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ULTSTR: A PROGRAM FOR ESTIMATING THE COLLAPSE MOMENT OF A SHIP'S HULL UNDER LONGITUDINAL BENDING

by

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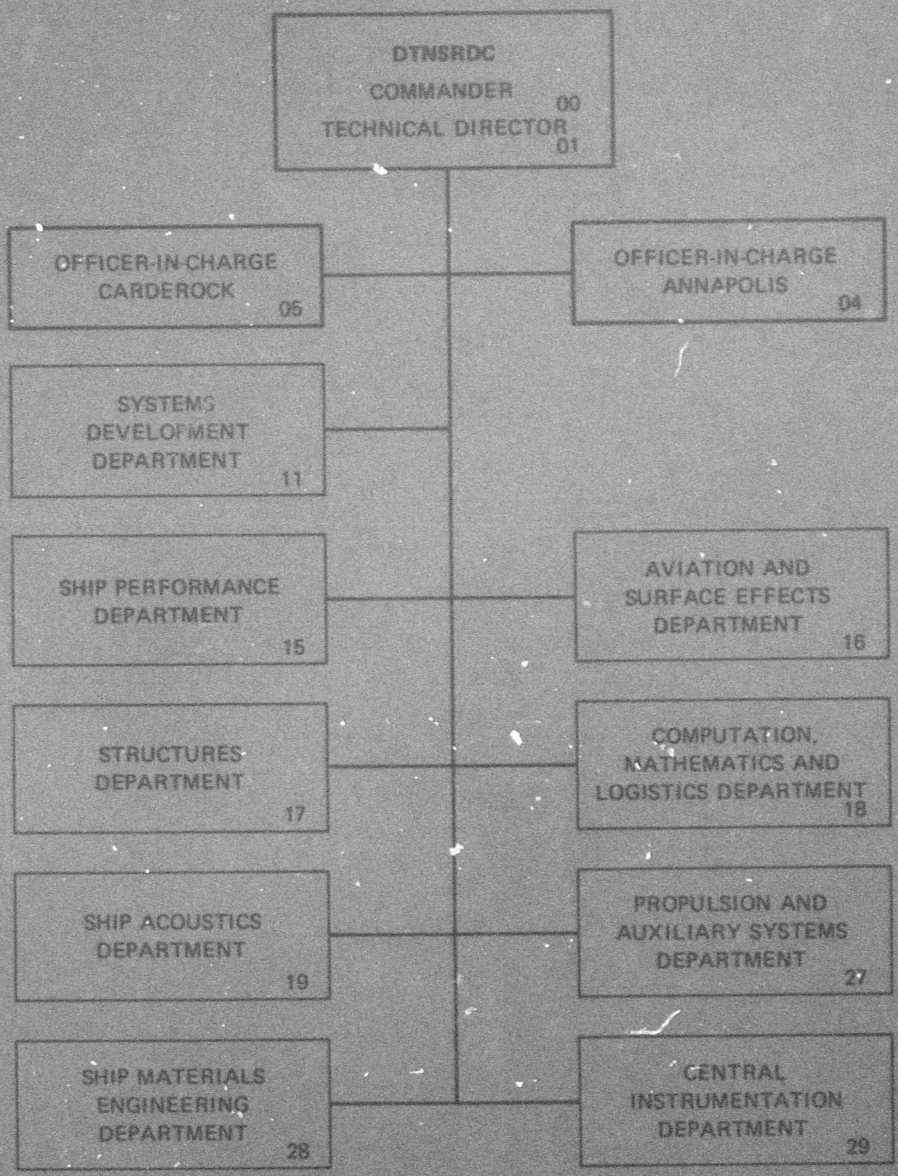
STRUCTURES DEPARTMENT
RESEARCH AND DEVELOPMENT REPORT

October 1982

DTNSRDC-82/076

MAJOR DTNSRDC ORGANIZATIONAL COMPONENTS



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REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: DTNSRDC-82/076	2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE (and Subtitle): ULTSTR: A PROGRAM FOR ESTIMATING THE COLLAPSE MOMENT OF A SHIP'S HULL UNDER LONGITUDINAL BENDING	5. TYPE OF REPORT & PERIOD COVERED: Final
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s): John C. Adamchak	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS: David W. Taylor Naval Ship Research and Development Center, Bethesda, Maryland 20084	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: Program Element 62766N, Task Area ZF66412001, Work Unit 1730-500
11. CONTROLLING OFFICE NAME AND ADDRESS	12. REPORT DATE: October 1982
	13. NUMBER OF PAGES: 152
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report): UNCLASSIFIED
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVED FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Ultimate Strength
Collapse Load
Hull Collapse
Longitudinal Strength
Collapse Moment

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report is a manual for the use of a computer program, ULTSTR, designed to be used to estimate the ductile collapse strength of conventional surface ship hulls under vertical longitudinal bending. The program is intended for use in the preliminary design stages and as such is approximate, being based on a variety of empirical solutions for the most probable ductile failure modes for grillage structure. The collapse moment is

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determined by incremental imposition of a curvature on the hull and computation of the equilibrium longitudinal moment which results, thus leading to the development of a moment-curvature relationship for the hull. Collapse is defined as the point at which the value of moment reaches its peak and then drops off. Ductile failure modes of structural yielding, beam-column buckling, and lateral-torsional (tripping) instability are included, as well as the effects of lateral pressure loadings, fabrication-induced distortion, and initial prestrain.

The report describes specific input instructions and provides two illustrative examples representing two typical naval hull cross sections. In addition, the appendices contain brief descriptions of the theories programmed for the various failure modes as well as complete output listings for the two illustrative examples.

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ABSTRACT

This report is a manual for the use of a computer program, ULTSTR, designed to be used to estimate the ductile collapse strength of conventional surface ship hulls under vertical longitudinal bending. The program is intended for use in the preliminary design stages and as such is approximate, being based on a variety of empirical solutions for the most probable ductile failure modes for grillage structure. The collapse moment is determined by incremental imposition of a curvature on the hull and computation of the equilibrium longitudinal moment which results, thus leading to the development of a moment-curvature relationship for the hull. Collapse is defined as the point at which the value of moment reaches its peak and then drops off. Ductile failure modes of structural yielding, beam-column buckling, and lateral-torsional (tripping) instability are included, as well as the effects of lateral pressure loadings, fabrication-induced distortion, and initial prestrain.

The report describes specific input instructions and provides two illustrative examples representing two typical naval hull cross sections. In addition, the appendices contain brief descriptions of the theories programmed for the various failure modes as well as complete output listings for the two illustrative examples.

ADMINISTRATIVE INFORMATION

The work described in this report was performed at the David W. Taylor Naval Ship Research and Development Center under the sponsorship of the In-House Exploratory Development (IED) Program, Program Element 62766N, Task Area ZF66412001, and Work Unit 1730-500.

INTRODUCTION

This report describes a computer program that may be used to predict the approximate collapse strength of the hull girder in ductile failure under longitudinal bending. Section yielding, interframe Euler beam-column buckling, and interframe stiffener tripping are included as the probable ductile modes of failure. The program also accounts for the effects of materials having different yield strengths in plating and stiffeners, for lateral pressure loading, and for initial out-of-plane distortion due to fabrication.

The basic theories on which this program is based originated primarily in a joint project on ship structural design concepts involving representatives of the

Royal Navy, the U.S. Navy, the Massachusetts Institute of Technology, and the Ship Structures Committee which upon completion, approximately ten years ago, was formally documented in References 1 and 2.* Further developments on this initial work, primarily directed towards various aspects of grillage behavior, were carried out by this author in the intervening years, and some of these developments were formally reported in References 3 and 4. Although current U.S. Navy design procedures include no requirement for estimating the ultimate longitudinal strength of the hull girder, an increasing interest in this subject in general, and a specific interest from the point of view of the latent strength of damaged structures led to the proposal that a program with such a capability be developed. Although other computer programs designed to address this same subject are either in existence or under development (see References 5 and 6), the primary focus of this project was the development of a program that was fast and easy enough to use that it could readily be applied in the preliminary stages of structural design. This emphasis on applicability in the early design stages resulted from the recognition that knowledge of the hull's ultimate moment capacity would have the greatest potential impact if it were in hand early enough in the design process to influence the major decisions regarding the structural configuration of the vessel.

In the sections that follow, the assumptions and the approach utilized in the program are described, and comprehensive instructions for program operation are given. Several illustrative examples utilizing typical naval hull designs are provided, and their input and output presented and evaluated. Finally, in the appendices, the structural theories upon which the analyses contained in the program are based are summarized, and the references from which more comprehensive treatments may be obtained are identified.

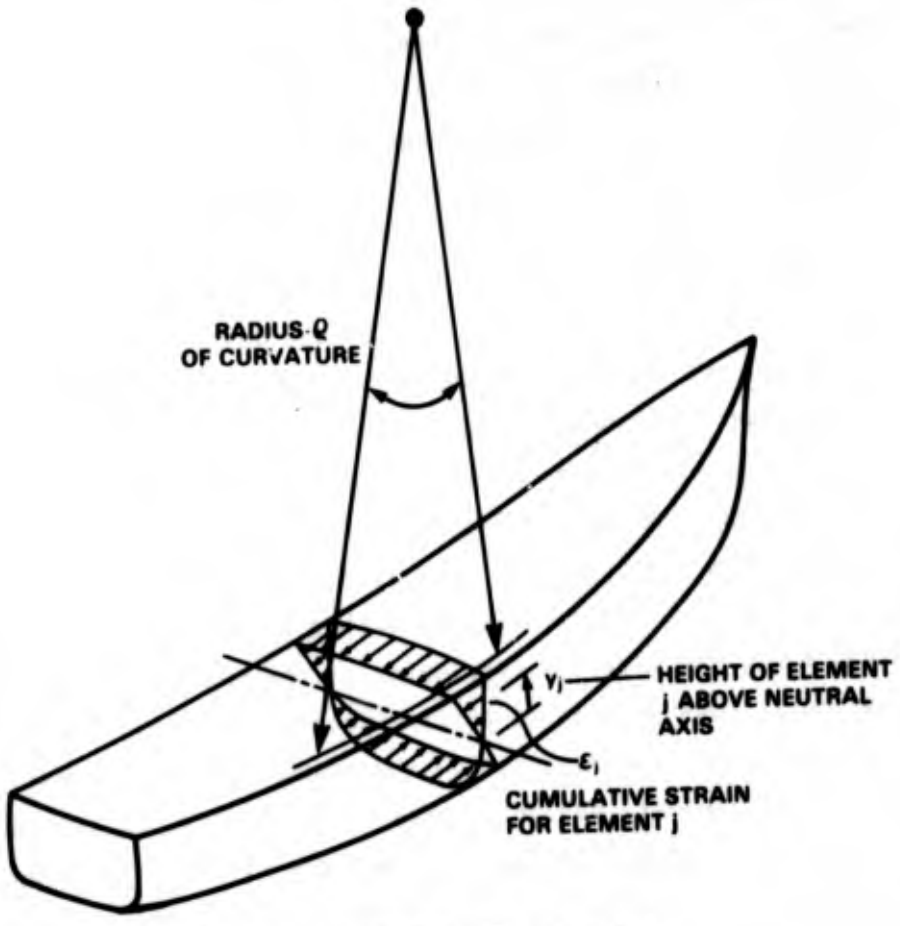
ASSUMPTIONS AND APPROACH

In addressing the ductile collapse of the hull girder, perhaps the most critical premise upon which the solution technique is based is that the collapse results from a sequence of failures of local components rather than from an overall simultaneous instability of the complete cross section. This allows one to address the collapse behavior of the hull by concentrating on the collapse behavior of the local components that make up the cross section, whether such components are represented as a

*A complete listing of references is given on page 145.

single plate-beam combination, an individual gross panel (comprised of several plate-beams), or a complete cross-stiffened grillage. This is certainly convenient, since the collapse behavior of the above-mentioned components is technically tractable, although to varying degrees, and a significant body of literature exists on this subject. This implies not that the collection of solutions for the collapse of local components is absolutely comprehensive and totally consistent, but rather that their behavior is understood well enough to allow development of a collapse model which provides the speed and accuracy needed in preliminary design and which can be utilized in a practical and meaningful fashion to address the major structural considerations. In contrast, addressing this problem as an overall simultaneous instability of the complete cross section presents a major practical obstacle. Numerical analysis, and specifically the finite element method, is most likely the only approach presently available that could be used to address this problem with any degree of rigor. And, in theory, the finite element method could treat this problem. However, in actual fact, the size and complexity of the mathematical model needed to treat the typical hull cross section is still effectively beyond the practical limits of time, cost, and capacity of today's computing systems. This is most certainly true relative to the preliminary design process. Fortunately, it is the author's belief that ductile hull collapse <u>is</u> due to a sequence of local failures rather than a simultaneous occurrence, at least in the vast majority of cases. With the possible exception of grillage general instability, the most probable ductile failure modes are primarily local phenomena in which there is relatively little direct influence from the other major components of the cross section. (Of course, the overall cross-section parameters of the hull do influence the stress-strain levels on the individual components.) Without this significant interaction between major components simultaneous failure is unlikely. Instead, a failure mode something like a chain reaction is more probable. Thus the choice of solution technique was dictated by what probably actually occurs rather than by expediency alone.

The actual solution approach involves dividing the hull cross section into a set of "gross panel" elements and "hard corner" elements and then imposing a curvature on the hull in small finite increments. This incremental loading concept is illustrated in Figure 1. Each increment of curvature is assumed to produce a linear



$$\text{GROSS CURVATIVE } \chi = \frac{1}{\varrho} = \sum_i (1/\Delta Q_i)$$

$$\text{ELEMENT STRAIN } \varepsilon_j = \sum_i y_{ij} (1/\Delta Q_i)$$

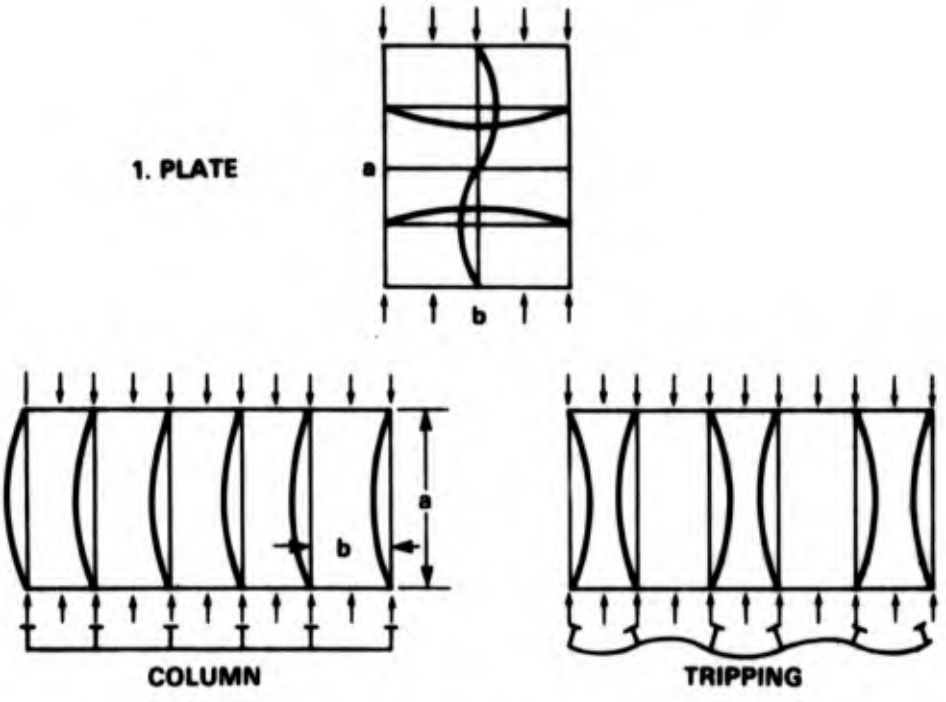
Figure 1 - Incremental Concept for Hull Bending

strain distribution through the depth of the cross section. The location of zero strain corresponds to what will be referred to as the "instantaneous" or "incremental" neutral axis. The assumption of linear strain through the cross section is common practice in naval architecture and is certainly "sufficiently" valid for stress levels at or below the so-called design values. When strain levels reach values at which structural components begin to demonstrate significant changes in behavior (buckling, yielding, formation of plastic hinges, etc.), then the validity of this assumption becomes more questionable. It is impossible to be definitive on

this issue at present; thus it has been assumed here that the assumption of linear strain is also "sufficiently" valid up to the point of hull collapse. This is certainly consistent with the degree of engineering accuracy expected and with the approximations that of necessity have been made concerning other aspects of the program. As experience is gained with this preliminary program the issue of the validity of this assumption may be more clearly illuminated, and changes may be required. Later versions of the program can be expected to incorporate the necessary modifications.

At each value of curvature, the program evaluates the equilibrium state of each gross panel and hard corner element relative to its state of stress and stability corresponding to its particular value of strain. It then computes the total moment on the cross section by summing the moment contributions (stress × effective area × lever arm) of all of the elements that make up the section. In this manner a moment-curvature relationship is defined. Since the stress distribution, unlike that of strain, is not necessarily linear across the depth of the section, the location of the instantaneous neutral axis must be determined in an iterative fashion from the condition that the net force on the cross section must be zero. This force is computed in the same fashion as the bending moment, that is, by summing the contributions of all the elements of the cross section. In the iteration process, the position of the instantaneous neutral axis is varied until the value of the net force is less than some predefined acceptable limit. In spite of the "motion" of the instantaneous neutral axis from increment to increment, the cumulative strain distribution that results is still linear through the depth of the cross section, since it represents the superposition of a number of linear increments.

Gross panel elements in the cross section can "fail" either through material yielding (in either tension or compression) or through some form of structural instability (in compression only). The instability failure modes presently incorporated include: (1) Euler beam-column buckling and (2) stiffener lateral-torsional buckling (tripping). These modes are symbolically illustrated in Figure 2. Plate buckling is not included as an explicit separate failure mode because it influences collapse more indirectly, that is, through influencing plating effectiveness relationships (effective breadth, width, etc.). These effects are considered in the analysis. Grillage general instability was also omitted as a failure mode in the



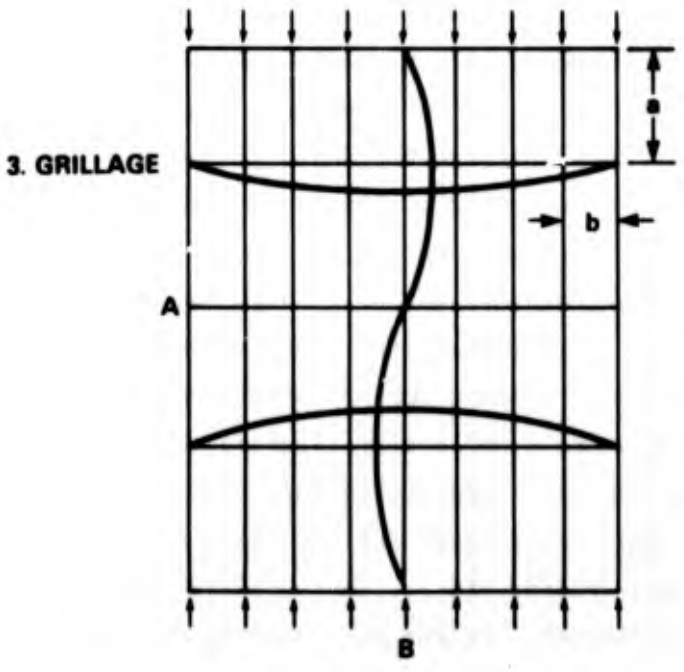
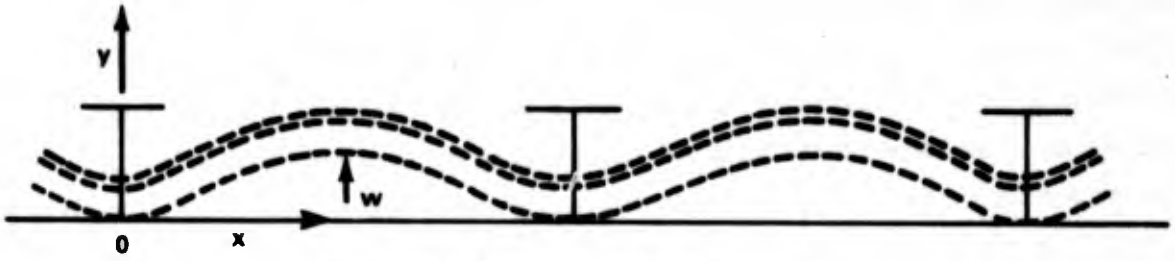


Figure 2 - Instability Failure Modes

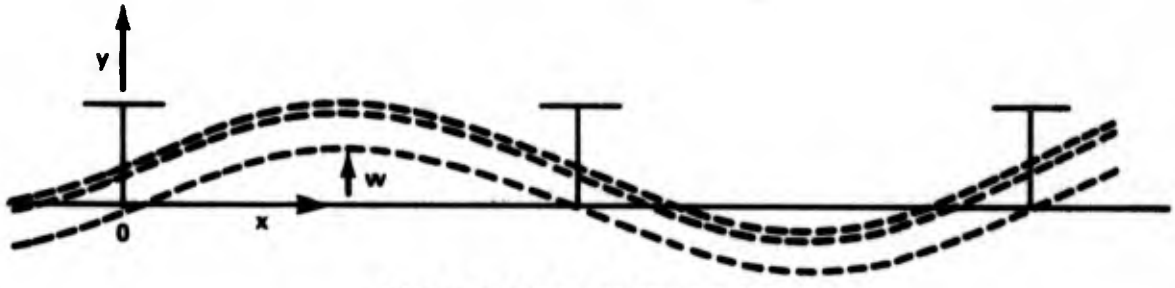
present version of the program. Because incorporating general instability will involve some significant modifications in programming logic, it was determined early in the development stage that this would be more appropriate for one of the "follow-on" versions of the program. The lack of a general instability mode need not be regarded as a serious shortcoming of the program at present; the structural proportions found in typical surface ships currently in design or in service seldom have general instability as their primary mode of failure. However, there may be instances when general instability may assume front stage, for example, if "lightweight" grillages incorporating thin gage, high strength steels are adopted for primary structure. In any case, grillage general instability should not be ignored; it should be a prime candidate for one of the future modifications of the program.

Although it is impossible to determine at a glance what failure mode may be most critical for a particular gross-panel element, we assumed that once instability is detected in a given mode, the behavior follows through to failure in that same mode. Interaction among different failure modes is incredibly complex and has not received much treatment. Because the development of a preliminary, operational program for hull collapse was the primary goal of this effort, the only practical approach that could be justified was that of ignoring this possible interaction.

Although listed as a single failure mode, Euler beam-column buckling is actually treated in the program as having two distinct types of failure patterns. This is illustrated in Figure 3. Type 1 is characterized by all lateral deformations occurring in the same direction. Although dependent on all the various geometrical and material properties that define the structural system or element, this type of failure is primarily a yield strength-dependent phenomenon. Also, it can only occur when either lateral loading or initial fabrication distortion, or both, are present. In contrast, type 2 failure is characterized by an alternating buckling pattern. It is primarily modulus (E) dependent, at least as far as initial buckling is concerned. This type of failure can occur whether or not lateral load or initial distortion (or both) are present. In a sense, it is a true instability phenomenon in the mathematical sense. The mathematical developments for both types of failure (as well as for tripping failure) as utilized in the program are described in more detail in the appendices.



TYPE 1 BEAM-COLUMN FAILURE



TYPE 2 BEAM-COLUMN FAILURE

Figure 3 - Beam-Column Failure Modes

Regardless of the specific type of failure involved, the general nature of an element's behavior can be described in terms of a "load-shortening" curve, illustrated in Figure 4. This curve has three distinct zones of behavior. The first represents a zone of stable behavior in which the load applied to the element is less than the critical value corresponding to its preferred mode of failure. Since load-dependent effectiveness relationships are utilized in this program for gross panel elements, the curve in this region will not generally be absolutely linear for such elements, although the deviations from linearity will need careful scrutiny for detection. The second zone, or plateau, occurs after an element has reached its critical load. On this plateau, the element will continue to deform without any increase in loading. This critical load may correspond to one of the possible forms of buckling or to the condition of material yielding. As the figure indicates, some elements have no third zone of behavior but remain indefinitely in the second zone after reaching their critical load. Gross panel elements under tension and hard

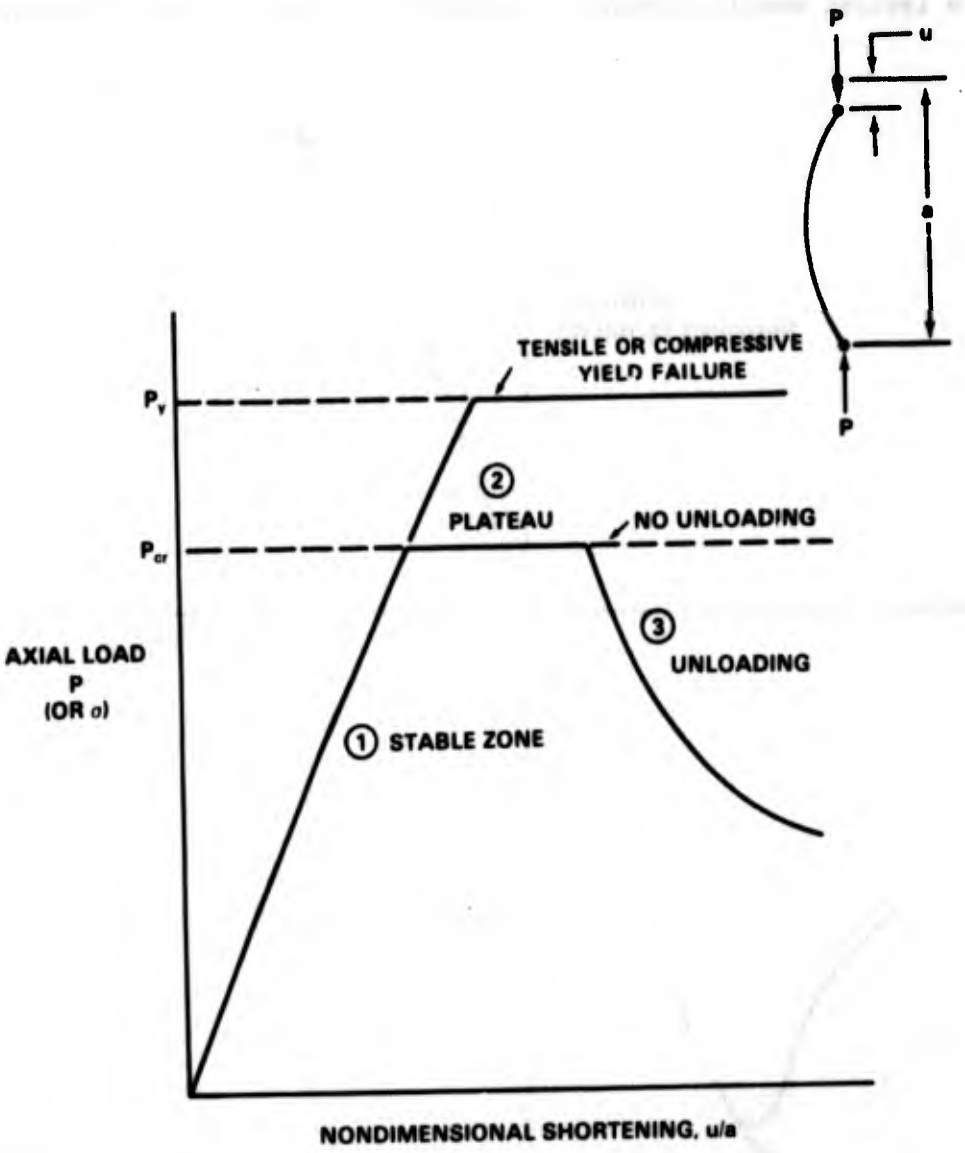


Figure 4 - Typical Gross Panel Load Shortening Curves

corner elements (under either tension or compression) are characterized by this type of behavior. The third and final zone is characterized by a drop-off in the element's load carrying capability as deformation increases. This necessity for reducing load to maintain equilibrium, called "unloading," can significantly affect the behavior of the overall hull cross section.

