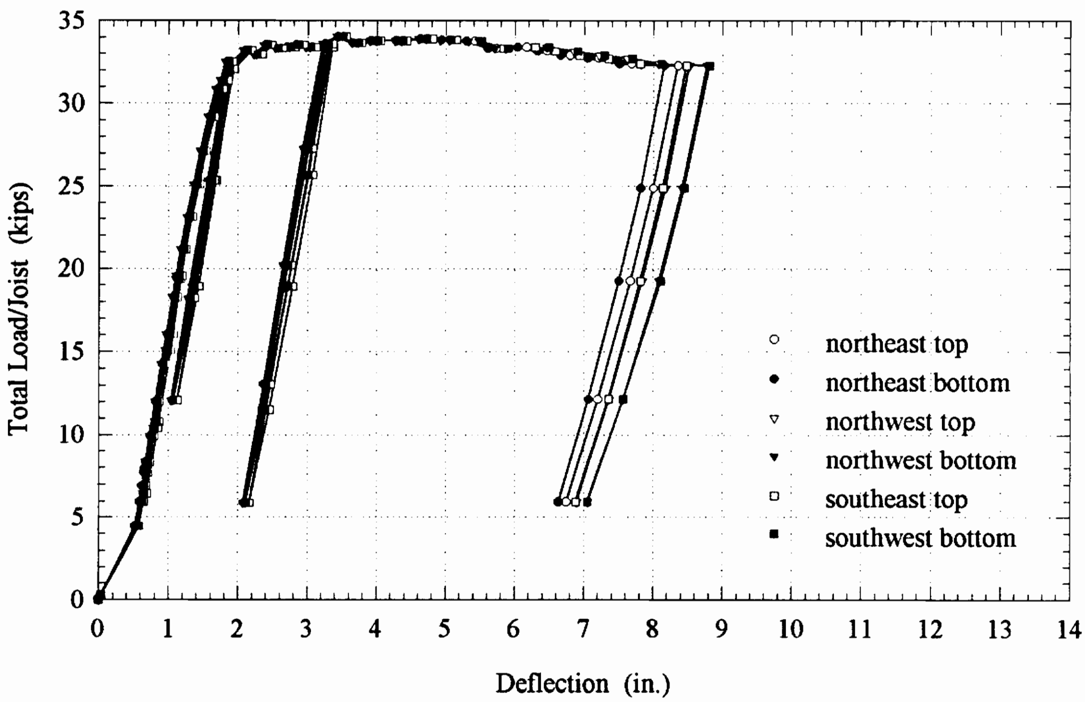


Figure A.6.2 Total Load/Joist vs. Quarter Point Deflection

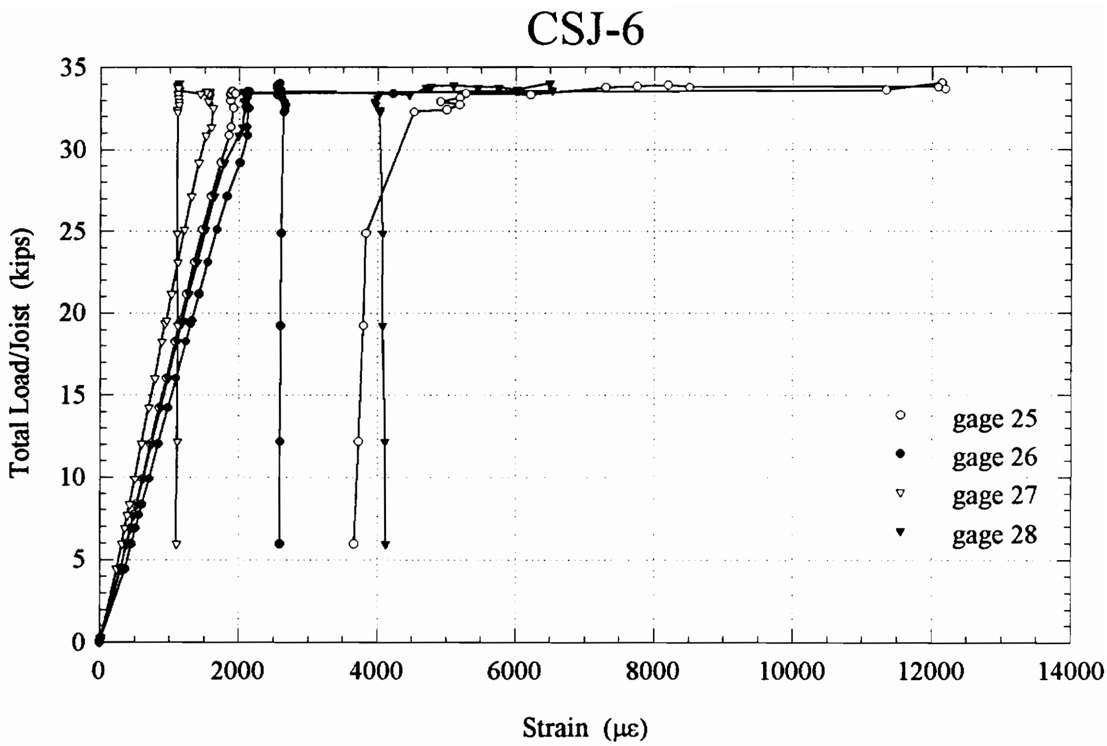



Figure A.6.3 Total Load/Joist vs. Bottom Chord Strain (BC1)

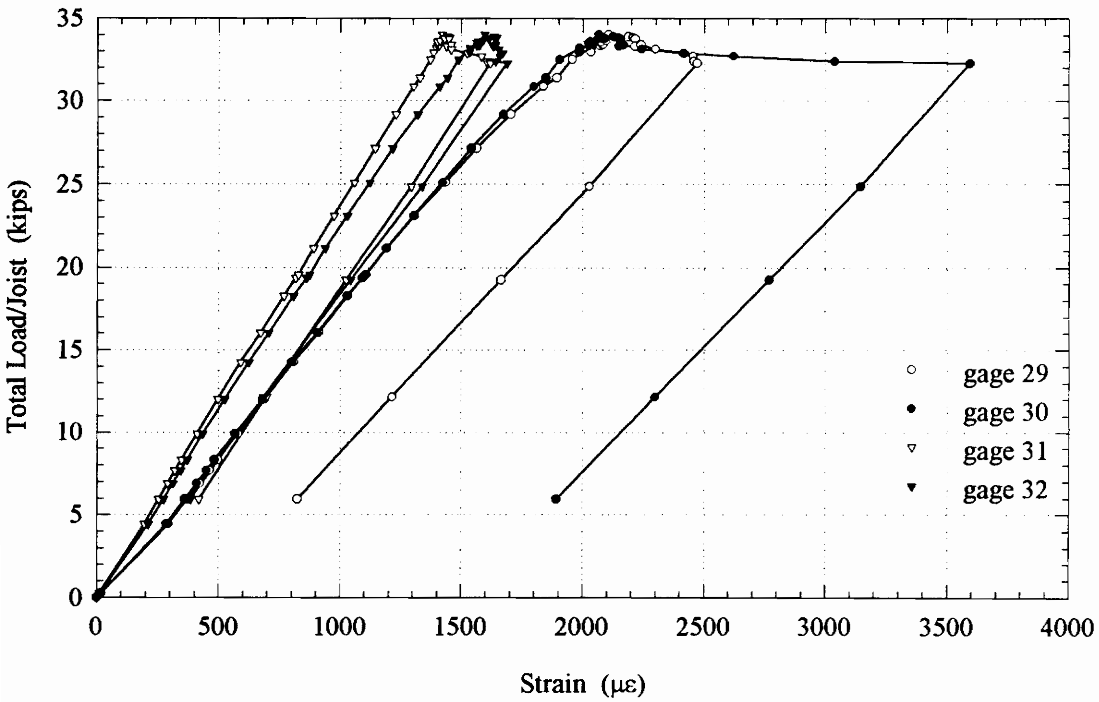



Figure A.6.4 Total Load/Joist vs. Bottom Chord Strain (BC2)

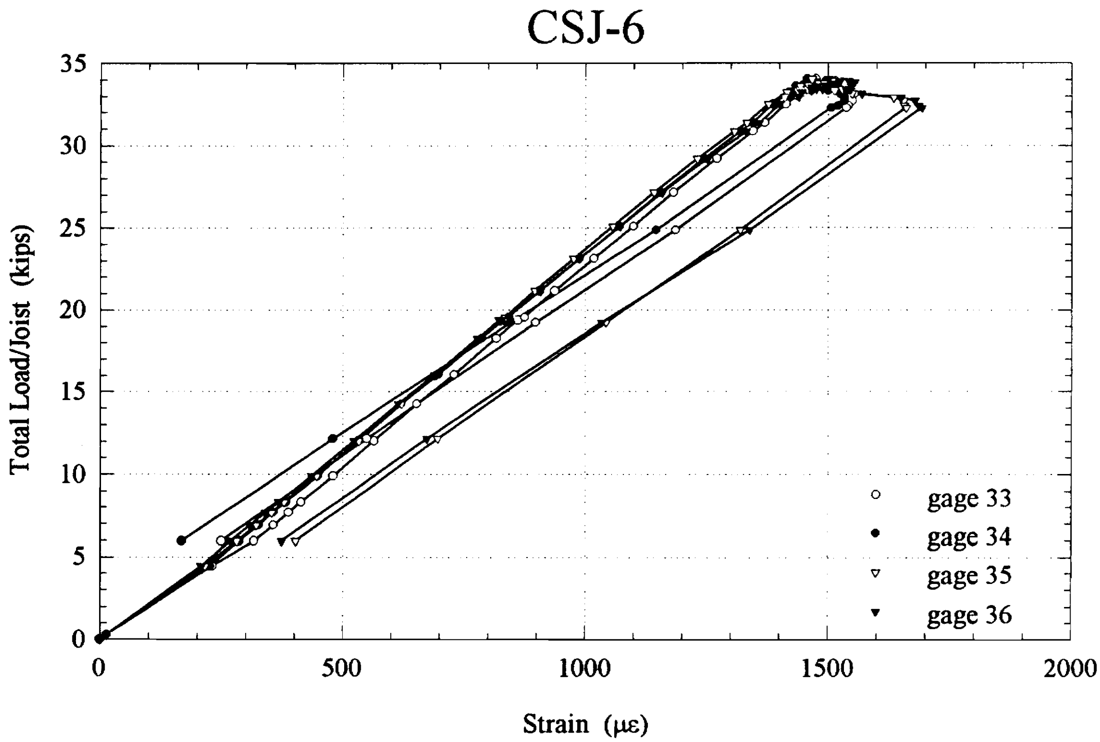



Figure A.6.5 Total Load/Joist vs. Bottom Chord Strain (BC3)

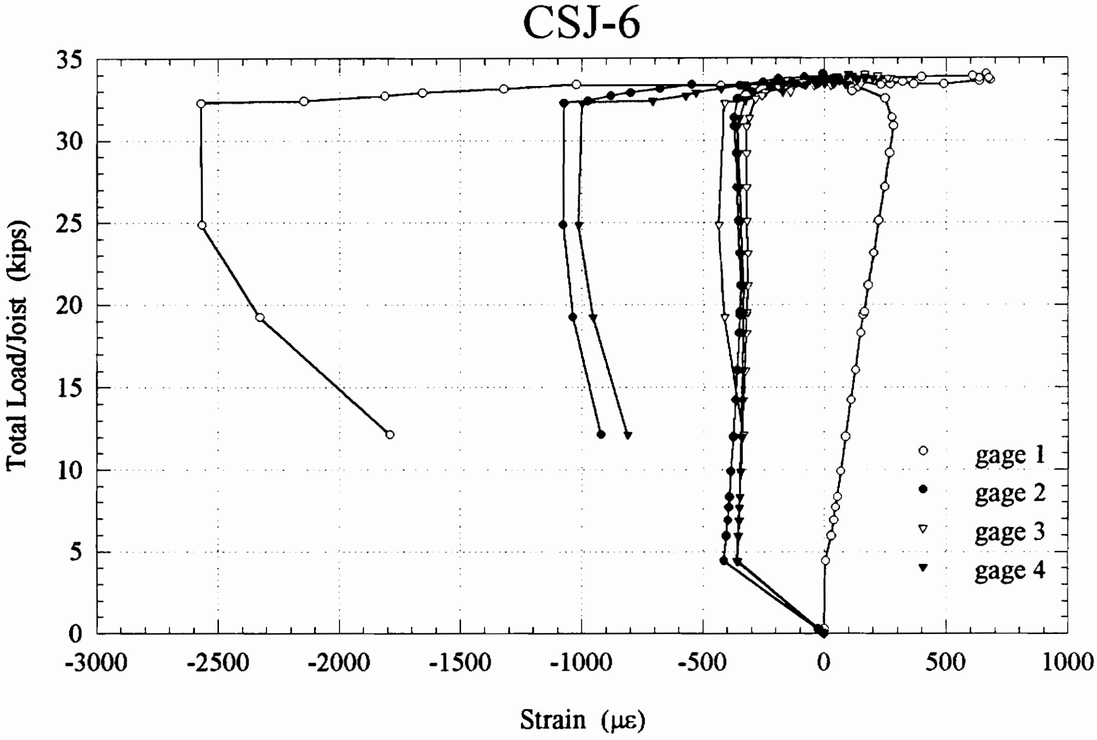



Figure A.6.6 Total Load/Joist vs. Top Chord Strain (TC1)

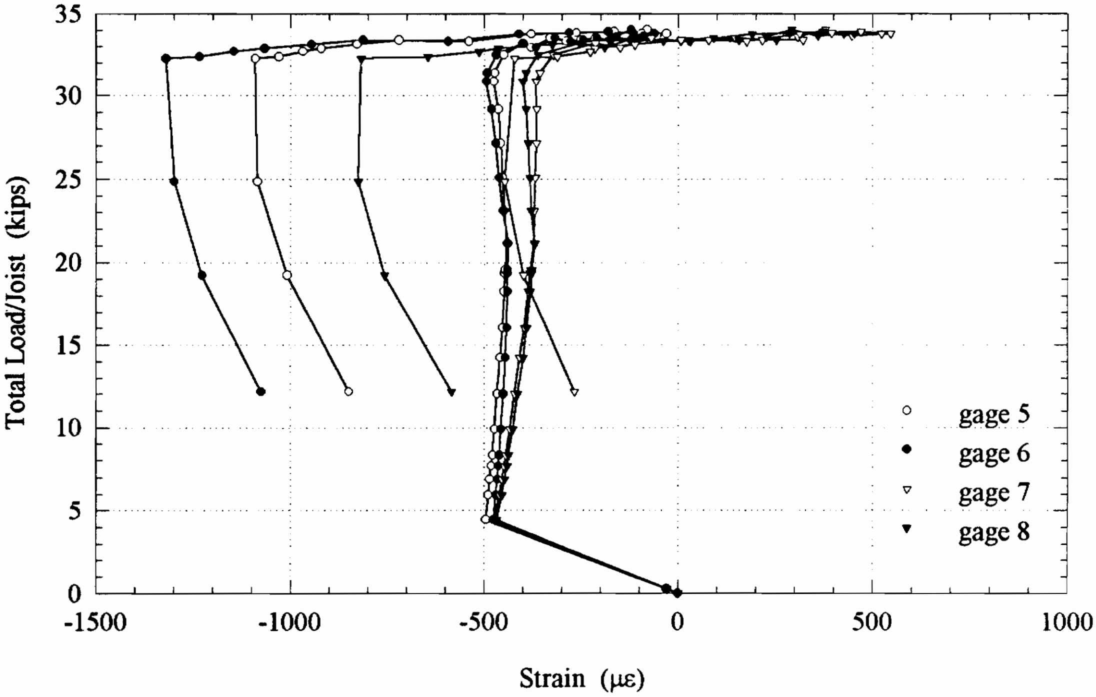



Figure A.6.7 Total Load/Joist vs. Top Chord Strain (TC2)

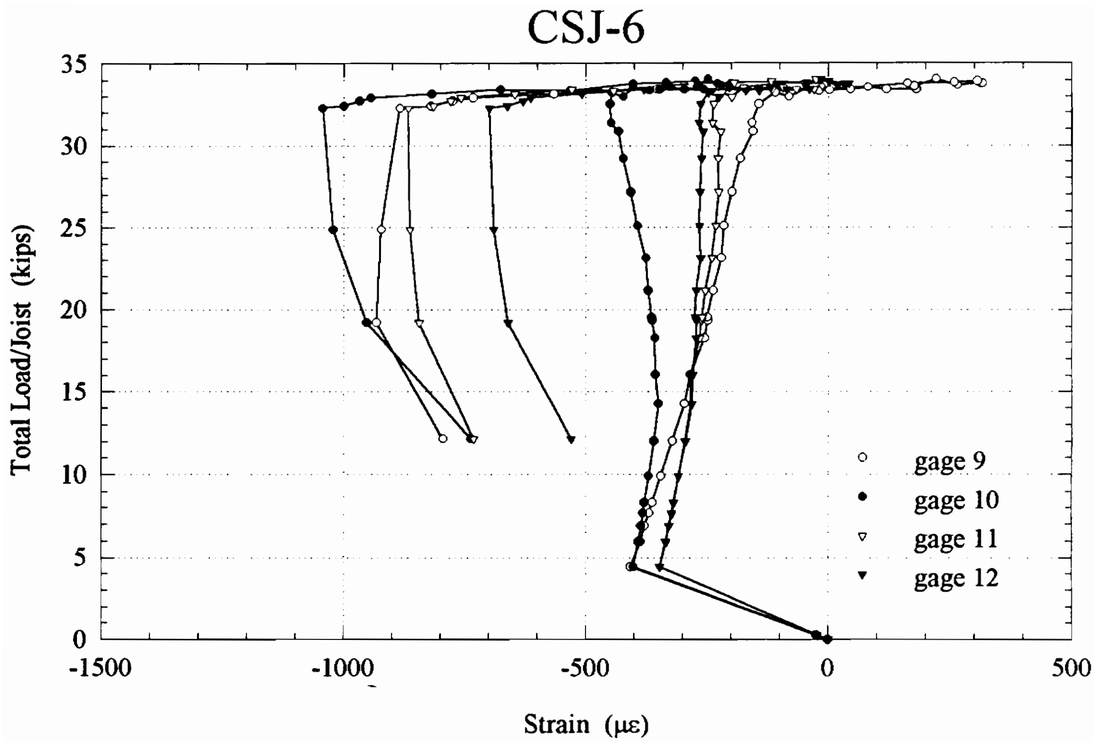



Figure A.6.8 Total Load/Joist vs. Top Chord Strain (TC3)

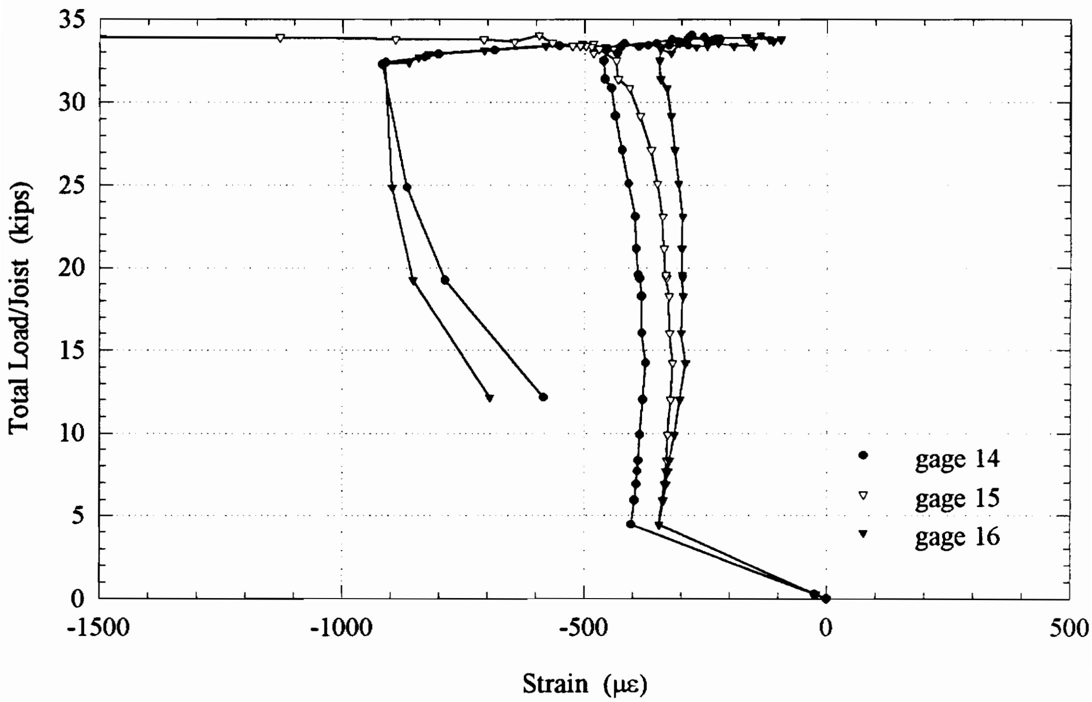



Figure A.6.9 Total Load/Joist vs. Top Chord Strain (TC4)

CSJ-6

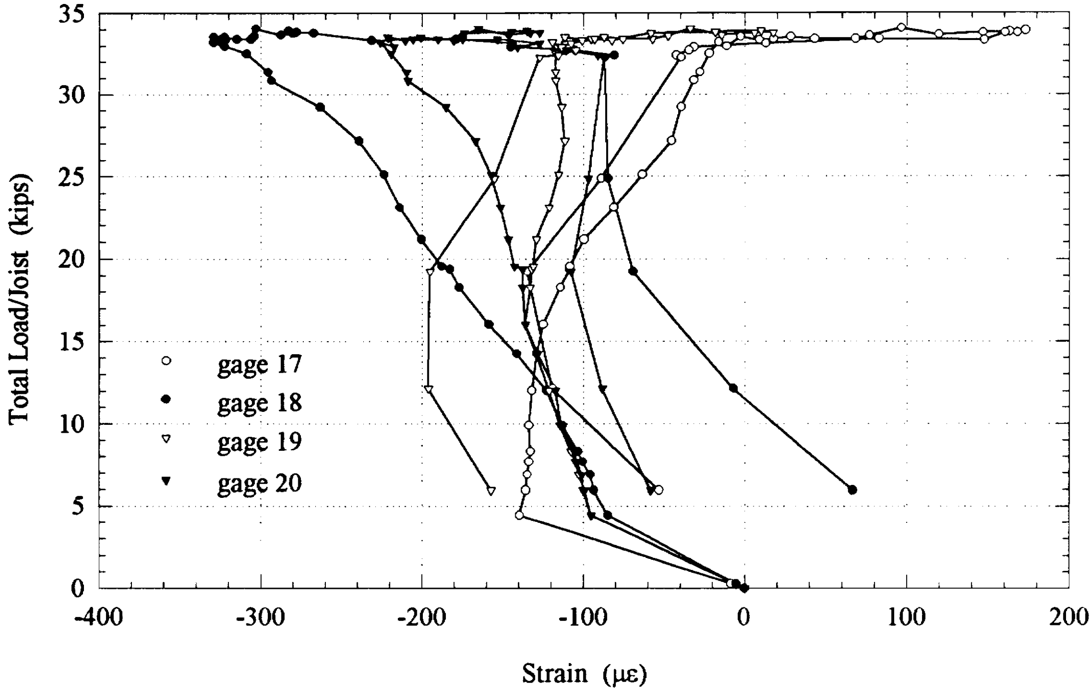



Figure A.6.10 Total Load/Joist vs. Top Chord Strain (TC5)

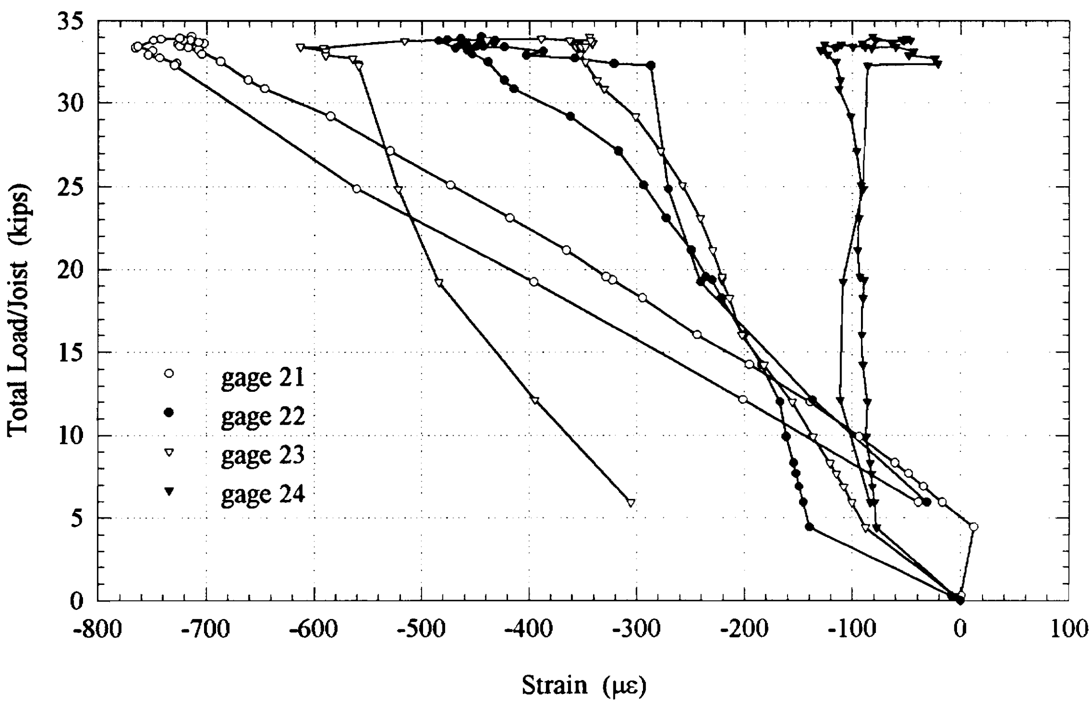



Figure A.6.11 Total Load/Joist vs. Top Chord Strain (TC6)

CSJ-6

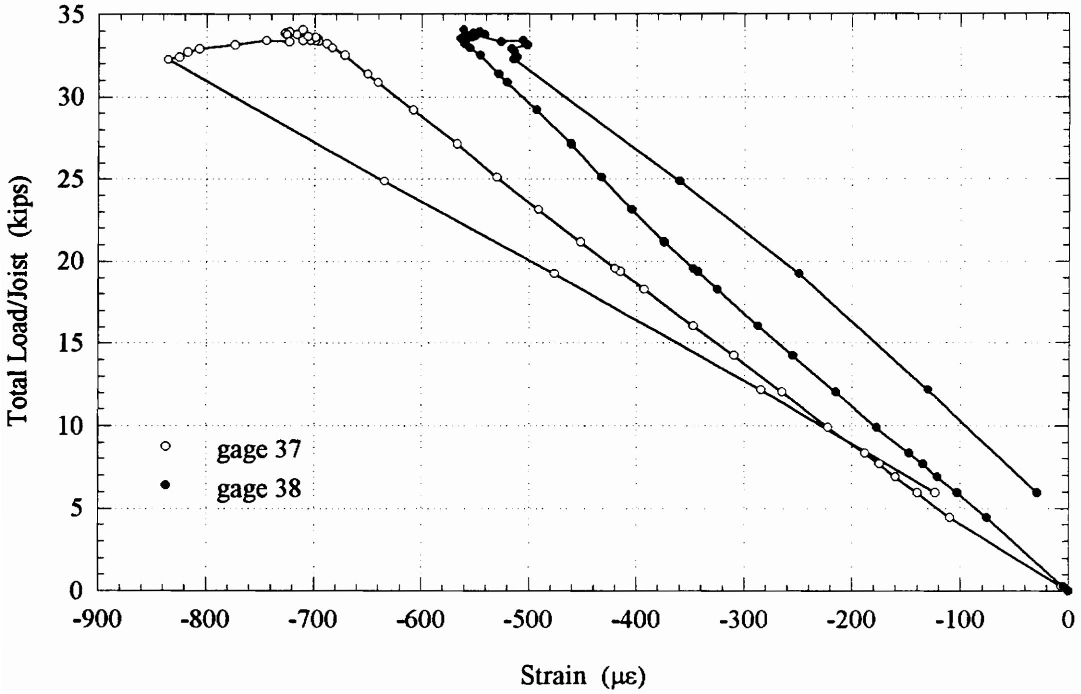



Figure A.6.12 Total Load/Joist vs. Web Strain (W1)