The effect of including unloading in element behavior can be seen in Figure 5, which shows a typical moment-curvature diagram for a complete hull cross section.

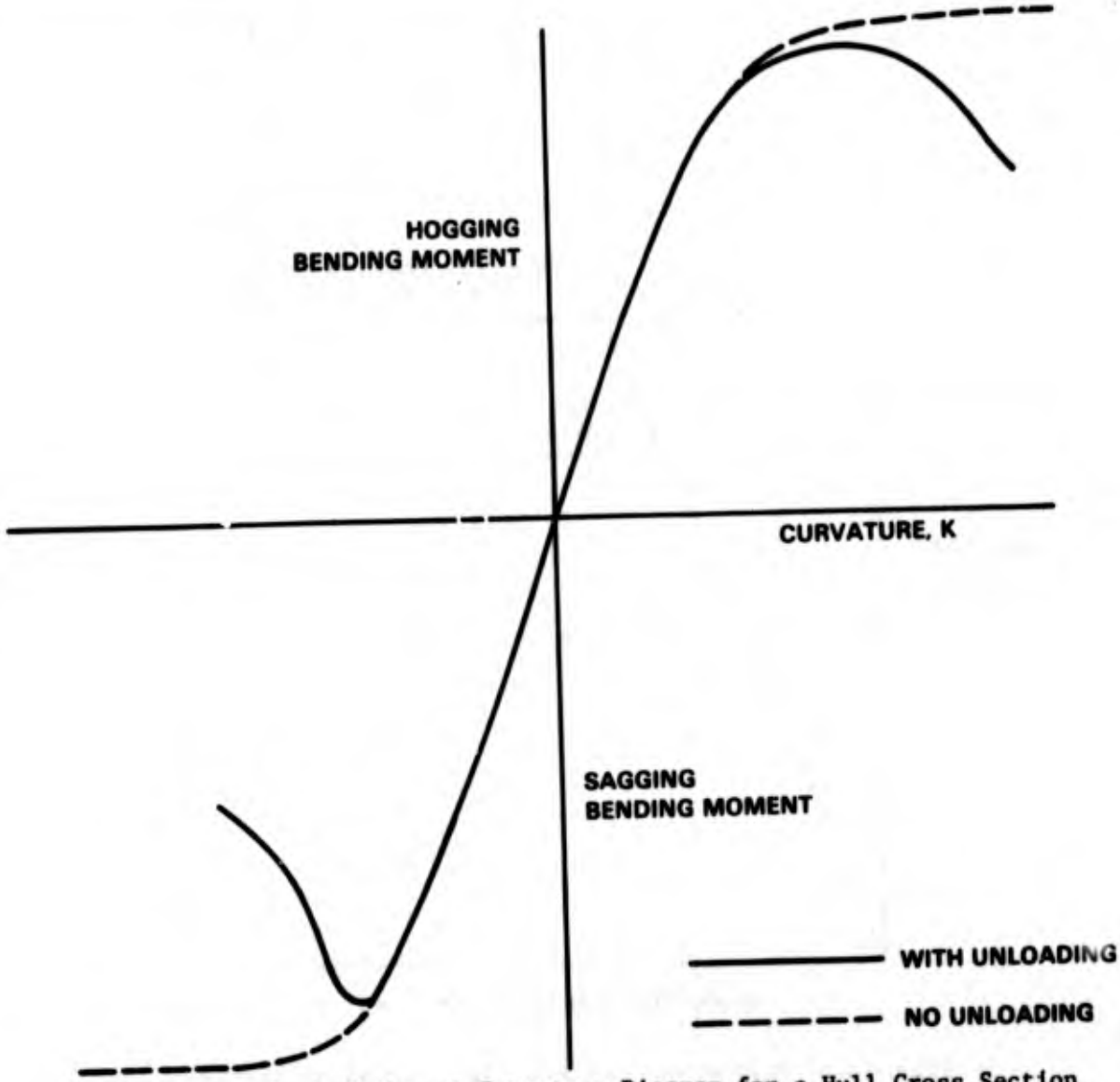


Figure 5 - Typical Moment-Curvature Diagram for a Hull Cross Section

The figure shows that including unloading in element behavior will lead to a similar type of behavior in the composite cross section. In fact, to get unloading in the composite cross section requires unloading in the elements; including only the first two types (zones) of behavior in the elements will lead to a moment-curvature diagram for the cross section that asymptotically approaches limits (hogging and sagging)

for the moments. The critical issue, however, is whether the peak moments defined including unloading differ significantly from the moment asymptotes. At present there is not enough experience with this subject to resolve this issue.

DESCRIPTION OF INPUT TERMS

The present version of the program is coded in the FORTRAN IV language and consists of a main program and twelve subprograms. The computer core required to run the program is quite modest (about 55,000 octal words on a CDC 6000 series computer) as the program is presently dimensioned. The capacity of the program, i.e., the number of allowable gross panel elements, hard corners, etc., can readily be changed by redimensioning the various arrays in the program, which naturally will influence the computer core required.

To perform an ultimate strength analysis on a hull cross section, the mathematical description of the structure must be input to the computer. The following is a list of the input terms and their definitions in the order required. The user must understand the precise definitions of these terms and must rigorously adhere to the correct input data formats, which are described in the next section.

CHECK - An alphanumeric parameter that is set equal to "START" when it is the first card or line of input data and "STOP" when it is the last.

HEAD - An alphanumeric parameter that provides the title or header statement on the program output. A maximum of 80 characters (including blanks) is allowed in this title.

NEL - Number of gross panel elements in the structure. As presently dimensioned a maximum of 50 gross panel elements is permissible.

NHS - Number of hard corners in the structure. As presently dimensioned a maximum of 40 hard corners may be defined.

NSTF - Number of <u>different</u> stiffeners occurring in the cross section. Presently this number is limited to a maximum of 45. To be considered identical, stiffeners must have the same geometry <u>and</u> material. Thus, two stiffeners with the same geometry but different materials are defined as different stiffeners.

NUMAT - Number of different materials in the cross section. At present a maximum of 20 different materials is allowed. A material is defined by its Young's modulus (E), Poisson's ratio (ν), yield strength (σ_y), and proportional limit ration (p_r). (Note that buckling of a hard corner element can be approximately accommodated by assigning the element a unique material whose "yield strength" is set equal to the defined buckling stress of the hard corner.)

NCYMAX - Maximum number of iteration cycles to determine the location of the instantaneous neutral axis. For each increment of curvature the location of the instantaneous neutral axis is determined in an iterative manner from the condition that the net force on the cross section must be zero. The logic built into the program will continue to iterate until either the convergence criteria is satisfied or the number of cycles reaches NCYMAX. The default value of this parameter is 20.

KOUT - A parameter to allow output of additional data on convergence criteria parameters (FAKK, EPSH, EPSA, and EPSB, defined individually below) and on individual element contributions to the calculations of "fully effective cross section characteristics." A nonzero value for KOUT will cause these data to be provided in the output, whereas a blank or zero value will prohibit this output.

FAKK - A scaling factor used in the logic to determine the location of the instantaneous neutral axis. When more than two cycles are required in the iteration procedure to determine the instantaneous neutral axis location, a two-stage process is invoked. The initial stage successively evaluates neutral axis locations DEL (above the baseline) to determine upper and lower bounds according to the relationship.

$$DEL_{i+1} = DEL_i + FAK*AK*EPS$$

In this expression EPS is the convergence criterion tolerance (see the definition for EPSH), AK is either +1.0 or -1.0 (to indicate direction of motion), and FAK is a scaling factor. The initial value of FAK is FAKK. As the cycles continue (in the first stage only) FAK is successively accelerated

$$FAK_{i+1} = FAK_i * ACCEL$$

where ACCEL is the acceleration factor and is currently defined internally in the program as 2.0. The default value for the parameter FAKK is 50.0.

EPSH - Nondimensional convergence criteria ratio. When iterations are being performed to determine instantaneous neutral axis location, convergence is assumed to have been achieved when the condition

$$|\text{DELP-DELN}| \leq \text{EPS}$$

is satisfied. In this expression DELP is a neutral axis location producing a net positive force on the cross section and DELN is that producing a net negative force. The "tolerance" EPS is defined relative to the half depth HFD of the hull cross section as follows

$$\text{EPS} = \text{EPSH}*\text{HFD}$$

The default value of EPSH currently is 0.005.

EPSA - Nondimensional convergence criteria ratio. For each increment of curvature, the initial estimate of the location of the instantaneous neutral axis, DEL_1, is made on the basis of the cumulative state of stress existing due to the cumulative curvature up to (but not including) the increment in question. With the new increment of curvature added, another estimate of instantaneous neutral axis location, DELPR, is computed. If the condition

$$\left|\frac{\text{DELPR-DEL}_1}{\text{HFD}}\right| \leq \text{EPSA}$$

is satisfied, then the initial estimate DEL_1 is assumed to be sufficiently accurate and no further iterations on neutral axis location for this increment of curvature are required. A value of 0.0025 is currently used as the default value of EPSA.

EPSB - Nondimensional convergence criteria ratio. If the condition mentioned above in the definition for EPSA is not satisfied, the following inequality is evaluated:

$$\left|\frac{\text{DELPR-DEL}_1}{\text{HFD}}\right| \leq \text{EPSB}$$

If this condition is satisfied, a new estimate of neutral axis location is computed and used equal to the arithmetic mean of DELPR and DEL_1 and no further iterations are performed. If the above condition is not satisfied, the two-staged iteration procedure previously mentioned must be utilized. A default value of 0.025 is currently used for EPSB.

ACMP - Compartment length (transverse bulkhead spacing). Since general instability is not presently included in the program, this parameter is not now required and may be left blank.

ATFR - Transverse frame spacing.

AILS - Effective length for tripping. This parameter is included to allow for the presence of intermediate lateral supports or to include the effects of end conditions that reduce the effective length for tripping. This value will be used for all gross panels unless overridden by the assigned values of AET(J) (defined below) given on the individual input data cards for gross panel elements. If zero or left blank on the input data card, AILS is assigned a default value equal to ATFR. A value of -1.0 will cause tripping to be ignored as a mode of failure [unless overridden by AET(J)].

Y1(J), Y2(J), Z1(J), Z2(J) - Coordinate locations of the Jth gross panel element edges. The coordinate system has its origin at the hull's baseline with the y-axis vertical and the z-axis horizontal, as shown on Figure 6. In general, the coordinate points for each gross panel element are placed at the midpoints of the plating panels between longitudinal frames such that the total width of the element is equal to an integer multiple of the longitudinal frame spacing. This is also illustrated in Figure 6. Since in real structure longitudinal frame spacing is frequently somewhat irregular rather than perfectly uniform, minor adjustments in the mathematical model must often be made based on engineering judgement. Because the longitudinal frame spacing is an important parameter in the structural behavior and the program computes this value by dividing the width of the gross panel by the number of longitudinals included, the coordinate points for the gross panel should be adjusted so that the computed mean frame spacing is consistent with the value the user desires [see the definition for B(J)]. How large each gross panel should be depends on location, orientation (vertical, horizontal, etc.), and the occurrence of changes in plate or stiffener geometry and material. Since strain from vertical bending is uniform in structure oriented horizontally (constant y coordinates), gross panel elements may be quite large (i.e., contain a relatively large number of stiffeners), provided that no geometric or material changes occur in the structure. This situation is typical of deck structure. For structure oriented vertically or at some

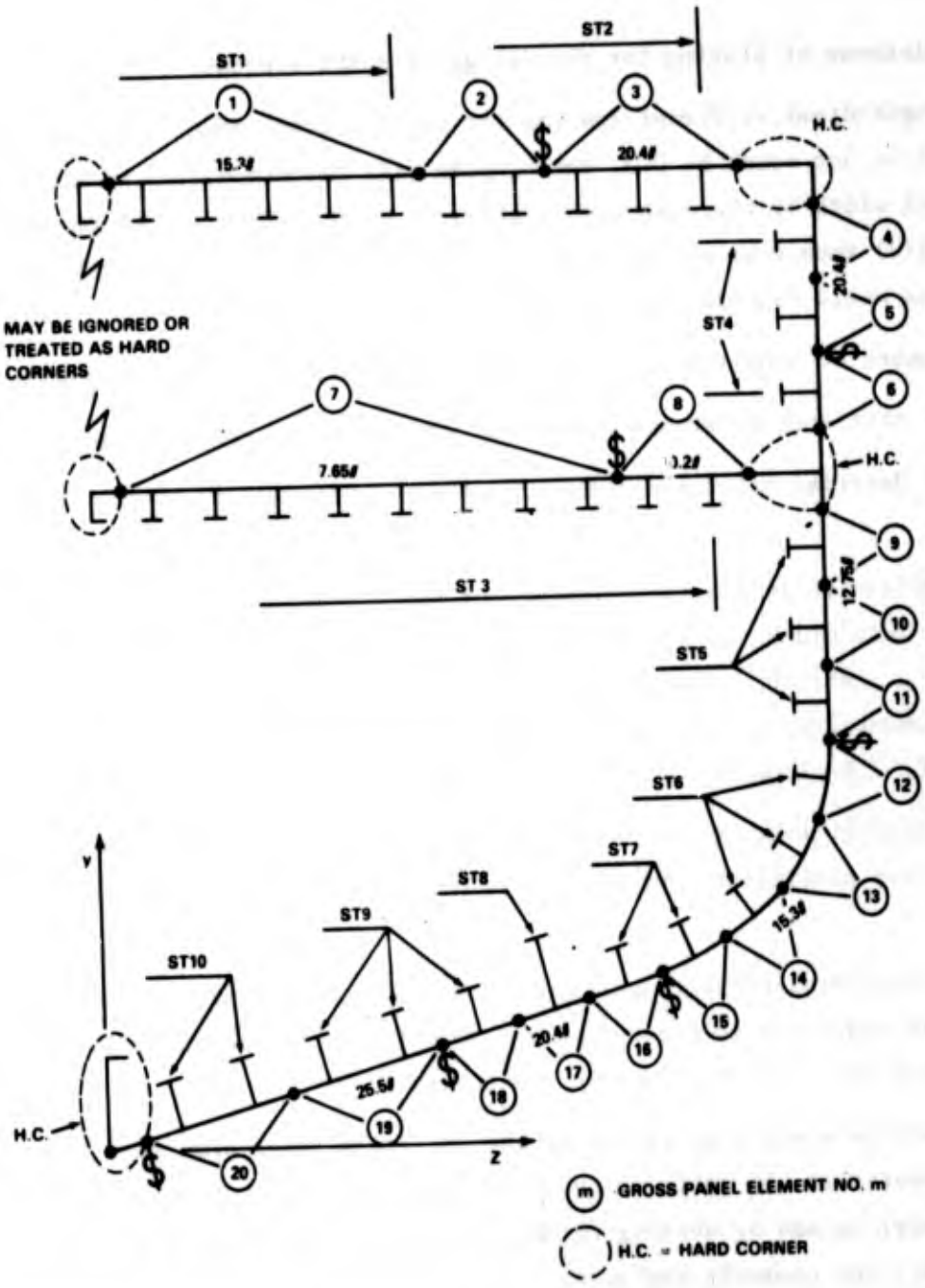


Figure 6 - Definition of Gross Panel Elements

reasonable angle to the horizontal, gross panel elements should be much smaller, even if no geometric or material changes occur, since the strain changes linearly and the average value within the gross panel is used to define the elements behavior. The logic can be observed on the model presented in Figure 6. The choice of edge 1 versus edge 2 is completely arbirtary.

T(J) - Thickness of plating for the Jth gross panel element.

B(J) - Longitudinal stiffener spacing for the Jth gross panel element. If B(J) is left blank or set equal to 0.0, the program will calculate B(J) by dividing the total gross panel width by the number of stiffeners on it. This is the recommended procedure. B(J) should be assigned only if for some reason a value different from what the program would calculate is desired.

NS(J) - Number of longitudinal stiffeners on the Jth gross panel element.

NSTIF(J) - Stiffener reference number for the Jth gross panel element.

NEMAT(J) - Material reference number for the plating (alone) of the Jth gross panel element.

AET(J) - Effective length for tripping for the Jth gross panel element. If AET(J) is zero or left blank, it will be set equal to the value of AILS defined earlier. Similarly, a positive, nonzero value of AET(J) will override the value of AILS for the Jth element only. A value of -1.0 will cause tripping to be ignored as a failure mode for the Jth element.

NGEN(J) - General instability code. Since general instability is not presently included in this preliminary version of the program, this parameter should be left blank.

PREL(J) - Structural proportional limit ratio for the Jth gross panel element. This parameter is discussed in the appendices describing the element failure modes. A default value of 0.5 is utilized in the program.

ETA(J) - Tension yield zone ratio for the Jth gross panel element. This nondimensional parameter is the ratio of the width of the tension yield zone (on one side of the stiffener) caused by welding to the thickness of the plating. Values in the range 3.0-4.5 are commonly employed.

PRSS(J) - Uniform lateral pressure loading (force per unit area) applied to the Jth gross panel element. Pressure loading is positive when applied to the outside surface (the side opposite to that to which the stiffeners are attached) and negative where applied to the inside surface.

DFAB(J) - Peak value of fabrication-induced lateral distortion of the stiffeners on the Jth gross panel element. This dimensional value of distortion (in the appropriate length unit) is assumed to occur at the midspan of the stiffeners in the direction which corresponds to the most severe condition relative to the failure mode in question. Thus a given distortion value may be assumed to be positive for one failure mode and negative for another. This means that only the absolute value of the distrotion need be provided; in fact, the sign provided with a negative value will be ignored.

PRESTN(J) - Value of initial strain (nondimensional) for the Jth gross panel element. Such "pre-strains" should be distributed around the cross section such that there is no net force and no net moment on the section. To determine the force and moment balance situation for a given distribution of prestrains, see the definitions for NLR, NINC(J), and CINC(J), which are provided later on in this section.

YH1, ZH1, YH2, ZH2 - Geometric parameters for a hard corner element. Since the geometric descriptions of hard corners can be read in using two different formats, these parameters can have two distinct definitions. If the thickness parameter TH (see the next definition) has a positive, nonzero value, the hard corner is described as an essentially flat plate connecting two endpoints whose y,z coordinates are defined by (YH1, ZH1) and (YH2, ZH2). This is illustrated in Figure 7. If TH is zero, blank, or negative, the above parameters are defined as follows:

YH1 = ASHS(J)
ZH1 = YHS(J)
YH2 = AIHS(J)
ZH2 = undefined

where ASHS(J) is the cross section area of the hard corner, YHS(J) is the vertical distance (y-coordinate) of the centroid of the hard corner from the origin, and AIHS(J) is the moment of inertia of the hard corner about an axis through its centroid and parallel to the global z-axis. Normally data preparation is easier when the first approach is used, that is, describing the hard corner as a number of interconnecting flat plates. This may require several hard corner elements, however. Thus, the use of the second approach, although requiring more manual calculations, offers the advantage of allowing several interconnecting plates to be described in terms of a single hard corner element.

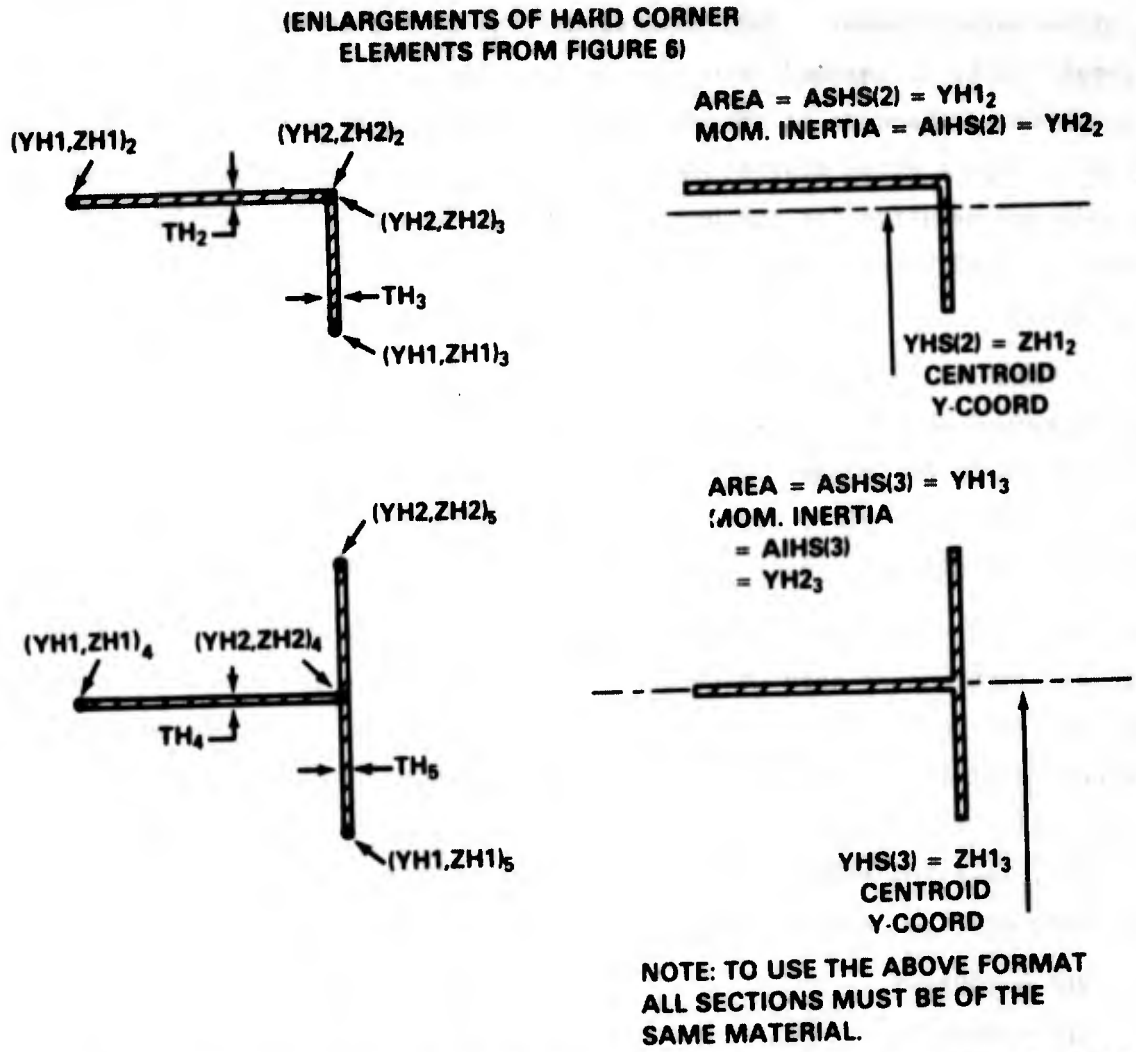


Figure 7 - Representations of Hard Corner Elements (Alternative Formats)

TH - Thickness of hard corner plate element. As described in the preceding definition, leaving this parameter blank indicates that hard corner data are being input in the "second" mode.

NHMAT(J) - Material reference number for the Jth hard corner element. If this parameter is left blank, a default value of 1 is assumed.

PRHSTN(J) - Value of the initial strain for the Jth hard corner element.

DSTF(J) - Overall depth of Jth tee stiffener (web depth + flange thickness).

TWEB(J) - Web thickness of Jth tee stiffener.

WFLG(J) - Flange width of Jth tee stiffener.

TFLG(J) - Flange thickness of Jth tee stiffener.

NSMAT(J) - Material reference number for the Jth tee stiffener. If left blank the material reference number for the highest numbered gross panel element that references this stiffener will be assigned. Although a gross panel's plating and stiffeners may be of different materials, both materials at present must have the same value of Young's modulus.

E(J) - Young's modulus for the Jth material.

GNU(J) - Poisson's ratio for the Jth material.

SY(J) - Yield stress for the Jth material.

PRMT(J) - Proportional limit ratio for the Jth material. This parameter is the ratio of the proportional limit stress to the yield stress and allows variations in the shape of the stress strain curve as shown on Figure 8. If left blank a value of 1.0 is assumed.

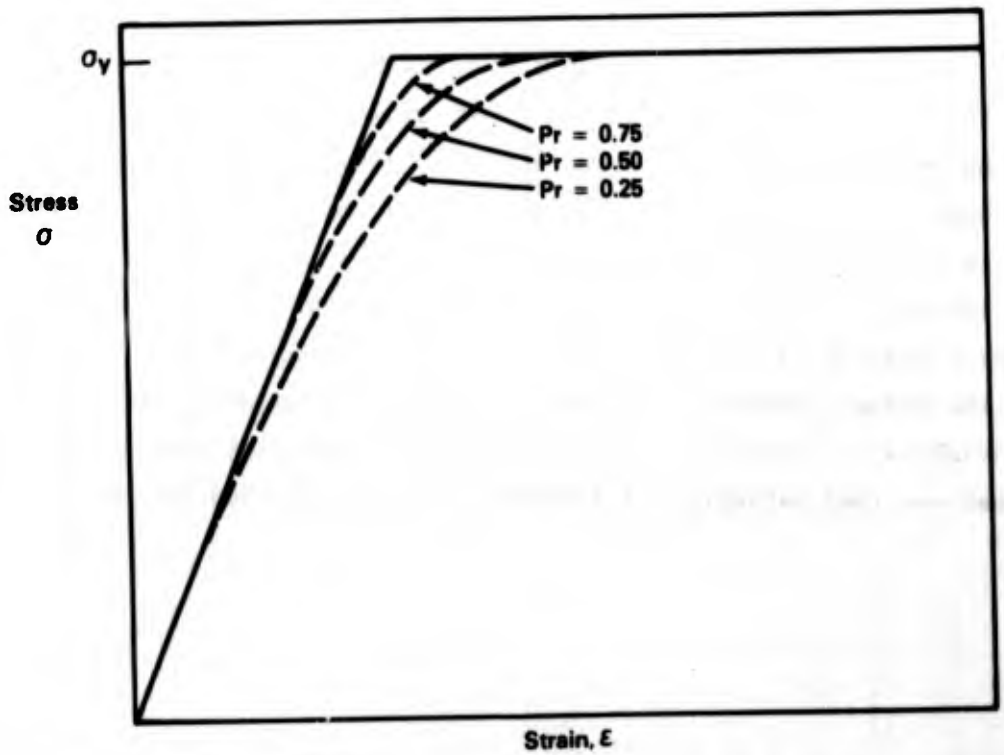


Figure 8 - Material Stress-Strain Curves

NLR - Number of load ranges. Curvature is applied in increments of constant value within each load range. Having multiple load ranges allows the sizes of the curvature increments to be changed. At present a maximum of 10 load ranges is permitted.

NINC(J) - Number of curvature increments in the Jth load range.

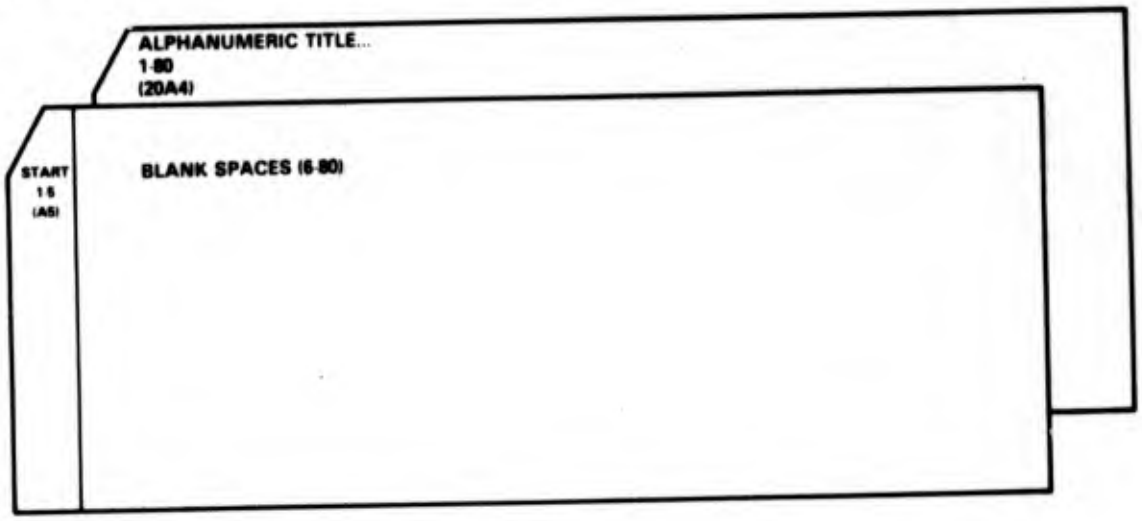
CINC(J) - Size of curvature increments (in units of length^{-1}) in the Jth load range. Positive curvature corresponds to hogging, negative to sagging. When a cross section has an initial strain distribution applied to it, the force and moment balance due to these prestrains can be evaluated by setting NLR=1, NINC(1) = 1, and CINC(1) = 0.0. The program will then compute the unbalanced force and cumulative moment due to these prestrains.

The input data involve both dimensional and nondimensional parameters. The program does not require that any specific units be used, but it does require that those used be a consistent set. That is, if pounds and inches are used for the weight and length units, all parameters that have dimensions involving weight or length must use pounds and inches. Since certain parameters have come to be associated with certain units (mainly through frequent use), it can be relatively easy to end up with an inconsistent set of data because certain parameters must be defined in terms of units not commonly associated with them.

INPUT DATA FORMAT

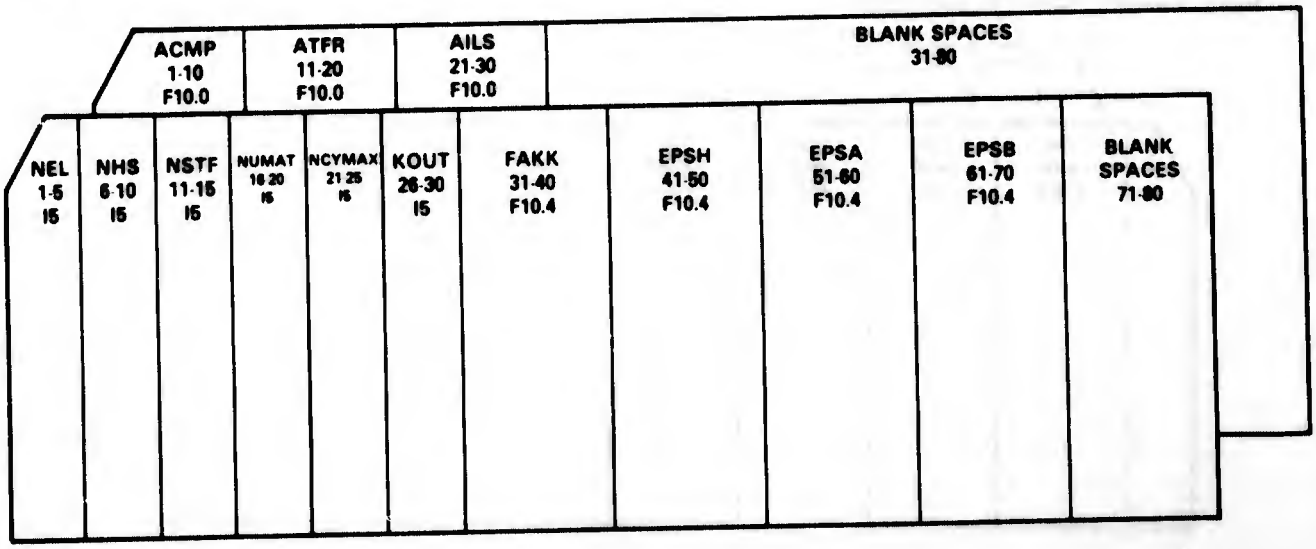
The following card images, in the order presented, constitute the input data and must be prepared according to the specified formats. It is important to distinguish between integer and real variables. The implicit scheme of FORTRAN IV is presumed in this respect; that is, names for integer variables are coded to begin with the letters I, J, K, L, M, or N, whereas the names of real variables begin with any of the remaining 20 letters of the alphabet. The numbers on the sample cards indicate the column numbers of the 80-column IBM card in which the respective values of the variables are punched. It is particularly important that integer variables in I-format and real variables in E-format be right adjusted in their respective columns.

INITIAL CARDS

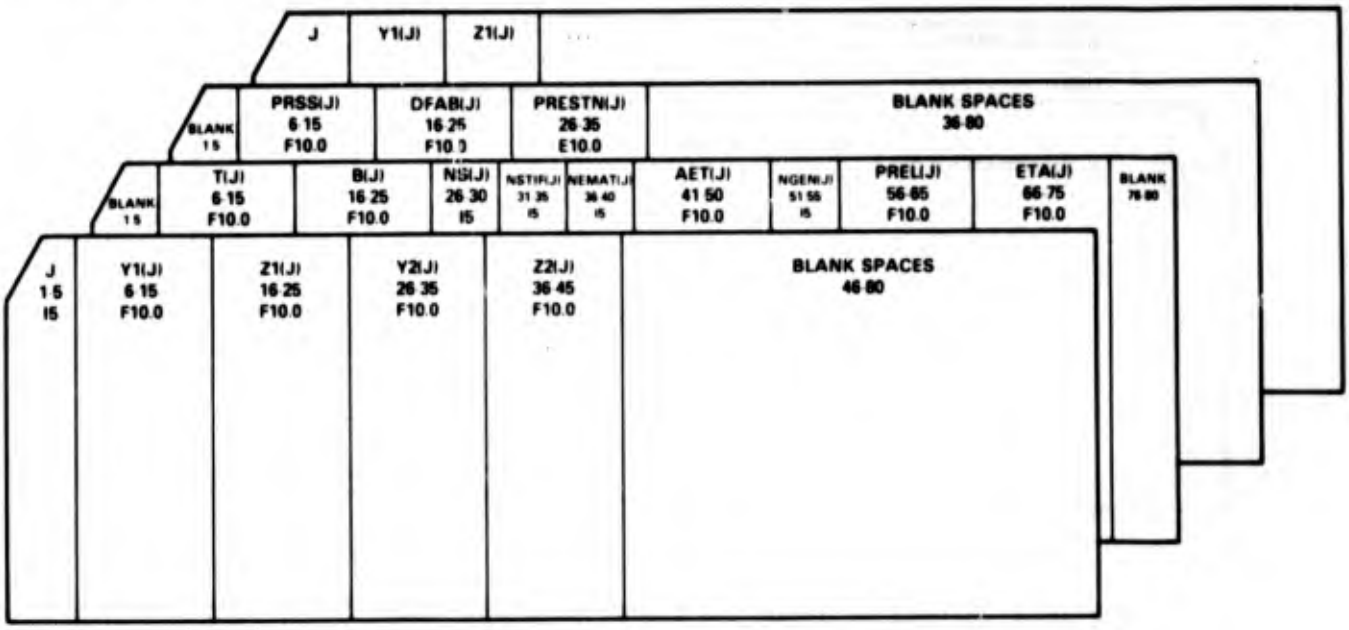


The first card or line of input data must have the word "START" punched in the first 5 columns. As indicated in the preceding section on definitions, this value must be assigned to the parameter CHECK to initiate program computation. The second card contains the 80 character (maximum) alphanumeric title, which is printed at the top of the first output page. Internally this title is stored as a 20-element array parameter HEAD.

GENERAL SECTION CHARACTERISTICS

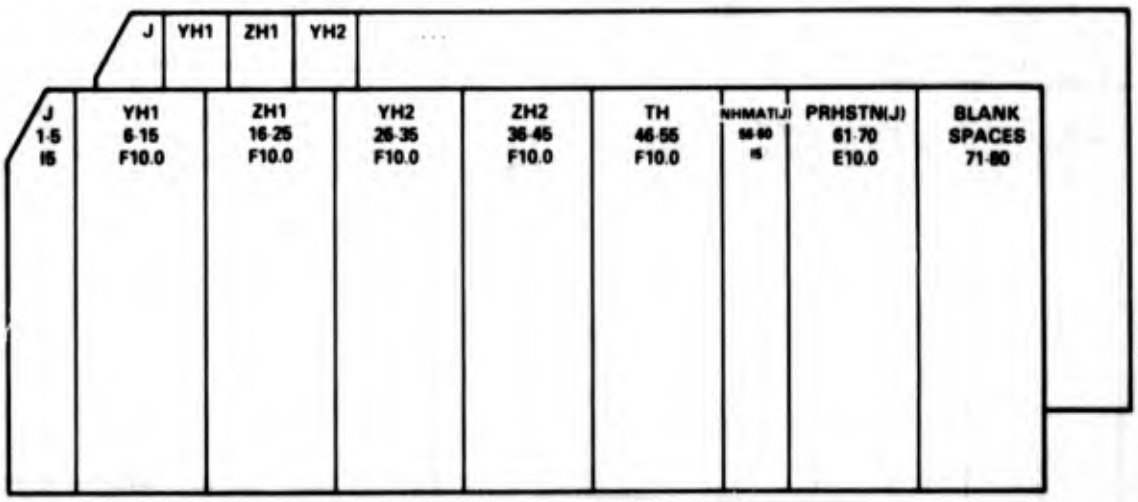


GROSS PANEL ELEMENT SPECIFICATIONS



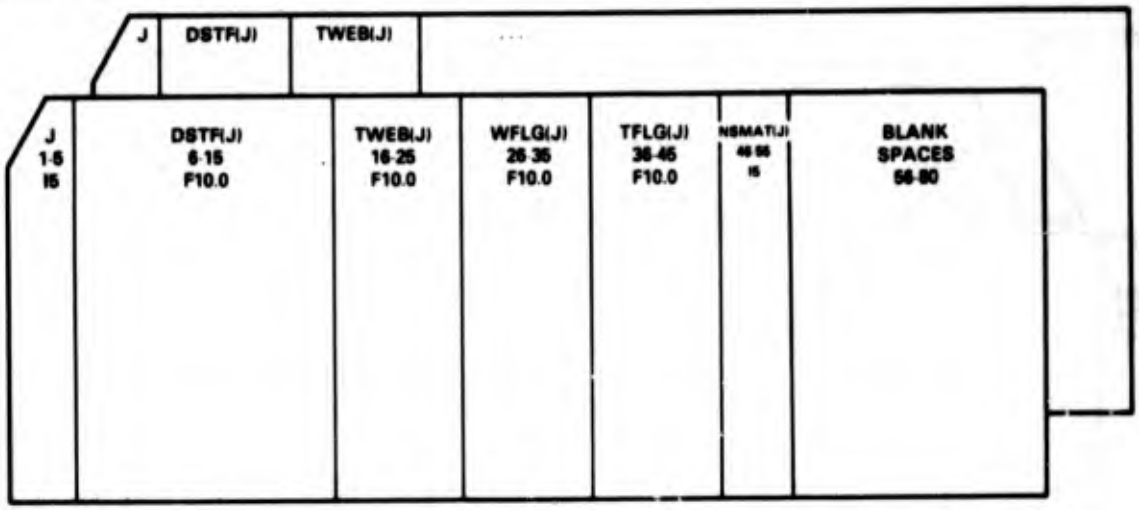
Three data cards, in the order shown, are required for each gross panel element. Gross panel elements must be numbered consecutively, starting from 1 (J = 1, 2, ..., NEL), with no gaps, but it is not necessary that the groups of three data cards be placed in this sequential order in the input data stream.

HARD CORNER SPECIFICATIONS



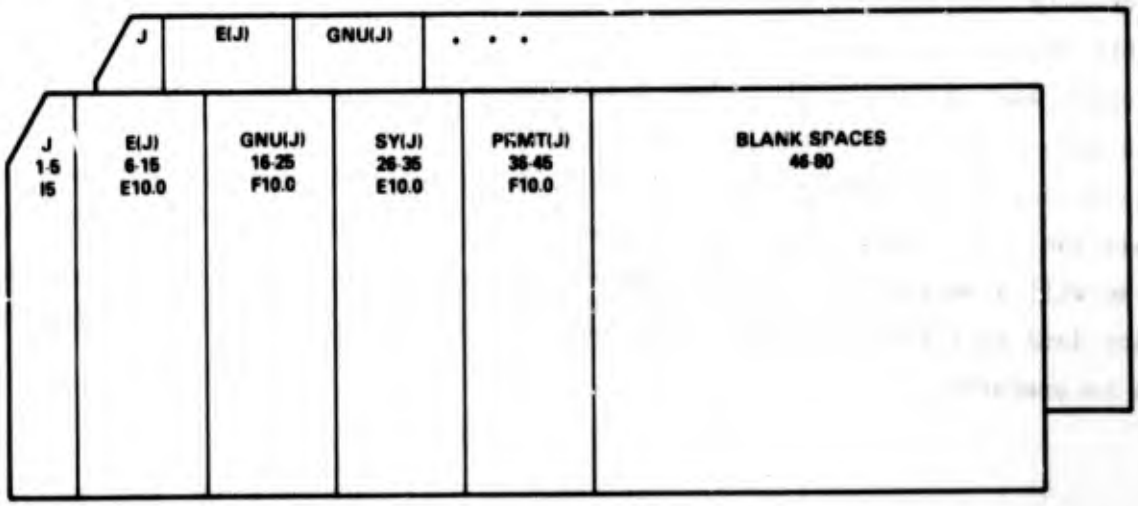
As with the gross panel elements, hard corners must also be numbered consecutively starting from 1, with no gaps, and may be placed in any sequence in the input data stream. If there are no hard corners, i.e., NHS = 0, these cards are omitted.

STIFFENER CHARACTERISTICS



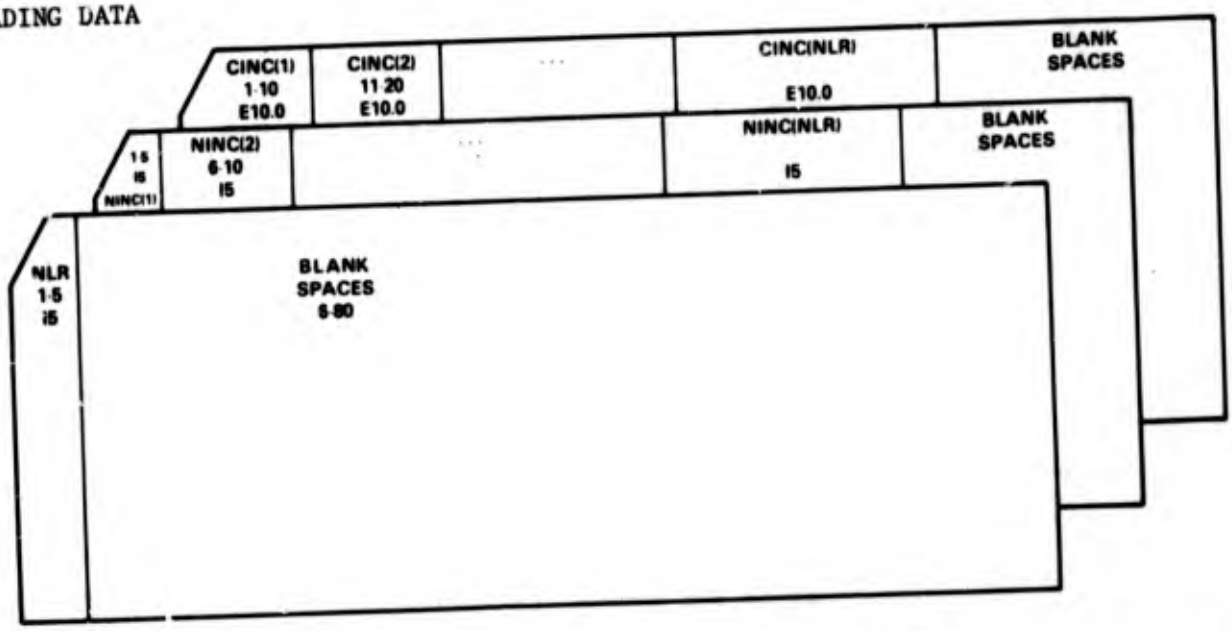
There is one stiffener card for each unique stiffener, thus resulting in a total of NSTF cards. They may appear in any sequence within their own group but, like the other data, they must be numbered consecutively starting from 1, without gaps.

MATERIAL SPECIFICATIONS



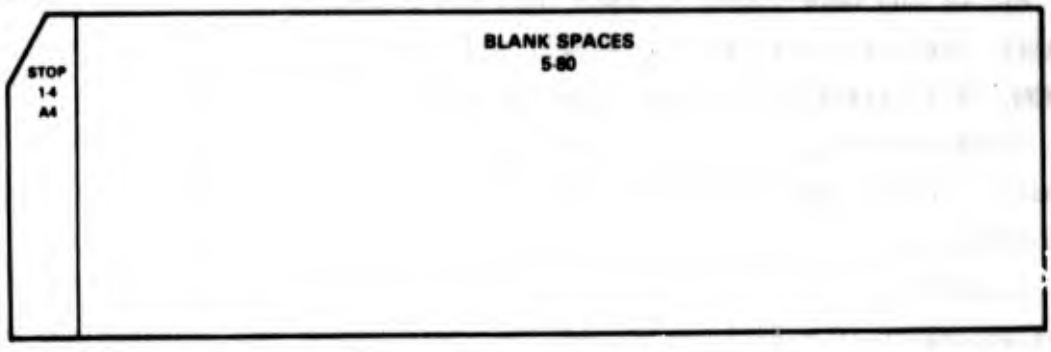
There is one material specification card for each material, making for a total of NUMAT cards. Gross panel elements, hard corners, and stiffeners may all reference the same material specification card. These cards may also be arranged in any order, but must be numbered consecutively starting from 1, without gaps.

LOADING DATA



Incremental loading data are provided in the formats shown above. If NLR is greater than zero, then the cards following for NINC(J) and CINC(J) are required. As currently dimensioned, one card will be adequate even for the maximum number of possible values for NINC(J); for CINC(J), however, two cards may be required since the format used (8E10.0) only allows a maximum of 8 entries per line or card. If NLR is zero or negative, then the cards for NINC(J) and CINC(J) are omitted. This may be desired, for example, when one needs the cross-section moment of inertia calculation to determine what size increments should be used. In this case the program will simply do all the preliminary calculations up to the point where the loading data have been provided. Data sets for additional problems following will still be executed.

EXIT CONTROL



The card with "STOP" punched in the first four columns is always the last entry in the data deck. It is not, however, the last card for each problem. If several problems are being run sequentially, the first card following the loading data cards will be the "START" card for the next problem data set. Only the final problem in the series will have a "STOP" card, and it will be the absolutely final data entry.

DESCRIPTION OF OUTPUT

Output from the program is, in general, self explanatory. No units are given, because, as previously explained, no specific units other than a consistent set are required. Including the chosen units in the problem header statement might be a wise approach.

The output from the program can be roughly divided into two sections, an "expanded" echo of the input data and the actual program output results labelled as the "Moment-Curvature History." A few explanatory notes concerning each section are appropriate.

INPUT DATA ECHO

This section is basically an echo of the input data and is intended primarily to allow data verification. As these data are presented, however, some changes and additional parameters appear, which require definition.

a. Parameters labelled "WIDTH," "SIN," and "COS" that appear with the gross panel element data refer to the width of the gross panel between side points and the sine and cosine of the angle of inclination of the panel to the horizontal, or z-axis.

b. All of the hard corner element data are presented in terms of the element's area (AREA), vertical lever arm (Y-COORD), and moment of inertia about its own centroid (MOM. IN.) regardless of what input data format was used.

c. Values of each stiffener's area (AREA), vertical moment of inertia (IZZ), and moment of inertia about its web plane (IYY) are provided along with its four physical dimensions. These values are for the stiffener alone.

d. In addition to the input parameters, the shear modulus, calculated according to the relationship ($G = E/(2(1+\nu))$), and the yield strain are provided for each material. When the proportional limit ratio is less than one, the lower linear portion of the material stress-strain curve is connected to the yield plateau by a section of a quadratic curve so that the material yield strain in this case, ε_y, is defined by the expression,

$$\varepsilon_y = \frac{\sigma_y}{E}(2-p_r)$$

e. If the output is requested using the parameter KOUT, an element by element breakdown is provided for the vertical moment of inertia calculation for the fully effective cross section. Each element is identified by its number, its type (GP for gross panels, HDCNR for hard corners), and its component ("P" for plating, "S" for stiffeners). Also provided is ET/E, the ratio of the component's modulus to the modulus of the reference material (material number one being used as the reference material), (ET/E)AREA, the components effective area, LEVER, the vertical lever arm, MOM1 and MOM2, the component's first and second moments, respectively, and I0, the component's moment of inertia about its own centroid. The results of the calculation are summarized at the bottom of the table. This summary is provided alone if the detailed output is not requested.

f. A table is provided that lists for each gross panel element the critical buckling strains and stresses for material yielding, Euler beam-column buckling (type 2 failure only), and stiffener tripping. These values effectively represent the "boundaries" between the zone of stable behavior and the second zone, or buckling (or yielding) plateau, discussed in an earlier section. These values are computed according to the theories described in the appendices. Scanning this table allows

the user to identify for each gross panel the critical failure mode, unless it happens to be beam-column buckling type 1, since the critical values for this mode are not at present included in the table.

g. The final data presented in the "input" section are referred to as the initial (unloaded) cross section characteristics. These values differ from those computed for the fully effective cross section only in that they include the influence of assumed residual stresses in reducing the effectiveness of plating loaded in compression. (The presence of residual stresses is included by means of the ETA(J) parameter.) Differences in the two sets of values are usually noticeable but not significant.

MOMENT-CURVATURE HISTORY

Data in tabular form for each gross panel element, and for each increment of curvature are provided in this section. The following elaborations are presented to more clearly define several key points in this output.

a. The term "CYCLE" refers to the iteration cycles used to determine instantaneous neutral axis location. A value of 1 indicates that the initial tolerance check (see EPSA) was met, a value of 2 indicates that the second but not the first (see EPSB) was met, and a value of 3 or greater indicates that the two-staged iteration procedure was required. If the default value of NCYMAX (=20) is used, a value of 21 for CYCLE indicates that the procedure did not converge in the allowed number of cycles. In general, a value of NCYMAX+1 will appear for CYCLE when this occurs.

b. The "instantaneous n.a. location (starting value)" refers to that value determined (if necessary) through the iteration procedure and used to produce the incremental strains presented in the table following.

c. For each gross panel element the table provides data on modulus (area weighted mean), incremental or reduced effective width ratio (BEP/B), cumulative effective width ratio (BE/B), usually referred to just as effective width, incremental strain, cumulative strain, cumulative stress (also an area weighted mean), and the failure code. A failure code of zero generally indicates no failure, that is, the gross panel is still in the zone of stable behavior. (A yield failure condition, however, will also indicate zero.) When buckling of some type occurs, this

code will indicate 1 for Euler beam-column buckling (type 1), 2 for Euler beam-column buckling (type 2), and 3 for stiffener tripping. A negative modulus indicates that failure has proceeded to the point where unloading, as defined earlier, is occurring.

d. After the new increment of curvature has been added, values are calculated that are, in effect, incremental values of neutral axis location and moment of inertia; they are to be used as the initial estimate for the addition of the next increment. These values are provided near the bottom of each table. Also provided here are the cumulative curvature, cumulative moment (which is the value that the user is primarily looking for), and the unbalanced force. The magnitude of the unbalanced force is a direct measure of how near to the correct location the instantaneous neutral axis for that particular increment has been placed.

e. To conserve space, no output is provided for the hard corner elements except for the last increment in each loading range. Since these elements exhibit considerably simpler behavior this state of stress and strain can readily be computed from the strain data for the gross panel elements and the material characteristics of the elements in question.

ILLUSTRATIVE EXAMPLES

Perhaps the most effective way to convey what use of this program involves is through illustrative examples. Two such examples, incorporating various degrees of complexity, are provided in this section. They were designed to touch on most of the features currently available in the program.

Figures 9 and 10 indicate the midship cross sections of the two vessels chosen for the examples. Figures 11 and 12 indicate the approximate locations and patterns of numbering of the gross panel and hard corner elements. The input data, translated into the appropriate formats, are provided in Figures 13 and 14.