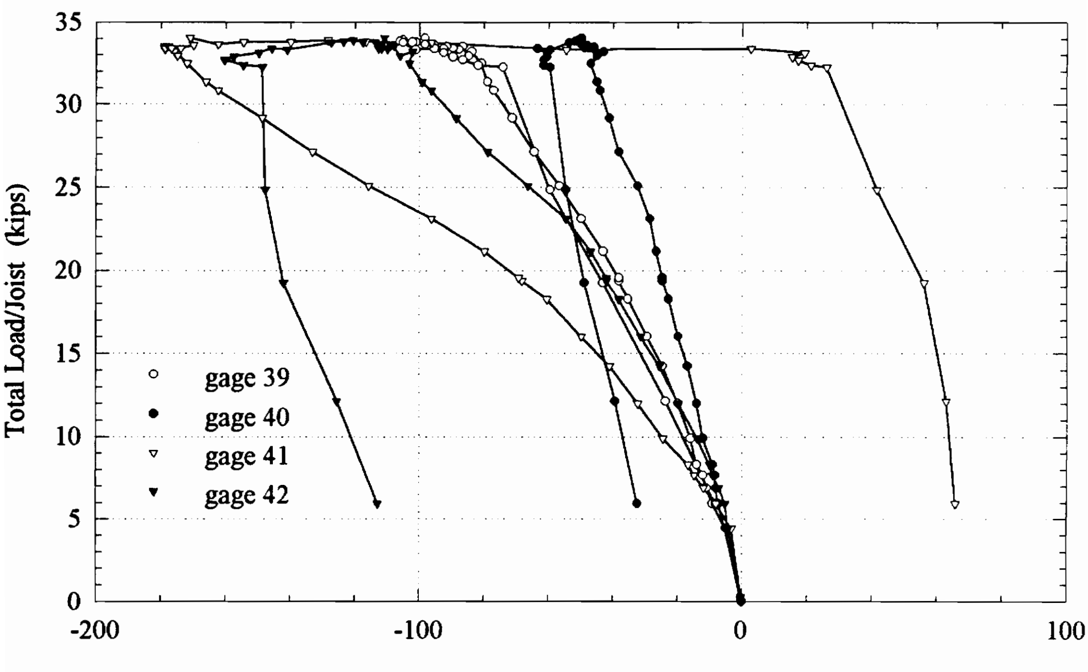



Figure A.6.13 Total Load/Joist vs. Web Strain (W2)

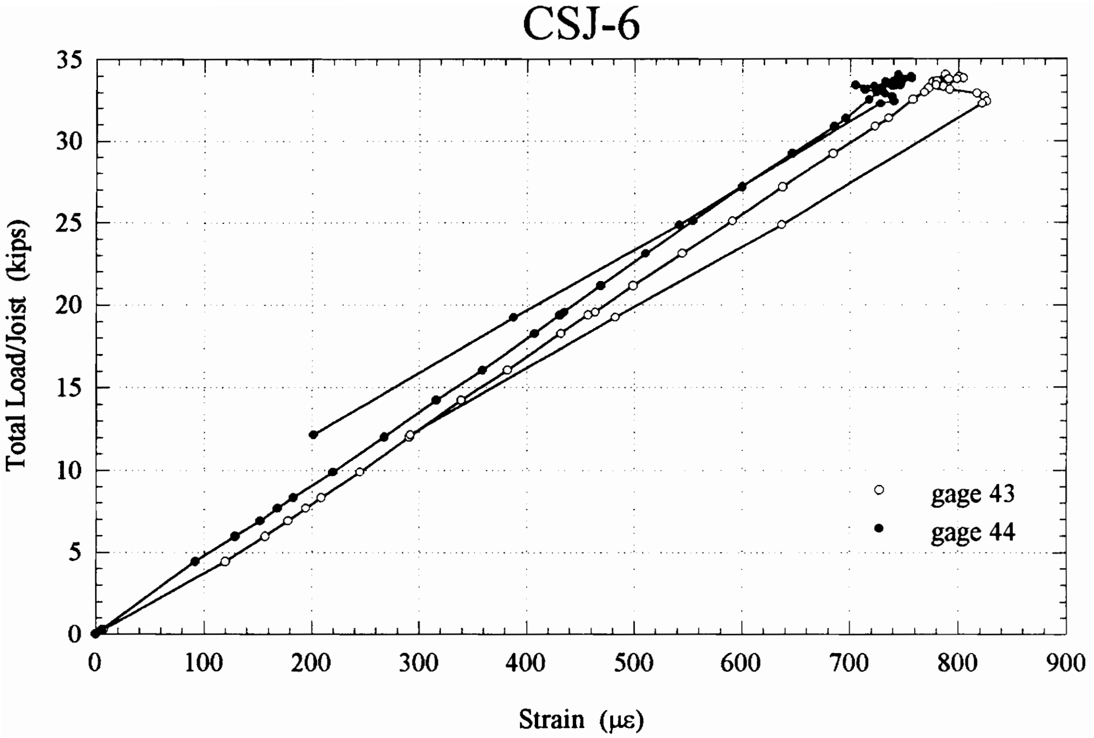



Figure A.6.14 Total Load/Joist vs. Web Strain (W3)

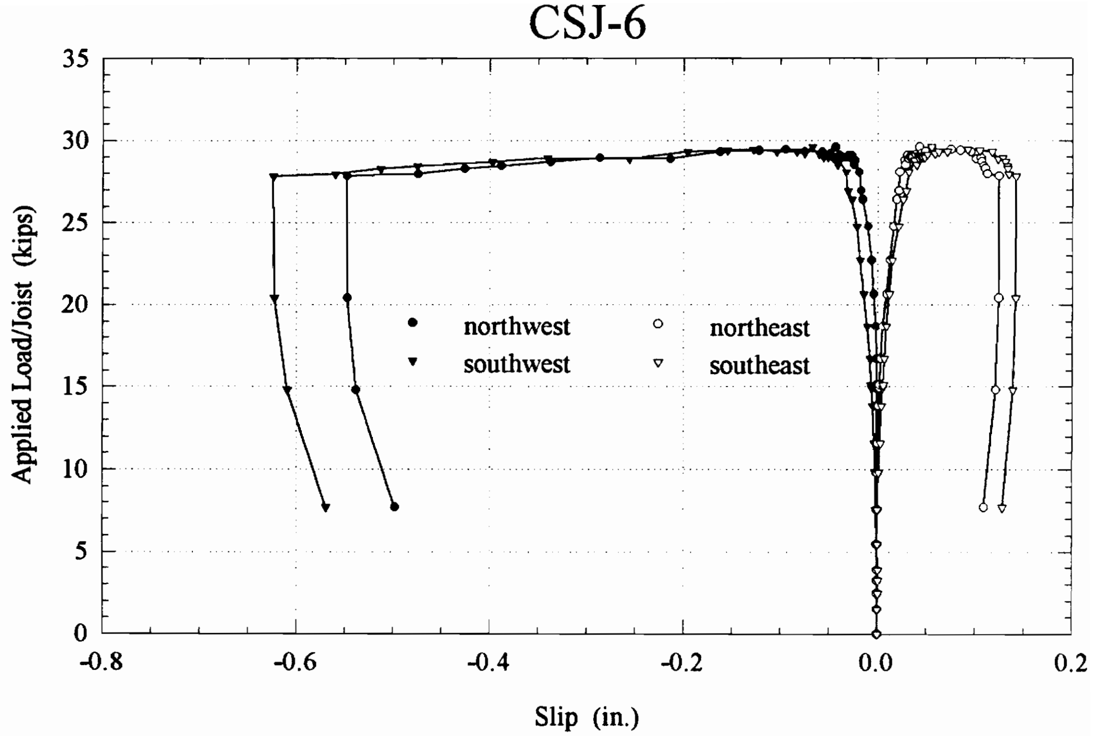



Figure A.6.15 Applied Load/Joist vs. End Slip

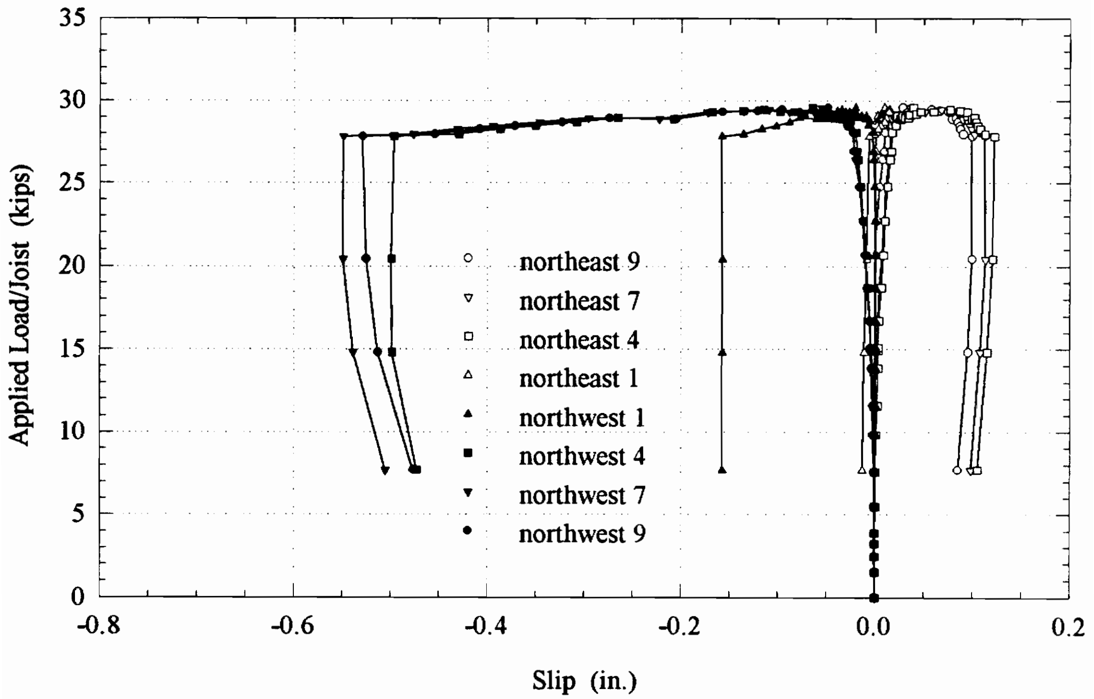



Figure A.6.16 Applied Load/Joist vs. Slip

CSJ-6

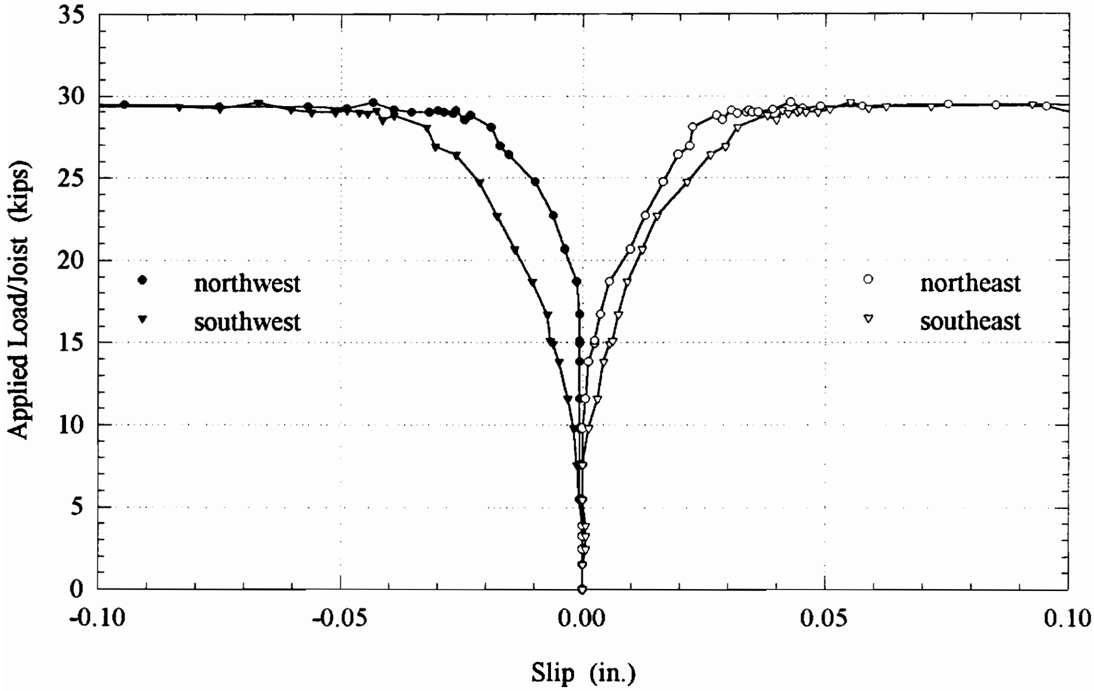



Figure A.6.17 Applied Load/Joist vs. End Slip

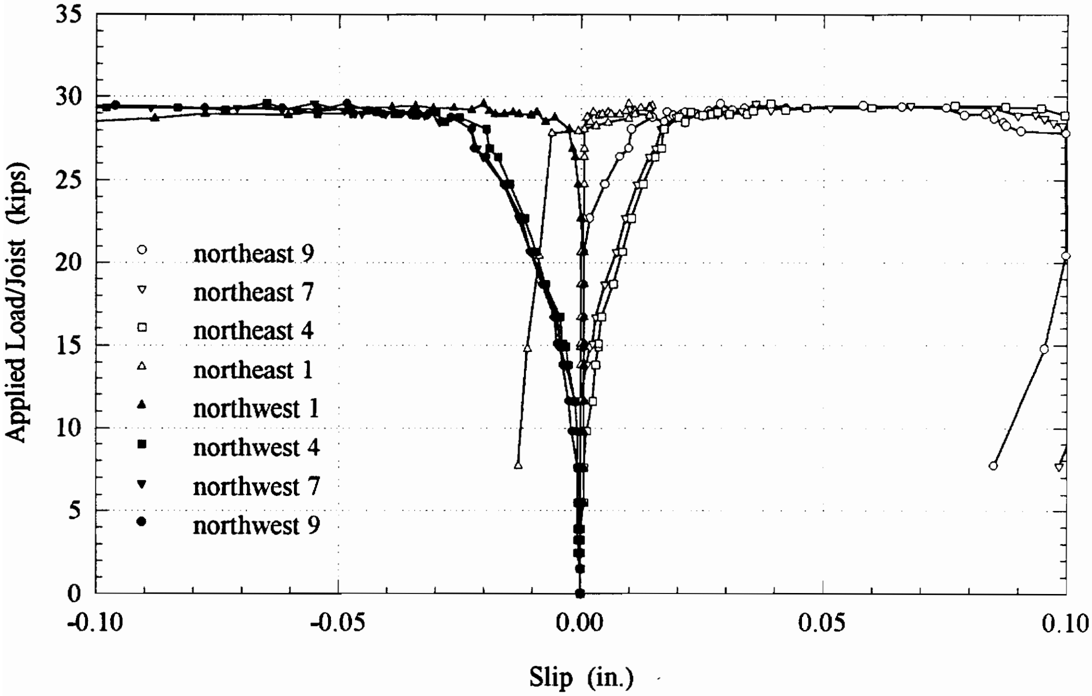



Figure A.6.18 Applied Load/Joist vs. Slip

## NUCOR COMPOSITE JOIST TEST SUMMARY SHEET

TEST DESIGNATION: CSJ-7 TEST DATE: 08 September 1992

### TEST DESCRIPTION

**Joist:** Span: 29'-7½" Weight: 11 plf
Depth: 18 in. Spacing: 40 in.
Top Chord: 2L-1.50x1.50x0.123 Yield Stress: 57.7 ksi
Bottom Chord: 2L-2.00x2.00x0.163 Yield Stress: 59.5 ksi

**Deck:** Type: 1.0C Gage: 26 ga

**Slab:** Total Depth: 4.0 in. Compressive Strength: 3600 psi

**Shear Connector:** Type: 1/2 in. dia. x 3 in. long welded headed shear stud
Quantity: 6 per half-span

### THEORETICAL CALCULATIONS

Theoretical Applied Load per Joist at Failure: 27.8 kips
Theoretical Total Load per Joist at Failure: 32.3 kips
Transformed Moment of Inertia: 357.3 in.$^4$
Theoretical Elastic Stiffness: 17.65 k/in.
Elastic Deflection at Yield: 1.72 in.

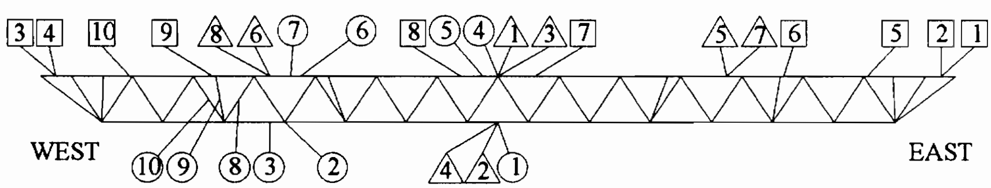
### TEST RESULTS

Applied Load per Joist at Failure: 24.3 kips
Total Load per Joist at Failure: 28.7 kips
Midspan Deflection at Failure: 3.28 in.
Maximum Slip and Location: 0.517 in. at stud SW6
Mode of Failure: buckling of the top chord

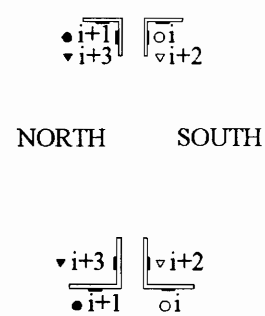
### COMPARISON OF ACTUAL TO THEORETICAL

Applied Load per Joist/Theoretical Applied Load per Joist: 0.87

### INSTRUMENTATION LOCATIONS




| | | |
|---|---|---|
| ① BC1 | △1 NMT Defl | □1 SE End Slip |
| ② BC2 | △2 NMB Defl | □2 NE End Slip |
| ③ BC3 | △3 SMT Defl | □3 SW End Slip |
| ④ TC1 | △4 SMB Defl | □4 NW End Slip |
| ⑤ TC2 | △5 NEQT Defl | □5 NE5 Slip |
| ⑥ TC3 | △6 NWQT Defl | □6 NE4 Slip |
| ⑦ TC4 | △7 SEQT Defl | □7 NE1 Slip |
| ⑧ W1 | △8 SWQT Defl | □8 NW1 Slip |
| ⑨ W2 | | □9 NW4 Slip |
| ⑩ W3 | | □10 NW5 Slip |




Strain Gage Locations

| TOTAL LOAD PER JOIST (kips) | CSJ-7 TEST DATA SHEET DEFLECTIONS SWQT (in.) | SMT (in.) | SMB (in.) | SEQT (in.) | NWQT (in.) | NMT (in.) | NMB (in.) | NEQT (in.) |
|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 0.27 | 0.032 | 0.044 | 0.044 | 0.033 | 0.031 | 0.044 | 0.044 | 0.031 |
| 4.45 | 0.533 | 0.724 | 0.724 | 0.535 | 0.517 | 0.723 | 0.723 | 0.513 |
| 5.95 | 0.593 | 0.807 | 0.807 | 0.592 | 0.573 | 0.796 | 0.796 | 0.569 |
| 7.99 | 0.654 | 0.914 | 0.910 | 0.656 | 0.628 | 0.902 | 0.899 | 0.626 |
| 6.71 | 0.628 | 0.844 | 0.849 | 0.625 | 0.606 | 0.833 | 0.833 | 0.602 |
| 8.24 | 0.671 | 0.927 | 0.933 | 0.672 | 0.640 | 0.924 | 0.918 | 0.642 |
| 9.84 | 0.728 | 1.020 | 1.012 | 0.736 | 0.697 | 1.007 | 0.998 | 0.705 |
| 11.88 | 0.821 | 1.144 | 1.137 | 0.829 | 0.783 | 1.130 | 1.127 | 0.802 |
| 13.48 | 0.901 | 1.250 | 1.239 | 0.907 | 0.859 | 1.227 | 1.237 | 0.886 |
| 9.71 | 0.782 | 1.052 | 1.040 | 0.782 | 0.751 | 1.034 | 1.028 | 0.765 |
| 6.65 | 0.652 | 0.872 | 0.868 | 0.649 | 0.625 | 0.860 | 0.858 | 0.635 |
| 10.16 | 0.769 | 1.070 | 1.063 | 0.779 | 0.729 | 1.053 | 1.049 | 0.751 |
| 14.12 | 0.942 | 1.296 | 1.291 | 0.949 | 0.894 | 1.277 | 1.285 | 0.925 |
| 15.90 | 1.044 | 1.430 | 1.411 | 1.045 | 0.987 | 1.410 | 1.411 | 1.023 |
| 18.14 | 1.178 | 1.601 | 1.588 | 1.176 | 1.110 | 1.584 | 1.581 | 1.159 |
| 19.74 | 1.293 | 1.753 | 1.741 | 1.287 | 1.220 | 1.726 | 1.727 | 1.277 |
| 21.27 | 1.434 | 1.942 | 1.918 | 1.427 | 1.350 | 1.909 | 1.902 | 1.418 |
| 22.48 | 1.521 | 2.067 | 2.038 | 1.521 | 1.443 | 2.023 | 2.021 | 1.517 |
| 14.31 | 1.204 | 1.601 | 1.588 | 1.198 | 1.144 | 1.579 | 1.576 | 1.210 |
| 6.84 | 0.769 | 1.029 | 1.021 | 0.760 | 0.729 | 1.021 | 1.012 | 0.776 |
| 14.31 | 1.144 | 1.555 | 1.541 | 1.145 | 1.075 | 1.533 | 1.537 | 1.144 |
| 21.40 | 1.501 | 2.016 | 1.997 | 1.490 | 1.408 | 1.987 | 1.980 | 1.490 |
| 23.82 | 1.703 | 2.293 | 2.257 | 1.694 | 1.601 | 2.243 | 2.234 | 1.692 |
| 25.67 | 1.911 | 2.569 | 2.531 | 1.915 | 1.811 | 2.509 | 2.514 | 1.909 |
| 27.90 | 2.247 | 3.008 | 2.963 | 2.272 | 2.137 | 2.948 | 2.945 | 2.251 |
| 28.73 | 2.483 | 3.317 | 3.269 | 2.509 | 2.356 | 3.250 | 3.243 | 2.480 |
| 27.13 | 2.672 | 3.557 | 3.506 | 2.632 | 2.526 | 3.415 | 3.418 | 2.590 |
| 24.26 | 2.732 | 3.584 | 3.548 | 2.624 | 2.643 | 3.484 | 3.480 | 2.591 |
| 22.79 | 2.774 | 3.617 | 3.576 | 2.612 | 2.697 | 3.511 | 3.507 | 2.588 |
| 19.92 | 3.034 | 3.856 | 3.831 | 2.667 | 2.978 | 3.750 | 3.743 | 2.649 |
| 10.92 | 2.583 | 3.206 | 3.181 | 2.102 | 2.568 | 3.108 | 3.088 | 2.107 |

| TOTAL LOAD PER JOIST (kips) | CSJ-7 TEST DATA SHEET TC1 2L1.50x1.50x0.123 | | | | AVG MEM LOAD (kips) | CSJ-7 TEST DATA SHEET TC2 2L1.50x1.50x0.123 | | | | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| | TC1 (1) | TC1 (2) | TC1 (3) | TC1 (4) | | TC2 (5) | TC2 (6) | TC2 (7) | TC2 (8) | |
| | (με) | | | | | (με) | | | | |
| 0.00 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 |
| 0.27 | -30 | -31 | -21 | -24 | -0.5 | -31 | -32 | -30 | -31 | -0.6 |
| 4.45 | -494 | -502 | -349 | -392 | -8.9 | -518 | -529 | -499 | -504 | -10.5 |
| 5.95 | -491 | -495 | -344 | -392 | -8.8 | -516 | -523 | -493 | -498 | -10.4 |
| 7.99 | -483 | -481 | -340 | -391 | -8.7 | -512 | -516 | -484 | -485 | -10.3 |
| 6.71 | -489 | -491 | -344 | -392 | -8.8 | -516 | -522 | -492 | -495 | -10.4 |
| 8.24 | -483 | -479 | -340 | -391 | -8.7 | -511 | -515 | -483 | -484 | -10.2 |
| 9.84 | -481 | -474 | -335 | -391 | -8.6 | -511 | -512 | -478 | -478 | -10.2 |
| 11.88 | -484 | -473 | -331 | -395 | -8.6 | -513 | -512 | -477 | -473 | -10.1 |
| 13.48 | -498 | -477 | -337 | -401 | -8.8 | -527 | -516 | -488 | -476 | -10.3 |
| 9.71 | -513 | -506 | -347 | -403 | -9.1 | -536 | -533 | -507 | -503 | -10.7 |
| 6.65 | -511 | -513 | -353 | -402 | -9.1 | -534 | -537 | -512 | -513 | -10.8 |
| 10.16 | -499 | -489 | -346 | -400 | -8.9 | -527 | -523 | -496 | -491 | -10.5 |
| 14.12 | -504 | -481 | -341 | -406 | -8.9 | -532 | -520 | -493 | -478 | -10.4 |
| 15.90 | -524 | -493 | -351 | -419 | -9.2 | -552 | -529 | -511 | -486 | -10.7 |
| 18.14 | -561 | -522 | -376 | -446 | -9.8 | -591 | -556 | -544 | -509 | -11.3 |
| 19.74 | -609 | -565 | -409 | -483 | -10.6 | -640 | -599 | -590 | -549 | -12.2 |
| 21.27 | -680 | -634 | -468 | -543 | -11.9 | -715 | -669 | -660 | -614 | -13.6 |
| 22.48 | -720 | -676 | -505 | -580 | -12.7 | -762 | -715 | -702 | -655 | -14.5 |
| 14.31 | -734 | -715 | -522 | -583 | -13.1 | -773 | -745 | -726 | -704 | -15.1 |
| 6.84 | -616 | -626 | -446 | -504 | -11.3 | -651 | -657 | -619 | -628 | -13.1 |
| 14.31 | -685 | -665 | -495 | -554 | -12.3 | -727 | -701 | -682 | -661 | -14.2 |
| 21.40 | -730 | -687 | -520 | -592 | -13.0 | -775 | -730 | -715 | -672 | -14.8 |
| 23.82 | -840 | -785 | -615 | -693 | -15.1 | -891 | -841 | -824 | -775 | -17.1 |
| 25.67 | -1003 | -897 | -764 | -830 | -17.9 | -1038 | -986 | -961 | -910 | -20.0 |
| 27.90 | -1342 | -1036 | -1042 | -1065 | -23.0 | -1280 | -1223 | -1181 | -1140 | -24.8 |
| 28.73 | -1516 | -1095 | -1288 | -1221 | -26.3 | -1459 | -1359 | -1335 | -1285 | -27.9 |
| 27.13 | -1570 | -1103 | -1429 | -1318 | -27.8 | -1530 | -1418 | -1420 | -1331 | -29.3 |
| 24.26 | -1502 | -894 | -1422 | -1210 | -25.8 | -1449 | -1169 | -1321 | -1040 | -25.6 |
| 22.79 | -1467 | -834 | -1420 | -1165 | -25.1 | -1404 | -1078 | -1292 | -970 | -24.4 |
| 19.92 | -1400 | -620 | -1388 | -1039 | -22.8 | -1324 | -776 | -1208 | -746 | -20.8 |
| 10.92 | -1315 | -512 | -1309 | -900 | -20.7 | -1228 | -610 | -1117 | -667 | -18.6 |