The data in these figures are mostly self explanatory. Two minor points, however, are worth noting. As was previously described, the hard corner element data can be provided in one of two different formats; a careful examination of these data listings will provide examples of both. In addition, hard corner element number 16 of hull B illustrates the use of a "special material" with an artificially low "yield" strength to approximate the buckling behavior of a wide plate hard corner

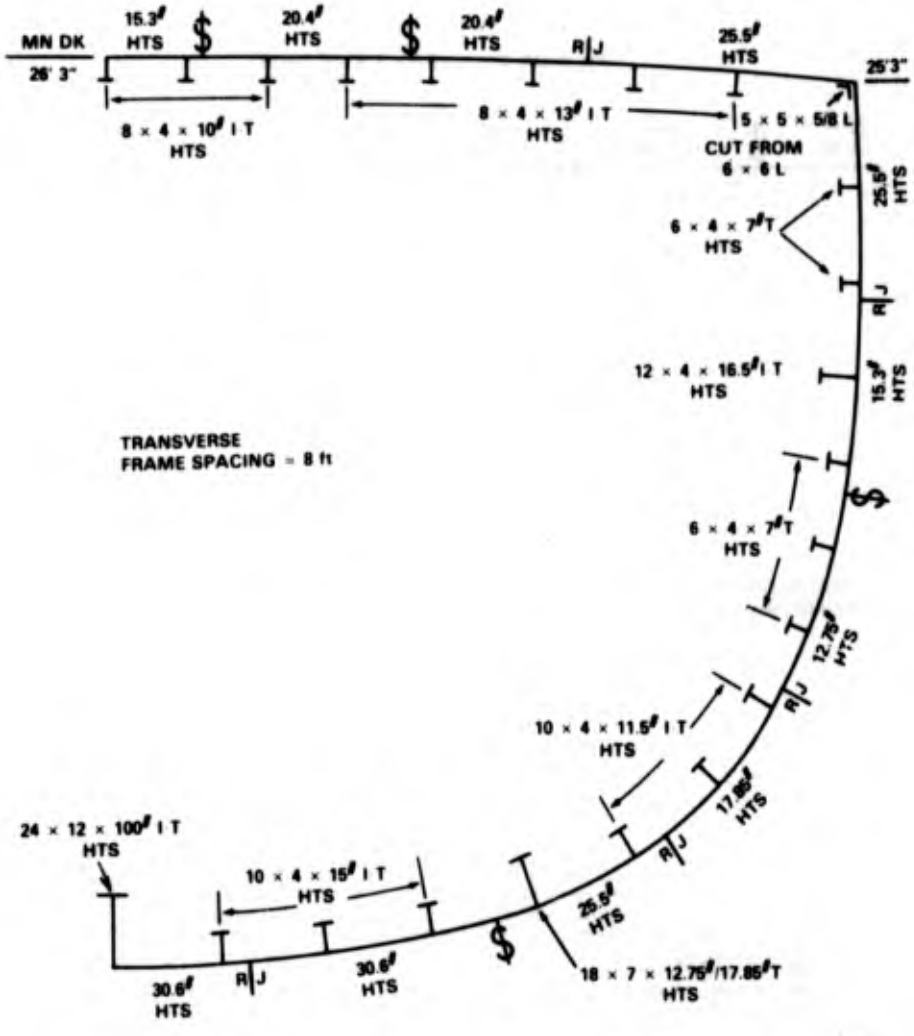


Figure 9 - Midship Section, Hull A

element. Although such an approach cannot provide unloading behavior, it can prevent the development of unreasonably high stress levels in elements where buckling can be expected to occur at stress levels well below the material's yield point.

The complete computer output listings for the two examples are provided in Appendix F. The previous section described what this output provides. Bending moment versus cumulative curvature from these data are plotted in Figures 15 and 16. These plots illustrate how the degree of redundancy of the structure influences the nature of the hull's behavior in the neighborhood of its peak, or ultimate, moment

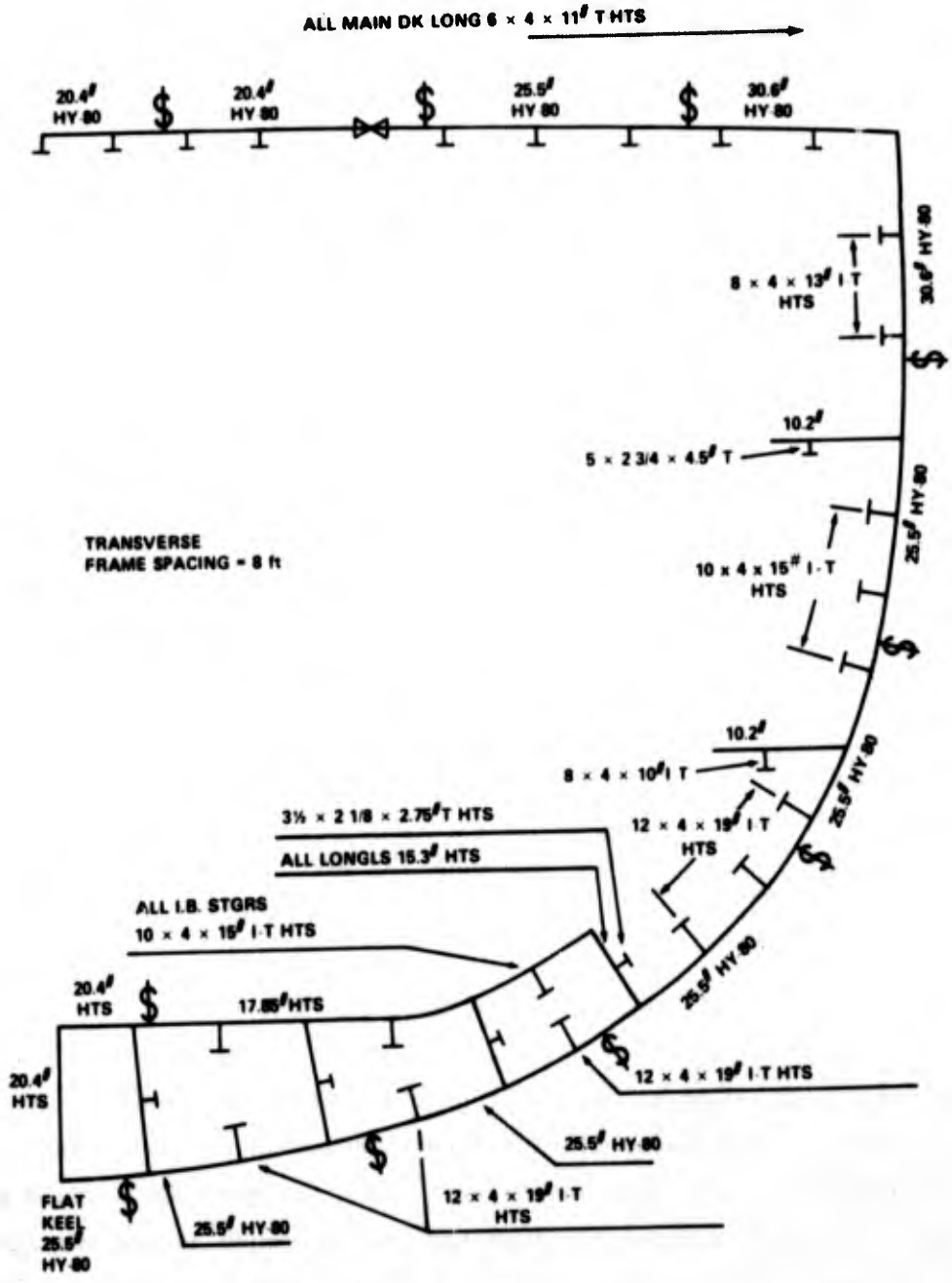


Figure 10 - Midship Section, Hull B

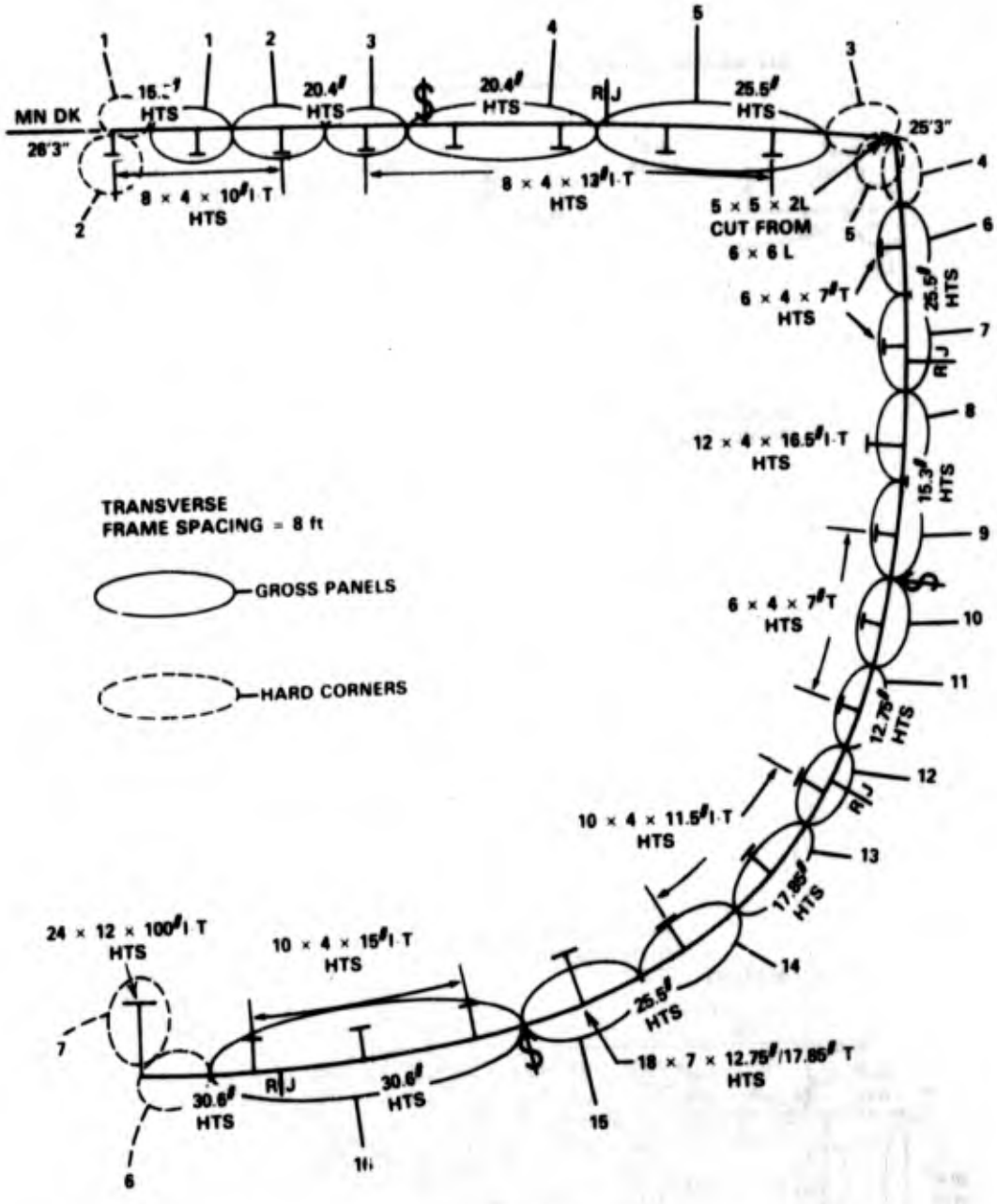


Figure 11 - Gross Panel and Hard Corner ID's, Hull A

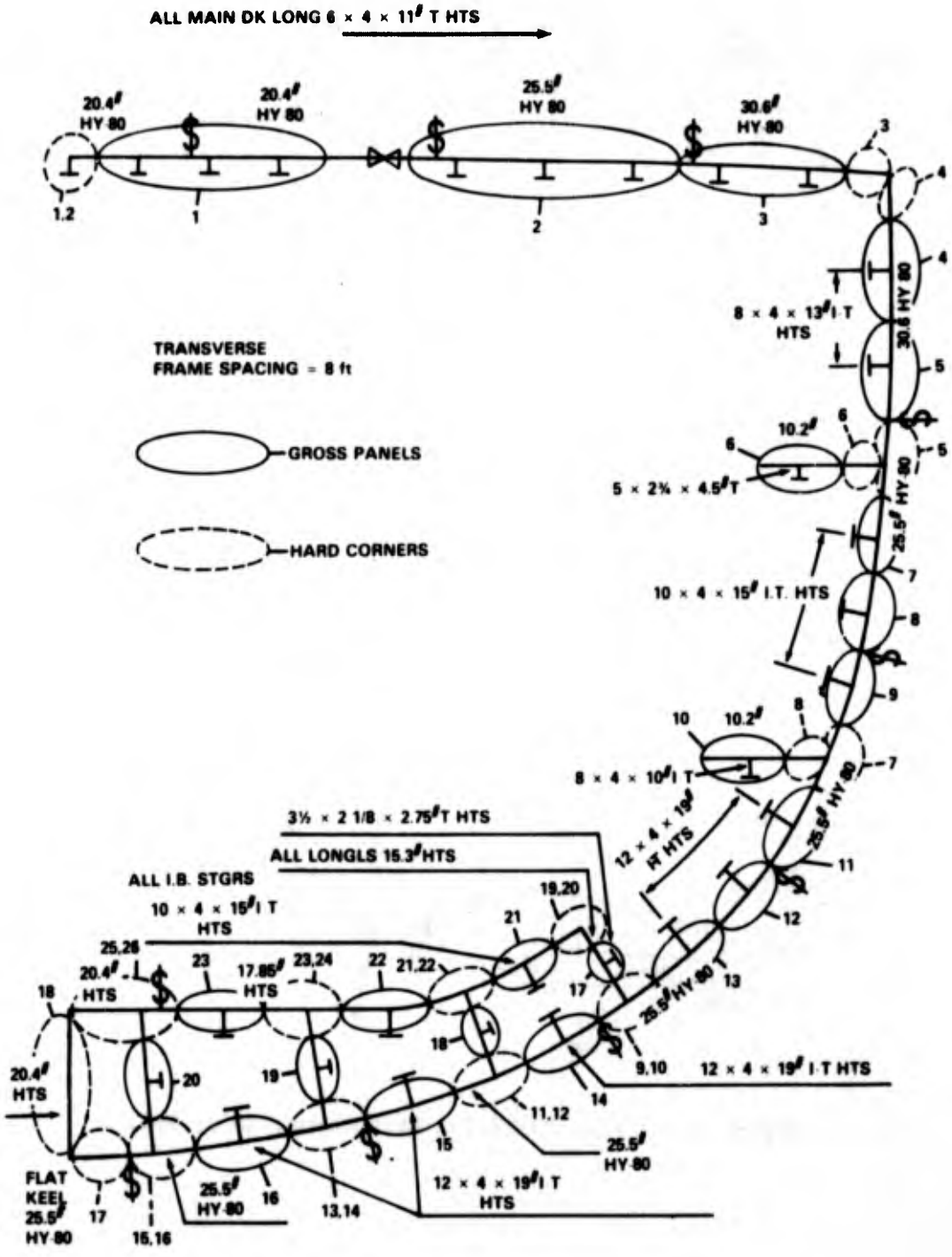


Figure 12 - Gross Panel and Hard Corner ID's, Hull B

Figure 13 - Input Data Listing for Hull A

```
START
ULTIMATE STRENGTH OF HULL A (NO ILS, AET=68.0) - HOGGING
   16     7     7     1          1
     480.0         96.0         68.0
    1      315.0        14.5       315.0        43.0
           0.375                   1    1     1                              3.0

    2      315.0        43.0       314.0        72.5
           0.500                   1    1     1                              3.0

    3      314.0        72.5       313.5       101.0
           0.500                   1    2     1                              3.0

    4      313.5       101.0       311.5       171.0
           0.500                   2    2     1                              3.0

    5      311.5       171.0       307.0       242.0
           0.625                   2    2     1                              3.0

    6      284.5       267.5       250.5       267.5
           0.625                   1    3     1                              3.0

    7      250.5       267.5       217.0       267.0
           0.625                   1    3     1                              3.0

    8      217.0       267.0       186.0       265.0
           0.375                   1    4     1                              3.0

    9      186.0       265.0       156.0       260.0
           0.375                   1    3     1                              3.0

   10      156.0       260.0       127.5       253.0
          0.3125                   1    3     1                              3.0

   11      127.5       253.0       100.0       242.0
          0.3125                   1    3     1                              3.0

   12      100.0       242.0        73.5       226.0
          0.4375                   1    5     1                              3.0

   13       73.5       226.0        47.0       202.0
          0.4375                   1    5     1                              3.0

   14       47.0       202.0        26.5       168.0
          0.625                    1    5     1                              3.0

   15       26.5       168.0        14.0       132.0
          0.625                    1    6     1                              3.0

   16       14.0       132.0         0.5        20.0
          0.750                    3    7     1                              3.0

    1      315.0         0.00      315.0        14.5      0.375    1
    2        1.10      309.7         7.8                          1
    3      307.0       242.0       303.0       267.5      0.625    1
    4      284.5       267.5       303.0       267.5      0.625    1
    5        6.25      302.0                                       1
    6        0.00        0.00        0.50       20.0      0.750    1
    7       10.36       17.04     661.5                          1
    1        7.90        0.17       3.94        0.20    1
```

Figure 13 (Continued)

```
     2       8.00        0.23        4.00        0.25     1
     3       5.96        0.20        3.97        0.22     1
     4      12.00        0.23        4.00        0.27     1
     5       9.86        0.18        3.95        0.20     1
     6      18.44        0.31        7.00        0.44     1
     7      10.00        0.23        4.00        0.27     1
     1     30.0E6        0.30    45000.0
     3
     6     2    10
     1.0E-6     0.5E-6     0.2E-6
START
ULTIMATE STRENGTH OF HULL A (NO ILS, AET=68.0) - SAGGING
    16     7     7     1
      480.0        96.0        68.0
     1      315.0        14.5      315.0        43.0
            0.375                  1     1     1                                  3.0

     2      315.0        43.0      314.0        72.5
            0.500                  1     1     1                                  3.0

     3      314.0        72.5      313.5       101.0
            0.500                  1     2     1                                  3.0

     4      313.5       101.0      311.5       171.0
            0.500                  2     2     1                                  3.0

     5      311.5       171.0      307.0       242.0
            0.625                  2     2     1                                  3.0

     6      284.5       267.5      250.5       267.5
            0.625                  1     3     1                                  3.0

     7      250.5       267.5      217.0       267.0
            0.625                  1     3     1                                  3.0

     8      217.0       267.0      186.0       265.0
            0.375                  1     4     1                                  3.0

     9      186.0       265.0      156.0       260.0
            0.375                  1     3     1                                  3.0

    10      156.0       260.0      127.5       253.0
           0.3125                  1     3     1                                  3.0

    11      127.5       253.0      100.0       242.0
           0.3125                  1     3     1                                  3.0

    12      100.0       242.0       73.5       226.0
           0.4375                  1     5     1                                  3.0

    13       73.5       226.0       47.0       202.0
           0.4375                  1     5     1                                  3.0

    14       47.0       202.0       26.5       168.0
            0.625                  1     5     1                                  3.0

    15       26.5       168.0       14.0       132.0
            0.625                  1     6     1                                  3.0

    16       14.0       132.0        0.5        20.0
            0.750                  3     7     1                                  3.0

     1      315.0         0.00      315.0         14.5      0.375     1
```

Figure 13 (Continued)

```
                                                                    1
2       1.10        309.7         7.8                               1
3     307.0         242.0       303.0       267.5       0.625       1
4     284.5         267.5       303.0       267.5       0.625       1
5      6.25         302.0                                           1
6      0.00           0.00        0.50      20.0         0.750      1
7     10.36          17.04      661.5                              1
1      7.90           0.17        3.94      0.20    1
2      8.00           0.23        4.00      0.25    1
3      5.96           0.20        3.97      0.22    1
4     12.00           0.23        4.00      0.27    1
5      9.86           0.18        3.95      0.20    1
6     18.44           0.31        7.00      0.44    1
7     10.00           0.23        4.00      0.27    1
1     30.0E6          0.30    45000.0
3
6     3   10
-1.0E-6    -0.5E-6    -0.2E-6
STOP
```

Figure 14 - Input Data Listing for Hull B

```
START
ULTIMATE STRENGTH OF HULL B (NO ILS, AET=68.0) - HOGGING
   23   26    8    4          1
     480.0       98.0       68.0
    1      369.0       13.5      369.0       94.5
           0.500                 3    1    1                        3.0

    2      368.0      130.0      367.0      229.0
           0.625                 3    1    1                        3.0

    3      367.0      229.0      364.0      295.0
           0.750                 2    1    1                        3.0

    4      345.0      310.0      309.0      310.0
           0.750                 1    2    1                        3.0

    5      309.0      310.0      273.0      310.0
           0.750                 1    2    1                        3.0

    6      255.0      262.0      255.0      288.0
           0.250                 1    3    3                        3.0

    7      242.5      307.0      213.5      304.0
           0.625                 1    4    1                        3.0

    8      213.5      304.0      186.5      298.0
           0.625                 1    4    1                        3.0

    9      186.5      298.0      159.0      291.0
           0.625                 1    4    1                        3.0

   10      147.0      238.0      147.0      276.0
           0.250                 1    5    3                        3.0

   11      134.0      280.0      108.0      265.0
           0.625                 1    6    1                        3.0

   12      108.0      265.0       85.0      245.0
           0.625                 1    6    1                        3.0

   13       85.0      245.0       65.0      222.0
           0.625                 1    6    1                        3.0

   14       49.0      193.0       35.0      173.0
           0.625                 1    6    1                        3.0

   15       23.5      145.0       15.0      112.5
           0.625                 1    6    1                        3.0

   16        8.0       80.0        3.0       48.0
           0.625                 1    6    1                        3.0

   17       77.0      197.0       63.0      206.0
           0.375                 1    7    2                        3.0

   18       53.0      152.0       38.0      157.0
           0.375                 1    7    2                        3.0

   19       43.0       91.0       22.0       94.5
           0.375                 1    7    2                        3.0
```

Figure 14 (Continued)

```
20      41.0        28.0        15.0        30.0                                3.0
        0.375                   1    7      2
21      77.0        182.0       65.0        160.0                               3.0
        0.4375                  1    8      2
22      56.0        135.0       54.0        105.0                               3.0
        0.4375                  1    8      2
23      54.0        73.0        54.0        43.0                                3.0
        0.4375                  1    8      2

 1      369.0       0.00        369.0       13.5        0.500       1
 2      1.62        364.5       11.70                               2
 3      364.0       295.0       363.0       310.0       0.750       1
 4      345.0       310.0       363.0       310.0       0.750       1
 5      242.5       307.0       273.0       310.0       0.625       1
 6      255.0       288.0       255.0       308.5       0.250       3
 7      134.0       280.0       159.0       291.0       0.625       1
 8      147.0       276.0       147.0       286.0       0.250       3
 9      49.0        198.0       65.0        222.0       0.625       1
10      57.0        210.0       63.0        206.0       0.375       2
11      23.5        145.0       35.0        173.0       0.625       1
12      29.0        159.0       38.0        157.0       0.375       2
13      8.0         80.0        15.0        112.5       0.625       1
14      11.5        96.0        22.0        94.5        0.375       2
15      3.0         48.0        0.0         24.0        0.625       1
16      2.0         31.0        15.0        30.0        0.375       2
17      0.0         0.0         0.0         24.0        0.625       1
18      0.0         0.0         54.0        0.0         0.250       4
19      77.0        197.0       83.5        193.0       0.375       2
20      77.0        182.0       83.5        193.0       0.4375      2
21      53.0        152.0       60.0        149.0       0.375       2
22      56.0        135.0       65.0        160.0       0.4375      2
23      43.0        91.0        54.0        89.0        0.375       2
24      54.0        73.0        54.0        105.0       0.4375      2
25      41.0        28.0        54.0        27.0        0.375       2
26      54.0        0.0         54.0        43.0        0.500       2
 1      6.16        0.26        4.03        0.42        2
 2      8.00        0.23        4.00        0.25        2
 3      5.00        0.16        2.68        0.20        3
 4      10.00       0.23        4.00        0.27        2
 5      7.90        0.17        3.94        0.20        3
 6      12.16       0.24        4.01        0.35        2
 7      3.50        0.13        2.08        0.18        2
 8      10.00       0.23        4.00        0.27        2
 1      30.0E6      0.30        80000.0
 2      30.0E6      0.30        45000.0
 3      30.0E6      0.30        33000.0
 4      30.0E6      0.30        11000.0
 2
 7   20
 1.0E-6     0.4E-6
START
ULTIMATE STRENGTH OF HULL B (NO ILS, AET=68.0) - SAGGING
   23   26     8     3
     480.0        96.0        68.0
 1      369.0       13.5        369.0       94.5                                3.0
        0.500                   3    1      1
 2      368.0       130.0       367.0       229.0                               3.0
        0.625                   3    1      1
```

Figure 14 (Continued)

3	367.0 0.750	229.0	364.0 2 1	295.0 1	3.0
4	345.0 0.750	310.0	309.0 1 2	310.0 1	3.0
5	309.0 0.750	310.0	273.0 1 2	310.0 1	3.0
6	255.0 0.250	262.0	255.0 1 3	288.0 3	3.0
7	242.5 0.625	307.0	213.5 1 4	304.0 1	3.0
8	213.5 0.625	304.0	186.5 1 4	298.0 1	3.0
9	186.5 0.625	298.0	159.0 1 4	291.0 1	3.0
10	147.0 0.250	238.0	147.0 1 5	276.0 3	3.0
11	134.0 0.625	280.0	108.0 1 6	265.0 1	3.0
12	108.0 0.625	265.0	85.0 1 6	245.0 1	3.0
13	85.0 0.625	245.0	65.0 1 6	222.0 1	3.0
14	49.0 0.625	198.0	35.0 1 6	173.0 1	3.0
15	23.5 0.625	145.0	15.0 1 6	112.5 1	3.0
16	8.0 0.625	80.0	3.0 1 6	48.0 1	3.0
17	77.0 0.375	197.0	63.0 1 7	206.0 2	3.0
18	53.0 0.375	152.0	38.0 1 7	157.0 2	3.0
19	43.0 0.375	91.0	22.0 1 7	94.5 2	3.0
20	41.0 0.375	28.0	15.0 1 7	30.0 2	3.0
21	77.0 0.4375	182.0	65.0 1 8	160.0 2	3.0
22	56.0 0.4375	135.0	54.0 1 8	105.0 2	3.0
23	54.0 0.4375	73.0	54.0 1 8	43.0 2	3.0

Figure 14 (Continued)

```
  1     369.0      0.00     369.0      13.5     0.500    1
  2      1.62     364.5     11.70                        2
  3     364.0     295.0     363.0     310.0     0.750    1
  4     345.0     310.0     363.0     310.0     0.750    1
  5     242.5     307.0     273.0     310.0     0.625    1
  6     255.0     288.0     255.0     308.5     0.250    3
  7     134.0     280.0     159.0     291.0     0.625    1
  8     147.0     276.0     147.0     286.0     0.250    3
  9      49.0     198.0      65.0     222.0     0.625    1
 10      57.0     210.0      63.0     206.0     0.375    2
 11      23.5     145.0      35.0     173.0     0.625    1
 12      29.0     159.0      38.0     157.0     0.375    2
 13       8.0      80.0      15.0     112.5     0.625    1
 14      11.5      96.0      22.0      94.5     0.375    2
 15       3.0      48.0       0.0      24.0     0.625    1
 16       2.0      31.0      15.0      30.0     0.375    2
 17       0.0       0.0       0.0      24.0     0.625    1
 18       0.0       0.0      54.0       0.0     0.250    2
 19      77.0     197.0      83.5     193.0     0.375    2
 20      77.0     182.0      83.5     193.0    0.4375    2
 21      53.0     152.0      60.0     149.0     0.375    2
 22      56.0     135.0      65.0     160.0    0.4375    2
 23      43.0      91.0      54.0      89.0     0.375    2
 24      54.0      73.0      54.0     105.0    0.4375    2
 25      41.0      28.0      54.0      27.0     0.375    2
 26      54.0       0.0      54.0      43.0     0.500    2
  1      6.16      0.26      4.03      0.42     2
  2      8.00      0.23      4.00      0.25     2
  3      5.00      0.16      2.68      0.20     3
  4     10.00      0.23      4.00      0.27     2
  5      7.90      0.17      3.94      0.20     3
  6     12.16      0.24      4.01      0.35     2
  7      3.50      0.13      2.08      0.18     2
  8     10.00      0.23      4.00      0.27     2
  1    30.0E6      0.30   80000.0
  2    30.0E6      0.30   45000.0
  3    30.0E6      0.30   33000.0
  3
  5     2   10
 -1.0E-6   -0.5E-6   -0.2E-6
STOP
```

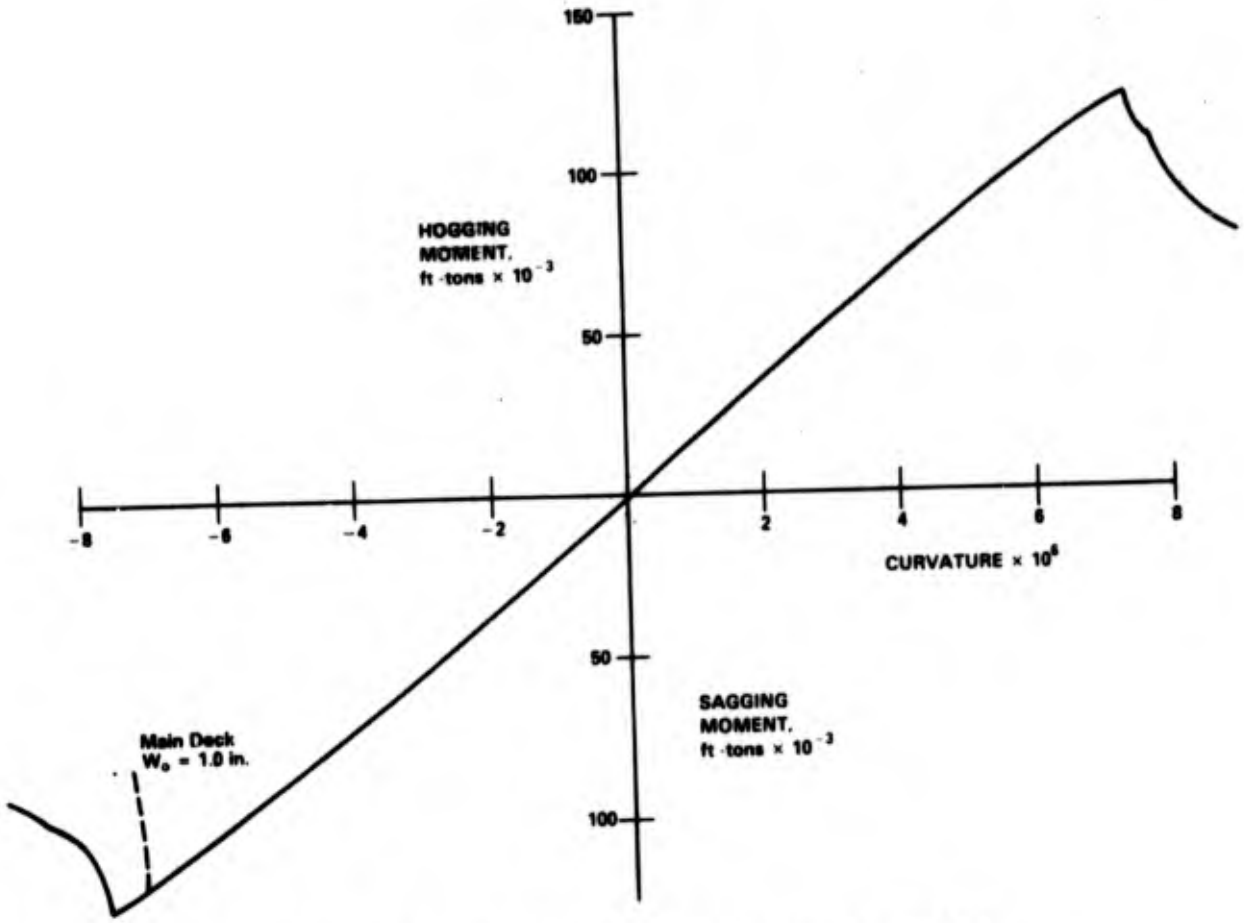


Figure 15 - Moment-Curvature Curve for Hull A

capacity. Where little redundancy exists, as in hull A, the collapse is characterized by a sudden and sizeable drop in moment capacity due to the often almost simultaneous collapse of major pieces of structure. Where greater redundancy exists, as in hull B, the collapse process is more gradual, with the successive failure of smaller units of structure, leading to a moment-curvature curve whose slope decreases in a more gradual manner until it eventually reaches zero and then turns negative at its peak moment. This peak moment is usually defined as the hull's "ultimate strength"; however, hulls with significant redundancy can have local moment peaks, that is, a moment-curvature behavior that builds up to a peak moment value, drops off a bit, and then builds up to a greater peak value before dropping off in capacity again. Certainly, in theory at least, more than one of these local peaks

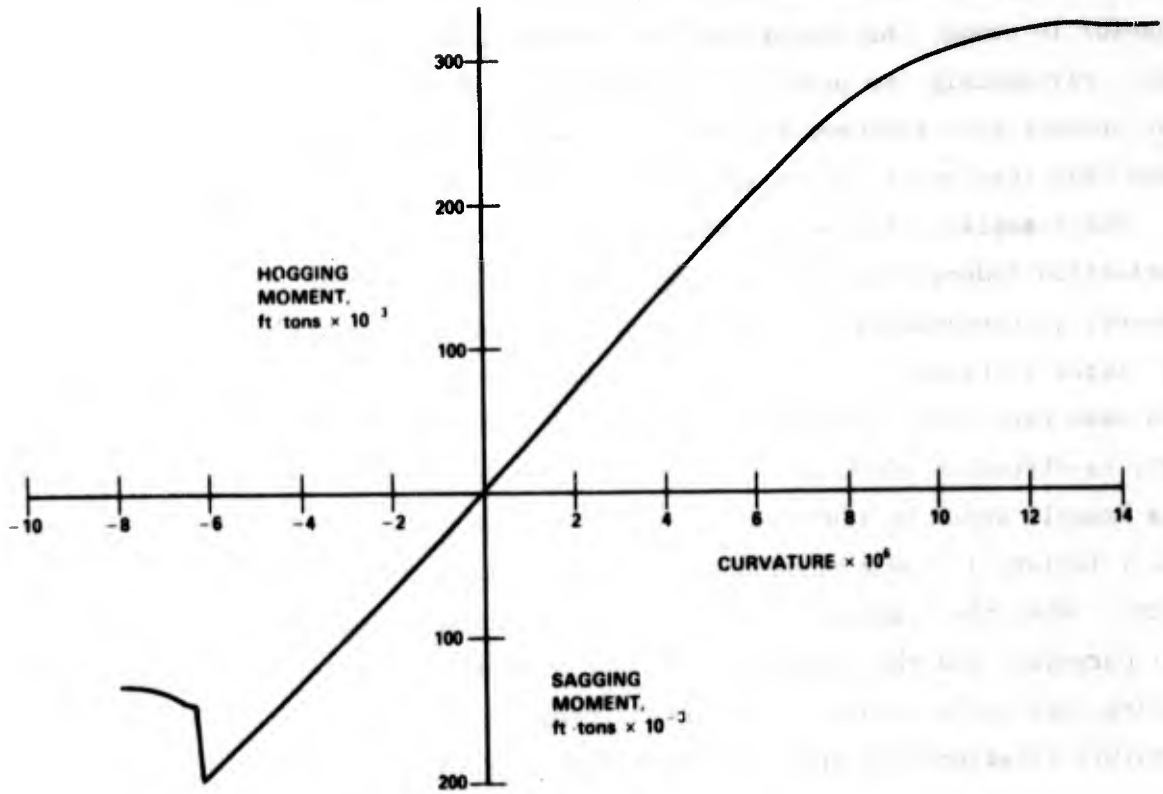


Figure 16 - Moment-Curvature Curve for Hull B

can occur, although whether this is likely in actual practice is problematical. When one or more such local peaks do occur, however, the issue of how to define the hull's ultimate strength becomes somewhat murky. If a definition is required, the interpretation probably will have to be made on a case-by-case basis, since not enough data exist at present to support any broad generalizations.

When a large piece of structure "fails" (most often this means moving into the zone of "unloading" behavior) a consequence often observed is the movement of the instantaneous neutral axis location outside of the confines of the hull cross section. (Mathematically this means that the increments of strain for each element must all be of the same sign to produce a zero force balance in the cross section.)

Such behavior may be noticed in the output for hull A. When this amount is very large, as it can be, then the viability of the predicted behavior for curvature increments imposed afterwards must be questioned. Although mathematically this behavior is sound, the concurrence of "Mother Nature" in this regard is not so certain. Fortunately the problem has been mainly academic so far, since the failures that produce this phenomenon virtually always cause the hull to collapse, which means that they occur in the immediate vicinity of the hull's peak bending moment.

The examples described to this point include neither lateral load nor fabrication-induced distortion. Input data for hull A, including both of these parameters (corresponding to a wave 20 ft high and lateral distortions equal to 1 in.), are listed in Figure 17. The moment-curvature results for the sagging condition in this case have been included on the plot of Figure 15. (The hogging condition moment curve is virtually identical to that for zero pressure.) The actual output data for this example would be identical in format to that already provided except that type 1 failure is now a possibility and could be so indicated under the FAILURE CODE column. When the loading conditions differ, the relationships between the cumulative hull curvature and the individual element strains can differ significantly from one loading case to the other. Thus considerable care is needed in comparing moment-curvature relationships when different loading conditions are involved.

CONCLUSIONS

When this project was first conceived about 2 years ago, the clear goal of all efforts was development of a preliminary working version of a computer program that would enable the structural naval architect to estimate the longitudinal bending moment capacity of a ship's hull with a minimum of effort. Because the effort was more a developmental than a research effort, it was understood from the beginning that "short cuts" and "gross approximations" would be needed in this preliminary version of the program. Therefore, we now hope that further research and development will address some of the recognized shortcomings, so as to put future editions of the program on a more solid footing. While not an all-inclusive list, several areas requiring further inquiry, which the author regards as more significant, are discussed below.

Figure 17 - Input Data Listing for Hull A Including Pressure Loading (Hogging) and Initial Distortion (Sagging)

```
START
ULTIMATE STRENGTH OF HULL A (NO ILS, AET=68.0, 20 FT. HEAD) - HOGGING
   16    7    7    1          1
    480.0        96.0        68.0
     1      315.0        14.5       315.0        43.0                                    3.0
            0.375                  1    1    1
     2      315.0        43.0       314.0        72.5                                    3.0
            0.500                  1    1    1
     3      314.0        72.5       313.5       101.0                                    3.0
            0.500                  1    2    1
     4      313.5       101.0       311.5       171.0                                    3.0
            0.500                  2    2    1
     5      311.5       171.0       307.0       242.0                                    3.0
            0.625                  2    2    1
     6      284.5       267.5       250.5       267.5                                    3.0
            0.625                  1    3    1
     7      250.5       267.5       217.0       267.0                                    3.0
            0.625                  1    3    1
            0.23
     8      217.0       267.0       186.0       265.0                                    3.0
            0.375                  1    4    1
            1.42
     9      186.0       265.0       156.0       260.0                                    3.0
            0.375                  1    3    1
            2.55
    10      156.0       260.0       127.5       253.0                                    3.0
          0 3125                   1    3    1
            3.64
    11      127.5       253.0       100.0       242.0                                    3.0
            0.3125                 1    3    1
            4.67
    12      100.0       242.0        73.5       226.0                                    3.0
            0.4375                 1    5    1
            5.67
    13       73.5       226.0        47.0       202.0                                    3.0
            0.4375                 1    5    1
            6.65
    14       47.0       202.0        26.5       168.0                                    3.0
            0.625                  1    5    1
            7.52
    15       26.5       168.0        14.0       132.0                                    3.0
            0.625                  1    6    1
            8.13
    16       14.0       132.0         0.5        20.0                                    3.0
            0.750                  3    7    1
            8.61
     1      315.0         0.00      315.0        14.5      0.375    1
     2        1.10      309.7         7.8                           1
     3      307.0       242.0       303.0       267.5      0.625    1
     4      284.5       267.5       303.0       267.5      0.625    1
     5        6.25      302.0                                       1
     6        0.00        0.00        0.50       20.0      0.750    1
     7       10.36       17.04     661.5                           1
     1        7.90        0.17       3.94        0.20    1
```

Figure 17 (Continued)

```
     2       8.00        0.23        4.00        0.25     1
     3       5.96        0.20        3.97        0.22     1
     4      12.00        0.23        4.00        0.27     1
     5       9.86        0.18        3.95        0.20     1
     6      18.44        0.31        7.00        0.44     1
     7      10.00        0.23        4.00        0.27     1
     1     30.0E6        0.30    45000.0
     3
     5    2   14
     1.0E-6     0.5E-6     0.2E-6
START
ULTIMATE STRENGTH OF HULL A (NO ILS, AET=68.0, 1.0 INCH DIST.) - SAGGING
    16    7    7    1
      480.0        96.0        68.0
     1      315.0        14.5       315.0        43.0
            0.375                    1    1    1                              3.0
                         1.0
     2      315.0        43.0       314.0        72.5
            0.500                    1    1    1                              3.0
                         1.0
     3      314.0        72.5       313.5       101.0
            0.500                    1    2    1                              3.0
                         1.0
     4      313.5       101.0       311.5       171.0
            0.500                    2    2    1                              3.0
                         1.0
     5      311.5       171.0       307.0       242.0
            0.625                    2    2    1                              3.0
                         1.0
     6      284.5       267.5       250.5       267.5
            0.625                    1    3    1                              3.0

     7      250.5       267.5       217.0       267.0
            0.625                    1    3    1                              3.0

     8      217.0       267.0       186.0       265.0
            0.375                    1    4    1                              3.0

     9      186.0       265.0       156.0       260.0
            0.375                    1    3    1                              3.0

    10      156.0       260.0       127.5       253.0
           0.3125                    1    3    1                              3.0

    11      127.5       253.0       100.0       242.0
           0.3125                    1    3    1                              3.0

    12      100.0       242.0        73.5       226.0
           0.4375                    1    5    1                              3.0

    13       73.5       226.0        47.0       202.0
           0.4375                    1    5    1                              3.0

    14       47.0       202.0        26.5       168.0
            0.625                    1    5    1                              3.0

    15       26.5       168.0        14.0       132.0
            0.625                    1    6    1                              3.0

    16       14.0       132.0         0.5        20.0
            0.750                    3    7    1                              3.0

     1      315.0         0.00      315.0        14.5      0.375    1
```

Figure 17 (Continued)

```
    2       1.10        309.7        7.8                                    1
    3      307.0        242.0      303.0       267.5       0.625           1
    4      284.5        267.5      303.0       267.5       0.625           1
    5       6.25        302.0                                               1
    6       0.00          0.00       0.50       20.0        0.750          1
    7      10.36         17.04     661.5                                    1
    1       7.90          0.17       3.94       0.20       1
    2       8.00          0.23       4.00       0.25       1
    3       5.96          0.20       3.97       0.22       1
    4      12.00          0.23       4.00       0.27       1
    5       9.86          0.18       3.95       0.20       1
    6      18.44          0.31       7.00       0.44       1
    7      10.00          0.23       4.00       0.27       1
    1     30.0E6          0.30   45000.0
    3
    5     2   14
   -1.0E-6    -0.5E-6    -0.2E-6
STOP
```

1. Plating Effectiveness - Plating effectiveness has been the focus of much research over many years. Here the question concerns the influence of buckling or initial distortion, or both, on the shear lag or effective breadth behavior of stiffened plating. This question has been raised because of the author's hypothesis that a reduced or incremental effective breadth concept should be employed (rather than "width") in computing the moment of inertia I of the plate-beam cross section for beam-column buckling, as defined by Equation (C.1) in Appendix C.

2. Tripping Failure - Improved predictive techniques for tripping failure are needed, particularly in the elasto-plastic range. This is especially significant for plate-beam cross sections incorporating stiffeners having lower yield strength materials (relative to their plating), since the theory currently used can never give tripping stresses greater in absolute magnitude than the stiffener yield stress. The validity of such predictions needs to be evaluated and modifications to the theory incorporated, as necessary.

3. Post-Buckling Behavior - Post-buckling behavior in general, involving all the modes of failure presently considered, probably includes the greatest number of gross approximations and educated guesses used in developing the program. Rigorous attack of this subject is incredibly complex, but recent advances in numerical analysis methods have clearly made certain types of post-buckling behavior analytically tractable. Perhaps the greatest challenge in this regard is to develop from these numerical analyses simplified, empirical relationships compatible with the program's method of operation.

4. New Capabilities - The preceding items have addressed shortcomings of the theories presently included in the program. This item, however, refers to developments that would increase the capability and applicability of the program. Such items might include: a) the addition of grillage general instability as a failure mode; b) the considerations of additional types of loading, such as shear, torsion, or horizontal bending; c) the effects of dynamic loading; and d) the consideration of transversely framed ship hulls. Certainly, other items could be added to the list.

The various shortcomings and limitations listed above do not imply that the program presented in this report has no practical value. On the contrary, the

several sample problems described pretty clearly demonstrate that even this initial version can provide a great deal of extremely useful information with relatively modest effort. This capability should prove valuable during preliminary hull design. And, at the very least, it should provide the basic building block for the future development of a more rigorous and comprehensive ultimate strength design tool.

ACKNOWLEDGMENTS

The author wishes to express his sincere appreciation to Dr. M. O. Critchfield and Mr. Michael R. Clark for their helpful suggestions and careful review of the organization and content of this report.

APPENDIX A

PLATING EFFECTIVENESS RELATIONSHIPS

Plating effectiveness relationships play an important role throughout the collapse mode theories summarized in the following appendices. Therefore the effectiveness relationships utilized in these theories are concisely presented here, with a minimum of theoretical and empirical back-up. For a more thorough description of the origins of these expressions, readers should consult the references cited. In this regard, however, an important point must be emphasized concerning the sign convention adopted. The assumption that tension is positive and compression is negative was chosen and strictly adhered to throughout this report. This poses a slight problem, because most of the references on compression behavior tend to assume the opposite, namely, that compression is positive. Thus the reader should keep this difference in mind when consulting any of the references cited in the appendices.

EFFECTIVE BREADTH

Effective breadth, closely related to the phenomenon of shear lag, is treated first because of the extremely simple form of the relationship assumed. Denoting the effective breadth by b_e, its relationship to the longitudinal frame spacing b is the following:

$$b_e = \frac{1}{2} b \tag{A.1}$$

This assumption is based on the work of Clarkson.[7]

EFFECTIVE WIDTH

The theory behind the effective width formulations is somewhat involved and is described in detail in References 1 and 2. The results of these developments are summarized here.

The effective width relationships can be represented in a more concise form if the plate slenderness parameter, β, is introduced. This parameter is defined as

$$\beta_e = \frac{b}{t} \sqrt{\frac{\sigma_{yp}}{E}} \tag{A.2}$$

where t = plate thickness

σ_{yp} = tensile yield stress of the plate material

E = Young's modulus of the plate material.

A modification of this slenderness, β_e, can also be defined

$$\beta_e = \frac{b}{t}\sqrt{\frac{-\sigma_e}{E}} \tag{A.3}$$

which is the original slenderness β with the yield stress replaced by the actual inplane compressive edge stress σ_e in the plating.

Using the above slenderness parameters, the effective width relationship utilized in the hull collapse program is the following:

$$\frac{b_e}{b} = \begin{cases} 1.0\ R_r & \beta_e \leq 1.0 \\ \left(\frac{2}{\beta_e} - \frac{1}{\beta_e^2}\right) R_r & \beta_e > 1.0 \end{cases} \tag{A.4}$$

In these expressions b_e now refers to the effective width and the term R_r is a residual stress reduction factor which is intended to take into account the reduction in plating effectiveness resulting from fabrication-induced residual stress. Introducing the constant parameter,

$$C_k = \frac{4\pi^2}{12(1-\nu_p^2)} \tag{A.5}$$

in which ν_p refers to the Poisson's ratio of the plate material, and the "structural tangent modulus ratio,"

$$\frac{E_t}{E} = \begin{cases} \left(\frac{C_k\beta^2}{C_k^2 + \frac{1}{4}\beta^4}\right)^2 & \beta^2 < 2C_k \\ 1.0 & \beta^2 \geq 2C_k \end{cases} \tag{A.6}$$

the residual stress reduction factor can be defined as follows,

$$R_r = \begin{cases} 1.0 + \left(\frac{\sigma_r}{\sigma_{yp}}\right)\frac{E_t}{E} & \beta \leq 1.0 \\ 1.0 + \left(\frac{\sigma_r}{\sigma_{yp}}\right)\frac{E_t}{E}\left(\frac{\beta^2}{2\beta-1}\right) & \beta > 1.0 \end{cases} \tag{A.7}$$

The ratio (σ_r/σ_{yp}) relates the level of compressive residual stress in the plating σ_r to the plate's yield stress. It is assumed that this compressive stress must balance the tensile yield zone along the edge of the stiffener induced by welding the stiffener to the plate. The width of this tensile block on each side of the stiffener is denoted by ηt and hence equilibrium requires that the level of residual compressive stress be defined by the relationship

$$\left(\frac{-\sigma_r}{\sigma_{yp}}\right) = \frac{2\eta}{(b/t)-2\eta} \tag{A.8}$$

Faulkner (Reference 1) recommends that values of η of 4.5 to 6 are typical for ships as welded, but values of 3 to 4.5 are more appropriate for design after allowing for shakedown.

Since the effective width as defined by Equation (A.4) is based on the total stress σ_e, it might be called a "cumulative" effective width. Closely related to this cumulative effective width is what has been termed a tangent width, reduced effective width, or even an incremental effective width, so called because it represents the effectiveness of the plating as it is stressed from the level σ_e to $\sigma_e + \Delta\sigma_e$. Denoting this quantity by b_e', it can readily be shown that if b_e' is defined as $\Delta P = \Delta\sigma_e b_e' t$, then this leads directly to the relationship

$$b_e' = b_e + \frac{db_e}{d(-\sigma_e)}(-\sigma_e) \tag{A.9}$$

Thus the formulation of b_e' is not independent of that for b_e, and if the above is applied to Equation (A.4), the result becomes

$$\frac{b'_e}{b} = \begin{cases} R_r & \beta_e \leq 1.0 \\ \frac{1}{\beta_e} R_r & \beta_e > 1.0 \end{cases} \qquad \text{(A.10)}$$

Note that if the effective width is not load dependent, then b_e and b'_e will be identical.

A similar parameter will also exist with respect to the concept of effective breadth. However with the assumption of effective breadth as defined by Equation (A.1), the effective breadth and the reduced or incremental effective breadth are identical.

APPENDIX B

BEAM-COLUMN COLLAPSE - TYPE 1

Consider a beam-column of length a as shown on Figure 3 loaded by a uniform lateral loading q (force per unit length) and an axial inplane force P and characterized by an initially distorted shape which is approximately represented by the function

$$w_o \sin \frac{\pi x}{a}$$

The behavior of this beam-column in terms of its additional lateral deflection w is described by the following differential equation,

$$EI \frac{d^2w}{dx^2} - Pw = Pw_o \sin \frac{\pi x}{a} - M_e - \frac{1}{2} qax + \frac{1}{2} qx^2 \qquad (B.1)$$

Since this beam-column is considered one of many repetitive elements (in the longitudinal direction) that are essentially similar in geometry and loading, the boundary conditions at its ends (where the support is provided by transverse web frames or bulkheads) are assumed clamped. With these assumptions, straightforward strength of materials methods can be used to determine the values of the bending moments (positive when the plate is in compression) at the beam-column's ends and center as well as its total ($w+w_o$) midpoint deflection. These moments and deflection are given by

$$M_e = \frac{\lambda}{\tan \lambda} \left[\frac{1}{4} q \left(\frac{a}{\lambda}\right)^2 + \frac{2w_o P}{\pi(1-\alpha)} \right] - \frac{1}{4} q \left(\frac{a}{\lambda}\right)^2 \qquad (B.2a)$$

for the ends and

$$M_c = \left[\frac{1}{4} q\lambda \left(\frac{a}{\lambda}\right)^2 + \frac{2\lambda w_o P}{\pi(1-\alpha)} \right] \sin \lambda + \left[\frac{\lambda}{\tan \lambda} \left| \frac{1}{4} q \left(\frac{a}{\lambda}\right)^2 + \frac{2w_o P}{\pi(1-\alpha)} \right| \right] \cos \lambda$$

$$- \frac{1}{4} q \left(\frac{a}{\lambda}\right)^2 - \frac{w_o P}{(1-\alpha)} \qquad (B.2b)$$

$$w_c = w_o + \frac{a^2}{4EI\lambda^2}\left[\left\{\frac{1}{4}\,q\left(\frac{a}{\lambda}\right)^2 + \frac{2Pw_o}{\pi(1-\alpha)}\right\}\left\{\lambda \sin\lambda + \frac{\lambda(\cos\lambda - 1)}{\tan\lambda}\right\}\right] - \frac{1}{32}\,q\,\frac{a^4}{EI\lambda^2} + \frac{\alpha w_o}{1-\alpha} \tag{B.2c}$$

for the center. In these expressions the parameters α and λ are defined as

$$\alpha = -\frac{Pa^2}{\pi^2 EI} \tag{B.3a}$$

$$\lambda = \pi\sqrt{\frac{1}{4}\alpha} \tag{B.3b}$$

in which the moment of inertia I is computed assuming an effective breadth of plating equal to b/2. (Note as previously indicated that the sign conventions adopted makes compression negative.) The above expressions are assumed valid provided that neither M_e nor M_c as defined above exceeds the fully plastic moment for the cross section. If either of them does, then modifications of the above expressions must be employed. Since idealized materials with no strain hardening are assumed, neither M_e nor M_c can exceed the fully plastic moment, M_{pl}. In general two possibilities exist. The first is that the end moments have reached $\pm M_{pl}$ (depending on the direction of loading and of w_o) while the center moment remains below this limit. In this case the moments and deflection are given by the expressions

$$M_e = \pm M_{pl} \tag{B.4a}$$

$$M_c = \left(\pm M_{pl} + \frac{1}{4}\,q\,\frac{a^2}{\lambda^2}\right)\tan\lambda \sin\lambda + \left(\pm M_{pl} + \frac{1}{4}\,q\,\frac{a^2}{\lambda^2}\right)\cos\lambda - \frac{1}{4}\,q\left(\frac{a}{\lambda}\right)^2 - \frac{Pw_o}{1-\alpha} \tag{B.4b}$$

$$w_c = w_o + \frac{a^2}{4EI\lambda^2}\left[\pm M_{pl} + \frac{1}{4}\,q\left(\frac{a}{\lambda}\right)^2\right]\left(\frac{1-\cos\lambda}{\cos\lambda}\right) - \frac{1}{32}\,q\,\frac{a^4}{EI\lambda^2} + \frac{\alpha w_o}{1-\alpha} \tag{B.4c}$$

If the center moment reaches the fully plastic moment before the end moments do, the situation is described by the following,

$$M_e = \frac{1}{\cos\lambda}\left[\pm M_{pl} + \frac{1}{4}\,q\left(\frac{a}{\lambda}\right)^2(1-\cos\lambda-\lambda\sin\lambda)+\frac{Pw_o}{1-\alpha}\left(1-\frac{2}{\pi}\lambda\sin\lambda\right)\right] \qquad (B.5a)$$

$$M_c = \pm M_{pl} \qquad (B.5b)$$

$$w_c = w_o + \frac{a^2}{4EI\lambda^2}\left[\left\{\frac{1}{4}\,q\left(\frac{a}{\lambda}\right)^2+\frac{2Pw_o}{\pi(1-\alpha)}\right\}\lambda\sin\lambda + \left\{M_e+\frac{1}{4}\,q\left(\frac{a}{\lambda}\right)^2\right\}(\cos\lambda-1)\right] - \frac{1}{32}\,q\,\frac{a^4}{EI\lambda^2}+\frac{\alpha w_o}{1-\alpha} \qquad (B.5c)$$

At some point, as the axial end displacement -u continues to increase,* the situation will be reached when both end and center moments are at their fully plastic values. When this occurs plastic hinges are assumed to form at the ends and center, and the beam-column is further deformed as rigid body motion of two bars linked together. In this case the total lateral deflection w_T of the midpoint of the beam-column is given approximately by

$$w_T = \pm\left[w_{cpl}^2+\frac{1}{2}\,a^2\left[\left(\frac{u}{a}\right)_{pl}-\left(\frac{u}{a}\right)+\frac{1}{2}\left\{\left(\frac{u}{a}\right)_{pl}^2-\left(\frac{u}{a}\right)^2\right\}\right]\right]^{1/2} \qquad (B.6)$$

where $(u/a)_{pl}$ is the value of axial end "strain" at which both M_e and M_c achieve their fully plastic value, (u/a) is the current value of this "strain," and w_{cpl} is the value of total lateral deflection (midpoint) corresponding to $(u/a)_{pl}$. In this situation as the beam-column is further compressed the lateral displacement w_T continues to grow. Since the moment capacity at the three hinge locations is limited by their respective fully plastic values, equilibrium can be maintained only if the absolute value of the axial force P decreases in the correct proportion. This is referred to as "unloading." If the values of the fully plastic moment for M_e and M_c are assumed to remain constant, then the relationship between lateral displacement and axial force for this unloading behavior is given by

---

*To be consistent with the convention for stresses, positive values of (u/a) are assumed tensile, and negative values compressive.

$$P = \left(M_{epl} - M_{cpl} + \frac{1}{8} qa^2\right) \Big/ w_T \qquad (B.7)$$

in which the terminology indicates that the respective fully plastic values for M_e and M_c (with their appropriate signs) are used. The assumption that the fully plastic moments remain constant as the compressive axial load decreases is clearly questionable; however, it is probably a conservative assumption, and developing a more mathematically rigorous description of the unloading phenomenon is beyond the scope of the present effort.