| TOTAL LOAD PER JOIST (kips) | CSJ-7 TEST DATA SHEET TC3 2L1.50x1.50x0.123 TC3 (9) | TC3 (10) | TC3 (11) | TC3 (12) | AVG MEM LOAD (kips) | CSJ-7 TEST DATA SHEET TC4 2L1.50x1.50x0.123 TC4 (13) | TC4 (14) | TC4 (15) | TC4 (16) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| | (με) | | | | | (με) | | | | |
| 0.00 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 |
| 0.27 | -26 | -23 | -24 | -22 | -0.5 | -27 | -27 | -22 | -21 | -0.5 |
| 4.45 | -429 | -379 | -390 | -368 | -8.0 | -441 | -441 | -367 | -348 | -8.2 |
| 5.95 | -421 | -355 | -378 | -350 | -7.7 | -435 | -435 | -351 | -333 | -8.0 |
| 7.99 | -414 | -332 | -365 | -332 | -7.4 | -436 | -455 | -342 | -354 | -8.1 |
| 6.71 | -423 | -342 | -377 | -341 | -7.6 | -438 | -448 | -348 | -347 | -8.1 |
| 8.24 | -413 | -326 | -363 | -329 | -7.3 | -437 | -459 | -340 | -360 | -8.2 |
| 9.84 | -409 | -301 | -353 | -310 | -7.0 | -439 | -483 | -333 | -382 | -8.4 |
| 11.88 | -420 | -272 | -355 | -298 | -6.9 | -458 | -535 | -334 | -419 | -9.0 |
| 13.48 | -441 | -272 | -369 | -306 | -7.1 | -482 | -587 | -338 | -434 | -9.4 |
| 9.71 | -454 | -313 | -390 | -334 | -7.7 | -473 | -538 | -353 | -391 | -9.0 |
| 6.65 | -443 | -357 | -388 | -355 | -7.9 | -446 | -471 | -357 | -334 | -8.3 |
| 10.16 | -438 | -325 | -376 | -335 | -7.6 | -462 | -524 | -349 | -381 | -8.8 |
| 14.12 | -452 | -275 | -375 | -313 | -7.3 | -493 | -613 | -346 | -442 | -9.7 |
| 15.90 | -486 | -270 | -399 | -325 | -7.6 | -533 | -693 | -360 | -486 | -10.6 |
| 18.14 | -548 | -284 | -442 | -358 | -8.4 | -601 | -808 | -401 | -541 | -12.1 |
| 19.74 | -612 | -317 | -485 | -405 | -9.3 | -665 | -895 | -445 | -579 | -13.3 |
| 21.27 | -698 | -363 | -545 | -476 | -10.7 | -758 | -994 | -507 | -628 | -14.8 |
| 22.48 | -746 | -382 | -581 | -512 | -11.4 | -813 | -1056 | -542 | -676 | -15.8 |
| 14.31 | -743 | -475 | -593 | -556 | -12.1 | -762 | -902 | -560 | -570 | -14.3 |
| 6.84 | -552 | -462 | -460 | -455 | -9.9 | -565 | -535 | -436 | -459 | -10.2 |
| 14.31 | -681 | -469 | -554 | -529 | -11.5 | -733 | -813 | -523 | -582 | -13.6 |
| 21.40 | -758 | -415 | -599 | -537 | -11.9 | -834 | -1045 | -561 | -697 | -16.1 |
| 23.82 | -861 | -449 | -671 | -620 | -13.3 | -941 | -1146 | -632 | -793 | -18.0 |
| 25.67 | -996 | -528 | -779 | -749 | -15.7 | -1097 | -1238 | -744 | -923 | -20.5 |
| 27.90 | -1199 | -666 | -955 | -970 | -19.5 | -1318 | -1366 | -949 | -1182 | -24.7 |
| 28.73 | -1289 | -714 | -1083 | -1127 | -21.6 | -1376 | -1460 | -1121 | -1401 | -27.5 |
| 27.13 | -1112 | -593 | -1100 | -1226 | -20.7 | -1094 | -1536 | -1271 | -1630 | -28.4 |
| 24.26 | -233 | -174 | -761 | -1115 | -11.7 | 202 | -1218 | -1330 | -1495 | -19.7 |
| 22.79 | -4 | -136 | -727 | -1066 | -9.9 | 640 | -1125 | -1379 | -1440 | -17.0 |
| 19.92 | 397 | 2 | -662 | -928 | -6.1 | 1648 | -851 | -1482 | -1344 | -10.4 |
| 10.92 | 418 | -184 | -645 | -899 | -6.7 | 1787 | -575 | -1480 | -1164 | -7.3 |

| TOTAL LOAD PER JOIST (kips) | CSJ-7 TEST DATA SHEET BC1 2L2.00x2.00x0.163 BC1 (17) (με) | BC1 (18) | BC1 (19) | BC1 (20) | AVG MEM LOAD (kips) | CSJ-7 TEST DATA SHEET BC2 2L2.00x2.00x0.163 BC2 (21) (με) | BC2 (22) | BC2 (23) | BC2 (24) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 |
| 0.27 | 21 | 21 | 19 | 18 | 0.7 | 18 | 20 | 15 | 14 | 0.6 |
| 4.45 | 350 | 354 | 309 | 302 | 11.9 | 300 | 331 | 250 | 236 | 10.1 |
| 5.95 | 436 | 443 | 391 | 385 | 15.0 | 381 | 408 | 316 | 298 | 12.7 |
| 7.99 | 546 | 557 | 497 | 490 | 19.0 | 484 | 504 | 403 | 376 | 16.0 |
| 6.71 | 476 | 485 | 429 | 423 | 16.5 | 421 | 443 | 361 | 327 | 14.1 |
| 8.24 | 565 | 578 | 516 | 510 | 19.7 | 505 | 521 | 455 | 390 | 17.0 |
| 9.84 | 651 | 668 | 599 | 592 | 22.8 | 587 | 598 | 554 | 453 | 19.9 |
| 11.88 | 774 | 796 | 717 | 709 | 27.2 | 706 | 710 | 697 | 541 | 24.1 |
| 13.48 | 870 | 895 | 808 | 799 | 30.6 | 796 | 796 | 807 | 611 | 27.3 |
| 9.71 | 652 | 669 | 598 | 588 | 22.8 | 595 | 608 | 651 | 459 | 21.0 |
| 6.65 | 478 | 488 | 428 | 420 | 16.5 | 430 | 454 | 521 | 335 | 15.8 |
| 10.16 | 677 | 695 | 622 | 613 | 23.7 | 618 | 628 | 669 | 476 | 21.7 |
| 14.12 | 910 | 935 | 847 | 837 | 32.0 | 834 | 834 | 881 | 640 | 29.0 |
| 15.90 | 1022 | 1051 | 954 | 943 | 36.0 | 941 | 937 | 994 | 720 | 32.6 |
| 18.14 | 1157 | 1191 | 1082 | 1070 | 40.9 | 1074 | 1064 | 1125 | 819 | 37.1 |
| 19.74 | 1254 | 1295 | 1176 | 1163 | 44.4 | 1174 | 1161 | 1222 | 892 | 40.4 |
| 21.27 | 1358 | 1406 | 1274 | 1261 | 48.1 | 1281 | 1263 | 1335 | 968 | 44.0 |
| 22.48 | 1434 | 1488 | 1348 | 1334 | 50.9 | 1357 | 1336 | 1405 | 1024 | 46.5 |
| 14.31 | 951 | 992 | 879 | 868 | 33.5 | 914 | 921 | 1059 | 690 | 32.5 |
| 6.84 | 504 | 529 | 450 | 439 | 17.5 | 491 | 525 | 732 | 376 | 19.3 |
| 14.31 | 946 | 984 | 874 | 861 | 33.3 | 907 | 911 | 1056 | 683 | 32.3 |
| 21.40 | 1373 | 1425 | 1288 | 1273 | 48.6 | 1304 | 1282 | 1366 | 979 | 44.7 |
| 23.82 | 1536 | 1597 | 1440 | 1425 | 54.4 | 1465 | 1431 | 1493 | 1098 | 49.8 |
| 25.67 | 1679 | 1748 | 1574 | 1556 | 59.5 | 1610 | 1567 | 1602 | 1207 | 54.3 |
| 27.90 | 1881 | 1961 | 1761 | 1741 | 66.7 | 1810 | 1753 | 1760 | 1352 | 60.6 |
| 28.73 | 1993 | 2053 | 1857 | 1858 | 70.4 | 1915 | 1844 | 1828 | 1432 | 63.7 |
| 27.13 | 1996 | 2024 | 1892 | 1867 | 70.6 | 1896 | 1827 | 1808 | 1441 | 63.3 |
| 24.26 | 1755 | 1779 | 1669 | 1642 | 62.1 | 1552 | 1517 | 1581 | 1284 | 53.9 |
| 22.79 | 1652 | 1674 | 1572 | 1546 | 58.5 | 1431 | 1416 | 1488 | 1217 | 50.4 |
| 19.92 | 1452 | 1471 | 1387 | 1362 | 51.5 | 1177 | 1229 | 1284 | 1095 | 43.4 |
| 10.92 | 869 | 879 | 836 | 811 | 30.8 | 648 | 778 | 871 | 713 | 27.3 |

| TOTAL LOAD PER JOIST (kips) | CSJ-7 TEST DATA SHEET BC3 2L2.00x2.00x0.163 BC3 (25) | BC3 (26) | BC3 (27) | BC3 (28) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|
| | (με) | | | | |
| 0.00 | 0 | 0 | 0 | 0 | 0.0 |
| 0.27 | 15 | 16 | 13 | 15 | 0.5 |
| 4.45 | 239 | 263 | 220 | 242 | 8.7 |
| 5.95 | 302 | 323 | 283 | 302 | 11.0 |
| 7.99 | 383 | 399 | 362 | 379 | 13.8 |
| 6.71 | 332 | 351 | 312 | 331 | 12.0 |
| 8.24 | 396 | 413 | 375 | 393 | 14.3 |
| 9.84 | 459 | 472 | 437 | 451 | 16.5 |
| 11.88 | 547 | 559 | 523 | 533 | 19.6 |
| 13.48 | 616 | 627 | 588 | 598 | 22.0 |
| 9.71 | 461 | 476 | 436 | 449 | 16.5 |
| 6.65 | 331 | 353 | 310 | 328 | 12.0 |
| 10.16 | 477 | 491 | 453 | 466 | 17.1 |
| 14.12 | 645 | 656 | 616 | 625 | 23.1 |
| 15.90 | 724 | 734 | 692 | 698 | 25.9 |
| 18.14 | 824 | 830 | 786 | 785 | 29.3 |
| 19.74 | 896 | 899 | 853 | 848 | 31.7 |
| 21.27 | 975 | 972 | 924 | 913 | 34.4 |
| 22.48 | 1032 | 1025 | 976 | 962 | 36.3 |
| 14.31 | 687 | 690 | 638 | 636 | 24.1 |
| 6.84 | 350 | 376 | 322 | 337 | 12.6 |
| 14.31 | 678 | 683 | 635 | 633 | 23.9 |
| 21.40 | 989 | 981 | 933 | 921 | 34.7 |
| 23.82 | 1108 | 1092 | 1043 | 1023 | 38.7 |
| 25.67 | 1211 | 1188 | 1137 | 1107 | 42.1 |
| 27.90 | 1346 | 1311 | 1257 | 1215 | 46.6 |
| 28.73 | 1416 | 1368 | 1312 | 1263 | 48.6 |
| 27.13 | 1397 | 1331 | 1287 | 1238 | 47.7 |
| 24.26 | 1214 | 1100 | 1092 | 1057 | 40.5 |
| 22.79 | 1128 | 1007 | 1007 | 980 | 37.4 |
| 19.92 | 950 | 821 | 830 | 830 | 31.1 |
| 10.92 | 536 | 449 | 443 | 461 | 17.1 |

| TOTAL LOAD PER JOIST (kips) | CSJ-7 W1 0.875 DIA. BAR W1 (29) (με) | W1 (30) (με) | AVG MEM LOAD (kips) | CSJ-7 W2 2L1.00x1.00x0.109 W2 (31) (με) | W2 (32) (με) | W2 (33) (με) | W2 (34) (με) | AVG MEM LOAD (kips) | CSJ-7 W3 0.875 DIA. BAR W3 (35) (με) | W3 (36) (με) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0.0 |
| 0.27 | -1 | -7 | -0.1 | -1 | 1 | -1 | 0 | 0.0 | 5 | 5 | 0.1 |
| 4.45 | -24 | -123 | -1.3 | -9 | 13 | -14 | -4 | 0.0 | 80 | 80 | 1.4 |
| 5.95 | -37 | -153 | -1.7 | -7 | 12 | -14 | -5 | 0.0 | 111 | 98 | 1.8 |
| 7.99 | -54 | -192 | -2.1 | -6 | 8 | -16 | -8 | -0.1 | 151 | 121 | 2.4 |
| 6.71 | -43 | -167 | -1.8 | -6 | 11 | -15 | -6 | -0.1 | 125 | 106 | 2.0 |
| 8.24 | -56 | -198 | -2.2 | -6 | 8 | -16 | -8 | -0.1 | 157 | 126 | 2.5 |
| 9.84 | -68 | -230 | -2.6 | -6 | 5 | -17 | -10 | -0.1 | 188 | 145 | 2.9 |
| 11.88 | -83 | -274 | -3.1 | -10 | 2 | -21 | -15 | -0.1 | 235 | 174 | 3.6 |
| 13.48 | -92 | -308 | -3.5 | -21 | 0 | -28 | -19 | -0.2 | 277 | 199 | 4.1 |
| 9.71 | -59 | -228 | -2.5 | -22 | 7 | -24 | -13 | -0.2 | 199 | 149 | 3.0 |
| 6.65 | -37 | -165 | -1.8 | -19 | 11 | -20 | -8 | -0.1 | 133 | 107 | 2.1 |
| 10.16 | -64 | -237 | -2.6 | -19 | 4 | -23 | -14 | -0.2 | 205 | 154 | 3.1 |
| 14.12 | -95 | -321 | -3.6 | -26 | -1 | -30 | -20 | -0.2 | 293 | 209 | 4.4 |
| 15.90 | -106 | -361 | -4.1 | -31 | -5 | -35 | -25 | -0.3 | 339 | 238 | 5.0 |
| 18.14 | -123 | -414 | -4.7 | -33 | -10 | -37 | -30 | -0.3 | 392 | 272 | 5.8 |
| 19.74 | -136 | -455 | -5.2 | -33 | -14 | -37 | -33 | -0.4 | 428 | 296 | 6.3 |
| 21.27 | -153 | -496 | -5.7 | -30 | -29 | -37 | -41 | -0.4 | 464 | 325 | 6.9 |
| 22.48 | -165 | -523 | -6.0 | -30 | -40 | -38 | -46 | -0.5 | 492 | 345 | 7.3 |
| 14.31 | -98 | -345 | -3.9 | -27 | -17 | -29 | -28 | -0.3 | 314 | 226 | 4.7 |
| 6.84 | -37 | -180 | -1.9 | -25 | 6 | -24 | -10 | -0.2 | 143 | 111 | 2.2 |
| 14.31 | -100 | -346 | -3.9 | -11 | -12 | -23 | -23 | -0.2 | 301 | 216 | 4.5 |
| 21.40 | -156 | -500 | -5.7 | -22 | -42 | -33 | -45 | -0.4 | 463 | 328 | 6.9 |
| 23.82 | -182 | -559 | -6.5 | -23 | -61 | -35 | -59 | -0.5 | 526 | 371 | 7.8 |
| 25.67 | -204 | -610 | -7.1 | -27 | -75 | -36 | -70 | -0.6 | 574 | 407 | 8.6 |
| 27.90 | -233 | -686 | -8.0 | -26 | -89 | -37 | -81 | -0.7 | 633 | 454 | 9.5 |
| 28.73 | -254 | -737 | -8.6 | -14 | -90 | -31 | -84 | -0.7 | 657 | 475 | 9.9 |
| 27.13 | -261 | -762 | -8.9 | -3 | -88 | -19 | -85 | -0.6 | 652 | 477 | 9.8 |
| 24.26 | -193 | -587 | -6.8 | -37 | -97 | -12 | -83 | -0.7 | 530 | 386 | 8.0 |
| 22.79 | -170 | -531 | -6.1 | -56 | -96 | -16 | -84 | -0.8 | 483 | 355 | 7.3 |
| 19.92 | -135 | -438 | -5.0 | -67 | -70 | -37 | -81 | -0.8 | 376 | 281 | 5.7 |
| 10.92 | -84 | -256 | -3.0 | -63 | -50 | -28 | -54 | -0.6 | 185 | 159 | 3.0 |

| APPLIED LOAD PER JOIST (kips) | CSJ-7 TEST DATA SHEET END SLIPS NEES (in.) | NWES (in.) | SEES (in.) | SWES (in.) |
|---|---|---|---|---|
| 0.00 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.50 | 0.000 | 0.000 | 0.000 | 0.000 |
| 3.54 | 0.001 | 0.000 | 0.000 | -0.002 |
| 2.26 | 0.001 | 0.000 | 0.000 | -0.002 |
| 3.80 | 0.002 | 0.000 | 0.000 | -0.002 |
| 5.39 | 0.003 | -0.002 | 0.000 | -0.004 |
| 7.44 | 0.005 | -0.004 | 0.001 | -0.008 |
| 9.03 | 0.008 | -0.008 | 0.004 | -0.013 |
| 5.27 | 0.008 | -0.008 | 0.004 | -0.011 |
| 2.20 | 0.004 | -0.004 | 0.001 | -0.005 |
| 5.71 | 0.006 | -0.005 | 0.002 | -0.009 |
| 9.67 | 0.010 | -0.010 | 0.006 | -0.015 |
| 11.46 | 0.015 | -0.018 | 0.010 | -0.022 |
| 13.69 | 0.027 | -0.031 | 0.021 | -0.032 |
| 15.29 | 0.040 | -0.043 | 0.035 | -0.043 |
| 16.82 | 0.057 | -0.059 | 0.056 | -0.059 |
| 18.04 | 0.070 | -0.068 | 0.069 | -0.068 |
| 9.86 | 0.064 | -0.059 | 0.064 | -0.059 |
| 2.39 | 0.031 | -0.023 | 0.029 | -0.023 |
| 9.86 | 0.052 | -0.047 | 0.053 | -0.049 |
| 16.95 | 0.069 | -0.067 | 0.070 | -0.068 |
| 19.38 | 0.096 | -0.089 | 0.095 | -0.093 |
| 21.23 | 0.127 | -0.115 | 0.127 | -0.124 |
| 23.46 | 0.183 | -0.109 | 0.181 | -0.179 |
| 24.29 | 0.218 | -0.087 | 0.217 | -0.224 |
| 22.69 | 0.231 | -0.051 | 0.229 | -0.319 |
| 19.82 | 0.231 | 0.024 | 0.227 | -0.366 |
| 18.35 | 0.228 | 0.056 | 0.225 | -0.397 |
| 15.48 | 0.221 | -0.121 | 0.217 | -0.517 |
| 6.48 | 0.162 | -0.121 | 0.159 | -0.500 |

| APPLIED LOAD PER JOIST (kips) | CSJ-7 TEST DATA SHEET INTERMEDIATE SLIPS | | | | | |
|---|---|---|---|---|---|---|
| | NE5S (in.) | NE4S (in.) | NE1S (in.) | NW1S (in.) | NW4S (in.) | NW5S (in.) |
| 0.00 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.50 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 3.54 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.26 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 3.80 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 5.39 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| 7.44 | -0.001 | 0.002 | -0.002 | 0.001 | 0.001 | 0.000 |
| 9.03 | 0.001 | 0.006 | -0.001 | 0.001 | -0.001 | -0.003 |
| 5.27 | 0.001 | 0.006 | -0.002 | 0.001 | -0.001 | -0.003 |
| 2.20 | 0.001 | 0.006 | -0.002 | 0.001 | -0.001 | -0.001 |
| 5.71 | 0.001 | 0.006 | -0.002 | 0.001 | -0.001 | -0.002 |
| 9.67 | 0.002 | 0.007 | -0.002 | 0.001 | -0.002 | -0.004 |
| 11.46 | 0.007 | 0.012 | -0.001 | 0.000 | -0.006 | -0.010 |
| 13.69 | 0.015 | 0.021 | -0.001 | -0.001 | -0.013 | -0.018 |
| 15.29 | 0.024 | 0.031 | 0.000 | -0.002 | -0.020 | -0.028 |
| 16.82 | 0.039 | 0.045 | 0.000 | -0.004 | -0.031 | -0.042 |
| 18.04 | 0.050 | 0.056 | 0.001 | -0.005 | -0.037 | -0.049 |
| 9.86 | 0.048 | 0.056 | 0.001 | -0.005 | -0.034 | -0.045 |
| 2.39 | 0.023 | 0.028 | 0.002 | -0.003 | -0.015 | -0.018 |
| 9.86 | 0.039 | 0.040 | 0.001 | -0.002 | -0.028 | -0.036 |
| 16.95 | 0.052 | 0.056 | 0.001 | -0.005 | -0.038 | -0.050 |
| 19.38 | 0.072 | 0.077 | 0.004 | -0.006 | -0.052 | -0.068 |
| 21.23 | 0.100 | 0.105 | 0.006 | -0.006 | -0.068 | -0.089 |
| 23.46 | 0.151 | 0.155 | 0.012 | -0.006 | -0.098 | -0.126 |
| 24.29 | 0.185 | 0.188 | 0.014 | -0.008 | -0.125 | -0.157 |
| 22.69 | 0.197 | 0.202 | 0.015 | -0.010 | -0.166 | -0.200 |
| 19.82 | 0.197 | 0.202 | 0.019 | -0.005 | -0.247 | -0.283 |
| 18.35 | 0.197 | 0.202 | 0.021 | -0.001 | -0.287 | -0.324 |
| 15.48 | 0.195 | 0.201 | 0.029 | 0.005 | -0.429 | -0.402 |
| 6.48 | 0.149 | 0.155 | 0.031 | 0.007 | -0.437 | -0.428 |

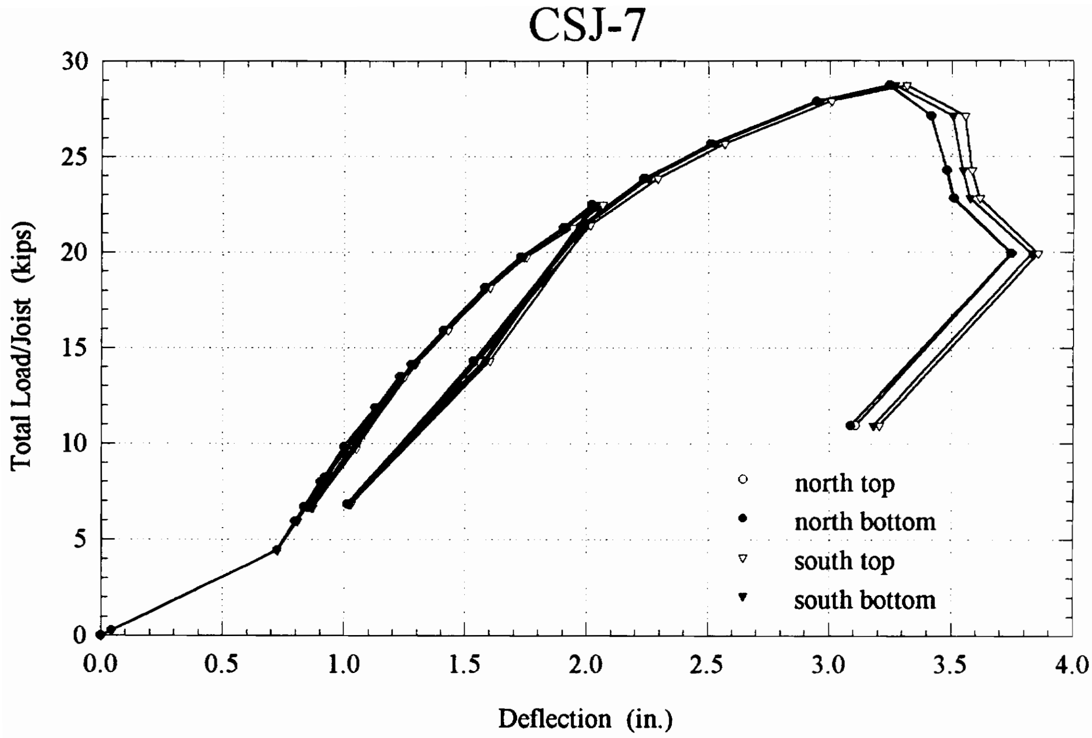



Figure A.7.1 Total Load/Joist vs. Midspan Deflection

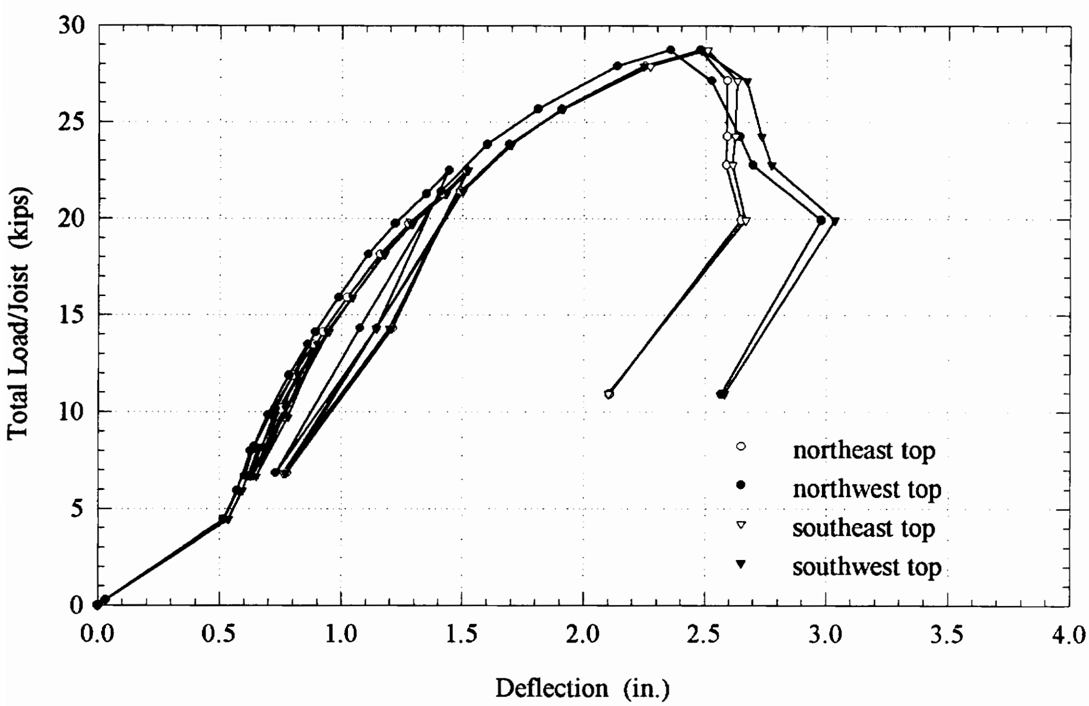



Figure A.7.2 Total Load/Joist vs. Quarter Point Deflection

# CSJ-7

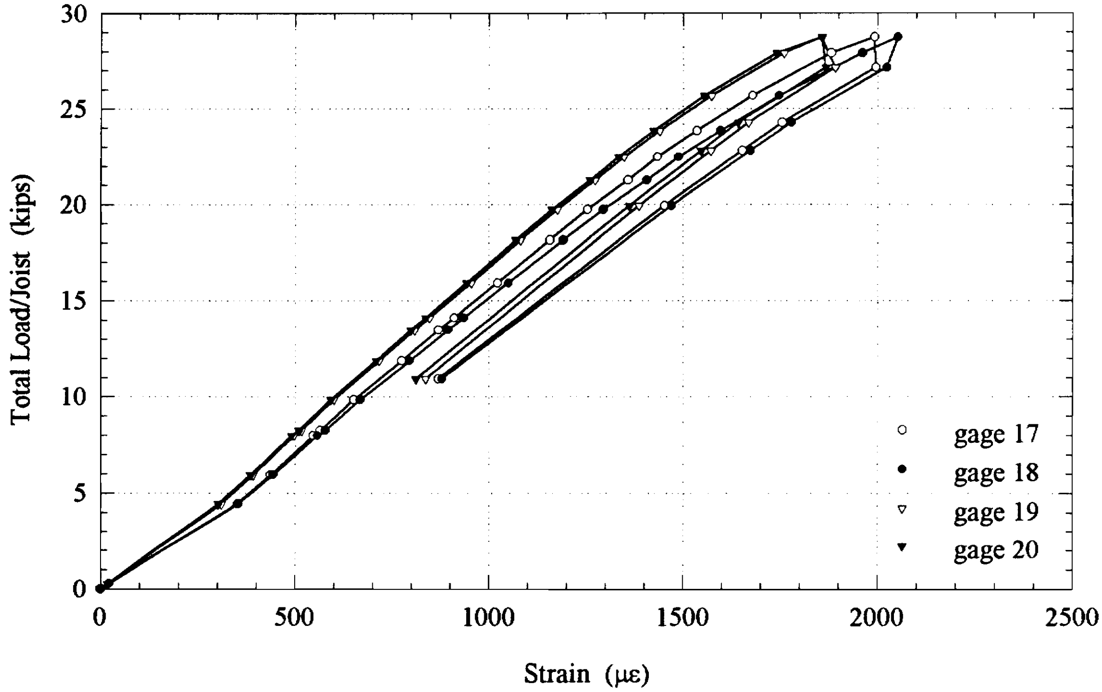



Figure A.7.3 Total Load/Joist vs. Bottom Chord Strain (BC1)

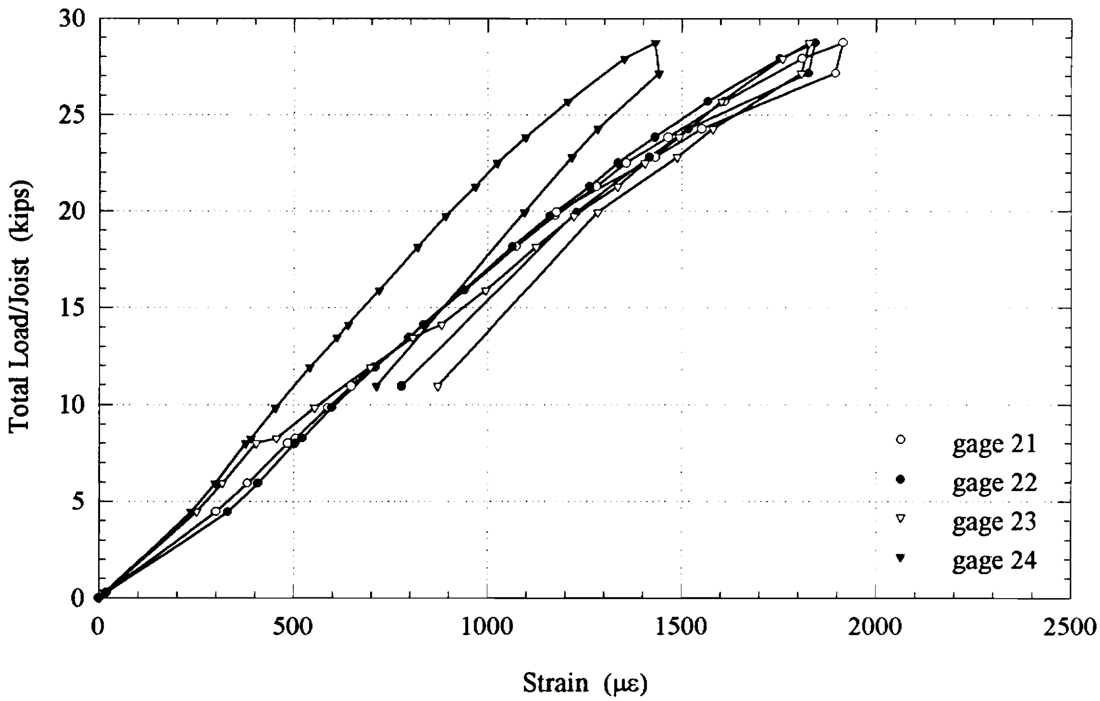



Figure A.7.4 Total Load/Joist vs. Bottom Chord Strain (BC2)

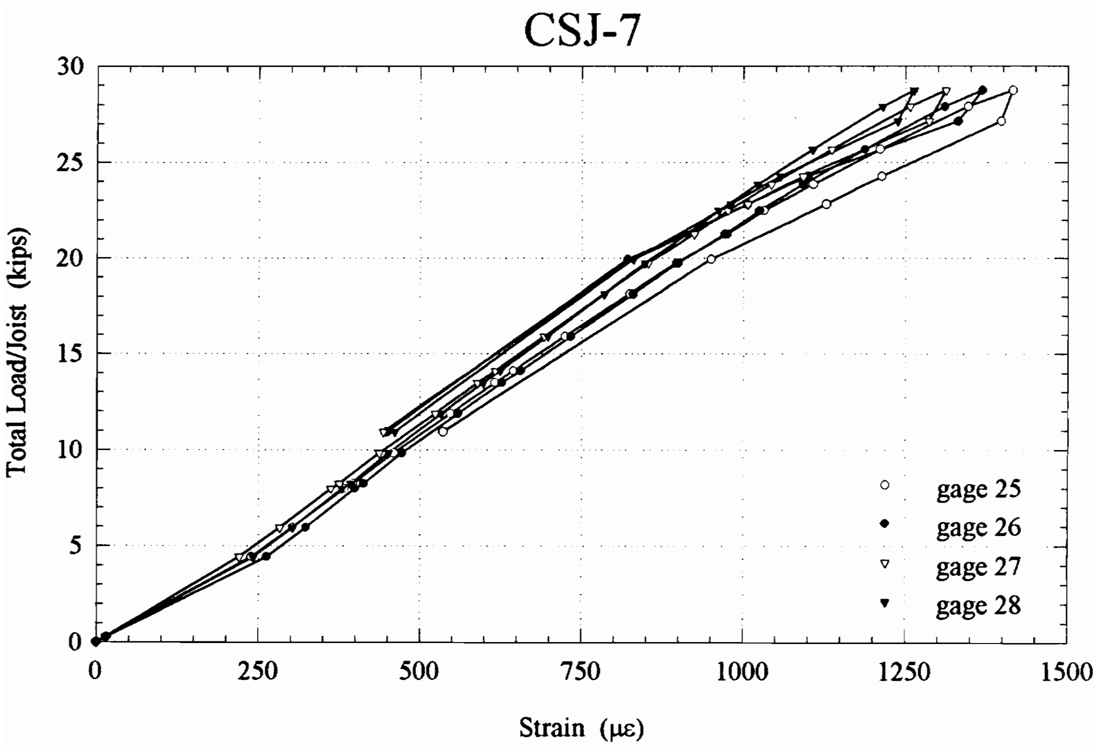



Figure A.7.5 Total Load/Joist vs. Bottom Chord Strain (BC3)

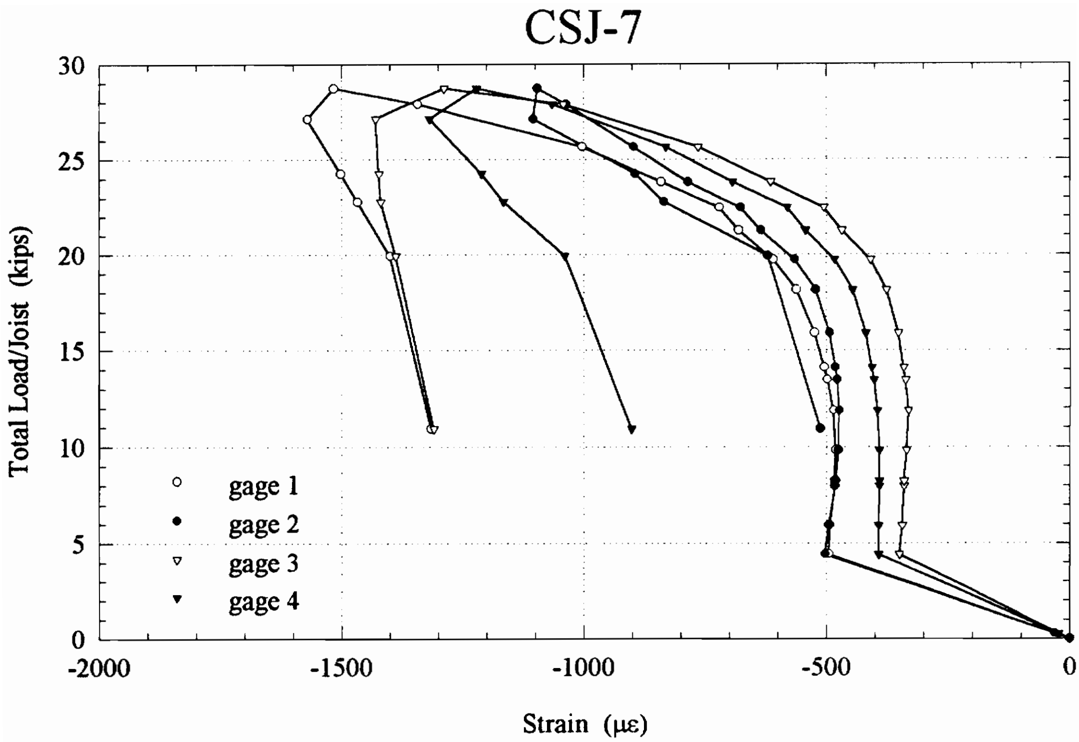



Figure A.7.6 Total Load/Joist vs. Top Chord Strain (TC1)

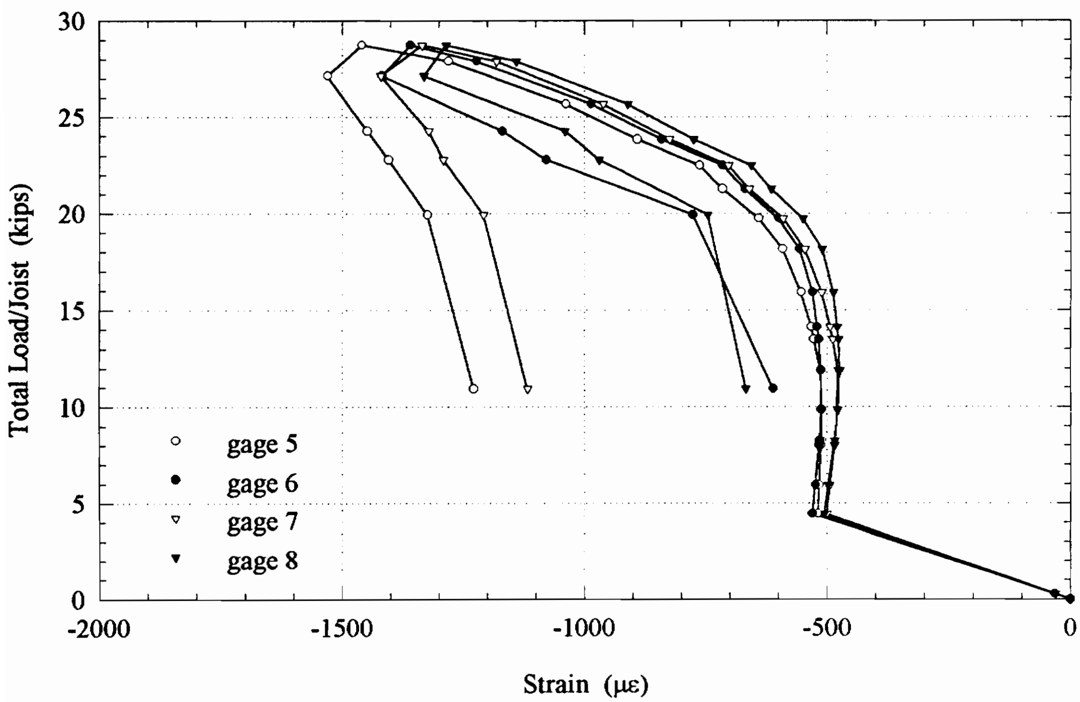



Figure A.7.7 Total Load/Joist vs. Top Chord Strain (TC2)

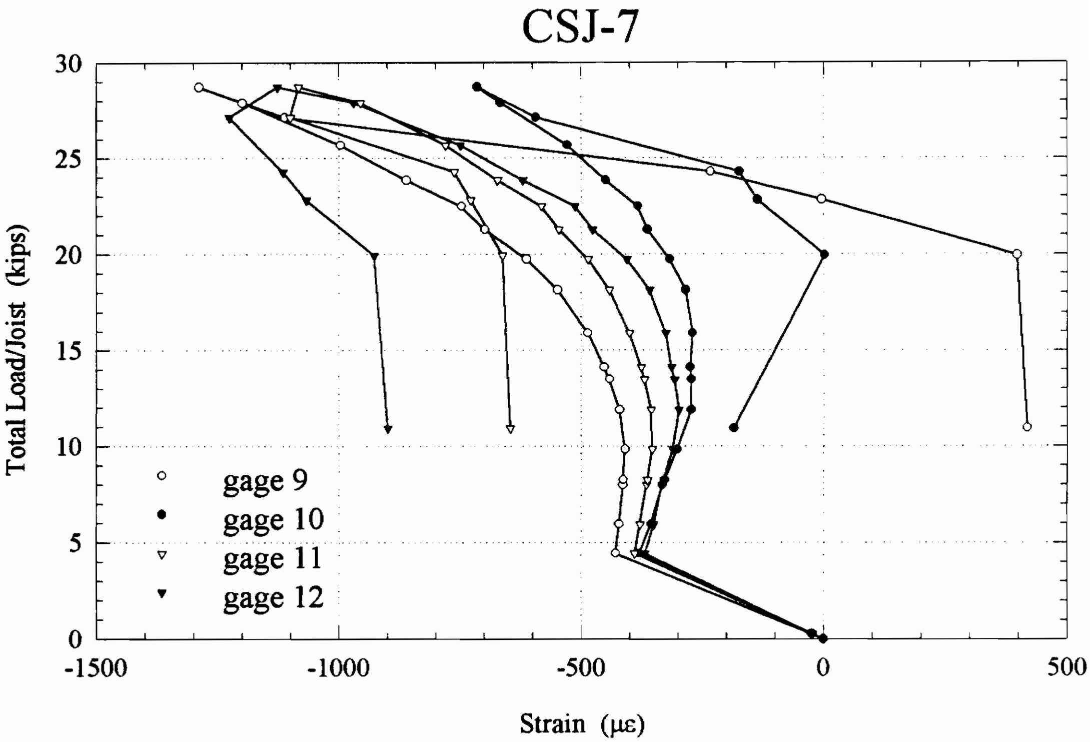



Figure A.7.8 Total Load/Joist vs. Top Chord Strain (TC3)

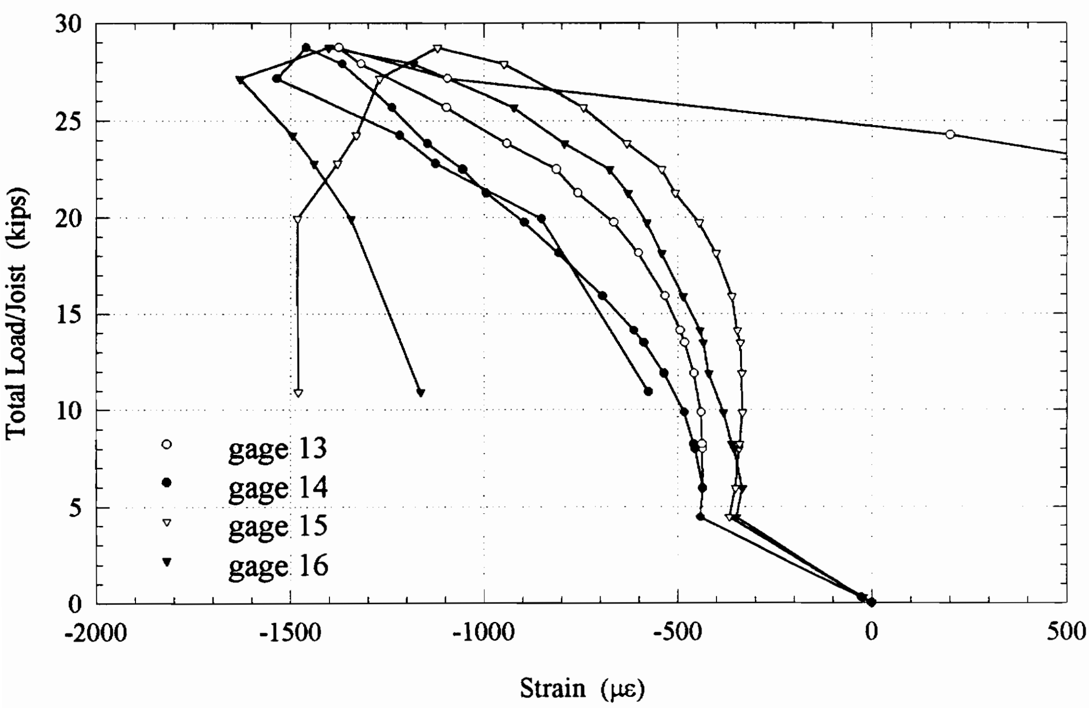



Figure A.7.9 Total Load/Joist vs. Top Chord Strain (TC4)

# CSJ-7

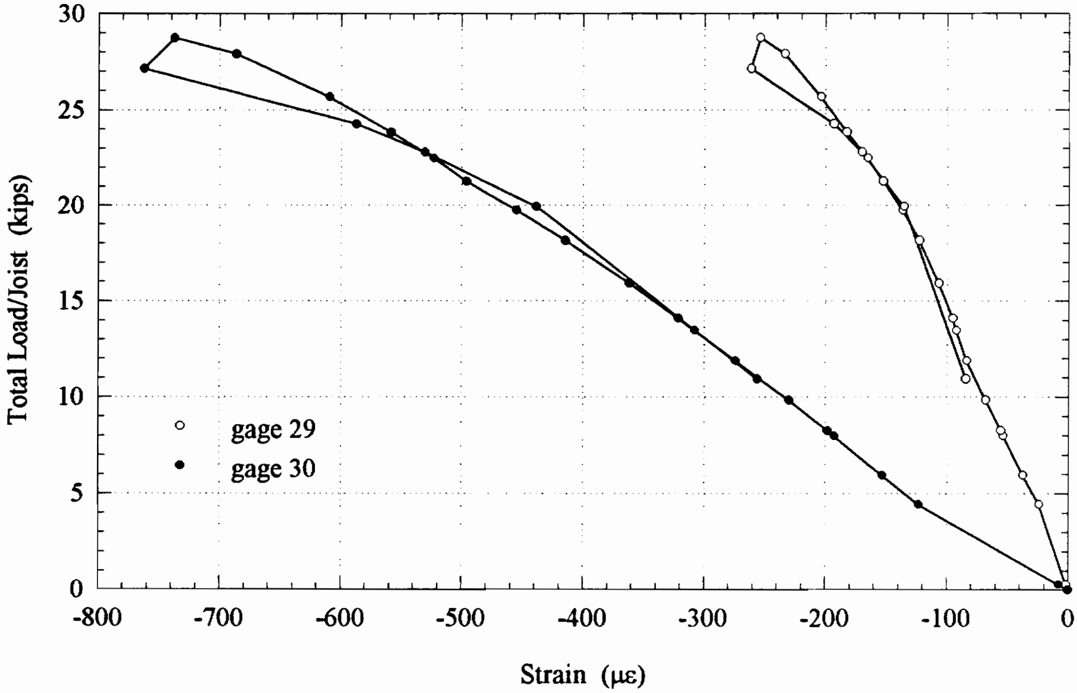



Figure A.7.10 Total Load/Joist vs. Web Strain (W1)

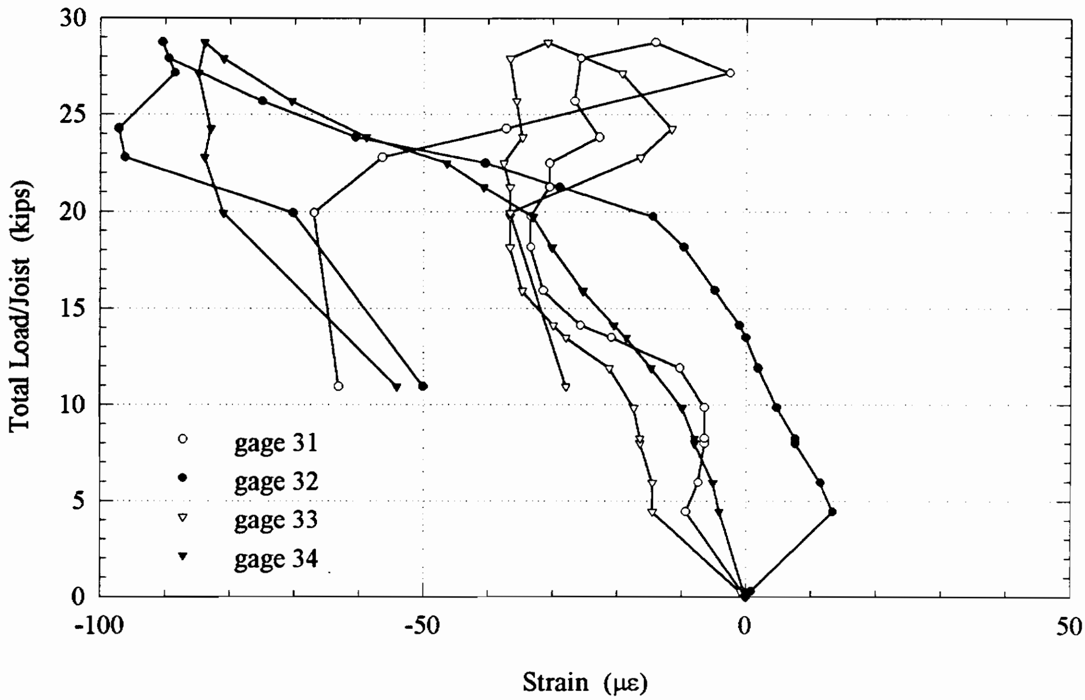



Figure A.7.11 Total Load/Joist vs. Web Strain (W2)

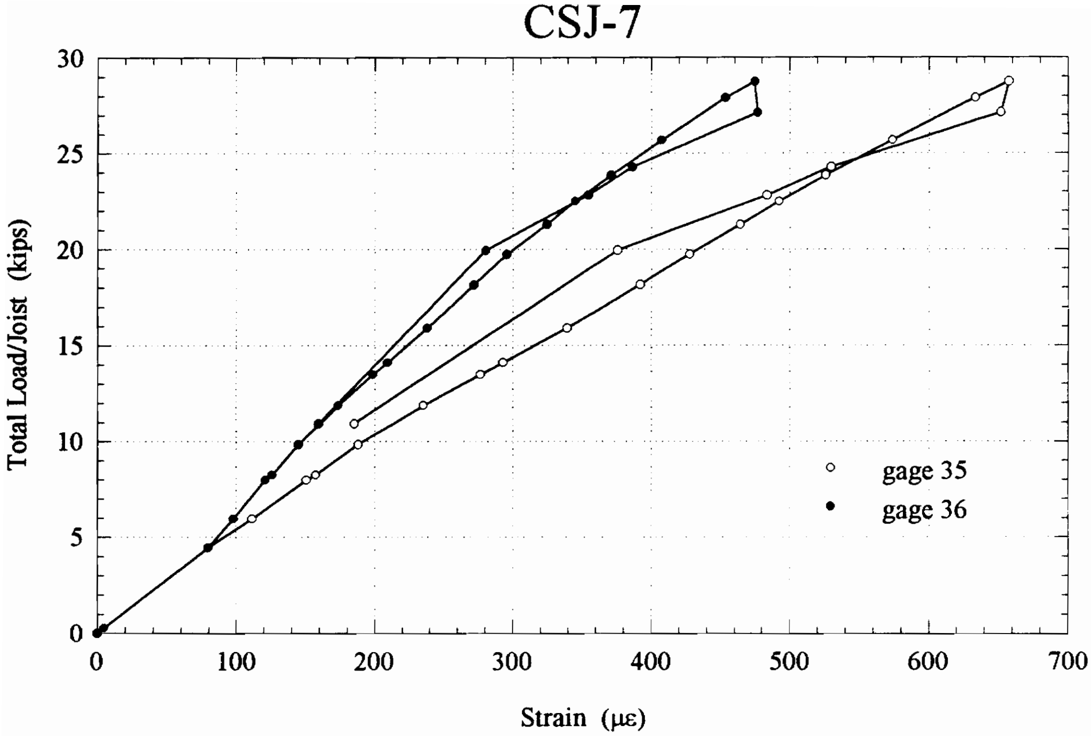



Figure A.7.12 Total Load/Joist vs. Web Strain (W3)