Since the total cross section moment for the hull is computed by integrating the stress over its effective area, the axial load above is converted to edge stress σ_e by simply dividing by the effective area A_e (based on the effective width b_e),

$$\sigma_e = P/A_e \qquad (B.8)$$

In this expression it is assumed that the effective area remains constant at the value corresponding to the peak value of P, namely that value occurring when the end shortening is equal to $(u/a)_{pl}$ and both M_e and M_c have just achieved their fully plastic values. Again, this is a debatable assumption that can be justified only by expediency and the recognition that a more rigorous treatment is a potential subject for future development. In any case, the stress computed according to Equation (B.8) is the actual edge stress only if stiffener and plate are of the same material; if stiffener and plate materials differ this stress is in effect a mean cross section stress. This is acceptable, however, since the integration for the computation of the longitudinal moment does not require that the precise state of stress in plate and stiffener be known in this case.

An estimate of the tangent modulus in the unloading region can be made by computing the derivative $d(\sigma_e)/d(u/a)$. (This parameter is used in the program to estimate the instantaneous neutral axis location.) This results in the expression

$$E_t \approx \frac{d(\sigma_e)}{d(u/a)} = \frac{1}{4} a^2 \frac{P}{A_e} \frac{1+(u/a)}{2} \frac{}{w_T} \qquad (B.9)$$

From the expressions presented it should be clear that the direction of w_o (indicated by its sign) can have a significant influence on the behavior of the beam-column. Since there is not enough experimental data from actual naval vessels to clearly define the directional patterns to be expected for w_o, it is assumed within the program that the distortion occurs in its potentially most damaging direction, that is, in the same direction as the applied lateral load. If no lateral load is present, a positive value of w_o is arbitrarily adopted since in this case the value of the axial collapse load is independent of the sign of w_o.

An example of load shortening curves for this type of collapse is provided in Figure 18. These curves do not exhibit the plateau described earlier and shown in Figure 4. This is because the assumption has been made that the relationship between axial end stress σ_e and displacement u remains linear until all three plastic hinges have formed. Once this occurs additional end displacement will thus result in an immediate "dropping off" in the value of the equilibrium end stress.

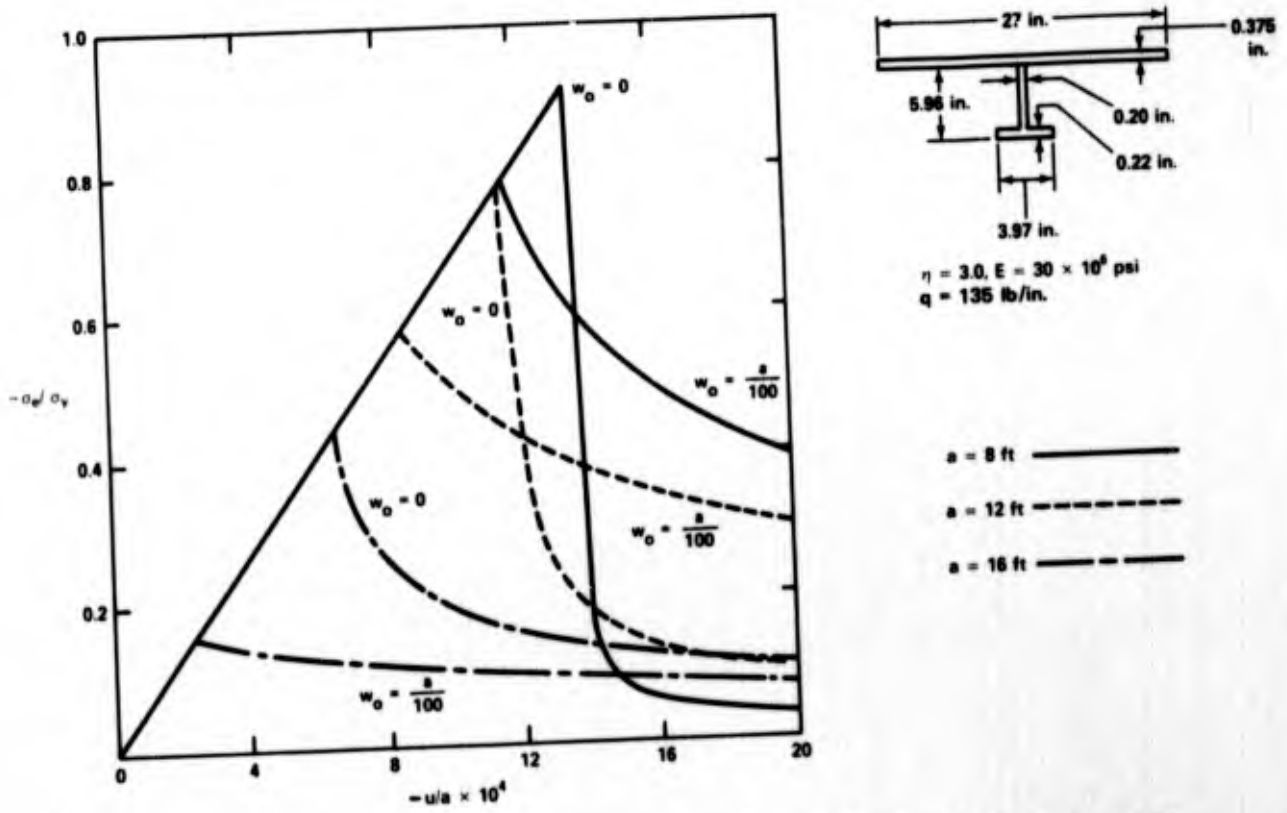


Figure 18 - Load Shortening Curves for Beam-Column Collapse (Type 1)

APPENDIX C

BEAM-COLUMN COLLAPSE - TYPE 2

In contrast with the type 1 form of beam-column collapse, beam-columns can also collapse in a mode in which the lateral deflections alternate in directions from one bay to the next. In this case the beam-column behaves more as if it were simply supported at the support points provided by the transverse web frames and bulkheads. Although the theory summarized in the following differs in some respects, many aspects of the development can be found in considerably greater detail in References 1 and 2.

Consider first the situation where a straight column of length a is loaded only by an axial load. The elastic buckling load for the column is calculated according to the relationship

$$\sigma_{cre} = -\frac{\pi^2 EI}{A_e a^2} \tag{C.1}$$

in which the moment of inertia I of the combined plate-stiffener cross section is based on the reduced effective width b_e', whereas the effective area A_e is based on the effective width b_e.

If both plate and stiffener materials are identical then the elastic buckling stress is modified using the tangent modulus as follows

$$\sigma_{cr} = \left(\frac{E_t}{E}\right) \sigma_{cre} \tag{C.2}$$

In this case the tangent modulus is approximated using the Ostenfeld-Bleich quadratic parabolae, namely

$$\frac{E_t}{E} = -\frac{4\sigma(\sigma_y+\sigma)}{\sigma_y^2} \tag{C.3}$$

Replacing σ by σ_{cr} above leads to the expression for the inelastic column buckling stress

$$\frac{\sigma_{cr}}{\sigma_y} = \begin{cases} \dfrac{\sigma_{cre}}{\sigma_y} & -\sigma_{cre} \leq \frac{1}{2}\sigma_y \\ -1 - \frac{1}{4}\left(\dfrac{\sigma_y}{\sigma_{cre}}\right) & -\sigma_{cre} > \frac{1}{2}\sigma_y \end{cases} \tag{C.4}$$

Since b_e and b_e' are stress dependent, the above equations must be solved in an iterative fashion, the cycles completed only when the stress value assumed in computing b_e and b_e' is "tolerably" close to the computed value of σ_{cr}.

If the plating and stiffener materials have different yield strengths, then the above computation procedure must be modified somewhat. In this case the inelastic "modification" depends on which material has the higher yield stress. If the plating tensile yield, σ_{yp}, is greater than that of the stiffener, σ_{ys}, the inelastic column buckling stress is based on an area-weighted mean yield stress, σ_{ym}, in the following manner

$$\frac{(\sigma_{cr})_m}{\sigma_{ym}} = \begin{cases} \dfrac{\sigma_{cre}}{\sigma_{ym}} & -\sigma_{cre} \leq \frac{1}{2}\sigma_{ym} \\ -1 - \frac{1}{4}\left(\dfrac{\sigma_{ym}}{\sigma_{cre}}\right) & -\sigma_{cre} > \frac{1}{2}\sigma_{ym} \end{cases} \tag{C.5}$$

where

$$\sigma_{ym} = \frac{\sigma_{yp} bt + \sigma_{ys} A_s}{bt + A_s} \tag{C.6}$$

and A_s is the stiffener cross section area. Equation (C.5) is used only if the absolute value computed from $(\sigma_{cr})_m$ is less than σ_{ys}; otherwise, the critical inelastic stress is set equal to $-\sigma_{ys}$. Since the current procedure allows differences only in yield strengths between plate and stiffener materials (no modulus variations acceptable), values of $(\sigma_{cr})_m$ calculated from Equation (C.5) correspond to the stress levels in both plate and stiffener.

If $\sigma_{ys} > \sigma_{yp}$, the inelastic modification is made with respect to the higher yield stress material, namely

$$\frac{(\sigma_{cr})_{stiff}}{\sigma_{ys}} = \begin{cases} \dfrac{\sigma_{cre}}{\sigma_{ys}} & -\sigma_{cre} \leq \dfrac{1}{2}\sigma_{ys} \\ -1 - \dfrac{1}{4}\left(\dfrac{\sigma_{ys}}{\sigma_{cre}}\right) & -\sigma_{cre} > \dfrac{1}{2}\sigma_{ys} \end{cases} \tag{C.7}$$

Once the inelastic buckling stress is computed for the stiffener material using the above expressions, the inelastic stress level for the plating is computed simply from the condition of strain compatability of the two components and the knowledge of the two materials' stress-strain curves. Except for these modifications, the iteration procedure for similar versus different materials is identical.

When the end shortening u/a reaches the value of the strain corresponding to the inelastic column buckling stress, the column is assumed to have buckled. As the shortening increases beyond this value the edge stress on the column (and hence the axial load P) is assumed to remain at the inelastic buckling value while lateral deflections at the midpoint of the column grow according to the relationship

$$w = \frac{2a}{\pi}\sqrt{\left(\frac{u}{a}\right)_{cr} - \left(\frac{u}{a}\right)} \tag{C.8}$$

where $(u/a)_{cr}$ is the end shortening corresponding to σ_{cr} and (u/a) the current value of the shortening. [The origin of Equation (C.8) is in nonlinear slender column theory.] Provided that Pw remains less than the fully plastic moment at the center of the beam (taking into consideration the appropriate signs of the moment), the axial inplane stress σ_e and hence load P remains constant as previously indicated.

At some value of (u/a) the applied moment Pw will reach and then exceed the fully plastic value, which is the maximum value the column can support. As the shortening continues to grow beyond this value, unloading must occur if the column is to remain in equilibrium. Thus the absolute magnitude of the axial load will drop in accordance with the relationship

$$P = \pm M_{pl}/w \tag{C.9}$$

As with type 1 beam-column collapse, the assumption is made that the fully plastic moment M_{pl} and the effective area remain constant [at the values corresponding to $(u/a)_{cr}$] during the unloading process. Thus the edge stress (representing a mean value if plate and stiffener materials differ) is simply determined according to

$$\sigma_e = P/A_e \tag{C.10}$$

The presence of lateral pressure or fabrication distortion or both is assumed not to influence the critical stress σ_{cr} at which buckling in this mode occurs. What pressure and distortion can do, however, is to force the column to fail by the type 1 mode of failure (already discussed in the preceding Appendix B) or to alter the behavior of the column in the post-buckling regions. This change in post-buckling behavior is addressed in the following paragraphs.

At or just before the occurrence of buckling, according to the theory presented in Appendix B, a certain moment and deflected state exist in the beam-column due to the combined action of the axial and lateral loads and the initial distortion. These moments and deflections, denoted here by M_{ecr}, M_{ccr}, and w_{Tcr} for convenience, are computed according to Equations (B.2), (B.4) or (B.5), whichever is appropriate. After buckling occurs, the moment state at the ends defined by M_{ecr} is assumed to be essentially "locked in" (since it arises from the loads still present) and the total midpoint lateral deflection then becomes the sum of w_{Tcr} and an additional amount given by Equation (C.8), and denoted here by w_b. In this condition equilibrium of moments requires that the center moment be equal to

$$M_c = M_{ecr} + \frac{1}{8} qa^2 - P(w_{Tcr}+w_b) \tag{C.11}$$

When w_b grows to the point where M_c reaches its fully plastic value, a plastic hinge will form at the center and further shortening will require that unloading occur. (As with the zero pressure case, it is assumed that P remains constant up to this point in the post-buckling range.) This value of w_b, called w_{bpl}, is given by

$$w_{bpl} = \frac{M_{ecr} - M_{cpl} + \frac{1}{8} qa^2}{P} - w_{Tcr} \tag{C.12}$$

where, as before, M_{cpl} indicates the center moment at its fully plastic value.

Because of the alternating nature of the buckling pattern a hinge at the center is all that is required to cause the beam-column to behave like two rigid, linked bars. Consequently, after the formation of the hinge, the total lateral deflection of the midpoint of the beam-column is given approximately by

$$w_T = \pm \left[(w_{Tcr} + w_{bpl})^2 + \frac{1}{2} a^2 \left[\left(\frac{u}{a}\right)_{pl} - \left(\frac{u}{a}\right) + \frac{1}{2} \left| \left(\frac{u}{a}\right)^2_{pl} - \left(\frac{u}{a}\right)^2 \right| \right] \right]^{1/2} \tag{C.13}$$

where $(u/a)_{pl}$ is the value of axial end shortening corresponding to w_{bpl} and is obtained from Equation (C.8) by rearranging and substituting w_{bpl} for w, resulting in

$$\left(\frac{u}{a}\right)_{pl} = \left(\frac{u}{a}\right)_{cr} - \frac{1}{4} \left(\frac{\pi w_{bpl}}{a}\right)^2 \tag{C.14}$$

Using Equation (C.13) for w_T, the axial load required so that equilibrium is maintained and the resulting axial stress are the following:

$$P = \frac{M_{ecr} - M_{cpl} + \frac{1}{8} qa^2}{w_T} \tag{C.15}$$

$$\sigma_e = P/A_e \tag{C.16}$$

This approach also relies on the assumptions that effective areas and fully plastic moments remain constant during unloading. In addition, however, certain inconsistencies in this approach have effectively been ignored. Primarily this involves the fact that although the buckling pattern is an alternating one, the lateral pressure loading is not, so that in reality, plastic hinges generally will not form at the

midspans simultaneously in adjacent beam-columns. The ramifications of ignoring this are not at all clear; it can only be hoped that this results in a conservative estimate of the beam-column's behavior. Our ignorance of elasto-plastic behavior in the post-buckling range is great, and yet some approach must be adopted here. This is the primary justification for the approach chosen. Future versions of this preliminary program may benefit from the development of more rigorous, or at least more consistent, solutions.

In any case, as with the type 1 failure mode, the tangent modulus in the unloading region can readily be estimated. This gives the identical form

$$E_t \approx \frac{1}{4} a^2 \left(\frac{P}{A_e}\right) \frac{1+(u/a)}{w_T^2} \qquad \text{(C.17)}$$

The inconsistencies alluded to earlier in this appendix also arise in regard to the choice of the appropriate sign for the fabrication distortion w_o. As with type 1 failure, the direction of w_o is assumed to be identical to the direction of the lateral loading for determining the moment state at buckling, but the direction of the fabrication distortion in adjacent longitudinal bays and its precise interaction with the bay in question is effectively ignored, and hence the inconsistencies arise. When no lateral load is present, w_o is assumed to follow an alternating pattern because this is clearly the most severe situation in this case.

Examples of load shortening curves for this collapse mode are provided in Figure 19.

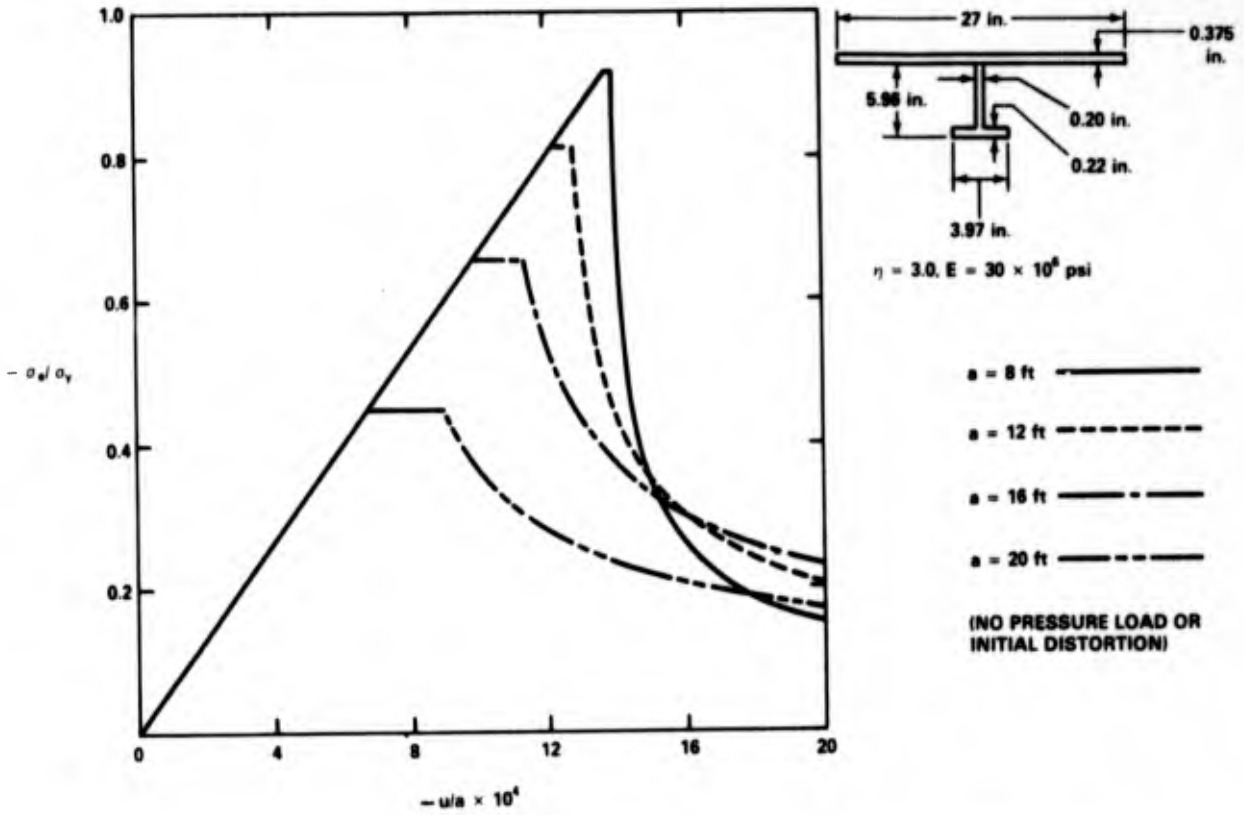


Figure 19 - Load Shortening Curves for Beam-Column Collapse (Type 2)

APPENDIX D

STIFFENER TRIPPING COLLAPSE

A comprehensive treatment of stiffener tripping (but not including post-buckling behavior) has recently been published and is listed as Reference 4. For the development of the theories summarized below readers should consult that reference.

The elastic inplane tripping stress (denoted here by $-\sigma_{cre}$) for a stiffener under inplane axial loading can be written in the form of a quadratic equation as follows,

$$(-\sigma_{cre})^2 (k_2k_4-k_6^2) + (-\sigma_{cre})(k_1k_4+k_2k_3-2k_5k_6) + (k_1k_3-k_5^2) = 0 \qquad (D.1)$$

in which the k_j's are defined as

$$k_1 = EI_z \left(\frac{m\pi}{a}\right)^2 + 3\frac{D_w}{d_c^3}\left(\frac{a}{m\pi}\right)^2 (1+3R)$$

$$k_2 = -A_s + d_c t_w \left(\frac{18}{35} + \frac{19}{140} R - \frac{3}{140} R^2\right)$$

$$k_3 = GJ + E\Gamma \left(\frac{m\pi}{a}\right)^2 + \frac{3D_w}{d_c}\left(\frac{a}{m\pi}\right)^2 \left(1+\frac{1}{3} R\right) \qquad (D.2)$$

$$k_4 = - I_{ps} + d_c^3 t_w \left(\frac{11}{35} + \frac{1}{84} R - \frac{1}{420} R^2\right)$$

$$k_5 = - \frac{3D_w}{d_c^2}\left(\frac{a}{m\pi}\right)^2 (1+R)$$

$$k_6 = d_c^2 t_w \left(\frac{3}{35} - \frac{17}{420} R + \frac{1}{140} R^2\right)$$

Many of the parameters appearing in Equation (D.2) are defined on Figure 20. The rest are defined below.

D_w - Flexural Rigidity of Stiffener Web

$$D_w = \frac{Et_w^2}{12(1-\nu_s^2)}$$

A_s - Stiffener Cross Section Area

$$A_s = d_w t_w + f_w t_f$$

I_{ps} - Polar Moment of Inertia About Shear Center

$$I_{ps} = I_p + A_s d_c^2 - 2A_s d_c \bar{z}$$

G - Stiffener Material Shear Modulus

$$G = \frac{E}{2(1+\nu_s)}$$

m - Tripping Mode Number

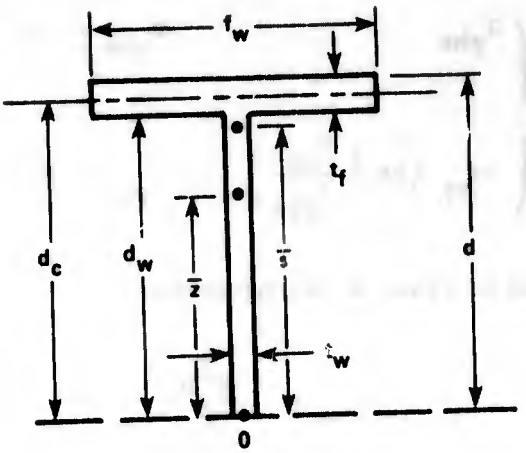
The parameter R is a dimensionless rotational restraint parameter that indicates the amount of rotational restraint that the plating to which the stiffener is attached provides to resist tripping. This parameter is defined as

$$R = \frac{\left(\frac{Cd_c}{4D_w}\right)}{1+\left(\frac{Cd_c}{4D_w}\right)} \qquad \text{(D.3)}$$

in which the parameter C is the rotational spring constant (in units of moment/rad/length) of the supporting plating. The formulation for C recommended in Reference 4 is:

$$C = \begin{cases} C_o\left(1-\frac{\sigma_e}{\sigma_{pb}}\right) & \sigma_e > \sigma_{pb} \\ 0 & \sigma_e \leq \sigma_{pb} \end{cases} \qquad \text{(D.4)}$$

in which σ_{pb} is the plate buckling stress



I_z - MOMENT OF INERTIA ABOUT THE WEB PLANE

$$I_z = \frac{1}{12}\left(t_f f_w^3 + d_w t_w^3\right)$$

$\bar{s}$ - HEIGHT OF SHEAR CENTER ABOVE TOE (ORIGIN)

$$\bar{s} = \frac{1}{2}\left[d_w + \frac{d_w + t_f}{1+(d_w/t_f)(t_w/f_w)^3}\right] \approx d_c$$

Γ - LONGITUDINAL WARPING CONSTANT

$$\Gamma = \frac{1}{36}\left(t_w^3 d_w^3 + \frac{1}{4}\, t_f^3 f_w^3\right)$$

J - ST. VENANT TORSION CONSTANT

$$J = \frac{1}{3}\left(d_w t_w^3 + f_w t_f^3\right)$$

I_t - VERTICAL MOMENT OF INERTIA ABOUT TOE (STIFFENER ALONE)

$$I_t = \frac{1}{3}\, t_w d_w^3 + f_w t_f \left(d_c^2 + \frac{1}{12}\, t_f^2\right)$$

I_p - POLAR MOMENT OF INERTIA ABOUT TOE

$$I_p = I_t + I_z$$

$\bar{z}$ - HEIGHT OF CENTROID ABOVE TOE

$$\bar{z} = \left[\frac{1}{2}\, t_w d_w^2 + f_w t_f d_c\right] \Big/ \left[t_w d_w + f_w t_f\right]$$

Figure 20 - Geometrical Tripping Parameters for Tee Stiffeners

$$\sigma_{pb} = \begin{cases} \sigma_{pbe} & -\sigma_{pbe} \leq 0.5\,\sigma_{yp} \\ -\sigma_{yp}\left(1+\frac{1}{4}\frac{\sigma_{yp}}{\sigma_{pbe}}\right) & -\sigma_{pbe} > 0.5\,\sigma_{yp} \end{cases} \tag{D.5}$$

based on the classical elastic plate buckling stress

$$\sigma_{pbe} = -\frac{4\pi^2 D}{tb^2} \tag{D.6}$$

and C_o is the unloaded rotational spring constant. The recommended relationship for C_o is

$$C_o = \frac{1}{2}\frac{\pi^2 D}{b}\left[1+\left(\frac{b}{a}\right)^2\right]^2 \tag{D.7}$$

in which the parameter D, also appearing in the expression for σ_{pbe}, refers to the flexural rigidity of the plating. Hence

$$D = \frac{Et^3}{12(1-\nu_p^2)} \tag{D.8}$$

The elastic tripping stress calculated according to Equation (D.1) is corrected for "inelastic effects" in a fashion similar to that for beam-column buckling, namely

$$\frac{\sigma_{cr}}{\sigma_{ys}} = \begin{cases} \frac{\sigma_{cre}}{\sigma_{ys}} & -\sigma_{cre} \leq 0.5\,\sigma_{ys} \\ -1-\frac{1}{4}\left(\frac{\sigma_{ys}}{\sigma_{cre}}\right) & -\sigma_{cre} > 0.5\,\sigma_{ys} \end{cases} \tag{D.9}$$

Since the rotational resistance provided by the plating is load dependent, the solution for σ_{cr} must be carried out in an iterative fashion. Convergence is

achieved when the computed value of σ_{cr} from Equation (D.9) is within an accepted tolerance of the value of σ_e assumed in Equation (D.4).