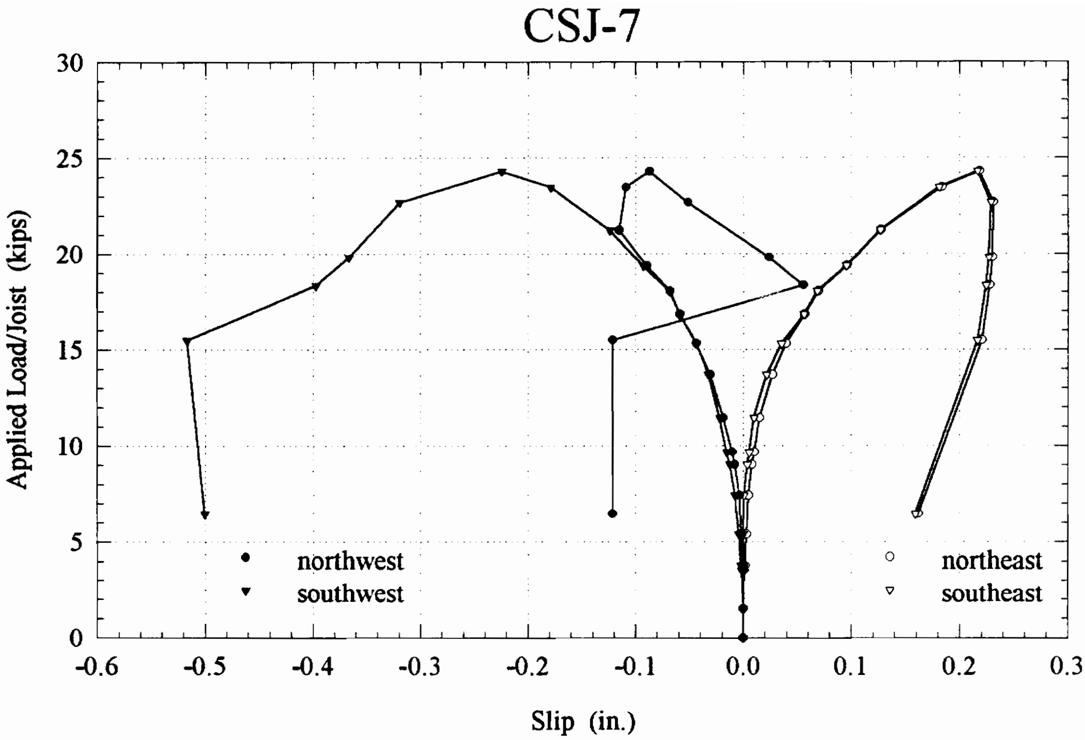



Figure A.7.13 Applied Load/Joist vs. End Slip

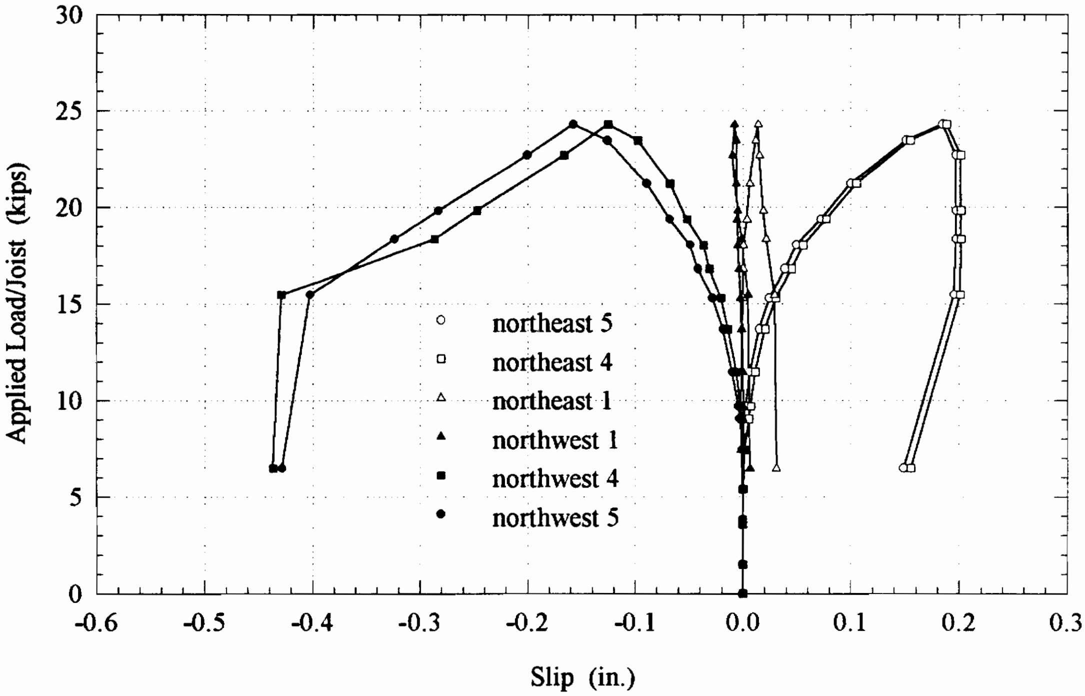



Figure A.7.14 Applied Load/Joist vs. Slip

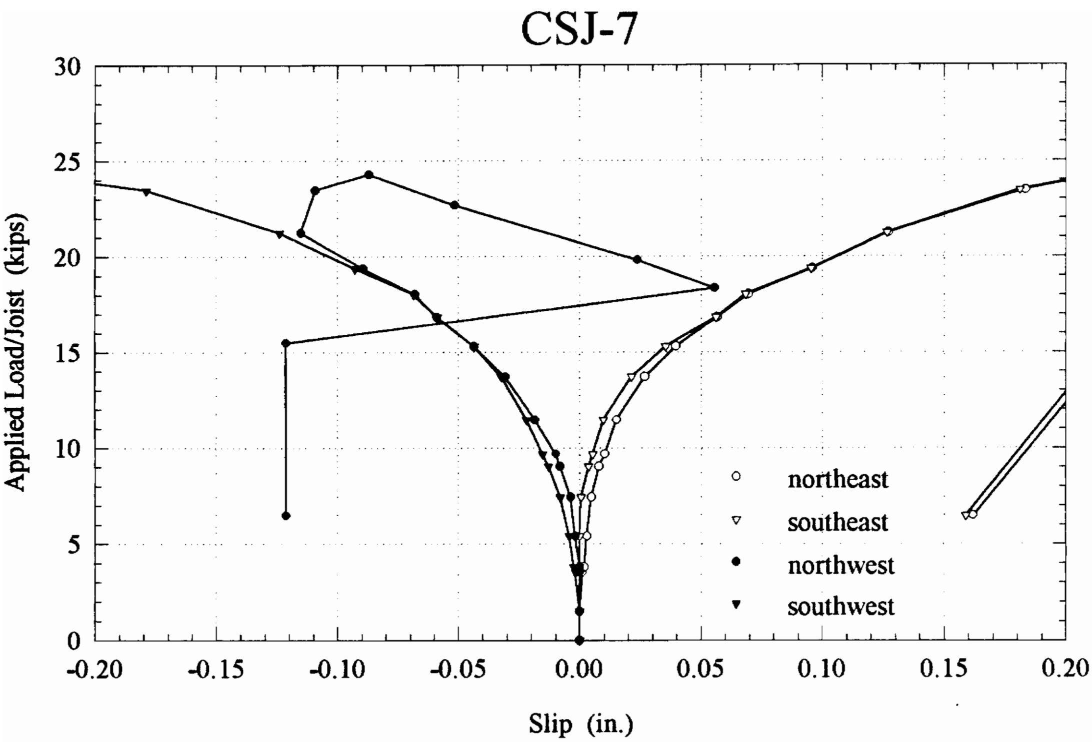



Figure A.7.15 Applied Load/Joist vs. End Slip

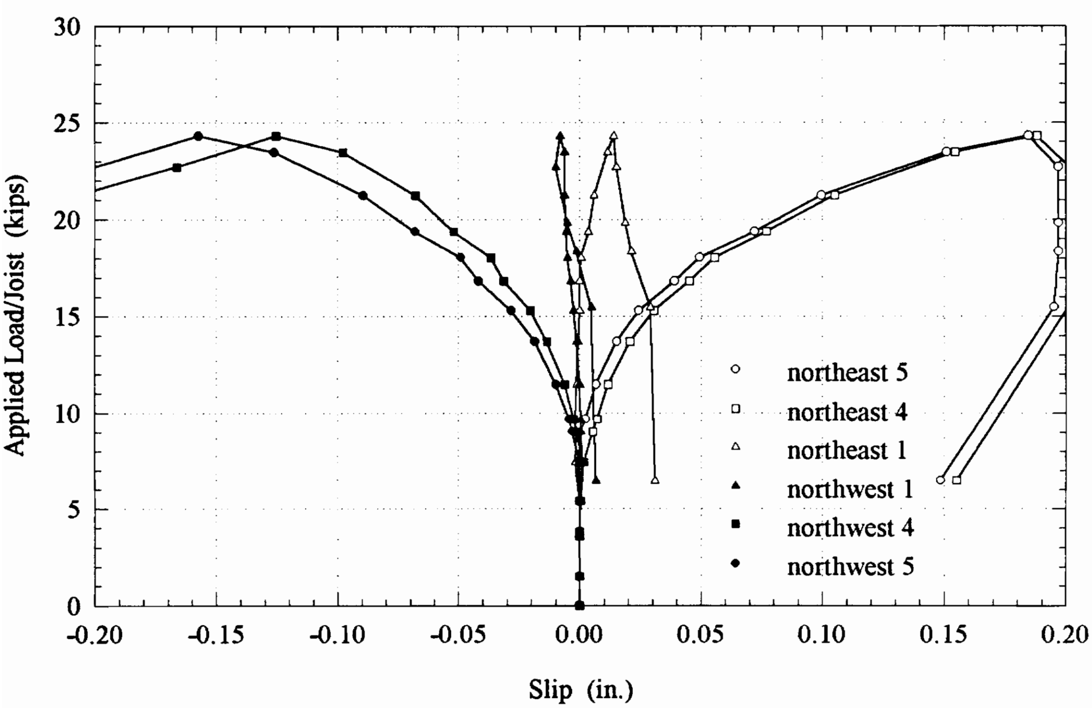



Figure A.7.16 Applied Load/Joist vs. Slip

## NUCOR COMPOSITE JOIST TEST SUMMARY SHEET

TEST DESIGNATION: CSJ-8 TEST DATE: 02 September 1992

### TEST DESCRIPTION

| | | | | |
|---|---|---|---|---|
| **Joist:** | Span: | 29'-7½" | Weight: | 11 plf |
| | Depth: | 18 in. | Spacing: | 40 in. |
| | Top Chord: | 2L-1.50x1.50x0.123 | Yield Stress: | 55.9 ksi |
| | Bottom Chord: | 2L-2.00x2.00x0.163 | Yield Stress: | 59.3 ksi |
| **Deck:** | Type: | 1.0C | Gage: | 26 ga |
| **Slab:** | Total Depth: | 4.0 in. | Compressive Strength: | 3600 psi |
| **Shear Connector:** | Type: | ELCO 5/16 in. dia. x 2 in. long standoff screw | | |
| | Quantity: | 9 per half-span | | |

### THEORETICAL CALCULATIONS

Theoretical Applied Load per Joist at Failure: 26.7 kips
Theoretical Total Load per Joist at Failure: 31.1 kips
Transformed Moment of Inertia: 357.3 $in.^4$
Theoretical Elastic Stiffness: 17.65 k/in.
Elastic Deflection at Yield: 1.39 in.

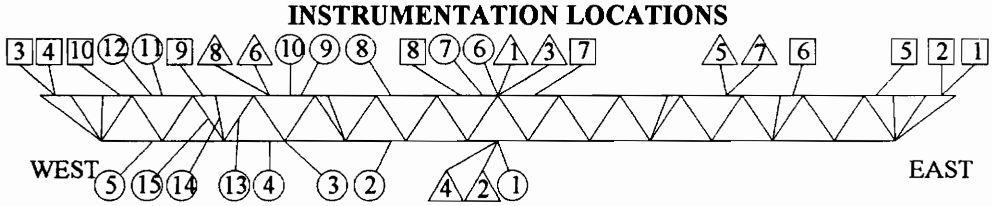
### TEST RESULTS

Applied Load per Joist at Failure: 23.8 kips
Total Load per Joist at Failure: 28.3 kips
Midspan Deflection at Failure: 3.52 in.
Maximum Slip and Location: 0.405 in. at screw NW9
Mode of Failure: buckling of the top chord

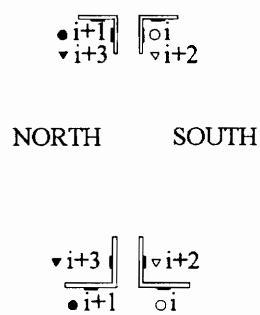
### COMPARISON OF ACTUAL TO THEORETICAL

Applied Load per Joist/Theoretical Applied Load per Joist: 0.89

### INSTRUMENTATION LOCATIONS




| | | | |
|---|---|---|---|
| ① BC1 | ⑬ W1 | △1 NMT Defl | [1] SE End Slip |
| ② BC2 | ⑭ W2 | △2 NMB Defl | [2] NE End Slip |
| ③ BC3 | ⑮ W3 | △3 SMT Defl | [3] SW End Slip |
| ④ BC4 | | △4 SMB Defl | [4] NW End Slip |
| ⑤ BC5 | | △5 NEQT Defl | [5] NE7 Slip |
| ⑥ TC1 | | △6 NWQT Defl | [6] NE5 Slip |
| ⑦ TC2 | | △7 SEQT Defl | [7] NE1 Slip |
| ⑧ TC3 | | △8 SWQT Defl | [8] NW1 Slip |
| ⑨ TC4 | | | [9] NW5 Slip |
| ⑩ TC5 | | | [10] NW7 Slip |
| ⑪ TC6 | | | |
| ⑫ TC7 | | | |



Strain Gage Locations

| TOTAL LOAD PER JOIST (kips) | CSJ-8 TEST DATA SHEET DEFLECTIONS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | SWQT (in.) | SMT (in.) | SMB (in.) | SEQT (in.) | NWQT (in.) | NMT (in.) | NMB (in.) | NEQT (in.) |
| 0.00 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 0.27 | 0.032 | 0.043 | 0.043 | 0.031 | 0.033 | 0.045 | 0.045 | 0.033 |
| 4.45 | 0.531 | 0.708 | 0.708 | 0.516 | 0.536 | 0.741 | 0.741 | 0.545 |
| 5.95 | 0.596 | 0.794 | 0.794 | 0.594 | 0.600 | 0.834 | 0.834 | 0.611 |
| 7.48 | 0.660 | 0.885 | 0.884 | 0.644 | 0.647 | 0.923 | 0.927 | 0.663 |
| 6.20 | 0.615 | 0.812 | 0.812 | 0.616 | 0.628 | 0.847 | 0.852 | 0.633 |
| 7.41 | 0.653 | 0.881 | 0.881 | 0.642 | 0.642 | 0.916 | 0.917 | 0.661 |
| 8.88 | 0.711 | 0.967 | 0.966 | 0.698 | 0.702 | 1.003 | 1.006 | 0.722 |
| 9.77 | 0.755 | 1.019 | 1.020 | 0.731 | 0.743 | 1.048 | 1.057 | 0.760 |
| 7.99 | 0.709 | 0.929 | 0.930 | 0.696 | 0.716 | 0.959 | 0.968 | 0.721 |
| 6.65 | 0.657 | 0.857 | 0.856 | 0.649 | 0.665 | 0.886 | 0.899 | 0.664 |
| 6.20 | 0.636 | 0.829 | 0.829 | 0.627 | 0.642 | 0.860 | 0.871 | 0.644 |
| 7.48 | 0.678 | 0.907 | 0.908 | 0.668 | 0.674 | 0.940 | 0.945 | 0.685 |
| 8.75 | 0.720 | 0.971 | 0.971 | 0.703 | 0.716 | 1.003 | 1.010 | 0.729 |
| 9.84 | 0.762 | 1.033 | 1.034 | 0.744 | 0.752 | 1.064 | 1.061 | 0.772 |
| 10.92 | 0.823 | 1.104 | 1.105 | 0.796 | 0.808 | 1.129 | 1.131 | 0.821 |
| 11.95 | 0.872 | 1.181 | 1.182 | 0.852 | 0.863 | 1.211 | 1.205 | 0.873 |
| 12.97 | 0.931 | 1.256 | 1.259 | 0.900 | 0.923 | 1.285 | 1.284 | 0.921 |
| 13.99 | 0.989 | 1.334 | 1.338 | 0.954 | 0.987 | 1.365 | 1.359 | 0.974 |
| 8.63 | 0.786 | 1.039 | 1.040 | 0.776 | 0.794 | 1.061 | 1.071 | 0.793 |
| 5.95 | 0.664 | 0.859 | 0.858 | 0.649 | 0.674 | 0.888 | 0.890 | 0.661 |
| 9.01 | 0.779 | 1.046 | 1.047 | 0.770 | 0.780 | 1.068 | 1.075 | 0.782 |
| 12.07 | 0.919 | 1.232 | 1.234 | 0.898 | 0.904 | 1.250 | 1.252 | 0.910 |
| 14.18 | 1.010 | 1.359 | 1.363 | 0.982 | 1.005 | 1.378 | 1.382 | 0.993 |
| 14.82 | 1.043 | 1.406 | 1.410 | 1.015 | 1.038 | 1.425 | 1.424 | 1.029 |
| 16.48 | 1.143 | 1.544 | 1.545 | 1.117 | 1.144 | 1.564 | 1.563 | 1.120 |
| 17.37 | 1.204 | 1.622 | 1.624 | 1.171 | 1.199 | 1.640 | 1.647 | 1.177 |
| 18.33 | 1.276 | 1.724 | 1.723 | 1.238 | 1.277 | 1.740 | 1.749 | 1.253 |
| 19.61 | 1.375 | 1.864 | 1.863 | 1.342 | 1.383 | 1.881 | 1.888 | 1.354 |
| 20.50 | 1.456 | 1.969 | 1.966 | 1.424 | 1.461 | 1.989 | 1.990 | 1.433 |
| 21.52 | 1.554 | 2.099 | 2.096 | 1.520 | 1.553 | 2.117 | 2.116 | 1.523 |
| 22.48 | 1.643 | 2.232 | 2.228 | 1.620 | 1.654 | 2.245 | 2.250 | 1.616 |
| 23.44 | 1.746 | 2.375 | 2.371 | 1.724 | 1.760 | 2.385 | 2.390 | 1.726 |
| 24.46 | 1.882 | 2.553 | 2.553 | 1.860 | 1.894 | 2.565 | 2.562 | 1.854 |
| 25.80 | 2.015 | 2.727 | 2.728 | 1.990 | 2.022 | 2.737 | 2.733 | 1.975 |
| 26.50 | 2.122 | 2.878 | 2.879 | 2.105 | 2.151 | 2.884 | 2.882 | 2.083 |
| 28.16 | 2.426 | 3.289 | 3.289 | 2.404 | 2.455 | 3.294 | 3.282 | 2.367 |
| 28.29 | 2.578 | 3.523 | 3.518 | 2.569 | 2.602 | 3.515 | 3.509 | 2.508 |
| 22.03 | 2.606 | 3.814 | 3.817 | 2.859 | 2.635 | 3.818 | 3.825 | 2.807 |
| 5.76 | 1.582 | 2.475 | 2.472 | 1.927 | 1.604 | 2.507 | 2.515 | 1.915 |

| TOTAL LOAD PER JOIST (kips) | CSJ-8 TEST DATA SHEET TC1 2L1.50x1.50x0.123 (με) | | | | AVG MEM LOAD (kips) | CSJ-8 TEST DATA SHEET TC2 2L1.50x1.50x0.123 (με) | | | | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| | TC1 (1) | TC1 (2) | TC1 (3) | TC1 (4) | | TC2 (5) | TC2 (6) | TC2 (7) | TC2 (8) | |
| 0.00 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 |
| 0.27 | -29 | -25 | -22 | -24 | -0.5 | -32 | -31 | -30 | -31 | -0.6 |
| 4.45 | -469 | -409 | -369 | -392 | -8.4 | -521 | -503 | -496 | -516 | -10.5 |
| 5.95 | -465 | -396 | -374 | -397 | -8.4 | -523 | -504 | -492 | -509 | -10.4 |
| 7.48 | -456 | -378 | -379 | -397 | -8.3 | -523 | -501 | -482 | -498 | -10.3 |
| 6.20 | -465 | -394 | -376 | -398 | -8.4 | -525 | -505 | -492 | -508 | -10.4 |
| 7.41 | -457 | -379 | -379 | -398 | -8.3 | -523 | -502 | -484 | -498 | -10.3 |
| 8.88 | -454 | -369 | -387 | -402 | -8.3 | -529 | -506 | -482 | -495 | -10.3 |
| 9.77 | -457 | -366 | -394 | -408 | -8.3 | -535 | -512 | -486 | -495 | -10.4 |
| 7.99 | -471 | -390 | -393 | -412 | -8.6 | -542 | -520 | -502 | -515 | -10.7 |
| 6.65 | -478 | -405 | -388 | -411 | -8.6 | -542 | -521 | -509 | -523 | -10.7 |
| 6.20 | -480 | -408 | -386 | -410 | -8.6 | -541 | -521 | -511 | -524 | -10.8 |
| 7.48 | -470 | -390 | -390 | -409 | -8.5 | -537 | -517 | -499 | -513 | -10.6 |
| 8.75 | -464 | -380 | -393 | -410 | -8.5 | -538 | -516 | -494 | -506 | -10.5 |
| 9.84 | -460 | -369 | -398 | -412 | -8.4 | -539 | -516 | -489 | -498 | -10.5 |
| 10.92 | -464 | -369 | -407 | -422 | -8.5 | -551 | -526 | -496 | -502 | -10.6 |
| 11.95 | -476 | -374 | -423 | -436 | -8.8 | -569 | -543 | -511 | -512 | -11.0 |
| 12.97 | -491 | -381 | -441 | -453 | -9.1 | -592 | -565 | -529 | -530 | -11.4 |
| 13.99 | -512 | -388 | -463 | -473 | -9.4 | -620 | -588 | -553 | -549 | -11.9 |
| 8.63 | -536 | -450 | -445 | -470 | -9.8 | -616 | -591 | -575 | -586 | -12.2 |
| 5.95 | -516 | -443 | -414 | -442 | -9.3 | -579 | -558 | -547 | -568 | -11.6 |
| 9.01 | -508 | -417 | -431 | -449 | -9.3 | -590 | -563 | -543 | -556 | -11.6 |
| 12.07 | -514 | -408 | -453 | -469 | -9.5 | -613 | -582 | -553 | -556 | -11.8 |
| 14.18 | -520 | -393 | -468 | -482 | -9.6 | -631 | -597 | -560 | -558 | -12.0 |
| 14.82 | -532 | -393 | -482 | -495 | -9.8 | -646 | -611 | -573 | -569 | -12.3 |
| 16.48 | -580 | -393 | -529 | -540 | -10.5 | -708 | -668 | -627 | -621 | -13.5 |
| 17.37 | -601 | -377 | -551 | -561 | -10.7 | -736 | -693 | -651 | -643 | -14.0 |
| 18.33 | -641 | -368 | -591 | -602 | -11.3 | -787 | -740 | -694 | -686 | -14.9 |
| 19.61 | -708 | -365 | -647 | -660 | -12.2 | -860 | -807 | -760 | -748 | -16.3 |
| 20.50 | -773 | -369 | -694 | -711 | -13.1 | -921 | -864 | -816 | -801 | -17.5 |
| 21.52 | -848 | -377 | -760 | -774 | -14.2 | -996 | -931 | -884 | -866 | -18.9 |
| 22.48 | -943 | -423 | -850 | -859 | -15.8 | -1088 | -1015 | -969 | -950 | -20.6 |
| 23.44 | -1106 | -504 | -979 | -959 | -18.2 | -1188 | -1099 | -1060 | -1033 | -22.5 |
| 24.46 | -1449 | -621 | -1156 | -1099 | -22.2 | -1318 | -1206 | -1180 | -1144 | -24.9 |
| 25.80 | -1698 | -677 | -1259 | -1191 | -24.8 | -1415 | -1284 | -1275 | -1226 | -26.7 |
| 26.50 | -2043 | -712 | -1386 | -1302 | -27.9 | -1504 | -1359 | -1378 | -1309 | -28.5 |
| 28.16 | -2821 | -805 | -1660 | -1565 | -35.2 | -1654 | -1505 | -1656 | -1490 | -32.4 |
| 28.29 | -2789 | -796 | -1777 | -1628 | -35.9 | -1634 | -1469 | -1738 | -1484 | -32.5 |
| 22.03 | -2330 | -25 | -1455 | -1170 | -25.6 | -1297 | -416 | -1186 | -795 | -19.0 |
| 5.76 | -2012 | -47 | -1095 | -730 | -19.9 | -834 | 22 | -794 | -427 | -10.4 |

| TOTAL LOAD PER JOIST (kips) | CSJ-8 TEST DATA SHEET TC3 2L1.50x1.50x0.123 TC3 (9) | TC3 (10) | TC3 (11) | TC3 (12) | AVG MEM LOAD (kips) | CSJ-8 TEST DATA SHEET TC4 2L1.50x1.50x0.123 TC4 (13) | TC4 (14) | TC4 (15) | TC4 (16) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| | (με) | | | | | (με) | | | | |
| 0.00 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 |
| 0.27 | -28 | -31 | -28 | -28 | -0.6 | -23 | -22 | -24 | -22 | -0.5 |
| 4.45 | -462 | -502 | -462 | -464 | -9.7 | -372 | -359 | -393 | -370 | -7.7 |
| 5.95 | -458 | -506 | -456 | -464 | -9.7 | -372 | -384 | -383 | -367 | -7.7 |
| 7.48 | -453 | -510 | -449 | -462 | -9.6 | -376 | -411 | -375 | -370 | -7.9 |
| 6.20 | -458 | -509 | -456 | -467 | -9.7 | -376 | -398 | -386 | -373 | -7.9 |
| 7.41 | -454 | -511 | -451 | -463 | -9.6 | -376 | -411 | -377 | -371 | -7.9 |
| 8.88 | -451 | -520 | -450 | -469 | -9.7 | -384 | -446 | -375 | -381 | -8.1 |
| 9.77 | -453 | -531 | -453 | -479 | -9.8 | -387 | -458 | -374 | -377 | -8.2 |
| 7.99 | -464 | -534 | -467 | -487 | -10.0 | -387 | -442 | -387 | -381 | -8.2 |
| 6.65 | -469 | -530 | -471 | -486 | -10.0 | -386 | -420 | -396 | -380 | -8.1 |
| 6.20 | -470 | -528 | -472 | -484 | -10.0 | -383 | -409 | -397 | -378 | -8.0 |
| 7.48 | -465 | -529 | -464 | -480 | -10.0 | -384 | -423 | -386 | -374 | -8.0 |
| 8.75 | -461 | -532 | -460 | -481 | -9.9 | -386 | -442 | -380 | -375 | -8.1 |
| 9.84 | -456 | -536 | -456 | -482 | -9.9 | -387 | -461 | -373 | -375 | -8.2 |
| 10.92 | -461 | -551 | -463 | -494 | -10.1 | -396 | -490 | -373 | -379 | -8.4 |
| 11.95 | -477 | -576 | -479 | -513 | -10.5 | -408 | -524 | -377 | -384 | -8.7 |
| 12.97 | -495 | -603 | -497 | -533 | -10.9 | -423 | -556 | -387 | -397 | -9.0 |
| 13.99 | -520 | -633 | -520 | -558 | -11.5 | -438 | -584 | -394 | -408 | -9.4 |
| 8.63 | -535 | -616 | -531 | -550 | -11.5 | -429 | -521 | -425 | -407 | -9.1 |
| 5.95 | -504 | -560 | -500 | -502 | -10.6 | -387 | -419 | -403 | -381 | -8.2 |
| 9.01 | -515 | -587 | -507 | -524 | -10.9 | -418 | -488 | -408 | -396 | -8.8 |
| 12.07 | -525 | -620 | -518 | -549 | -11.3 | -439 | -557 | -406 | -409 | -9.3 |
| 14.18 | -532 | -643 | -526 | -566 | -11.6 | -449 | -592 | -402 | -417 | -9.6 |
| 14.82 | -545 | -662 | -540 | -579 | -11.9 | -463 | -615 | -411 | -429 | -9.8 |
| 16.48 | -599 | -727 | -591 | -634 | -13.1 | -492 | -671 | -442 | -457 | -10.6 |
| 17.37 | -623 | -758 | -615 | -660 | -13.6 | -510 | -703 | -456 | -474 | -11.0 |
| 18.33 | -666 | -810 | -657 | -704 | -14.6 | -548 | -743 | -480 | -499 | -11.7 |
| 19.61 | -731 | -886 | -721 | -768 | -15.9 | -609 | -809 | -523 | -546 | -12.8 |
| 20.50 | -784 | -949 | -775 | -823 | -17.1 | -660 | -866 | -560 | -588 | -13.7 |
| 21.52 | -851 | -1025 | -841 | -889 | -18.5 | -727 | -944 | -609 | -644 | -15.0 |
| 22.48 | -926 | -1110 | -918 | -965 | -20.1 | -800 | -1029 | -660 | -705 | -16.4 |
| 23.44 | -1005 | -1207 | -1001 | -1048 | -21.9 | -868 | -1111 | -725 | -773 | -17.8 |
| 24.46 | -1101 | -1339 | -1107 | -1154 | -24.1 | -965 | -1228 | -802 | -864 | -19.8 |
| 25.80 | -1168 | -1446 | -1189 | -1241 | -25.9 | -1034 | -1293 | -867 | -948 | -21.3 |
| 26.50 | -1223 | -1553 | -1268 | -1323 | -27.5 | -1082 | -1353 | -921 | -1017 | -22.4 |
| 28.16 | -1251 | -1680 | -1501 | -1541 | -30.7 | -1138 | -1494 | -1010 | -1174 | -24.7 |
| 28.29 | -1121 | -1668 | -1626 | -1453 | -30.1 | -994 | -1456 | -962 | -1209 | -23.7 |
| 22.03 | -7 | -541 | -834 | -991 | -12.2 | 540 | -830 | -255 | -798 | -6.9 |
| 5.76 | 116 | -159 | -698 | -665 | -7.2 | 584 | -395 | -225 | -664 | -3.6 |

| TOTAL LOAD PER JOIST (kips) | CSJ-8 TEST DATA SHEET TC5 2L1.50x1.50x0.123 TC5 (17) | TC5 (18) (με) | TC5 (19) | TC5 (20) | AVG MEM LOAD (kips) | CSJ-8 TEST DATA SHEET TC6 2L1.50x1.50x0.123 TC6 (21) | TC6 (22) (με) | TC6 (23) | TC6 (24) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 0 | xxx | 0 | 0.0 | 0 | 0 | 0 | xxx | 0.0 |
| 0.27 | -28 | -25 | xxx | -17 | -0.5 | -16 | -16 | -15 | xxx | -0.3 |
| 4.45 | -460 | -412 | xxx | -287 | -7.9 | -257 | -255 | -254 | xxx | -5.2 |
| 5.95 | -463 | -425 | xxx | -298 | -8.1 | -221 | -251 | -249 | xxx | -4.9 |
| 7.48 | -467 | -442 | xxx | -310 | -8.3 | -203 | -255 | -258 | xxx | -4.9 |
| 6.20 | -469 | -436 | xxx | -309 | -8.3 | -214 | -252 | -247 | xxx | -4.9 |
| 7.41 | -467 | -443 | xxx | -311 | -8.4 | -204 | -256 | -258 | xxx | -4.9 |
| 8.88 | -474 | -469 | xxx | -333 | -8.7 | -178 | -265 | -265 | xxx | -4.8 |
| 9.77 | -473 | -477 | xxx | -332 | -8.8 | -159 | -264 | -261 | xxx | -4.7 |
| 7.99 | -475 | -469 | xxx | -327 | -8.7 | -177 | -261 | -250 | xxx | -4.7 |
| 6.65 | -474 | -457 | xxx | -317 | -8.5 | -201 | -255 | -245 | xxx | -4.8 |
| 6.20 | -472 | -449 | xxx | -311 | -8.4 | -207 | -251 | -240 | xxx | -4.8 |
| 7.48 | -470 | -456 | xxx | -313 | -8.5 | -191 | -254 | -253 | xxx | -4.8 |
| 8.75 | -472 | -467 | xxx | -323 | -8.6 | -174 | -260 | -260 | xxx | -4.7 |
| 9.84 | -472 | -478 | xxx | -331 | -8.8 | -154 | -262 | -261 | xxx | -4.6 |
| 10.92 | -477 | -499 | xxx | -343 | -9.0 | -137 | -263 | -258 | xxx | -4.5 |
| 11.95 | -484 | -525 | xxx | -356 | -9.3 | -120 | -266 | -260 | xxx | -4.4 |
| 12.97 | -497 | -554 | xxx | -375 | -9.8 | -105 | -268 | -255 | xxx | -4.3 |
| 13.99 | -509 | -577 | xxx | -391 | -10.1 | -96 | -276 | -255 | xxx | -4.3 |
| 8.63 | -512 | -525 | xxx | -370 | -9.6 | -190 | -275 | -253 | xxx | -4.9 |
| 5.95 | -474 | -452 | xxx | -318 | -8.5 | -214 | -248 | -243 | xxx | -4.8 |
| 9.01 | -499 | -499 | xxx | -350 | -9.2 | -183 | -265 | -265 | xxx | -4.9 |
| 12.07 | -516 | -551 | xxx | -384 | -9.9 | -137 | -276 | -265 | xxx | -4.6 |
| 14.18 | -521 | -586 | xxx | -401 | -10.3 | -104 | -284 | -266 | xxx | -4.5 |
| 14.82 | -530 | -608 | xxx | -414 | -10.6 | -113 | -300 | -266 | xxx | -4.6 |
| 16.48 | -572 | -663 | xxx | -450 | -11.5 | -106 | -342 | -282 | xxx | -5.0 |
| 17.37 | -592 | -695 | xxx | -471 | -12.0 | -102 | -361 | -293 | xxx | -5.2 |
| 18.33 | -622 | -736 | xxx | -499 | -12.7 | -103 | -395 | -312 | xxx | -5.5 |
| 19.61 | -680 | -803 | xxx | -550 | -13.9 | -121 | -443 | -345 | xxx | -6.2 |
| 20.50 | -732 | -862 | xxx | -597 | -15.0 | -152 | -487 | -374 | xxx | -6.9 |
| 21.52 | -803 | -949 | xxx | -657 | -16.5 | -187 | -544 | -411 | xxx | -7.8 |
| 22.48 | -884 | -1048 | xxx | -725 | -18.2 | -240 | -602 | -461 | xxx | -8.9 |
| 23.44 | -983 | -1161 | xxx | -797 | -20.1 | -284 | -654 | -517 | xxx | -10.0 |
| 24.46 | -1116 | -1324 | xxx | -911 | -22.9 | -353 | -720 | -593 | xxx | -11.4 |
| 25.80 | -1214 | -1452 | xxx | -1006 | -25.1 | -396 | -768 | -653 | xxx | -12.4 |
| 26.50 | -1314 | -1642 | xxx | -1108 | -27.8 | -438 | -807 | -718 | xxx | -13.4 |
| 28.16 | -1475 | -1779 | xxx | -1459 | -32.3 | -504 | -878 | -843 | xxx | -15.2 |
| 28.29 | -1347 | -1677 | xxx | -1710 | -32.4 | -458 | -864 | -837 | xxx | -14.8 |
| 22.03 | 255 | -951 | xxx | -1871 | -17.6 | 260 | -448 | -462 | xxx | -4.4 |
| 5.76 | 342 | -548 | xxx | -1643 | -12.7 | 60 | -240 | -214 | xxx | -2.7 |

| TOTAL LOAD PER JOIST (kips) | CSJ-8 TEST DATA SHEET TC7 2L1.50x1.50x0.123 TC7 (25) | TC7 (26) | TC7 (27) | TC7 (28) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|
| | ($\mu\varepsilon$) | | | | |
| 0.00 | 0 | 0 | 0 | 0 | 0.0 |
| 0.27 | -15 | -13 | -13 | -11 | -0.3 |
| 4.45 | -243 | -219 | -214 | -189 | -4.4 |
| 5.95 | -253 | -215 | -213 | -183 | -4.4 |
| 7.48 | -267 | -218 | -217 | -182 | -4.5 |
| 6.20 | -257 | -213 | -215 | -181 | -4.4 |
| 7.41 | -267 | -218 | -218 | -183 | -4.5 |
| 8.88 | -301 | -226 | -234 | -189 | -4.9 |
| 9.77 | -313 | -222 | -236 | -185 | -4.9 |
| 7.99 | -300 | -218 | -230 | -184 | -4.8 |
| 6.65 | -273 | -213 | -218 | -181 | -4.5 |
| 6.20 | -260 | -210 | -210 | -178 | -4.4 |
| 7.48 | -274 | -216 | -215 | -181 | -4.5 |
| 8.75 | -298 | -221 | -228 | -184 | -4.8 |
| 9.84 | -315 | -221 | -234 | -183 | -4.9 |
| 10.92 | -335 | -217 | -238 | -181 | -5.0 |
| 11.95 | -364 | -215 | -243 | -181 | -5.1 |
| 12.97 | -390 | -213 | -244 | -180 | -5.3 |
| 13.99 | -418 | -214 | -248 | -181 | -5.4 |
| 8.63 | -342 | -225 | -230 | -194 | -5.1 |
| 5.95 | -262 | -209 | -201 | -177 | -4.4 |
| 9.01 | -307 | -223 | -222 | -187 | -4.8 |
| 12.07 | -381 | -224 | -243 | -189 | -5.3 |
| 14.18 | -428 | -223 | -254 | -186 | -5.6 |
| 14.82 | -441 | -229 | -254 | -189 | -5.7 |
| 16.48 | -504 | -255 | -278 | -207 | -6.4 |
| 17.37 | -536 | -267 | -295 | -217 | -6.8 |
| 18.33 | -578 | -291 | -321 | -236 | -7.3 |
| 19.61 | -641 | -326 | -355 | -265 | -8.1 |
| 20.50 | -686 | -360 | -384 | -290 | -8.8 |
| 21.52 | -741 | -405 | -416 | -316 | -9.6 |
| 22.48 | -802 | -455 | -454 | -347 | -10.6 |
| 23.44 | -857 | -502 | -495 | -374 | -11.4 |
| 24.46 | -917 | -557 | -550 | -406 | -12.5 |
| 25.80 | -962 | -595 | -593 | -431 | -13.3 |
| 26.50 | -987 | -629 | -628 | -451 | -13.8 |
| 28.16 | -1043 | -685 | -698 | -489 | -15.0 |
| 28.29 | -1038 | -667 | -693 | -468 | -14.7 |
| 22.03 | -651 | -257 | -372 | -116 | -7.2 |
| 5.76 | -222 | -86 | -100 | -19 | -2.2 |

| TOTAL LOAD PER JOIST (kips) | CSJ-8 TEST DATA SHEET BC1 2L2.00x2.00x0.163 BC1 (29) | BC1 (30) | BC1 (31) | BC1 (32) | AVG MEM LOAD (kips) | CSJ-8 TEST DATA SHEET BC2 2L2.00x2.00x0.163 BC2 (33) | BC2 (34) | BC2 (35) | BC2 (36) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| | (με) | | | | | (με) | | | | |
| 0.00 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 |
| 0.27 | 22 | 20 | 19 | 17 | 0.7 | 20 | 18 | 17 | 16 | 0.6 |
| 4.45 | 357 | 334 | 306 | 286 | 11.6 | 331 | 299 | 276 | 269 | 10.7 |
| 5.95 | 451 | 427 | 395 | 375 | 15.0 | 421 | xxx | 361 | 352 | 13.7 |
| 7.48 | 551 | 526 | 491 | 467 | 18.5 | 513 | xxx | 448 | 440 | 17.0 |
| 6.20 | 469 | 445 | 414 | 391 | 15.6 | 438 | xxx | 377 | 369 | 14.3 |
| 7.41 | 546 | 520 | 486 | 461 | 18.3 | 509 | xxx | 442 | 435 | 16.8 |
| 8.88 | 634 | 607 | 568 | 542 | 21.3 | 590 | xxx | 519 | 511 | 19.6 |
| 9.77 | 687 | 660 | 618 | 589 | 23.2 | 638 | xxx | 564 | 555 | 21.3 |
| 7.99 | 580 | 553 | 516 | 489 | 19.4 | 540 | xxx | 471 | 463 | 17.8 |
| 6.65 | 498 | 473 | 439 | 415 | 16.6 | 465 | xxx | 400 | 392 | 15.2 |
| 6.20 | 468 | 443 | 410 | 387 | 15.5 | 438 | xxx | 374 | 366 | 14.3 |
| 7.48 | 555 | 528 | 493 | 466 | 18.5 | 516 | xxx | 448 | 440 | 17.0 |
| 8.75 | 626 | 597 | 559 | 532 | 21.0 | 582 | xxx | 511 | 501 | 19.3 |
| 9.84 | 696 | 667 | 625 | 596 | 23.5 | 646 | xxx | 571 | 562 | 21.5 |
| 10.92 | 766 | 736 | 692 | 659 | 25.9 | 711 | xxx | 632 | 622 | 23.8 |
| 11.95 | 834 | 803 | 755 | 720 | 28.3 | 773 | xxx | 689 | 679 | 25.9 |
| 12.97 | 902 | 868 | 817 | 780 | 30.6 | 835 | xxx | 746 | 735 | 28.0 |
| 13.99 | 969 | 934 | 878 | 838 | 32.9 | 896 | xxx | 802 | 791 | 30.1 |
| 8.63 | 631 | 601 | 557 | 527 | 21.0 | 587 | xxx | 510 | 500 | 19.3 |
| 5.95 | 461 | 435 | 399 | 375 | 15.2 | 429 | xxx | 363 | 353 | 13.9 |
| 9.01 | 652 | 622 | 580 | 548 | 21.8 | 608 | xxx | 531 | 520 | 20.1 |
| 12.07 | 846 | 812 | 762 | 725 | 28.5 | 787 | xxx | 698 | 686 | 26.3 |
| 14.18 | 980 | 943 | 887 | 847 | 33.2 | 909 | xxx | 813 | 801 | 30.5 |
| 14.82 | 1021 | 984 | 925 | 883 | 34.6 | 947 | xxx | 848 | 836 | 31.8 |
| 16.48 | 1124 | 1085 | 1018 | 973 | 38.1 | 1041 | xxx | 934 | 923 | 35.1 |
| 17.37 | 1190 | 1149 | 1079 | 1031 | 40.4 | 1102 | xxx | 988 | 977 | 37.1 |
| 18.33 | 1259 | 1217 | 1141 | 1089 | 42.7 | 1164 | xxx | 1045 | 1035 | 39.3 |
| 19.61 | 1354 | 1308 | 1224 | 1168 | 45.9 | 1249 | xxx | 1119 | 1110 | 42.1 |
| 20.50 | 1421 | 1372 | 1284 | 1224 | 48.1 | 1309 | xxx | 1172 | 1163 | 44.1 |
| 21.52 | 1500 | 1446 | 1351 | 1287 | 50.7 | 1378 | xxx | 1232 | 1224 | 46.4 |
| 22.48 | 1579 | 1520 | 1419 | 1351 | 53.3 | 1445 | xxx | 1290 | 1282 | 48.6 |
| 23.44 | 1656 | 1593 | 1485 | 1411 | 55.8 | 1510 | xxx | 1345 | 1339 | 50.8 |
| 24.46 | 1749 | 1678 | 1563 | 1482 | 58.7 | 1584 | xxx | 1407 | 1406 | 53.2 |
| 25.80 | 1857 | 1782 | 1658 | 1573 | 62.4 | 1674 | xxx | 1485 | 1493 | 56.3 |
| 26.50 | 1931 | 1856 | 1721 | 1634 | 64.8 | 1732 | xxx | 1531 | 1549 | 58.2 |
| 28.16 | 2041 | 2400 | 1982 | 1807 | yield | 1863 | xxx | 1631 | 1677 | 62.6 |
| 28.29 | 2024 | 2714 | 2244 | 1839 | yield | 1842 | xxx | 1611 | 1673 | 62.0 |
| 22.03 | 1567 | 2255 | 1854 | 1452 | 64.7 | 1551 | xxx | 899 | 1040 | 42.2 |
| 5.76 | 446 | 1142 | 824 | 465 | 26.1 | 614 | xxx | 29 | 167 | 9.8 |

| TOTAL LOAD PER JOIST (kips) | CSJ-8 TEST DATA SHEET BC3 2L2.00x2.00x0.163 BC3 (37) (με) | BC3 (38) | BC3 (39) | BC3 (40) | AVG MEM LOAD (kips) | CSJ-8 TEST DATA SHEET BC4 2L2.00x2.00x0.163 BC4 (41) (με) | BC4 (42) | BC4 (43) | BC4 (44) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 |
| 0.27 | 15 | 17 | 13 | 12 | 0.5 | 13 | 15 | 12 | 13 | 0.5 |
| 4.45 | 244 | 283 | 212 | 206 | 8.6 | 214 | 242 | 198 | 218 | 7.9 |
| 5.95 | 312 | 361 | 278 | 270 | 11.1 | 276 | 306 | 261 | 283 | 10.2 |
| 7.48 | 385 | 442 | 347 | 335 | 13.7 | 339 | 372 | 324 | 350 | 12.6 |
| 6.20 | 328 | 377 | 292 | 283 | 11.6 | 287 | 319 | 273 | 295 | 10.7 |
| 7.41 | 382 | 437 | 342 | 332 | 13.6 | 336 | 368 | 322 | 345 | 12.4 |
| 8.88 | 450 | 511 | 404 | 388 | 15.9 | 393 | 426 | 378 | 404 | 14.5 |
| 9.77 | 488 | 555 | 440 | 424 | 17.3 | 426 | 459 | 411 | 438 | 15.7 |
| 7.99 | 414 | 474 | 368 | 358 | 14.6 | 357 | 390 | 343 | 367 | 13.2 |
| 6.65 | 355 | 408 | 313 | 305 | 12.5 | 305 | 336 | 290 | 312 | 11.3 |
| 6.20 | 333 | 384 | 294 | 286 | 11.8 | 286 | 316 | 271 | 292 | 10.6 |
| 7.48 | 395 | 452 | 350 | 341 | 14.0 | 341 | 373 | 325 | 349 | 12.6 |
| 8.75 | 446 | 508 | 398 | 386 | 15.8 | 386 | 419 | 372 | 396 | 14.3 |
| 9.84 | 496 | 564 | 446 | 432 | 17.6 | 430 | 464 | 416 | 443 | 15.9 |
| 10.92 | 550 | 622 | 496 | 477 | 19.5 | 476 | 509 | 460 | 488 | 17.5 |
| 11.95 | 603 | 681 | 544 | 524 | 21.3 | 519 | 552 | 503 | 533 | 19.1 |
| 12.97 | 654 | 739 | 592 | 570 | 23.2 | 561 | 596 | 545 | 576 | 20.7 |
| 13.99 | 705 | 798 | 640 | 615 | 25.0 | 603 | 639 | 586 | 619 | 22.2 |
| 8.63 | 467 | 536 | 416 | 402 | 16.5 | 389 | 422 | 372 | 396 | 14.3 |
| 5.95 | 344 | 400 | 302 | 293 | 12.2 | 278 | 307 | 263 | 283 | 10.3 |
| 9.01 | 483 | 554 | 432 | 417 | 17.1 | 403 | 436 | 387 | 412 | 14.9 |
| 12.07 | 624 | 708 | 562 | 541 | 22.1 | 528 | 564 | 511 | 541 | 19.5 |
| 14.18 | 719 | 813 | 652 | 627 | 25.5 | 615 | 651 | 597 | 630 | 22.6 |
| 14.82 | 751 | 850 | 681 | 656 | 26.7 | 641 | 678 | 623 | 657 | 23.6 |
| 16.48 | 834 | 945 | 758 | 730 | 29.7 | 707 | 746 | 686 | 723 | 26.0 |
| 17.37 | 885 | 1003 | 805 | 774 | 31.5 | 750 | 788 | 727 | 765 | 27.5 |
| 18.33 | 942 | 1069 | 857 | 825 | 33.5 | 793 | 833 | 770 | 809 | 29.1 |
| 19.61 | 1018 | 1156 | 927 | 891 | 36.2 | 851 | 892 | 824 | 867 | 31.2 |
| 20.50 | 1072 | 1217 | 975 | 936 | 38.1 | 892 | 934 | 863 | 907 | 32.6 |
| 21.52 | 1135 | 1287 | 1032 | 989 | 40.3 | 940 | 982 | 908 | 953 | 34.3 |
| 22.48 | 1196 | 1357 | 1088 | 1039 | 42.5 | 986 | 1028 | 950 | 996 | 36.0 |
| 23.44 | 1257 | 1428 | 1141 | 1088 | 44.6 | 1029 | 1074 | 991 | 1037 | 37.5 |
| 24.46 | 1330 | 1513 | 1203 | 1144 | 47.1 | 1078 | 1125 | 1036 | 1083 | 39.2 |
| 25.80 | 1415 | 1608 | 1277 | 1211 | 50.0 | 1141 | 1188 | 1095 | 1144 | 41.5 |
| 26.50 | 1476 | 1680 | 1330 | 1256 | 52.1 | 1177 | 1226 | 1129 | 1180 | 42.8 |
| 28.16 | 1609 | 1842 | 1445 | 1357 | 56.8 | 1259 | 1305 | 1207 | 1258 | 45.7 |
| 28.29 | 1611 | 1847 | 1449 | 1364 | 56.9 | 1256 | 1303 | 1203 | 1258 | 45.6 |
| 22.03 | 1211 | 1370 | 1123 | 1086 | 43.5 | 907 | 923 | 885 | 932 | 33.1 |
| 5.76 | 438 | 579 | 427 | 430 | 17.0 | 218 | 266 | 224 | 258 | 8.8 |

| TOTAL LOAD PER JOIST (kips) | CSJ-8 TEST DATA SHEET BC5 2L2.00x2.00x0.163 BC5 (45) | BC5 (46) | BC5 (47) | BC5 (48) (με) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|
| 0.00 | 0 | 0 | 0 | 0 | 0.0 |
| 0.27 | 5 | 6 | 5 | 7 | 0.2 |
| 4.45 | 76 | 102 | 87 | 114 | 3.4 |
| 5.95 | 101 | 126 | 116 | 148 | 4.5 |
| 7.48 | 127 | 149 | 144 | 182 | 5.5 |
| 6.20 | 104 | 130 | 120 | 154 | 4.6 |
| 7.41 | 126 | 148 | 143 | 180 | 5.4 |
| 8.88 | 149 | 170 | 167 | 210 | 6.3 |
| 9.77 | 162 | 182 | 182 | 227 | 6.8 |
| 7.99 | 133 | 157 | 151 | 191 | 5.7 |
| 6.65 | 111 | 137 | 127 | 162 | 4.9 |
| 6.20 | 103 | 129 | 119 | 152 | 4.6 |
| 7.48 | 126 | 149 | 144 | 181 | 5.5 |
| 8.75 | 146 | 167 | 164 | 205 | 6.2 |
| 9.84 | 164 | 184 | 183 | 229 | 6.9 |
| 10.92 | 181 | 199 | 203 | 252 | 7.6 |
| 11.95 | 199 | 215 | 220 | 273 | 8.2 |
| 12.97 | 216 | 229 | 239 | 294 | 8.9 |
| 13.99 | 232 | 244 | 256 | 315 | 9.5 |
| 8.63 | 145 | 167 | 162 | 204 | 6.1 |
| 5.95 | 100 | 125 | 114 | 146 | 4.4 |
| 9.01 | 151 | 173 | 170 | 214 | 6.4 |
| 12.07 | 202 | 221 | 225 | 279 | 8.4 |
| 14.18 | 238 | 252 | 263 | 323 | 9.8 |
| 14.82 | 249 | 262 | 273 | 337 | 10.2 |
| 16.48 | 276 | 287 | 300 | 369 | 11.2 |
| 17.37 | 294 | 302 | 319 | 391 | 11.8 |
| 18.33 | 312 | 320 | 336 | 412 | 12.5 |
| 19.61 | 338 | 343 | 360 | 441 | 13.4 |
| 20.50 | 355 | 359 | 376 | 460 | 14.1 |
| 21.52 | 376 | 378 | 395 | 483 | 14.8 |
| 22.48 | 398 | 398 | 414 | 505 | 15.6 |
| 23.44 | 417 | 415 | 430 | 525 | 16.2 |
| 24.46 | 439 | 435 | 447 | 549 | 17.0 |
| 25.80 | 465 | 459 | 472 | 579 | 17.9 |
| 26.50 | 481 | 473 | 487 | 596 | 18.5 |
| 28.16 | 514 | 502 | 518 | 632 | 19.7 |
| 28.29 | 514 | 501 | 518 | 633 | 19.7 |
| 22.03 | 371 | 370 | 387 | 481 | 14.6 |
| 5.76 | 95 | 107 | 96 | 129 | 3.9 |

| TOTAL LOAD PER JOIST (kips) | CSJ-8 W1 0.875 DIA. BAR W1 (49) (με) | W1 (50) | AVG MEM LOAD (kips) | CSJ-8 W2 2L1.00x1.00x0.109 W2 (51) (με) | W2 (52) | W2 (53) | W2 (54) | AVG MEM LOAD (kips) | CSJ-8 W3 0.875 DIA. BAR W3 (55) (με) | W3 (56) | AVG MEM LOAD (kips) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0.0 |
| 0.27 | -5 | -5 | -0.1 | -1 | 0 | -1 | -1 | 0.0 | 7 | 5 | 0.1 |
| 4.45 | -76 | -84 | -1.4 | -13 | -1 | -8 | -10 | -0.1 | 118 | 76 | 1.7 |
| 5.95 | -101 | -108 | -1.8 | -13 | 0 | -8 | -13 | -0.1 | 153 | 101 | 2.2 |
| 7.48 | -126 | -135 | -2.3 | -13 | -2 | -8 | -17 | -0.1 | 190 | 127 | 2.8 |
| 6.20 | -106 | -114 | -1.9 | -14 | -1 | -8 | -14 | -0.1 | 160 | 106 | 2.3 |
| 7.41 | -125 | -134 | -2.3 | -14 | -3 | -9 | -17 | -0.1 | 188 | 126 | 2.7 |
| 8.88 | -145 | -159 | -2.6 | -16 | -5 | -9 | -20 | -0.2 | 221 | 149 | 3.2 |
| 9.77 | -157 | -172 | -2.9 | -17 | -7 | -10 | -22 | -0.2 | 240 | 162 | 3.5 |
| 7.99 | -133 | -143 | -2.4 | -18 | -5 | -10 | -19 | -0.2 | 201 | 134 | 2.9 |
| 6.65 | -114 | -122 | -2.1 | -17 | -3 | -9 | -17 | -0.1 | 171 | 113 | 2.5 |
| 6.20 | -106 | -114 | -1.9 | -17 | -3 | -9 | -16 | -0.1 | 159 | 105 | 2.3 |
| 7.48 | -127 | -138 | -2.3 | -17 | -5 | -10 | -18 | -0.2 | 192 | 127 | 2.8 |
| 8.75 | -145 | -156 | -2.6 | -17 | -6 | -10 | -21 | -0.2 | 218 | 146 | 3.2 |
| 9.84 | -161 | -176 | -2.9 | -17 | -7 | -10 | -23 | -0.2 | 244 | 164 | 3.6 |
| 10.92 | -177 | -195 | -3.2 | -19 | -9 | -11 | -25 | -0.2 | 272 | 182 | 4.0 |
| 11.95 | -195 | -214 | -3.6 | -20 | -11 | -11 | -28 | -0.2 | 300 | 199 | 4.3 |
| 12.97 | -213 | -233 | -3.9 | -21 | -12 | -12 | -30 | -0.2 | 326 | 215 | 4.7 |
| 13.99 | -231 | -252 | -4.2 | -22 | -12 | -13 | -31 | -0.2 | 352 | 232 | 5.1 |
| 8.63 | -151 | -159 | -2.7 | -18 | -7 | -12 | -23 | -0.2 | 224 | 143 | 3.2 |
| 5.95 | -108 | -112 | -1.9 | -16 | -2 | -11 | -17 | -0.1 | 158 | 101 | 2.3 |
| 9.01 | -155 | -164 | -2.8 | -18 | -8 | -12 | -23 | -0.2 | 229 | 151 | 3.3 |
| 12.07 | -202 | -217 | -3.7 | -21 | -12 | -13 | -29 | -0.2 | 302 | 199 | 4.4 |
| 14.18 | -235 | -255 | -4.3 | -23 | -14 | -14 | -33 | -0.3 | 354 | 233 | 5.1 |
| 14.82 | -246 | -267 | -4.5 | -24 | -13 | -14 | -34 | -0.3 | 371 | 245 | 5.4 |
| 16.48 | -272 | -295 | -4.9 | -24 | -12 | -15 | -36 | -0.3 | 409 | 269 | 5.9 |
| 17.37 | -288 | -314 | -5.2 | -25 | -12 | -16 | -38 | -0.3 | 433 | 285 | 6.3 |
| 18.33 | -304 | -331 | -5.5 | -27 | -12 | -17 | -40 | -0.3 | 456 | 302 | 6.6 |
| 19.61 | -323 | -355 | -5.9 | -31 | -12 | -19 | -43 | -0.3 | 489 | 323 | 7.1 |
| 20.50 | -335 | -371 | -6.2 | -33 | -11 | -23 | -45 | -0.3 | 510 | 337 | 7.4 |
| 21.52 | -351 | -390 | -6.5 | -36 | -10 | -22 | -47 | -0.3 | 532 | 352 | 7.7 |
| 22.48 | -365 | -408 | -6.7 | -38 | -11 | -24 | -50 | -0.4 | 557 | 367 | 8.1 |
| 23.44 | -379 | -424 | -7.0 | -39 | -10 | -26 | -52 | -0.4 | 581 | 381 | 8.4 |
| 24.46 | -396 | -441 | -7.3 | -43 | -8 | -28 | -54 | -0.4 | 606 | 397 | 8.7 |
| 25.80 | -419 | -464 | -7.7 | -46 | -6 | -29 | -56 | -0.4 | 638 | 419 | 9.2 |
| 26.50 | -429 | -475 | -7.9 | -47 | -3 | -30 | -57 | -0.4 | 657 | 430 | 9.5 |
| 28.16 | -447 | -499 | -8.2 | -52 | 5 | -31 | -61 | -0.4 | 701 | 452 | 10.1 |
| 28.29 | -431 | -492 | -8.1 | -55 | 6 | -31 | -64 | -0.4 | 701 | 443 | 10.0 |
| 22.03 | -214 | -334 | -4.8 | -55 | -29 | -28 | -74 | -0.6 | 491 | 303 | 6.9 |
| 5.76 | -43 | -60 | -0.9 | -29 | 24 | -18 | -28 | -0.2 | 155 | 29 | 1.6 |

| APPLIED LOAD PER JOIST (kips) | CSJ-8 TEST DATA SHEET END SLIPS NEES (in.) | NWES (in.) | SEES (in.) | SWES (in.) |
|---|---|---|---|---|
| 0.00 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.50 | 0.000 | 0.000 | 0.000 | 0.000 |
| 3.03 | 0.001 | 0.000 | 0.001 | -0.002 |
| 1.75 | 0.001 | 0.000 | 0.001 | -0.002 |
| 2.97 | 0.001 | 0.000 | 0.001 | -0.002 |
| 4.44 | 0.003 | 0.000 | 0.002 | -0.004 |
| 5.33 | 0.005 | -0.001 | 0.004 | -0.004 |
| 3.54 | 0.005 | -0.001 | 0.004 | -0.004 |
| 2.20 | 0.004 | -0.001 | 0.002 | -0.004 |
| 1.75 | 0.003 | -0.001 | 0.002 | -0.004 |
| 3.03 | 0.003 | -0.001 | 0.002 | -0.004 |
| 4.31 | 0.004 | -0.001 | 0.002 | -0.004 |
| 5.39 | 0.005 | -0.001 | 0.004 | -0.005 |
| 6.48 | 0.007 | -0.003 | 0.006 | -0.006 |
| 7.50 | 0.009 | -0.006 | 0.009 | -0.009 |
| 8.52 | 0.013 | -0.008 | 0.013 | -0.012 |
| 9.54 | 0.017 | -0.012 | 0.016 | -0.015 |
| 4.18 | 0.015 | -0.013 | 0.012 | -0.014 |
| 1.50 | 0.006 | -0.007 | 0.006 | -0.004 |
| 4.57 | 0.010 | -0.008 | 0.009 | -0.010 |
| 7.63 | 0.016 | -0.012 | 0.014 | -0.014 |
| 9.74 | 0.019 | -0.015 | 0.017 | -0.016 |
| 10.37 | 0.021 | -0.017 | 0.020 | -0.018 |
| 12.03 | 0.030 | -0.026 | 0.028 | -0.028 |
| 12.93 | 0.034 | -0.031 | 0.032 | -0.033 |
| 13.89 | 0.043 | -0.038 | 0.039 | -0.041 |
| 15.16 | 0.054 | -0.050 | 0.054 | -0.053 |
| 16.06 | 0.062 | -0.059 | 0.062 | -0.062 |
| 17.08 | 0.075 | -0.072 | 0.075 | -0.073 |
| 18.04 | 0.086 | -0.087 | 0.087 | -0.086 |
| 18.99 | 0.101 | -0.102 | 0.099 | -0.100 |
| 20.01 | 0.118 | -0.123 | 0.115 | -0.121 |
| 21.35 | 0.133 | -0.140 | 0.132 | -0.137 |
| 22.06 | 0.149 | -0.156 | 0.147 | -0.152 |
| 23.71 | 0.187 | -0.202 | 0.193 | -0.194 |
| 23.84 | 0.202 | -0.238 | 0.217 | -0.218 |
| 17.58 | 0.204 | -0.405 | 0.220 | -0.362 |
| 1.31 | 0.110 | -0.341 | 0.123 | -0.307 |

| APPLIED LOAD PER JOIST (kips) | CSJ-8 TEST DATA SHEET INTERMEDIATE SLIPS | | | | | |
|---|---|---|---|---|---|---|
| | NE7S (in.) | NE5S (in.) | NE1S (in.) | NW1S (in.) | NW5S (in.) | NW7S (in.) |
| 0.00 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.50 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 3.03 | 0.001 | 0.001 | 0.000 | 0.001 | -0.001 | 0.000 |
| 1.75 | 0.001 | 0.001 | 0.000 | 0.001 | -0.001 | 0.000 |
| 2.97 | 0.001 | 0.001 | 0.000 | 0.001 | -0.001 | 0.000 |
| 4.44 | 0.002 | 0.002 | 0.000 | 0.001 | -0.003 | -0.001 |
| 5.33 | 0.002 | 0.003 | 0.000 | 0.001 | -0.004 | -0.002 |
| 3.54 | 0.002 | 0.003 | 0.000 | 0.001 | -0.004 | -0.002 |
| 2.20 | 0.002 | 0.002 | 0.000 | 0.001 | -0.004 | -0.001 |
| 1.75 | 0.002 | 0.002 | 0.000 | 0.001 | -0.004 | -0.001 |
| 3.03 | 0.002 | 0.002 | 0.000 | 0.001 | -0.004 | -0.002 |
| 4.31 | 0.002 | 0.002 | 0.000 | 0.001 | -0.004 | -0.001 |
| 5.39 | 0.003 | 0.004 | 0.000 | 0.001 | -0.004 | -0.002 |
| 6.48 | 0.005 | 0.006 | 0.000 | 0.001 | -0.007 | -0.003 |
| 7.50 | 0.008 | 0.008 | 0.001 | 0.001 | -0.010 | -0.006 |
| 8.52 | 0.010 | 0.012 | 0.001 | 0.001 | -0.013 | -0.009 |
| 9.54 | 0.015 | 0.015 | 0.001 | 0.001 | -0.017 | -0.013 |
| 4.18 | 0.015 | 0.012 | 0.001 | 0.001 | -0.013 | -0.012 |
| 1.50 | 0.008 | 0.006 | 0.001 | 0.001 | -0.006 | -0.004 |
| 4.57 | 0.009 | 0.009 | 0.001 | 0.001 | -0.009 | -0.007 |
| 7.63 | 0.013 | 0.013 | 0.001 | 0.001 | -0.015 | -0.012 |
| 9.74 | 0.017 | 0.016 | 0.002 | 0.001 | -0.018 | -0.014 |
| 10.37 | 0.018 | 0.018 | 0.002 | 0.001 | -0.021 | -0.017 |
| 12.03 | 0.026 | 0.025 | 0.003 | 0.001 | -0.029 | -0.025 |
| 12.93 | 0.030 | 0.029 | 0.003 | 0.001 | -0.034 | -0.029 |
| 13.89 | 0.037 | 0.035 | 0.004 | 0.001 | -0.040 | -0.036 |
| 15.16 | 0.047 | 0.043 | 0.005 | 0.001 | -0.051 | -0.047 |
| 16.06 | 0.054 | 0.050 | 0.005 | 0.001 | -0.059 | -0.056 |
| 17.08 | 0.066 | 0.061 | 0.007 | 0.001 | -0.070 | -0.067 |
| 18.04 | 0.076 | 0.070 | 0.008 | 0.001 | -0.083 | -0.080 |
| 18.99 | 0.089 | 0.081 | 0.009 | 0.001 | -0.097 | -0.093 |
| 20.01 | 0.105 | 0.095 | 0.010 | 0.001 | -0.115 | -0.113 |
| 21.35 | 0.118 | 0.108 | 0.011 | 0.001 | -0.130 | -0.129 |
| 22.06 | 0.132 | 0.121 | 0.012 | 0.000 | -0.145 | -0.145 |
| 23.71 | 0.168 | 0.154 | 0.014 | -0.001 | -0.187 | -0.188 |
| 23.84 | 0.184 | 0.168 | 0.014 | 0.000 | -0.224 | -0.224 |
| 17.58 | 0.187 | 0.177 | 0.088 | 0.055 | -0.410 | -0.318 |
| 1.31 | 0.106 | 0.100 | 0.088 | 0.063 | -0.344 | -0.289 |