In the theoretical development of the tripping Equation (D.1), the mode number m, strictly speaking, should take on only integer values. However, one may notice that in the expressions for the coefficients k_j the mode number always occurs in combination with the panel or stiffener length, a. Thus it is possible to define an effective length for tripping, labelled a_{et}, which is equal to a/m, and which can be used to approximate various degrees of rotational restraint in the plane of the stiffener web provided by the connecting structure at the stiffener's ends. For example, in the current design practice in use in the U.S. Navy for determining when ILS (intermediate lateral supports) are required, the effective length for tripping assumed is equal to $a/\sqrt{2}$. This corresponds to a value of $m = \sqrt{2}$. For the hull collapse program it is reasonable (as a rough guide) to assume values for a_{et} in the range a to $a\sqrt{2}$ when no ILS are present, and appropriately smaller values when such supports are present, the specific values depending on the number and location of the supports.

When lateral pressure is present, the axial tripping stress is modified to reflect its influence. (Fabrication distortion effects are not presently taken into account.) The beam is treated as uniformly loaded with clamped end supports. The angle of rotation, β, about its line of attachment to the plating is assumed in the form

$$\beta = \beta_o \left[K \sin \frac{\pi x}{a_{et}} + (K-1) \sin \frac{3\pi x}{a_{et}} \right] \qquad (D.10)$$

in which the (initially) unknown coefficient K controls the relative mix of the first and third mode shapes. The effect of the rotational resistance provided by the plating is ignored in dealing with uniform pressure loading because experience with the solution has shown it to be overly optimistic when rotational restraint is included. This is a conservative decision that can be at least partially justified on the grounds that: (1) the amount of rotational restraint present is frequently small or zero because of the value of σ_{cr} relative to σ_{pb}; (2) critical tripping pressures are usually quite high because of the relatively small regions of compressive stress

in the stiffener; and (3) pressure levels encountered for most naval vessels are relatively modest, which in combination with high critical levels frequently makes the influence of lateral pressure somehwat insignificant.

The solution for the critical lateral pressure for elastic tripping can be presented in the form

$$q_{cre} = -\frac{12IGJ}{Sa^2}\frac{\bar{H}_m(K)}{\bar{F}_m(K)} \tag{D.11}$$

where I is the vertical moment of inertia of the plate-beam combination (with an effective breadth of b/2), and S is a geometrical parameter defined as

$$S = \frac{1}{4}\left[t_w d_w^4 - 4\left(h - \frac{1}{2}t\right) I_p + 4d_c\left(f_w t_f d_c^2 + \frac{1}{12}t_f f_w^3\right)\right] \tag{D.12}$$

where h is the height of the neutral axis of the plate-beam combination from the mid-plane of the plating, and $\bar{H}_m(K)$ and $\bar{F}_m(K)$ are quadratic functions in the coefficient K. Defining, in essence, a "modified" mode number

$$\bar{m} = a/a_{et} \tag{D.13}$$

these functions are defined as follows

$$\bar{H}_m(K) = \left[\left|\bar{m}^2K^2 + (\bar{m}+2)^2(K-1)^2\right| + \left|\bar{m}^4K^2 + (\bar{m}+2)^4(K-1)^2\right|\left(\frac{\pi}{a}\right)^2\left(\frac{E}{GJ}\right)(I_z\bar{s}^2+\Gamma)\right] \tag{D.14}$$

$$\bar{F}_m(K) = -\frac{3}{\pi^2}K^2 + \frac{6}{\pi^2}\bar{m}(\bar{m}+2)\left|1 + \frac{1}{(\bar{m}+1)^2}\right|K(1-K) - \frac{3}{\pi^2}(K-1)^2$$

$$-\frac{6d_w}{\pi^2 S}\left[f_w t_f^2\left(d_c - h + \frac{1}{2}t\right) + b_e t^2 h\right]\left[K^2 + (K-1)^2\right] \tag{D.15}$$

Reference 4 describes in complete detail how the appropriate value of K is determined for use in Equations (D.11), (D.14), and (D.15).

With q_{cre} determined, the critical elastic tripping stress σ_{cre} computed from Equation (D.1) is modified as follows

$$\sigma_{cre}\Big|_{q\neq 0} = \sigma_{cre}\Big|_{q=0} \cdot (1-q/q_{cre}) \tag{D.16}$$

This stress, which now includes the effects of pressure, is then used in exactly the same fashion in determining the inelastic axial tripping stress (including the iteration process) as previously described.

The approach to handling tripping in the post-buckling regions is very similar to that for beam-column buckling. Once tripping has occurred the axial force in the stiffener is assumed to remain constant while the sideways deflection of the stiffener increases with increasing end shortening. Denoting the sideways deflection of the flange by v, its relationship to the end shortening (by analogy with slender column theory) is hypothesized to be given by

$$v = \frac{2a_{et}}{\pi}\sqrt{\left(\frac{u}{a}\right)_{cr} - \left(\frac{u}{a}\right)} \tag{D.17}$$

where $(u/a)_{cr}$ in this case corresponds to the critical end shortening associated with σ_{cr} for stiffener tripping. As long as $P_s(v\ \bar{z}/d_c)$—the subscript s indicates the load in the stiffener—is less than the fully plastic moment of the stiffener alone about its web plane, the constant load, constant stress behavior will continue. When $P_s(v\ \bar{z}/d_c)$ exceeds this value, however, a plastic hinge forms in the stiffener and unloading will occur (due to the alternating nature of the lateral tripping deflections). The load in the stiffener then becomes

$$P_s = \pm M_{pl}\Big/\left(v\,\frac{\bar{z}}{d_c}\right) \tag{D.18}$$

where in this case M_{pl} refers to the horizontal fully plastic moment.

The presence of lateral pressure is assumed to influence the post-buckling behavior only through its influence on the value of the horizontal fully plastic moment. The bending moment at the center of the beam, M_c, calculated for the lateral loading q and the axial force P at the occurrence of tripping is computed according to Equations (B.2), (B.4), or (B.5) as given in Appendix B. The stress in the flange due to this moment, σ_{flg} is computed (based on an effective breadth of b/2) and an increment of force equal to

$$\sigma_{flg} \cdot w_f \cdot t_f$$

is added to the axial force P_s due to the end loading. Thus when the horizontal fully plastic moment is computed it is based on an axial load in the stiffener of

$$P_s + \sigma_{flg} w_f t_f$$

rather than P_s alone. (Since fabrication distortion is considered in the determination of the moment M_c, its presence is felt in a very secondary way in the tripping phenomenon.)

Once the axial force in the stiffener is determined according to Equation (D.18) the axial stress in the stiffener is simply equal to

$$\sigma_e\Big|_{stiff} = P_s/A_s \qquad \text{(D.19)}$$

Although there is no sound theoretical basis for it, it is assumed that the effective stress in the plating takes on the same value, namely

$$\sigma_e\Big|_{plate} = \sigma_e\Big|_{stiff} \qquad \text{(D.20)}$$

As with beam-column collapse, once the hinge forms in the stiffener, the two halves are assumed to deform relative to each other like two linked rigid bars. Thus the sideways deformation of the midpoint of the flange is given approxiamtely by

$$v = \pm \left[v_{tpl}^2 + \frac{1}{2} a_{et}^2 \left[\left(\frac{u}{a}\right)_{tpl} - \left(\frac{u}{a}\right) + \frac{1}{2} \left\{ \left(\frac{u}{a}\right)_{tpl}^2 - \left(\frac{u}{a}\right)^2 \right\} \right] \right] \quad (D.21)$$

where $(u/a)_{tpl}$ and v_{tpl} are the values of end shortening and sideways deflection, respectively, corresponding to achieving the fully plastic moment in the stiffener. The value of $(u/a)_{tpl}$ is obtained from Equation (D.17) by rearranging and substituting v_{tpl} for v, leading to

$$\left(\frac{u}{a}\right)_{tpl} = \left(\frac{u}{a}\right)_{cr} - \frac{1}{4}\left(\frac{\pi v_{tpl}}{a_{et}}\right)^2 \quad (D.22)$$

From Equations (D.19) and (D.21) an effective value of the tangent modulus can be deduced, namely

$$E_t \approx \frac{1}{4} a_{et}^2 \frac{P_s}{A_s} \frac{1+(u/a)}{v^2} \quad (D.23)$$

Examples of load shortening curves for this collapse mode are provided in Figure 21.

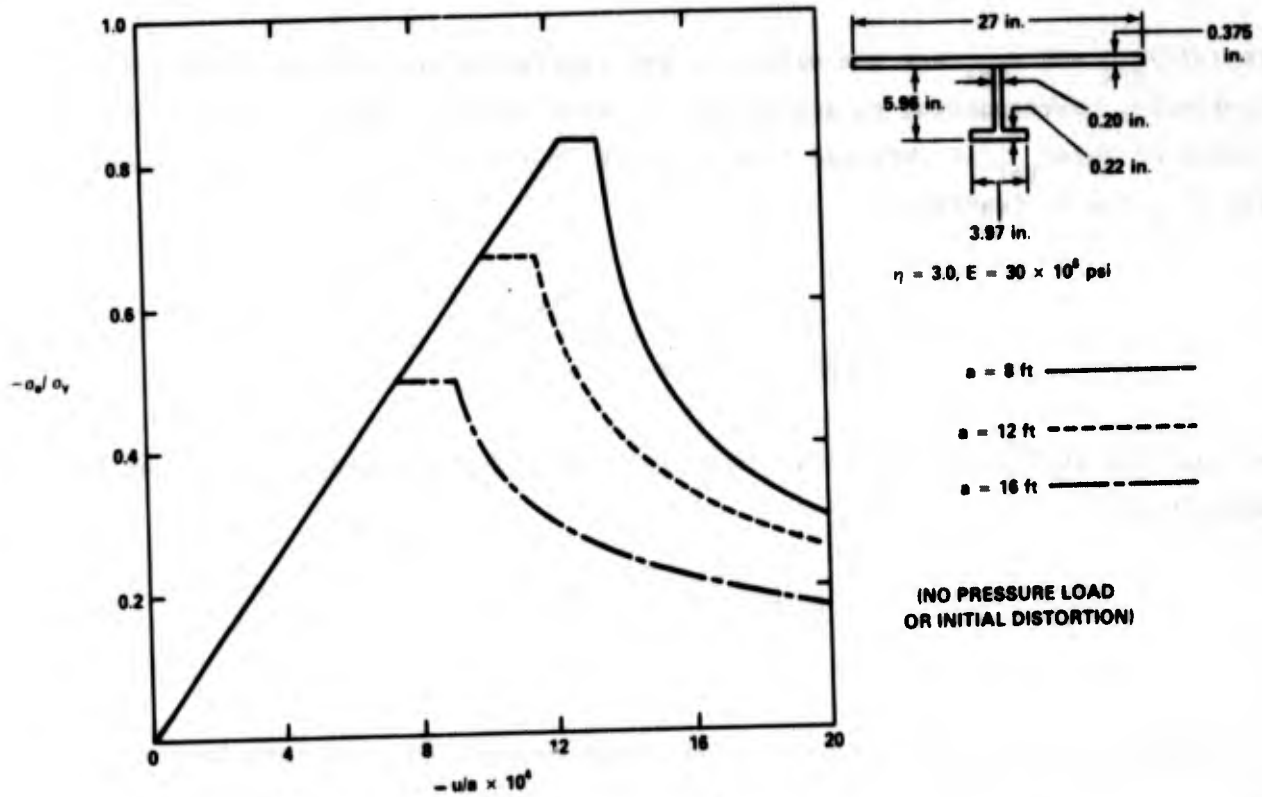
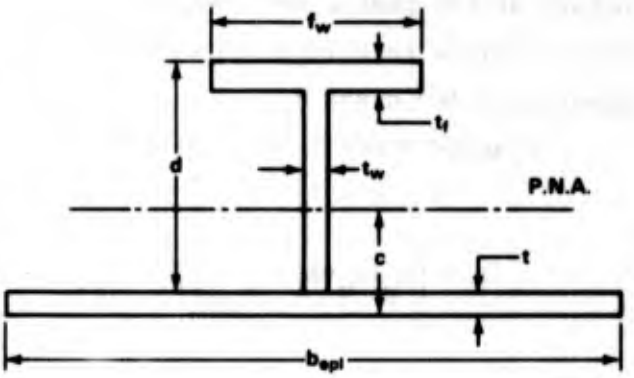


Figure 21 - Load Shortening Curves for Tripping Collapse

APPENDIX E

FULLY PLASTIC MOMENT

VERTICAL BENDING MOMENT



The expressions for the fully plastic moment which are presented below are valid for plate-beam combinations of the same material as well as for those in which the plating and stiffeners are made of materials having different yield strengths. The calculations are made on the basis of an equivalent section, assumed to be totally of one material, in this case that of the stiffener, in which the thickness of the plating remains unchanged, but the actual width of the material assumed to be effective, b_{epl}, is replaced by an equivalent width, b_{eq}, according to the relationship

$$b_{eq} = \frac{\sigma_{yp}}{\sigma_{ys}} \cdot b_{epl} \qquad \text{(E.1)}$$

To facilitate the writing of the expressions which follow, some shorthand notation is introduced. The parameters defined are

Plate Area

$$A_p = b_{eq} \cdot t$$

Web Area

$$A_w = (d-t_f)\ t_w = d_w t_w$$

Flange Area

$$A_f = f_w \cdot t_f$$

Mean Depth

$$d_m = \frac{d+t}{2}$$

The expressions that follow are based on the assumption that the total axial load, P, is known, and that the fully plastic moment in the presence of this load is what is desired. In this case the knowledge of P and the geometry of the cross section completely define the location of the plastic neutral axis c above the outer surface of the plate, and thus the value of the fully plastic moment, M_{pl}. However, three possible locations for c must be considered, each of which results in unique expressions for c and M_{pl}.

- Plastic Neutral Axis in the Plate

$$0 \leq c \leq t$$

$$c = \left(A_p + A_w + A_f - \frac{P}{\sigma_{ys}}\right) \Big/ (2\, b_{eq})$$

$$M_{pl} = \sigma_{ys} \left[b_{eq} c \left(d + t - \frac{1}{2} c - \frac{1}{2} b_{eq} \frac{c}{f_w} \right) \right]$$

where

$$b_{eq} c \leq A_f$$

$$M_{pl} = \sigma_{ys} \left[b_{eq} c \left(d_m - \frac{1}{2} c \right) + s t_w \left(d_w + t - \frac{1}{2} s - d_m \right) + A_f \left(d_w + t + \frac{1}{2} t_f - d_m \right) \right]$$

where

$$s = [b_{eq} c - A_f] / t_w$$

and

$$A_f \leq b_{eq} c \leq A_f + A_w$$

$$M_{pl} = \sigma_{ys} \left[b_{eq} c \left(d_m - \frac{1}{2} c \right) + b_{eq} s \left(t - \frac{1}{2} s - d_m \right) \right.$$

$$\left. + A_w \left(t + \frac{1}{2} d_w - d_m \right) + A_f \left(d_w + t + \frac{1}{2} t_f - d_m \right) \right]$$

where

$$s = [b_{eq} c - A_f - A_w] / b_{eq}$$

and

$$A_f + A_w \leq b_{eq} c \leq A_f + A_w + (t - c) b_{eq}$$

$$M_{pl} = \sigma_{ys}\left[b_{eq}s\left(d_m - \frac{1}{2}s\right) + b_{eq}(t-c)\left(\frac{1}{2}t + \frac{1}{2}c - d_m\right) + A_w\left(t + \frac{1}{2}d_w - d_m\right) + A_f\left(d_w + t + \frac{1}{2}t_f - d_m\right)\right]$$

where

$$s = [A_f + A_w + b_{eq}(t-c)]/b_{eq}$$

and

$$(t-c)b_{eq} + A_w + A_f \leq b_{eq}c$$

- Plastic Neutral Axis in Web

$$t \leq c \leq d_w + t$$

$$c = \left(A_f + A_w - A_p + 2tt_w - \frac{P}{\sigma_{ys}}\right)\Big/(2t_w)$$

$$M_{pl} = \sigma_{ys}\left[A_p\left(d_m - \frac{1}{2}t\right) + t_w(t-c)\left(\frac{1}{2}c + \frac{1}{2}t - d_m\right) + f_w s\left(d + t - \frac{1}{2}s - d_m\right)\right]$$

where

$$s = [A_p + t_w(c-t)]/f_w$$

and

$$A_p + t_w(c-t) \leq A_f$$

$$M_{pl} = \sigma_{ys}\left[A_p\left(d_m - \frac{1}{2}t\right) + t_w(t-c)\left(\frac{1}{2}c + \frac{1}{2}t - d_m\right) + st_w\left(d_w + t - \frac{1}{2}s - d_m\right) + A_f\left(d_w + t + \frac{1}{2}t_f - d_m\right)\right]$$

where

$$s = [A_p + t_w(c-t) - A_f]/t_w$$

and

$$A_f \leq A_p + t_w(c-t) \leq A_f + t_w(d_w - c + t)$$

$$M_{pl} = \sigma_{ys}\left[A_p\left(d_m - \frac{1}{2}t\right) + t_w s\left(d_m - t - \frac{1}{2}s\right) + t_w(d_w - c + t)\left(\frac{c + d_w + t}{2} - d_m\right) + A_f\left(d_w + t + \frac{1}{2}t_f - d_m\right)\right]$$

where

$$s = [A_f - A_p + t_w(d_w - c + t)]/t_w$$

and

$$A_f + t_w(d_w - c + t) \leq A_p + t_w(c - t) \leq A_f + d_w t_w$$

$$M_{pl} = \sigma_{ys}\left[b_{eq} s\left(d_m - \frac{1}{2}s\right) + t_w(d_w - c + t)\left(\frac{d_w + t + c}{2} - d_m\right) + A_f\left(d + t - \frac{1}{2}t_f - d_m\right)\right]$$

where

$$s = [A_f + t_w(d_w - c + t)]/b_{eq}$$

and

$$A_f + t_w d_w \leq A_p + t_w(c - t)$$

- Plastic Neutral Axis in Flange

$$d_w + t \leq c \leq d_w + t + t_f$$

$$c = \left[A_f - A_p - A_w + 2f_w(d_w + t) - \frac{P}{\sigma_{ys}}\right] \Big/ [2f_w]$$

$$M_{pl} = \sigma_{ys}\left[A_p\left(d_m - \frac{1}{2}t\right) + A_w\left(d_m - t - \frac{1}{2}d_w\right) + f_w(d_w + t - c)\left(\frac{c + d_w + t}{2} - d_m\right) + f_w s\left(d + t - \frac{1}{2}s - d_m\right)\right]$$

where

$$s = [A_p + A_w + f_w(c - d_w - t)]/f_w$$

and

$$A_p + A_w + f_w(c - d_w - t) \leq A_f + f_w(d_w + t - c)$$

$$M_{pl} = \sigma_{ys}\left[A_p\left(d_m - \tfrac{1}{2}t\right) + A_w\left(d_m - t - \tfrac{1}{2}d_w\right) + f_w s\left(d_m - d_w - t - \tfrac{1}{2}s\right) + f_w(d+t-c)\left(\frac{d+t+c}{2} - d_m\right)\right]$$

where

$$s = [f_w(d+t-c) - A_p - A_w]/f_w$$

and

$$A_f + f_w(d_w+t-c) \leq A_p + A_w + f_w(c-d_w-t) \leq A_f$$

$$M_{pl} = \sigma_{ys}\left[A_p\left(d_m - \tfrac{1}{2}t\right) + t_w s\left(d_m - t - \tfrac{1}{2}s\right) + f_w(d+t-c)\left(\frac{d+t+c}{2} - d_m\right)\right]$$

where

$$s = [f_w(d+t-c) - A_p]/t_w$$

and

$$A_f \leq A_p + A_w + f_w(c-d_w-t) \leq A_f + A_w$$

$$M_{pl} = \sigma_{ys}\left[b_{eq} s\left(d_m - \tfrac{1}{2}s\right) + f_w(d+t-c)\left(\frac{d+t+c}{2} - d_m\right)\right]$$

where

$$s = (f_w/b_{eq})(d+t-c)$$

and

$$A_w + A_f \leq A_p + A_w + f_w(c-d_w-t)$$

The above expressions employ the sign convention adopted generally, that is, tension is positive and compression negative. If a positive value of σ_{ys} is used in the above (meaning tension in the stiffener flange), the resulting moment, M_{pl}, will be positive and will cause compression in the plating.

HORIZONTAL BENDING MOMENT

In the prediction of collapse due to stiffener tripping, the horizontal (or lateral) fully plastic moment for the stiffener alone is required. As in the

previous case, it is assumed that the axial load (in this case not the total load but that in the stiffener, P_s) is known and that the fully plastic moment in the presence of this load is desired. This leads to the following:

- Plastic Neutral Axis in Web

$$(|c| \leq 0.5\ t_w)$$

$$c = -\frac{1}{2}\frac{P_s}{\sigma_{ys}(d_w+t_f)}$$

$$M_{pl} = \sigma_{ys}\left[d_w\left(\frac{1}{4}t_w^2-c^2\right)+t_f\left(\frac{1}{4}f_w^2-c^2\right)\right]$$

- Plastic Neutral Axis Outside of Web

$$(0.5\ t_w \leq |c| \leq 0.5\ f_w)$$

$$c = \frac{1}{2t_f}\left(-A_w+\left|\frac{P_s}{\sigma_{ys}}\right|\right)$$

$$M_{pl} = \sigma_{ys}\ t_f\left(\frac{1}{4}f_w^2-c^2\right)$$

If the sign of c, representing the side of the web on which the plastic neutral axis is located, were significant, there would need to be two distinct expressions for c for the case "outside of the web." Since only the value of the moment is required by the program, the expression above, which effectively gives the absolute value of neutral axis location c, is sufficient.

APPENDIX F

OUTPUT DATA LISTINGS

ULTIMATE STRENGTH OF HULL A (NO ILS, AET=68.0) - HOGGING

INPUT DATA

NUMBER OF GROSS PANEL ELEMENTS	16
NUMBER OF HARD CORNERS	7
NUMBER OF DIFFERENT STIFFENERS	7
NUMBER OF DIFFERENT MATERIALS	1
MAXIMUM NUMBER OF ITERATIONS	20

TOLERANCE FACTORS
FAKK = 50.00 EPSH = .5000E-02 EPSA = .2500E-02 EPSB = .2500E-01

SHIP CHARACTERISTICS

COMPARTMENT LENGTH	480.00
TRANSVERSE FRAME SPACING	96.00

GROSS PANEL ELEMENT DATA

ELEMENT	Y1	Z1	Y2	Z2	YAVE	ZAVE	WIDTH	SIN	COS
1	315.000	4.500	315.000	43.000	315.000	28.750	28.5000	0.00000	1.00000
2	315.000	43.000	314.000	72.500	314.500	57.750	29.5169	-.03388	.99943
3	314.000	72.500	313.500	101.000	313.750	86.750	28.5044	-.01754	.99985
4	313.500	101.000	311.500	171.000	312.500	136.000	70.0286	-.02856	.99959
5	311.500	171.000	307.000	242.000	309.250	206.500	71.1425	-.06325	.99800
6	284.500	267.500	250.500	267.500	267.500	267.500	34.0000	-1.00000	0.00000
7	250.500	267.500	217.000	267.000	233.750	267.250	33.5037	-.99989	-.01492
8	217.000	267.000	186.000	265.000	201.500	266.000	31.0644	-.99793	-.06438
9	186.000	265.000	156.000	260.000	171.000	262.500	30.4138	-.98639	-.16440
10	156.000	260.000	127.500	253.000	141.750	256.500	29.3471	-.97114	-.23852
11	127.500	253.000	100.000	242.000	113.750	247.500	29.6184	-.92848	-.37139
12	100.000	242.000	73.500	226.000	86.750	234.000	30.9556	-.85606	-.51687
13	73.500	226.000	47.000	202.000	60.250	214.000	35.7526	-.74120	-.67128
14	47.000	202.000	26.500	168.000	36.750	185.000	39.7020	-.51635	-.85638
15	26.500	168.000	14.000	132.000	20.250	150.000	38.1084	-.32801	-.94467
16	14.000	132.000	.500	20.000	7.250	76.000	112.8107	-.11967	-.99281

GEOMETRY ELEMENT	PLATE THICK.	STIFF. SPACING	NO. OF STIFF.	STIFF. REF. NO.	MATERIAL REF. NO.	TRIPPING EFF.LEN.	G.I. CODE	PROP. LIMIT	RES.STR. FACTOR
1	.37500	28.5000	1	1	1	68.0000	0	.5000	3.0000
2	.50000	29.5169	1	1	1	68.0000	0	.5000	3.0000
3	.50000	28.5044	1	2	1	68.0000	0	.5000	3.0000
4	.50000	35.0143	2	2	1	68.0000	0	.5000	3.0000
5	.62500	35.5712	2	2	1	68.0000	0	.5000	3.0000
6	.62500	34.0000	1	3	1	68.0000	0	.5000	3.0000
7	.62500	33.5037	1	3	1	68.0000	0	.5000	3.0000
8	.37500	31.0644	1	4	1	68.0000	0	.5000	3.0000
9	.37500	30.4138	1	3	1	68.0000	0	.5000	3.0000
10	.31250	29.3471	1	3	1	68.0000	0	.5000	3.0000
11	.31250	29.6184	1	3	1	68.0000	0	.5000	3.0000
12	.43750	30.9556		5	1	68.0000	0	.5000	3.0000
13	.43750	35.7526	1	5	1	68.0000	0	.5000	3.0000
14	.62500	39.7020	1	5	1	68.0000	0	.5000	3.0000
15	.62500	38.1084	1	6	1	68.0000	0	.5000	3.0000
16	.75000	37.6036	3	7	1	68.0000	0	.5000	3.0000

PRESSURE LOADING AND INITIAL DISTORTION

ELEMENT	PRESSURE LOAD	INITIAL DISTORT.	PRE-STRAIN
1	0.000	0.000000	0.
2	0.000	0.000000	0.
3	0.000	0.000000	0.
4	0.000	0.000000	0.
5	0.000	0.000000	0.
6	0.000	0.000000	0.
7	0.000	0.000000	0.
8	0.000	0.000000	0.
9	0.000	0.000000	0.
10	0.000	0.000000	0.
11	0.000	0.000000	0.
12	0.000	0.000000	0.
13	0.000	0.000000	0.
14	0.000	0.000000	0.
15	0.000	0.000000	0.
16	0.000	0.000000	0.