# CSJ-8

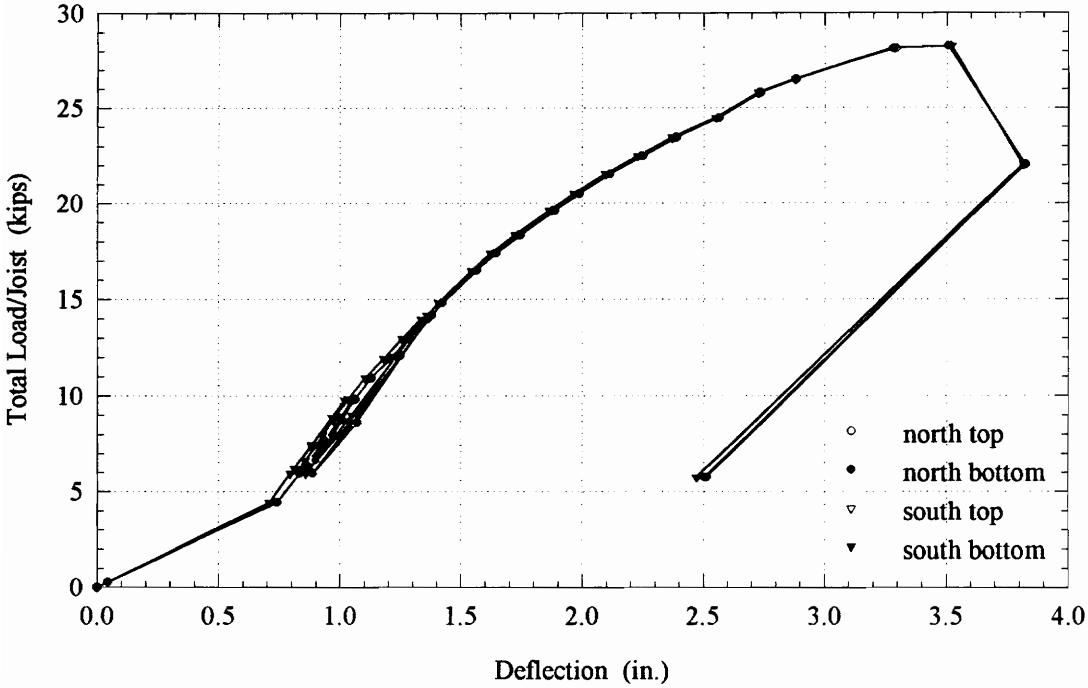



Figure A.8.1 Total Load/Joist vs. Midspan Deflection

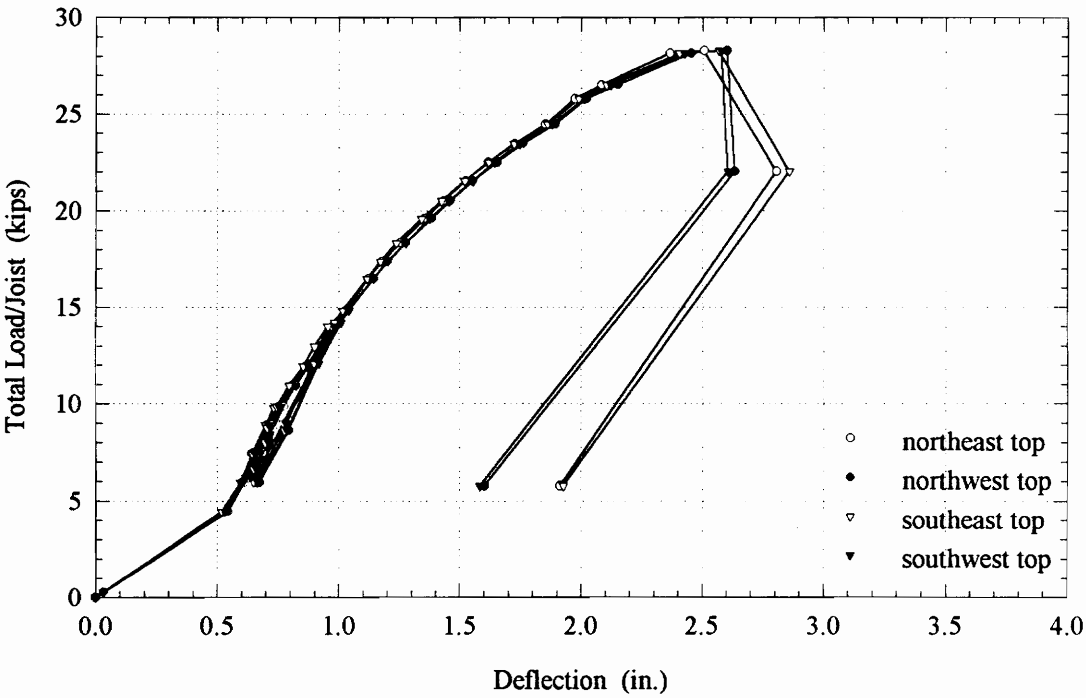



Figure A.8.2 Total Load/Joist vs. Quarter Point Deflection

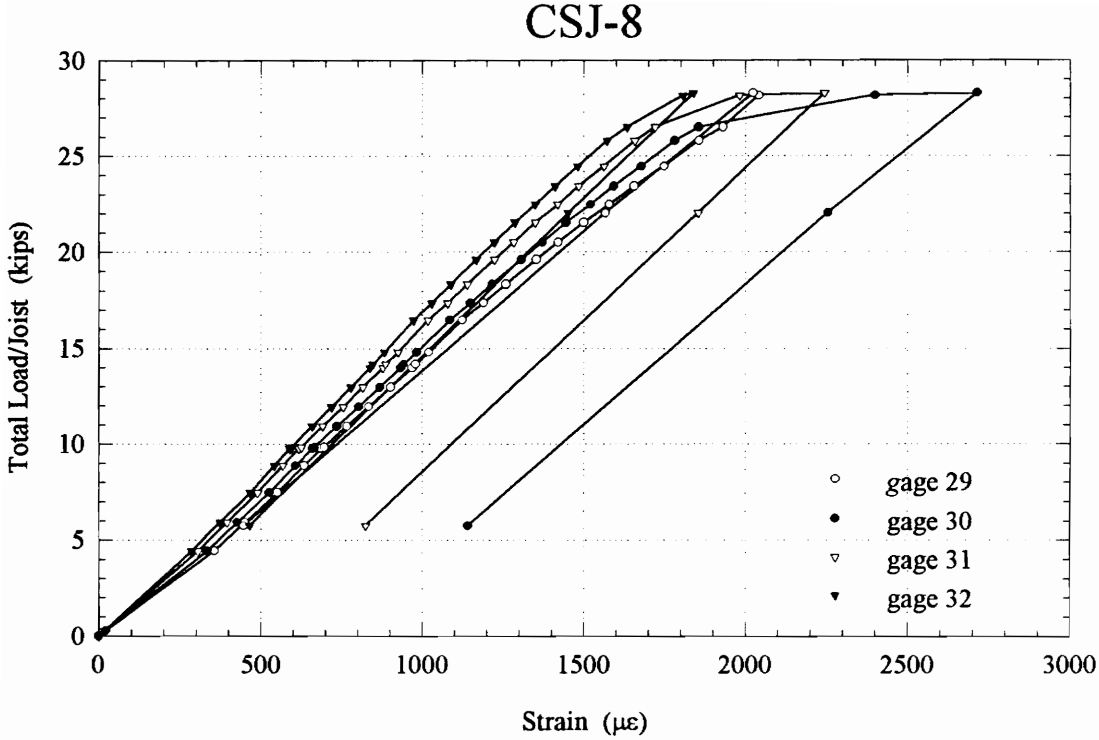



Figure A.8.3 Total Load/Joist vs. Bottom Chord Strain (BC1)

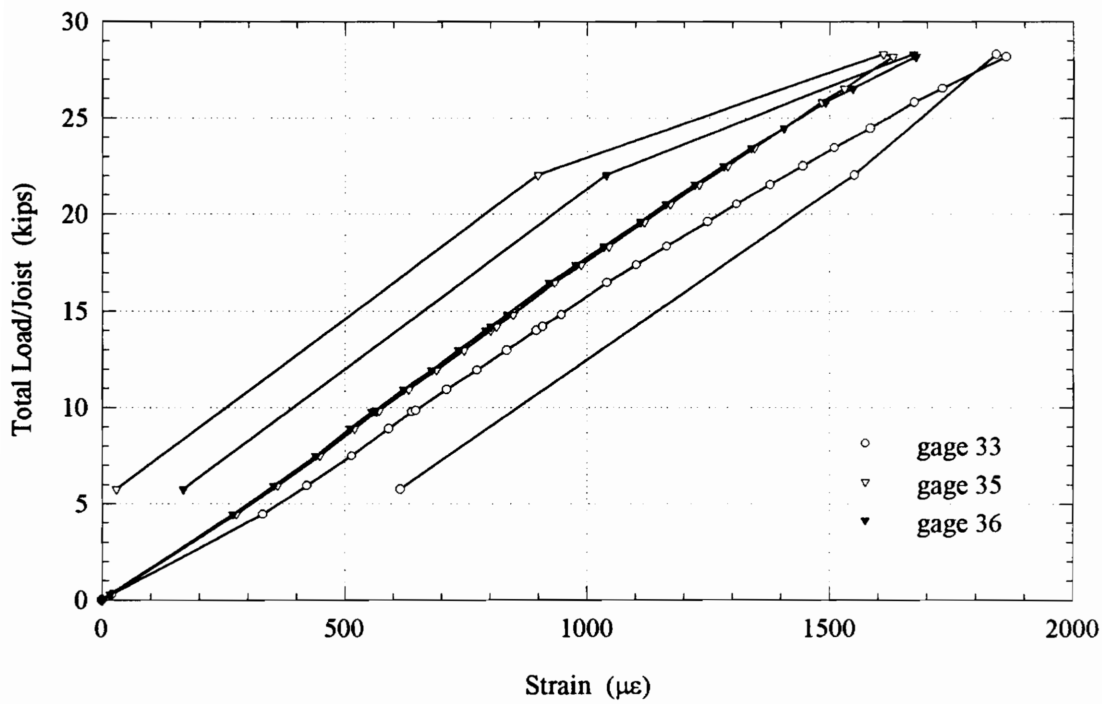



Figure A.8.4 Total Load/Joist vs. Bottom Chord Strain (BC2)

# CSJ-8

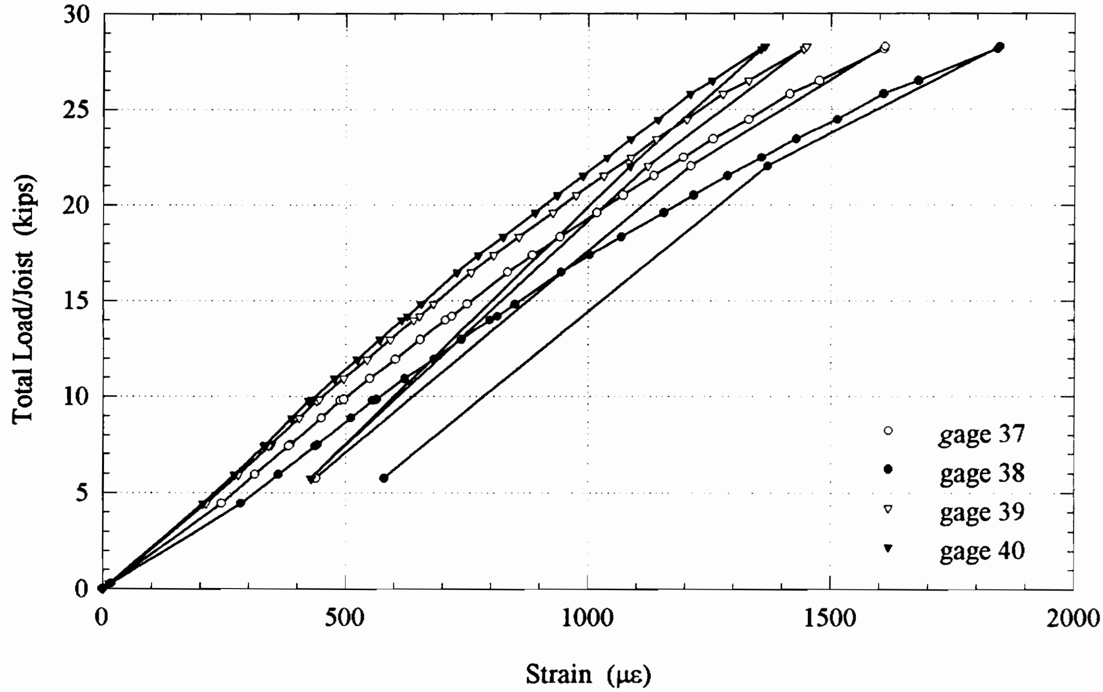



Figure A.8.5 Total Load/Joist vs. Bottom Chord Strain (BC3)

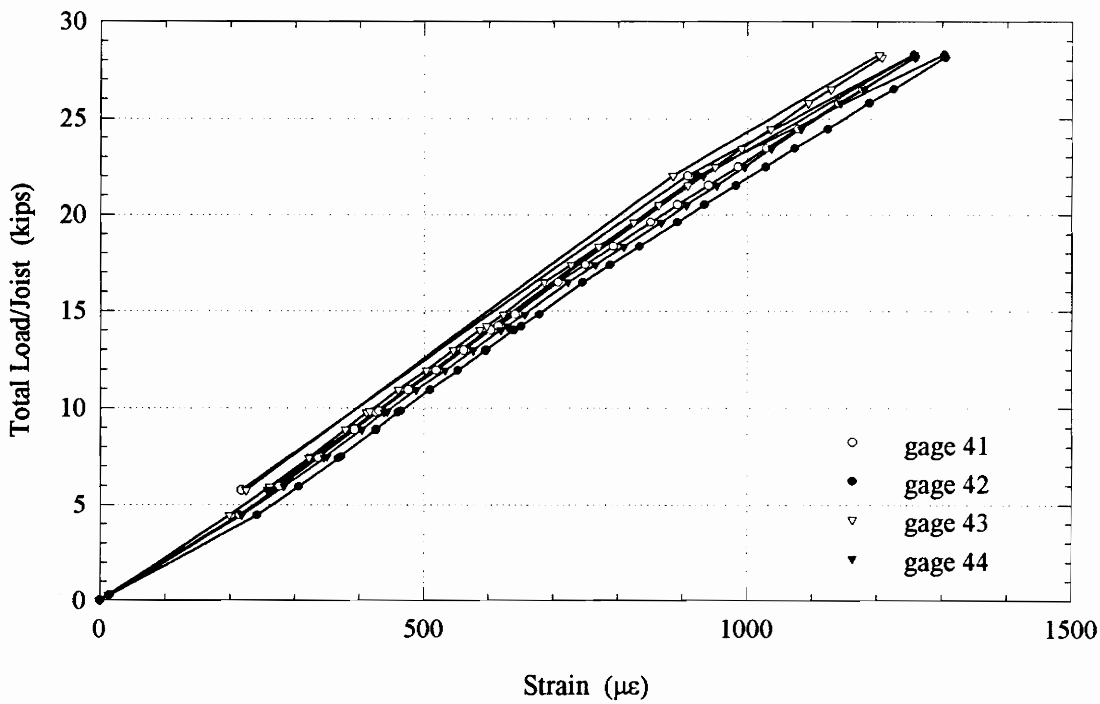



Figure A.8.6 Total Load/Joist vs. Bottom Chord Strain (BC4)

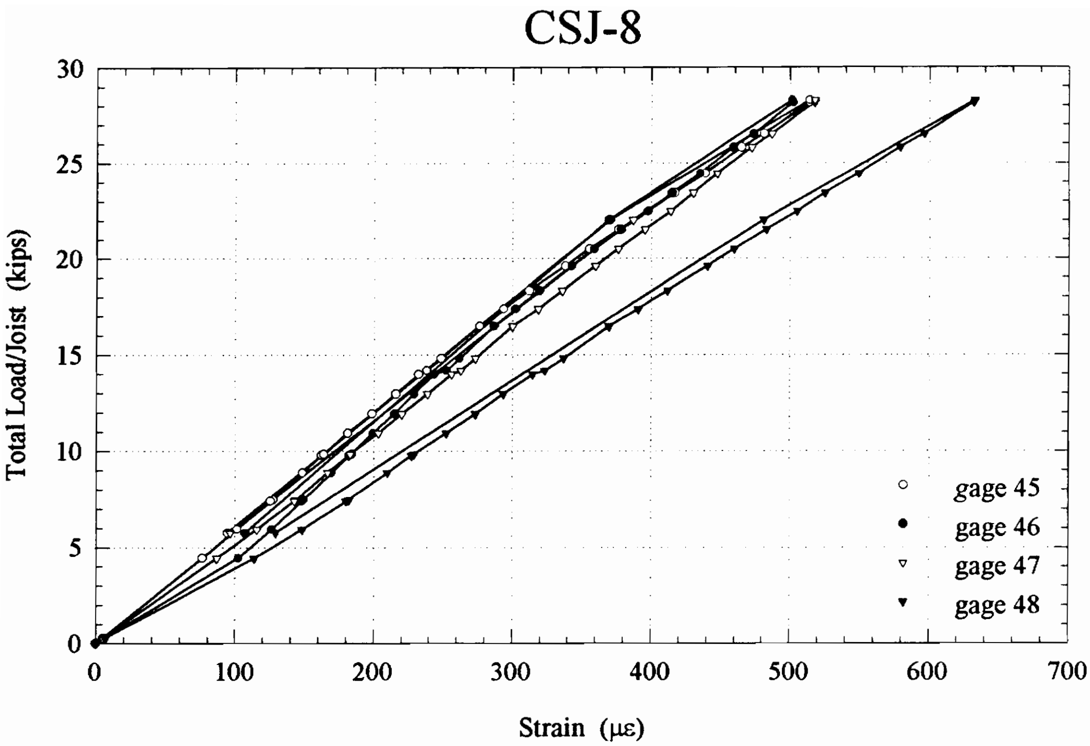


Figure A.8.7 Total Load/Joist vs. Bottom Chord Strain (BC5)

# CSJ-8

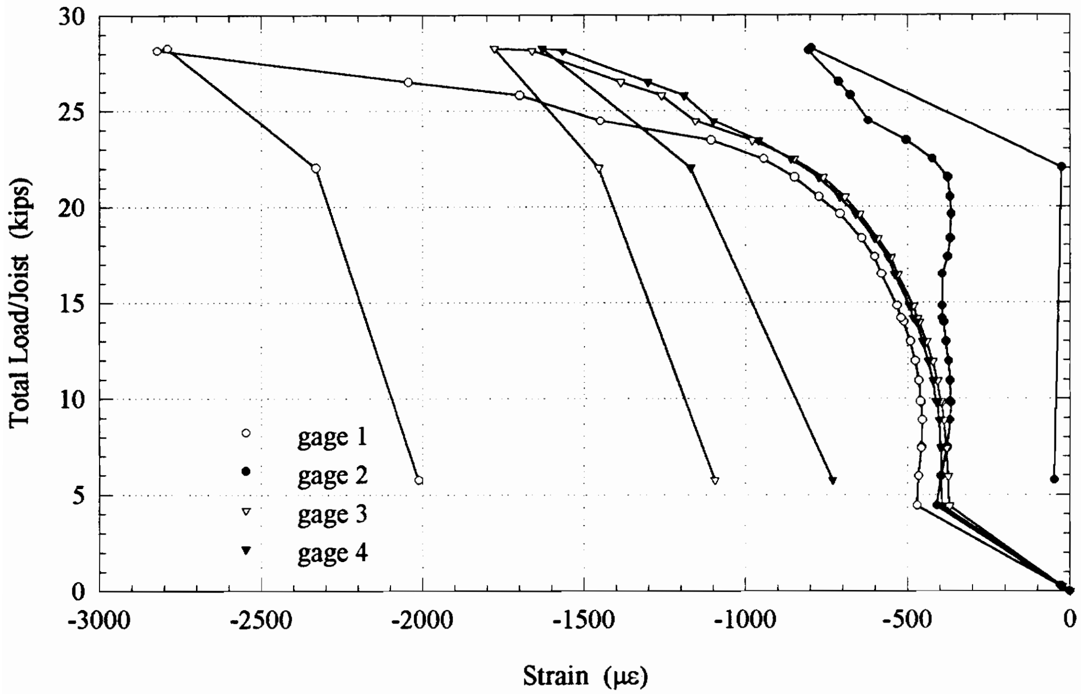



Figure A.8.8 Total Load/Joist vs. Top Chord Strain (TC1)

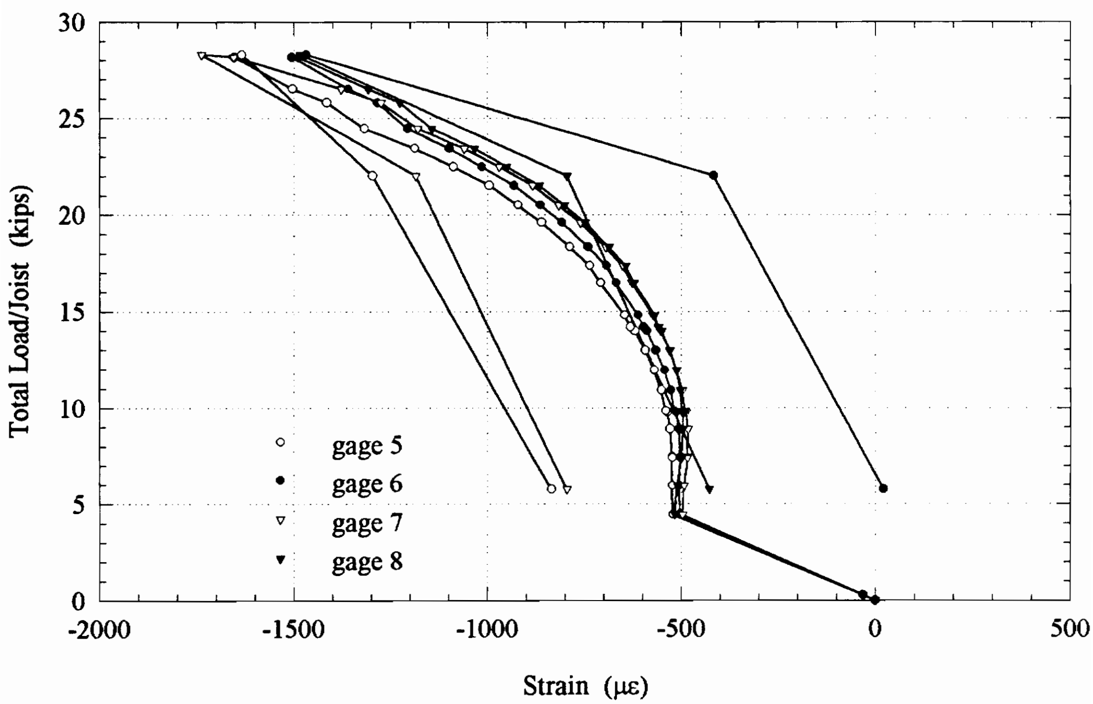



Figure A.8.9 Total Load/Joist vs. Top Chord Strain (TC2)

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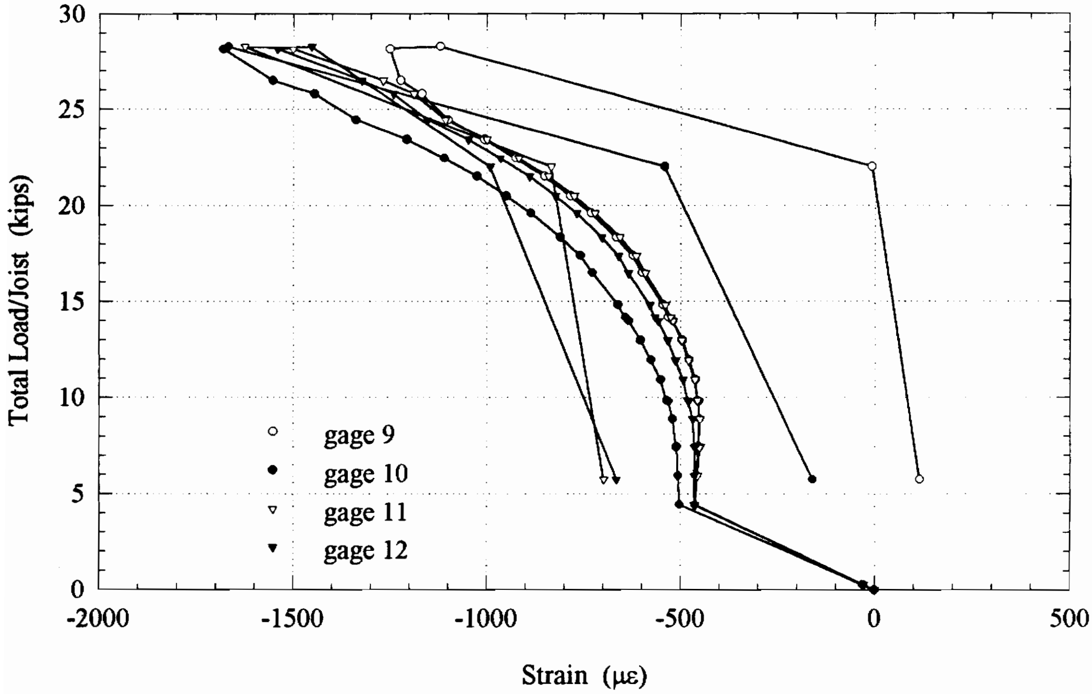


Figure A.8.10 Total Load/Joist vs. Top Chord Strain (TC3)

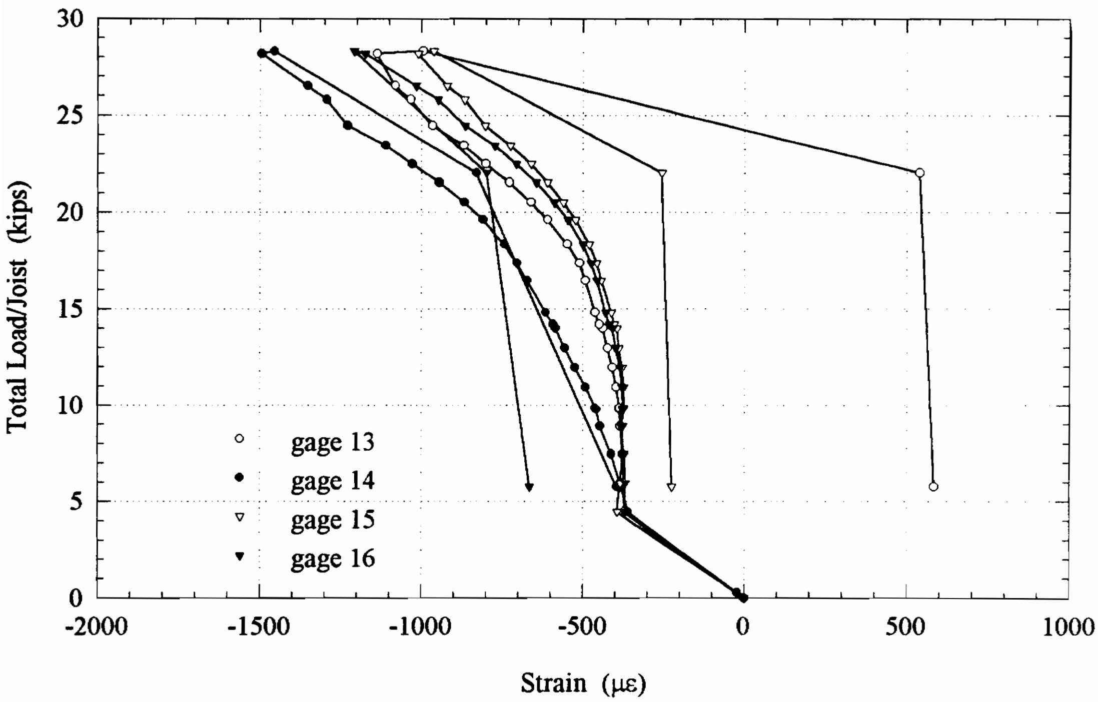


Figure A.8.11 Total Load/Joist vs. Top Chord Strain (TC4)

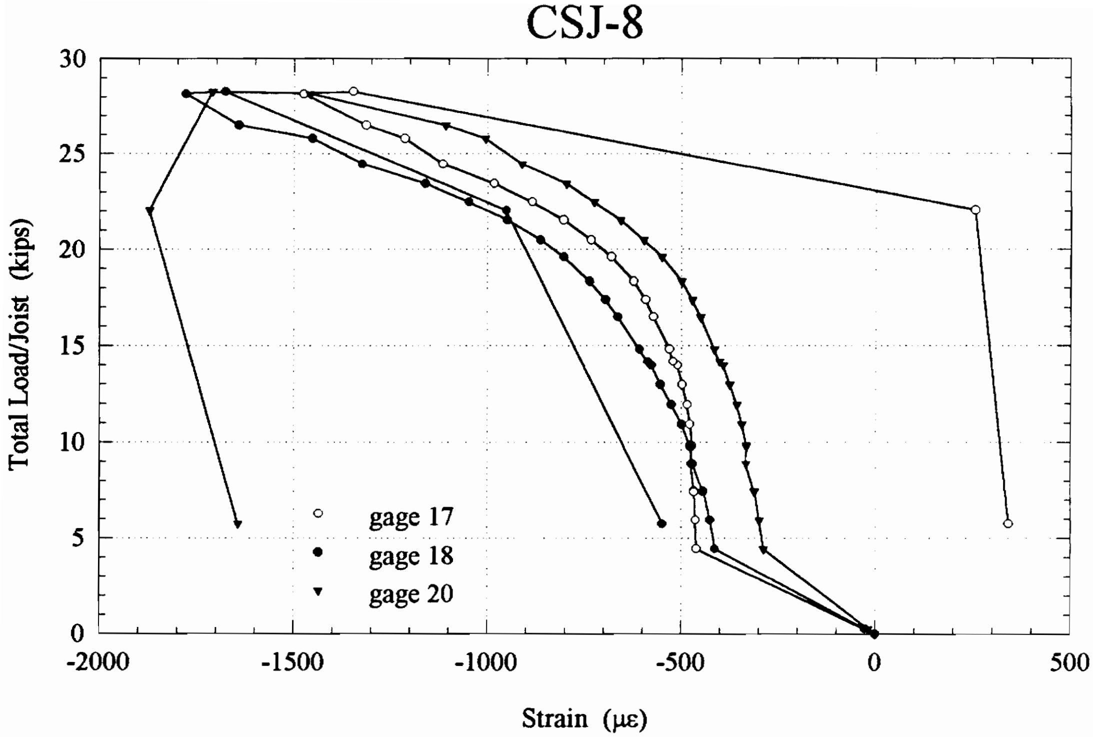


Figure A.8.12 Total Load/Joist vs. Top Chord Strain (TC5)

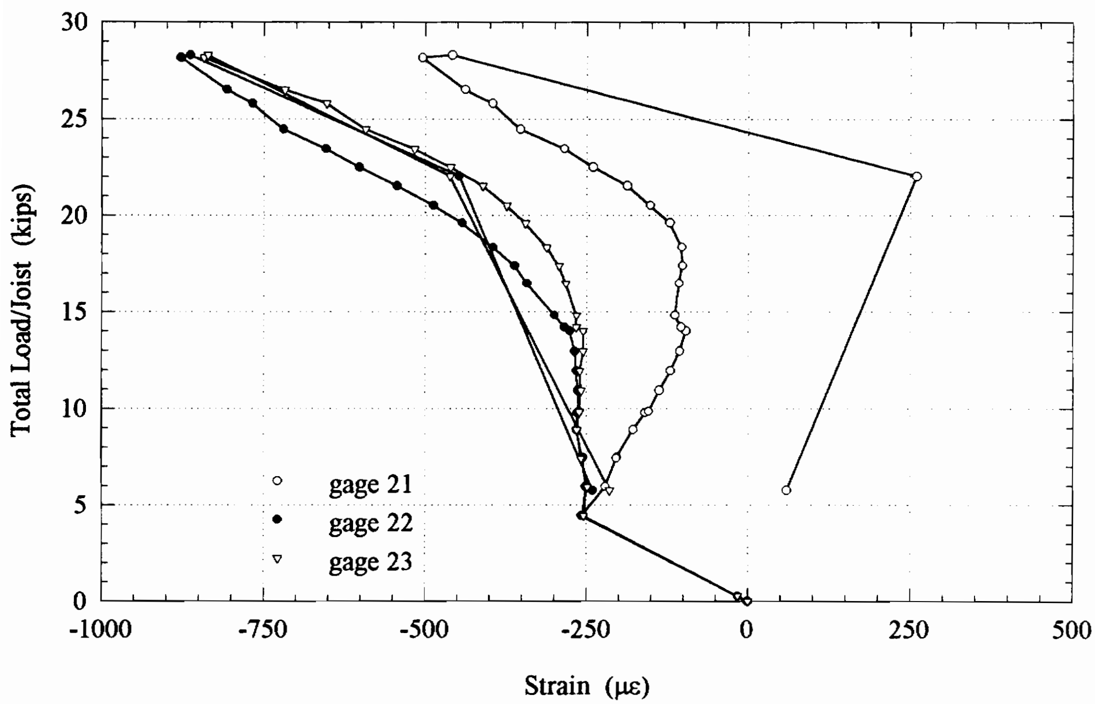


Figure A.8.13 Total Load/Joist vs. Top Chord Strain (TC6)

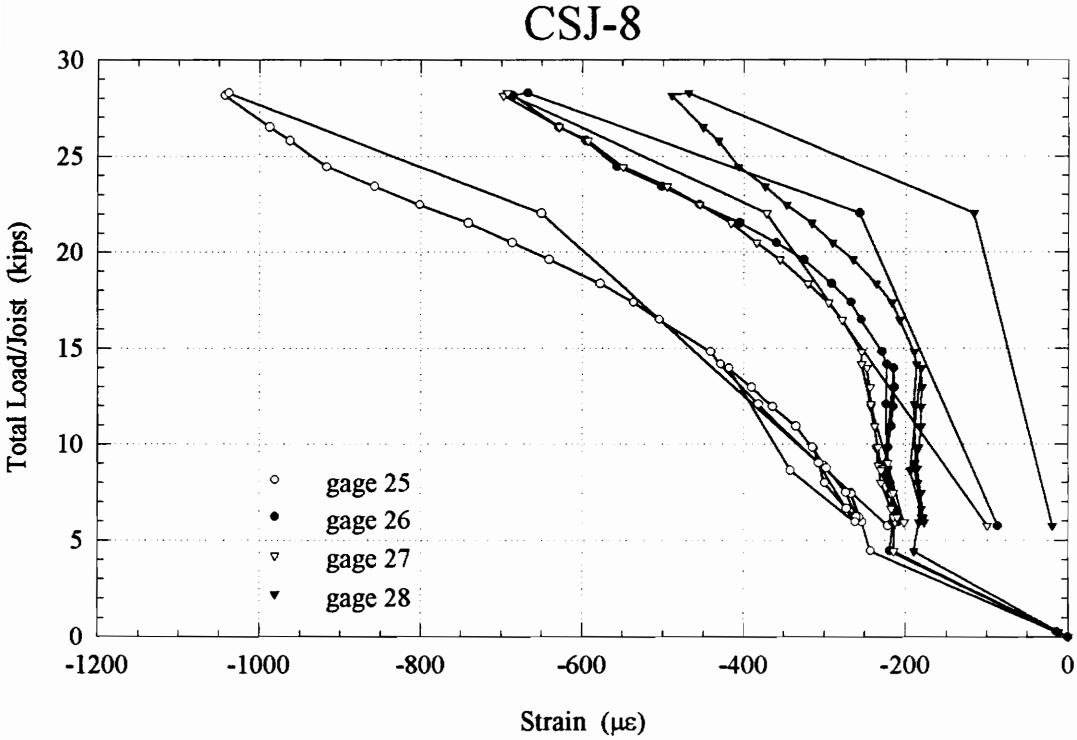


Figure A.8.14 Total Load/Joist vs. Top Chord Strain (TC7)

# CSJ-8

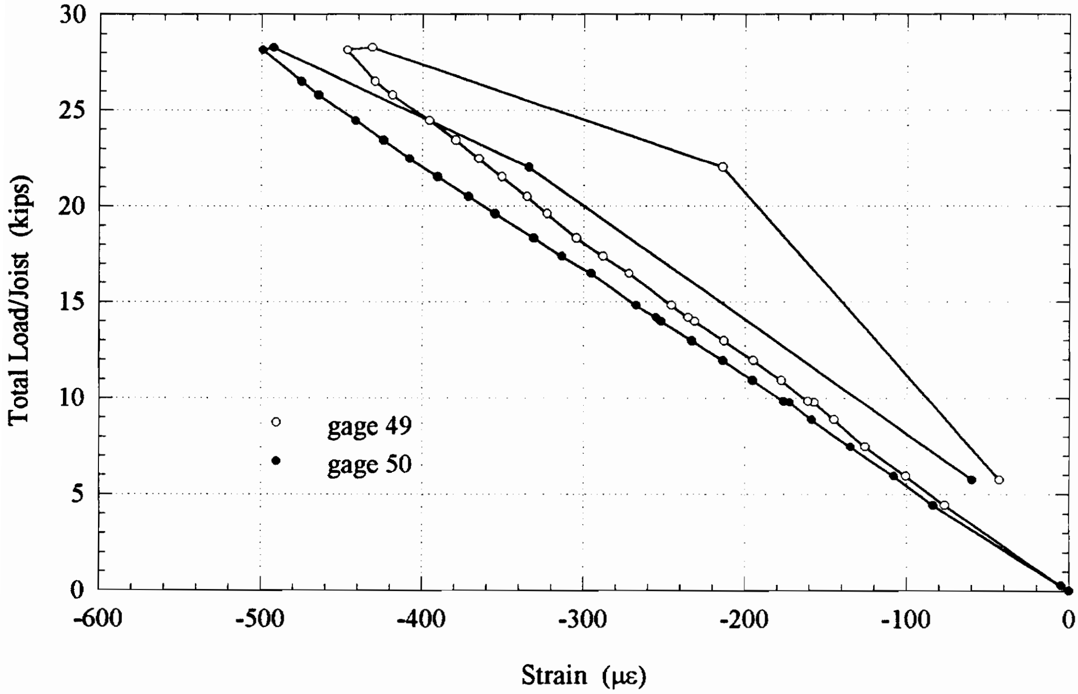


Figure A.8.15 Total Load/Joist vs. Web Strain (W1)

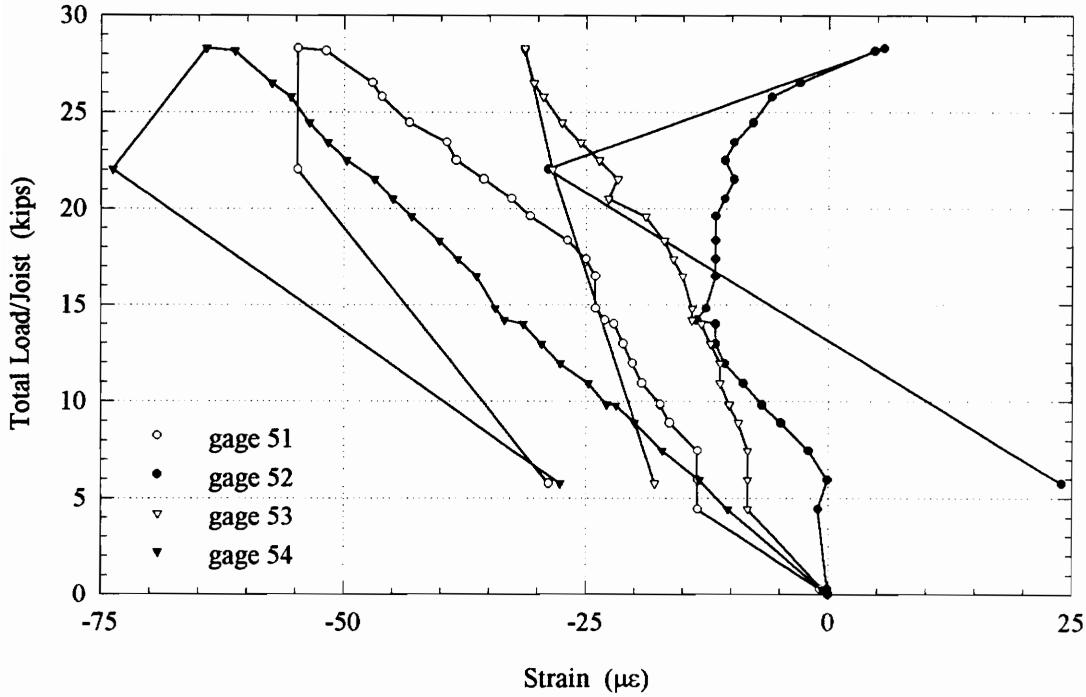


Figure A.8.16 Total Load/Joist vs. Web Strain (W2)

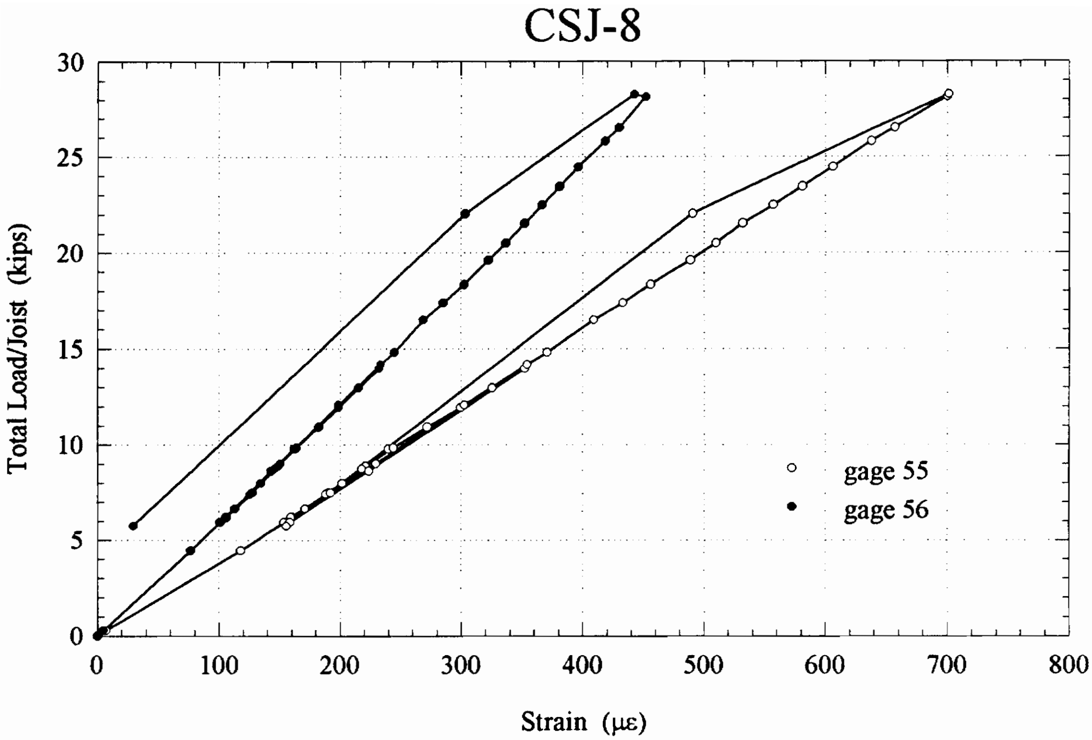


Figure A.8.17 Total Load/Joist vs. Web Strain (W3)

# CSJ-8

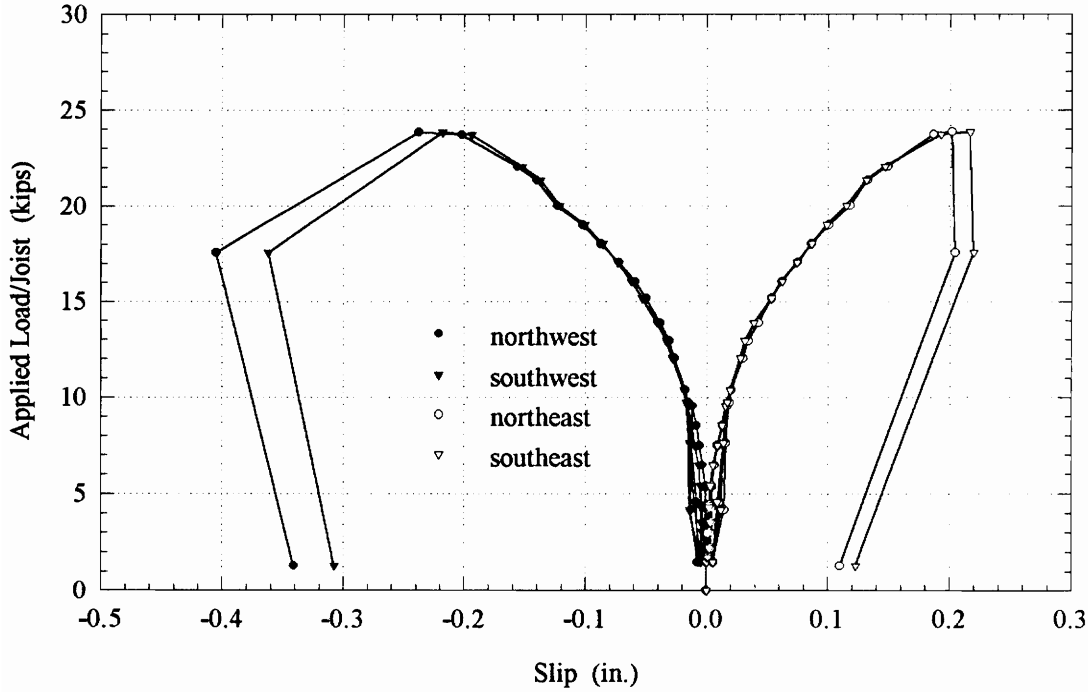


Figure A.8.18 Applied Load/Joist vs. End Slip

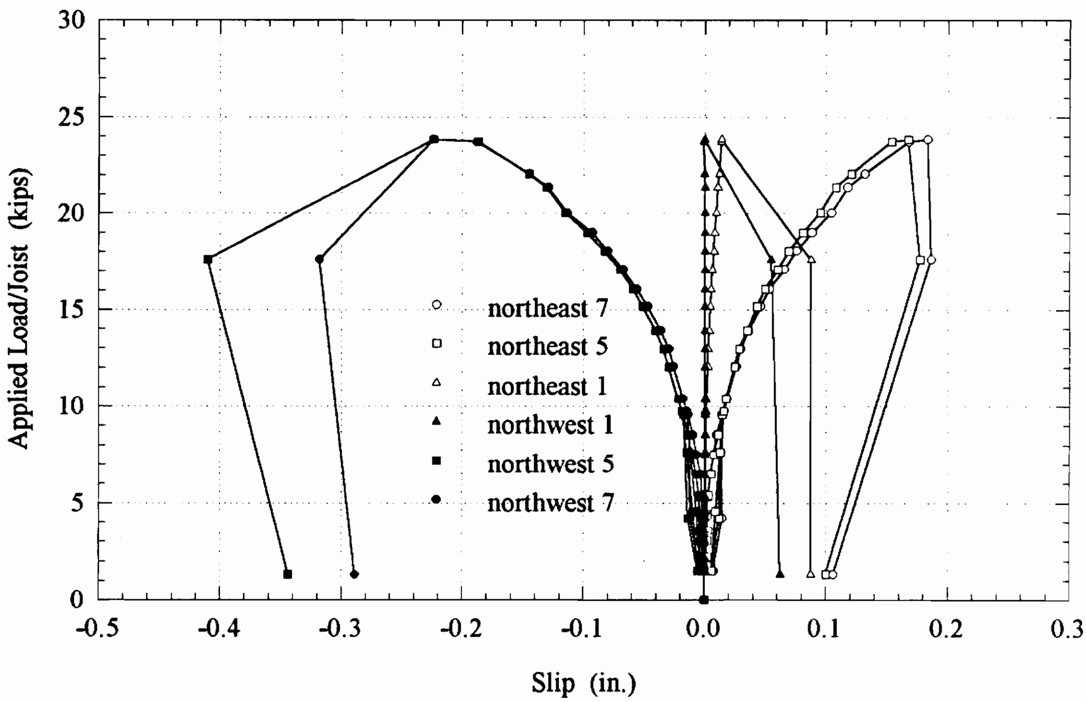


Figure A.8.19 Applied Load/Joist vs. Slip

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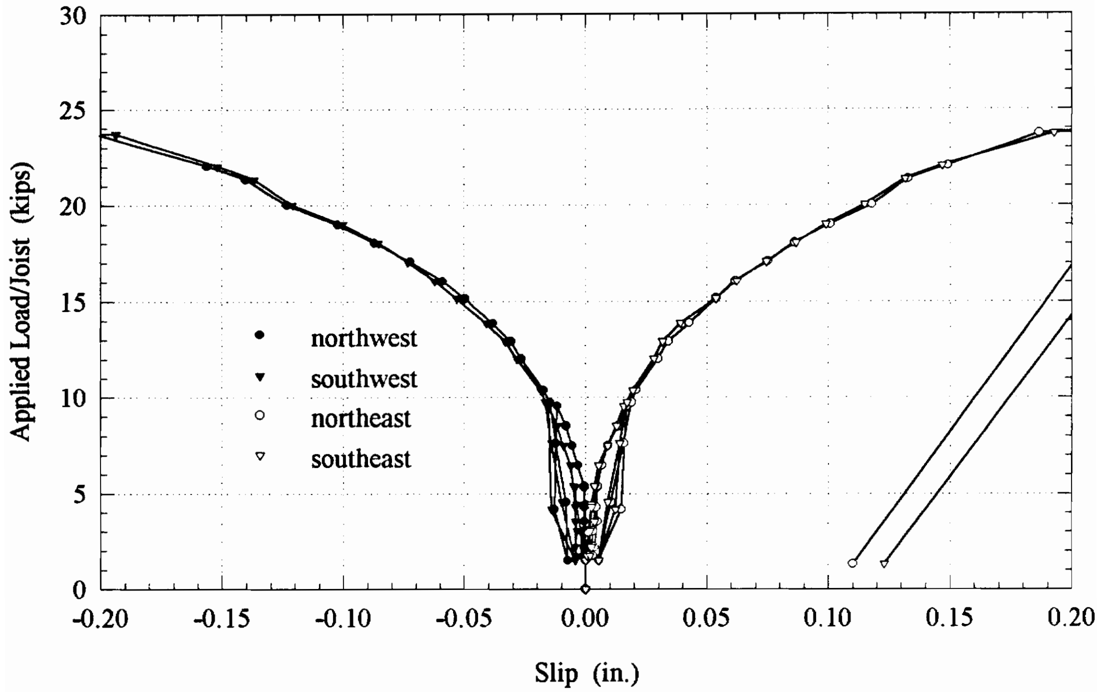


Figure A.8.20 Applied Load/Joist vs. End Slip

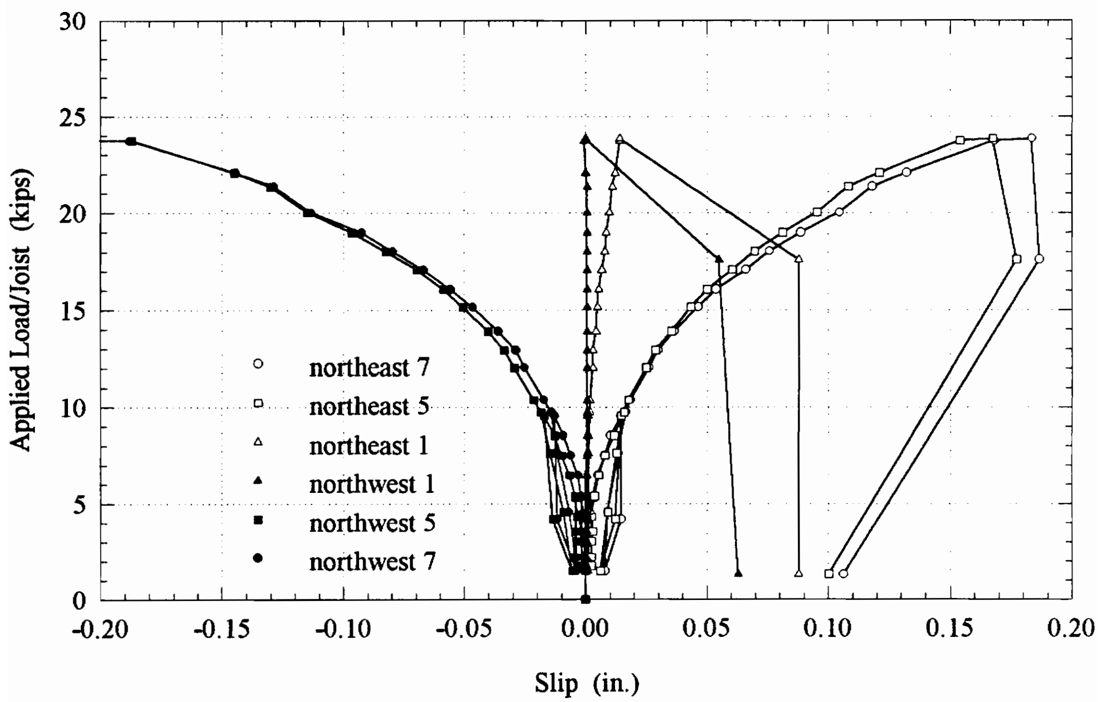


Figure A.8.21 Applied Load/Joist vs. Slip

## VITA

Douglas F. Lauer was born and raised in Arlington, Virginia where he graduated from Washington Lee High School. He entered Virginia Tech in September, 1983 and received his undergraduate degree in Civil Engineering in 1990. He continued his studies at Virginia Tech, working toward a graduate degree in Civil Engineering. In August, 1992, he went to work for Bechtel Savannah River, Inc. in South Carolina. He completed the requirements for the Master of Science Degree in Civil Engineering during the Fall semester, 1994. Doug now resides in Augusta, Georgia.