HARD CORNER ELEMENT DATA

ELEMENT	AREA	Y-COORD	MOM. IN.	MAT.REF.	PRE-STRAIN
1	5.4375	315.000	.064	1	0.
2	1.1000	309.700	7.800	1	0.
3	16.1324	305.000	22.022	1	0.
4	11.5625	293.750	329.772	1	0.
5	6.2500	302.000	0.000	1	0.
6	15.0047	.250	1.016	1	0.
7	10.3600	17.040	661.500	1	0.

STIFFENER DATA

NUMBER	AREA	IZZ	IYY	DEPTH	TWEB	WFLG	TFLG	MAT.REF.
1	2.0970	14.145	1.023	7.9000	.17000	3.9400	.20000	1
2	2.7825	19.177	1.341	8.0000	.23000	4.0000	.25000	1
3	2.0214	7.560	1.151	5.9600	.20000	3.9700	.22000	1
4	3.7779	58.706	1.452	12.0000	.23000	4.0000	.27000	1
5	2.5288	26.727	1.032	9.8600	.18000	3.9500	.20000	1
6	8.6600	319.415	12.621	18.4400	.31000	7.0000	.44000	1
7	3.3179	35.874	1.450	10.0000	.23000	4.0000	.27000	1

MATERIAL CHARACTERISTICS

MATERIAL	YOUNGS MODULUS	POISSON RATIO	YIELD STRESS	SHEAR MODULUS	PROP.LIM RATIO	YIELD STRAIN
	.30000E+08	.3000	45000.0	.11538E+08	1.0000	.15000E-02

MOMENT OF INERTIA CALCULATION

ELEMENT	ET/E	(ET/E)AREA	LEVER	MOM1	MOM2	IO
1GP(P)	1.00000	10.688	315.000	.336656E+04	.106047E+07	.125244E+00
1GP(S)	1.00000	2.097	315.000	.660555E+03	.208075E+06	.141449E+02
2GP(P)	1.00000	14.758	314.500	.464154E+04	.145976E+07	.153699E+01
2GP(S)	1.00000	2.097	314.500	.659507E+03	.207415E+06	.141298E+02
3GP(P)	1.00000	14.252	313.750	.447163E+04	.140297E+07	.593750E+00
3GP(S)	1.00000	2.783	313.750	.873009E+03	.273907E+06	.191713E+02
4GP(P)	1.00000	17.507	312.000	.546223E+04	.170422E+07	.182336E+01
4GP(S)	1.00000	2.783	312.000	.868140E+03	.270860E+06	.191622E+02
4GP(P)	1.00000	17.507	313.000	.547974E+04	.171516E+07	.182336E+01
4GP(S)	1.00000	2.783	313.000	.870923E+03	.272599E+06	.191622E+02
5GP(P)	1.00000	22.232	308.125	.685024E+04	.211073E+07	.100999E+02

5GP(S)	1.00000	2.783	308.125	.857358E+03	.264173E+06	.191054E+02
5GP(P)	1.00000	22.232	310.375	.690026E+04	.214167E+07	.100999E+02
5GP(S)	1.00000	2.783	310.375	.863618E+03	.268046E+06	.191054E+02
6GP(P)	1.00000	21.250	267.500	.568438E+04	.152057E+07	.204708E+04
6GP(S)	1.00000	2.021	267.500	.540725E+03	.144644E+06	.115096E+01
7GP(P)	1.00000	20.940	233.752	.489472E+04	.114415E+07	.195875E+04
7GP(S)	1.00000	2.021	233.752	.472506E+03	.110449E+06	.115096E+01
8GP(P)	1.00000	11.649	201.500	.234731E+04	.472982E+06	.932905E+03
8GP(S)	1.00000	3.778	201.500	.761247E+03	.153391E+06	.168922E+01
9GP(P)	1.00000	11.405	171.000	.195029E+04	.333499E+06	.855392E+03
9GP(S)	1.00000	2.021	171.000	.345659E+03	.591078E+05	.132419E+01
10GP(P)	1.00000	9.171	141.750	.129998E+04	.184273E+06	.620763E+03
10GP(S)	1.00000	2.021	141.750	.286533E+03	.406161E+05	.151562E+01
11GP(P)	1.00000	9.256	113.750	.105284E+04	.119761E+06	.583316E+03
11GP(S)	1.00000	2.021	113.750	.229934E+03	.261550E+05	.203502E+01
12GP(P)	1.00000	13.543	86.750	.117486E+04	.101919E+06	.792610E+03
12GP(S)	1.00000	2.529	86.750	.219373E+03	.190306E+05	.789629E+01
13GP(P)	1.00000	15.642	60.250	.942417E+03	.567806E+05	.915482E+03
13GP(S)	1.00000	2.529	60.250	.152360E+03	.917970E+04	.126103E+02
14GP(P)	1.00000	24.814	36.750	.911906E+03	.335125E+05	.869591E+03
14GP(S)	1.00000	2.529	36.750	.929334E+02	.341530E+04	.198760E+02
15GP(P)	1.00000	23.818	20.250	.482309E+03	.976677E+04	.310819E+03
15GP(S)	1.00000	8.660	20.250	.175365E+03	.355114E+04	.286407E+03
16GP(P)	1.00000	28.203	2.750	.775573E+02	.213283E+03	.488951E+02
16GP(S)	1.00000	3.318	2.750	.912423E+01	.250916E+02	.353806E+02
16GP(P)	1.00000	28.203	7.250	.204469E+03	.148240E+04	.488951E+02
16GP(S)	1.00000	3.318	7.250	.240548E+02	.174397E+03	.353806E+02
16GP(P)	1.00000	28.203	11.750	.331381E+03	.389373E+04	.488951E+02
16GP(S)	1.00000	3.318	11.750	.389853E+02	.458078E+03	.353806E+02
1HDCNR	1.00000	5.438	315.000	.171281E+04	.539536E+06	.637207E-01
2HDCNR	1.00000	1.100	309.700	.340670E+03	.105505E+06	.780000E+01
3HDCNR	1.00000	16.132	305.000	.492038E+04	.150072E+07	.220224E+02
4HDCNR	1.00000	11.563	293.750	.339648E+04	.997717E+06	.329772E+03
5HDCNR	1.00000	6.250	302.000	.188750E+04	.570025E+06	0.
6HDCNR	1.00000	15.005	.250	.375117E+01	.937793E+00	.101550E+01
7HDCNR	1.00000	10.360	17.040	.176534E+03	.300815E+04	.661500E+02

AREA = 489.310 MOM1 = 79966.66 MOM2+IO = 21641207.2

FULLY EFFECTIVE CROSS SECTION CHARACTERISTICS

CROSS SECTION AREA	489.310
HEIGHT OF N.A. ABOVE BASE LINE	163.427
SECTION MOMENT OF INERTIA	8572474.0

CURVATURE INCREMENT DATA

LOAD RANGE	NUMBER OF INCREMENTS	INCREMENT SIZE
1	6	.1000E-05
2	2	.5000E-06
3	10	.2000E-06

CRITICAL STRAIN (MEAN STRESS) VALUES

ELEMENT	PLATE YIELD STRAIN	STIFF YIELD STRAIN	EULER COLUMN BUCKLING	STIFFENER TRIPPING
1	.15000E-02	.15000E-02	-.14270E-02	-.11959E-02
	(.45000E+05) (	.45000E+05) (	-.42810E+05) (	-.35877E+05)
2	.15000E-02	.15000E-02	-.14079E-02	-.11959E-02
	(.45000E+05) (	.45000E+05) (	-.42237E+05) (	-.35877E+05)
3	.15000E-02	.15000E-02	-.14217E-02	-.12115E-02

	(.45000E+05)	(.45000E+05)	(-.42651E+05)	(-.36344E+05)
4	.15000E-02	.15000E-02	-.14189E-02	-.12115E-02
	(.45000E+05)	(.45000E+05)	(-.42567E+05)	(-.36344E+05)
5	.15000E-02	.15000E-02	-.14002E-02	-.12115E-02
	(.45000E+05)	(.45000E+05)	(-.42006E+05)	(-.36344E+05)
6	.15000E-02	.15000E-02	-.12958E-02	-.12397E-02
	(.45000E+05)	(.45000E+05)	(-.38873E+05)	(-.37191E+05)
7	.15000E-02	.15000E-02	-.12962E-02	-.12397E-02
	(.45000E+05)	(.45000E+05)	(-.38887E+05)	(-.37191E+05)
8	.15000E-02	.15000E-02	-.14707E-02	-.11416E-02
	(.45000E+05)	(.45000E+05)	(-.44120E+05)	(-.34248E+05)
9	.15000E-02	.15000E-02	-.13749E-02	-.12397E-02
	(.45000E+05)	(.45000E+05)	(-.41246E+05)	(-.37191E+05)
10	.15000E-02	.15000E-02	-.13874E-02	-.12397E-02
	(.45000E+05)	(.45000E+05)	(-.41622E+05)	(-.37191E+05)
11	.15000E-02	.15000E-02	-.13873E-02	-.12397E-02
	(.45000E+05)	(.45000E+05)	(-.41618E+05)	(-.37191E+05)
12	.15000E-02	.15000E-02	-.14481E-02	-.11537E-02
	.45000E+05)	(.45000E+05)	(-.43443E+05)	(-.34612E+05)
13	.15000E-02	.15000E-02	-.14467E-02	-.11537E-02
	(.45000E+05)	(.45000E+05)	(-.43402E+05)	(-.34612E+05)
14	.15000E-02	.15000E-02	-.14251E-02	-.11537E-02
	(.45000E+05)	(.45000E+05)	(-.42752E+05)	(-.34612E+05)
15	.15000E-02	.15000E-02	-.14884E-02	-.13641E-02
	(.45000E+05)	(.45000E+05)	(-.44652E+05)	(-.40923E+05)
16	.15000E-02	.15000E-02	-.14264E-02	-.11818E-02
	(.45000E+05)	(.45000E+05)	(-.42791E+05)	(-.35454E+05)

INITIAL (UNLOADED) CROSS SECTION CHARACTERISTICS

CROSS SECTION AREA	464.602
HEIGHT OF N.A. ABOVE BASE LINE	170.073
SECTION MOMENT OF INERTIA	8125660.6

MOMENT-CURVATURE HISTORY

LOAD RANGE 1 INCREMENT 1 CYCLE 1
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 170.073
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	1.000000	1.000000	.144927E-03	.144927E-03	.434781E+04	0
2	.300000E+08	1.000000	1.000000	.144427E-03	.144427E-03	.433281E+04	0
3	.300000E+08	1.000000	1.000000	.143677E-03	.143677E-03	.431031E+04	0
4	.300000E+08	1.000000	1.000000	.142427E-03	.142427E-03	.427281E+04	0
5	.300000E+08	1.000000	1.000000	.139177E-03	.139177E-03	.417531E+04	0
6	.300000E+08	1.000000	1.000000	.974270E-04	.974270E-04	.292281E+04	0
7	.300000E+08	1.000000	1.000000	.636770E-04	.636770E-04	.191031E+04	0
8	.300000E+08	1.000000	1.000000	.314270E-04	.314270E-04	.942809E+03	0
9	.300000E+08	1.000000	1.000000	.926967E-06	.926967E-06	.278090E+02	0
10	.300000E+08	.856098	.856098	-.283230E-04	-.283230E-04	-.849691E+03	0
11	.300000E+08	.856398	.856398	-.563230E-04	-.563230E-04	-.168969E+04	0
12	.300000E+08	.844711	.844711	-.833230E-04	-.833230E-04	-.249969E+04	0
13	.300000E+08	.851077	.851077	-.109823E-03	-.109823E-03	-.329469E+04	0
14	.300000E+08	.843948	.843948	-.133323E-03	-.133323E-03	-.399969E+04	0
15	.300000E+08	.847064	.847064	-.149823E-03	-.149823E-03	-.449469E+04	0
16	.300000E+08	.880479	.880479	-.162823E-03	-.162823E-03	-.488469E+04	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .464602E+03 N.A. LOCATION = 170.073 MOMENT OF INERTIA = .812566E+07
CUMULATIVE CURVATURE = .10000E-05 CUMULATIVE MOMENT = .24343E+09 UNBALANCED FORCE = -.12851E+01

LOAD RANGE 1 INCREMENT 2 CYCLE 2
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 170.634
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	1.000000	1.000000	.144366E-03	.289293E-03	.867878E+04	0
2	.300000E+08	1.000000	1.000000	.143866E-03	.288293E-03	.864878E+04	0
3	.300000E+08	1.000000	1.000000	.143116E-03	.286793E-03	.860378E+04	0
4	.300000E+08	1.000000	1.000000	.141866E-03	.284293E-03	.852878E+04	0
5	.300000E+08	1.000000	1.000000	.138616E-03	.277793E-03	.833378E+04	0
6	.300000E+08	1.000000	1.000000	.968658E-04	.194293E-03	.582878E+04	0
7	.300000E+08	1.000000	1.000000	.631158E-04	.126793E-03	.380378E+04	0
8	.300000E+08	1.000000	1.000000	.308658E-04	.622928E-04	.186878E+04	0
9	.300000E+08	1.000000	1.000000	.365827E-06	.129279E-05	.387838E+02	0
10	.300000E+08	.856098	.856098	-.288842E-04	-.572072E-04	-.171622E+04	0
11	.300000E+08	.849233	.856338	-.568842E-04	-.113207E-03	-.339622E+04	0
12	.300000E+08	.844711	.844711	-.838842E-04	-.167207E-03	-.501622E+04	0
13	.300000E+08	.701816	.824900	-.110384E-03	-.220207E-03	-.660622E+04	0
14	.300000E+08	.812754	.842795	-.133884E-03	-.267207E-03	-.801622E+04	0
15	.300000E+08	.801798	.844645	-.150384E-03	-.300207E-03	-.900622E+04	0
16	.300000E+08	.880479	.880479	-.163384E-03	-.326207E-03	-.978622E+04	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .460349E+03 N.A. LOCATION = 171.213 MOMENT OF INERTIA = .805839E+07
CUMULATIVE CURVATURE = .20000E-05 CUMULATIVE MOMENT = .48646E+09 UNBALANCED FORCE = -.43687E+04

LOAD RANGE 1 INCREMENT 3 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 173.674
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE

1	.300000E+08	1.000000	1.000000	.141326E-03	.430619E-03	.129186E+05	0
2	.300000E+08	1.000000	1.000000	.140826E-03	.429119E-03	.128736E+05	0
3	.300000E+08	1.000000	1.000000	.140076E-03	.426869E-03	.128061E+05	0
4	.300000E+08	1.000000	1.000000	.138826E-03	.423119E-03	.126936E+05	0
5	.300000E+08	1.000000	1.000000	.135576E-03	.413369E-03	.124011E+05	0
6	.300000E+08	1.000000	1.000000	.938259E-04	.288119E-03	.864356E+04	0
7	.300000E+08	1.000000	1.000000	.600759E-04	.186869E-03	.560606E+04	0
8	.300000E+08	1.000000	1.000000	.278259E-04	.901187E-04	.270356E+04	0
9	.300000E+08	.850775	.850775	-.267412E-05	-.138133E-05	-.414399E+02	0
10	.300000E+08	.856098	.856098	-.319241E-04	-.891313E-04	-.267394E+04	0
11	.300000E+08	.686714	.822777	-.599241E-04	-.173131E-03	-.519394E+04	0
12	.300000E+08	.748890	.833841	-.869241E-04	-.254131E-03	-.762394E+04	0
13	.300000E+08	.570172	.758362	-.113424E-03	-.333631E-03	-.100089E+05	0
14	.300000E+08	.660879	.804237	-.136924E-03	-.404131E-03	-.121239E+05	0
15	.300000E+08	.652265	.802266	-.153424E-03	-.453631E-03	-.136089E+05	0
16	.300000E+08	.791207	.871428	-.166424E-03	-.492631E-03	-.147789E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .438902E+03 N.A. LOCATION = 177.383 MOMENT OF INERTIA = .764854E+07
CUMULATIVE CURVATURE = .30000E-05 CUMULATIVE MOMENT = .72291E+09 UNBALANCED FORCE = -.29077E+04

LOAD RANGE 1 INCREMENT 4 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 180.459
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	1.000000	1.000000	.134541E-03	.565160E-03	.169548E+05	0
2	.300000E+08	1.000000	1.000000	.134041E-03	.563160E-03	.168948E+05	0
3	.300000E+08	1.000000	1.000000	.133291E-03	.560160E-03	.168048E+05	0
4	.300000E+08	1.000000	1.000000	.132041E-03	.555160E-03	.166548E+05	0
5	.300000E+08	1.000000	1.000000	.128791E-03	.542160E-03	.162648E+05	0
6	.300000E+08	1.000000	1.000000	.870413E-04	.375160E-03	.112548E+05	0
7	.300000E+08	1.000000	1.000000	.532913E-04	.240160E-03	.720480E+04	0
8	.300000E+08	1.000000	1.000000	.210413E-04	.111160E-03	.333480E+04	0
9	.300000E+08	.850775	.850775	-.945868E-05	-.108400E-04	-.325200E+03	0
10	.300000E+08	.806261	.853197	-.387087E-04	-.127840E-03	-.383520E+04	0
11	.300000E+08	.583449	.769404	-.667087E-04	-.239840E-03	-.719520E+04	0
12	.300000E+08	.640114	.795156	-.937087E-04	-.347840E-03	-.104352E+05	0
13	.300000E+08	.488864	.696921	-.120209E-03	-.453840E-03	-.136152E+05	0
14	.300000E+08	.567618	.753471	-.143709E-03	-.547840E-03	-.164352E+05	0
15	.300000E+08	.560723	.750269	-.160209E-03	-.613840E-03	-.184152E+05	0
16	.300000E+08	.680560	.835086	-.173209E-03	-.665840E-03	-.199752E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .420888E+03 N.A. LOCATION = 183.608 MOMENT OF INERTIA = .722705E+07
CUMULATIVE CURVATURE = .40000E-05 CUMULATIVE MOMENT = .94544E+09 UNBALANCED FORCE = -.42113E+03

LOAD RANGE 1 INCREMENT 5 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 186.069
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	1.000000	1.000000	.128931E-03	.694091E-03	.208227E+05	0
2	.300000E+08	1.000000	1.000000	.128431E-03	.691591E-03	.207477E+05	0
3	.300000E+08	1.000000	1.000000	.127681E-03	.687841E-03	.206352E+05	0
4	.300000E+08	1.000000	1.000000	.126431E-03	.681591E-03	.204477E+05	0
5	.300000E+08	1.000000	1.000000	.123181E-03	.665341E-03	.199602E+05	0
6	.300000E+08	1.000000	1.000000	.814308E-04	.450591E-03	.136977E+05	0
7	.300000E+08	1.000000	1.000000	.476808E-04	.287841E-03	.863522E+04	0
8	.300000E+08	1.000000	1.000000	.154308E-04	.126591E-03	.379772E+04	0
9	.300000E+08	.850775	.850775	-.150692E-04	-.259092E-04	-.777277E+03	0

10	.300000E+08	.694774	.825698	-.443192E-04	-.172159E-03	-.516478E+04	0
11	.300000E+08	.511418	.717431	-.723192E-04	-.312159E-03	-.936478E+04	0
12	.300000E+08	.564567	.751803	-.993192E-04	-.447159E-03	-.134148E+05	0
13	.300000E+08	.432566	.645278	-.125819E-03	-.579659E-03	-.173898E+05	0
14	.300000E+08	.503173	.706348	-.149319E-03	-.697159E-03	-.209148E+05	0
15	.300000E+08	.497535	.702836	-.165819E-03	-.779659E-03	-.233898E+05	0
16	.300000E+08	.604242	.793814	-.178819E-03	-.844659E-03	-.253398E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .407734E+03 N.A. LOCATION = 188.309 MOMENT OF INERTIA = .691409E+07
CUMULATIVE CURVATURE = .50000E-05 CUMULATIVE MOMENT = .11571E+10 UNBALANCED FORCE = -.49858E+03

LOAD RANGE 1 INCREMENT 6 CYCLE 2
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 190.125
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	1.000000	1.000000	.124875E-03	.818966E-03	.245690E+05	0
2	.300000E+08	1.000000	1.000000	.124375E-03	.815966E-03	.244790E+05	0
3	.300000E+08	1.000000	1.000000	.123625E-03	.811466E-03	.243440E+05	0
4	.300000E+08	1.000000	1.000000	.122375E-03	.803966E-03	.241190E+05	0
5	.300000E+08	1.000000	1.000000	.119125E-03	.784466E-03	.235340E+05	0
6	.300000E+08	1.000000	1.000000	.773750E-04	.533966E-03	.160190E+05	0
7	.300000E+08	1.000000	1.000000	.436250E-04	.331466E-03	.994397E+04	0
8	.300000E+08	1.000000	1.000000	.113750E-04	.137966E-03	.413897E+04	0
9	.300000E+08	.850775	.850775	-.191250E-04	-.450342E-04	-.135103E+04	0
10	.300000E+08	.613862	.787557	-.483750E-04	-.220534E-03	-.661603E+04	0
11	.300000E+08	.458405	.671439	-.763750E-04	-.388534E-03	-.116560E+05	0
12	.300000E+08	.508809	.711138	-.103375E-03	-.550534E-03	-.165160E+05	0
13	.300000E+08	.390978	.602344	-.129875E-03	-.709534E-03	-.212860E+05	0
14	.300000E+08	.455551	.665202	-.153375E-03	-.850534E-03	-.255160E+05	0
15	.300000E+08	.450838	.661724	-.169875E-03	-.949534E-03	-.284860E+05	0
16	.300000E+08	.547839	.754810	-.182875E-03	-.102753E-02	-.308260E+05	0

HARD CORNER ELEMENT DATA

ELEMENT	MODULUS	INC. STRAIN	CUM. STRAIN	CUM. STRESS
1	.300000E+08	.124875E-03	.943841E-03	.283152E+05
2	.300000E+08	.119575E-03	.906741E-03	.272022E+05
3	.300000E+08	.114875E-03	.873841E-03	.262152E+05
4	.300000E+08	.103625E-03	.795091E-03	.238527E+05
5	.300000E+08	.111875E-03	.852841E-03	.255852E+05
6	.300000E+08	-.189875E-03	-.125941E-02	-.377823E+05
7	.300000E+08	-.173085E-03	-.114188E-02	-.342564E+05

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .398030E+03 N.A. LOCATION = 191.980 MOMENT OF INERTIA = .667069E+07
CUMULATIVE CURVATURE = .60000E-05 CUMULATIVE MOMENT = .13605E+10 UNBALANCED FORCE = .57102E+03

LOAD RANGE 2 INCREMENT 1 CYCLE 2
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 192.756
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	1.000000	1.000000	.611222E-04	.880088E-03	.264026E+05	0
2	.300000E+08	1.000000	1.000000	.608722E-04	.876838E-03	.263051E+05	0
3	.300000E+08	1.000000	1.000000	.604972E-04	.871963E-03	.261589E+05	0
4	.300000E+08	1.000000	1.000000	.598722E-04	.863838E-03	.259151E+05	0
5	.300000E+08	1.000000	1.000000	.582472E-04	.842713E-03	.252814E+05	0
6	.300000E+08	1.000000	1.000000	.373722E-04	.571338E-03	.171401E+05	0
7	.300000E+08	1.000000	1.000000	.204972E-04	.351963E-03	.105589E+05	0

8	.300000E+08	1.000000	1.000000	.437215E-05	.142338E-03	.427014E+04	0
9	.300000E+08	.850775	.850775	-.108778E-04	-.559121E-04	-.167736E+04	0
10	.300000E+08	.581177	.767812	-.255028E-04	-.246037E-03	-.738111E+04	0
11	.300000E+08	.436740	.650754	-.395028E-04	-.428037E-03	-.128411E+05	0
12	.300000E+08	.485954	.692343	-.530028E-04	-.603537E-03	-.181061E+05	0
13	.300000E+08	.373911	.583548	-.662528E-04	-.775787E-03	-.232736E+05	0
14	.300000E+08	.435997	.646751	-.780028E-04	-.928537E-03	-.278561E+05	0
15	.300000E+08	.431659	.643347	-.862528E-04	-.103579E-02	-.310736E+05	0
16	.300000E+08	.524671	.736694	-.927528E-04	-.112029E-02	-.336086E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .394051E+03 N.A. LOCATION = 193.539 MOMENT OF INERTIA = .656753E+07
CUMULATIVE CURVATURE = .65000E-05 CUMULATIVE MOMENT = .15006E+10 UNBALANCED FORCE = -.17605E+04

LOAD RANGE 2 INCREMENT 2 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 203.998

GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	1.000000	1.000000	.555010E-04	.935589E-03	.280677E+05	0
2	.300000E+08	1.000000	1.000000	.552510E-04	.932089E-03	.279627E+05	0
3	.300000E+08	1.000000	1.000000	.548760E-04	.926839E-03	.278052E+05	0
4	.300000E+08	1.000000	1.000000	.542510E-04	.918039E-03	.275427E+05	0
5	.300000E+08	1.000000	1.000000	.526260E-04	.895339E-03	.268602E+05	0
6	.300000E+08	1.000000	1.000000	.317510E-04	.603089E-03	.180927E+05	0
7	.300000E+08	1.000000	1.000000	.148760E-04	.366839E-03	.110052E+05	0
8	.300000E+08	1.000000	1.000000	-.124896E-05	.141089E-03	.423267E+04	0
9	.300000E+08	.850775	.850775	-.164990E-04	-.724110E-04	-.217233E+04	0
10	.300000E+08	.547574	.744911	-.311240E-04	-.277161E-03	-.831483E+04	0
11	.300000E+08	.415393	.629301	-.451240E-04	-.473161E-03	-.141948E+05	0
12	.300000E+08	.463943	.673074	-.586240E-04	-.662161E-03	-.198648E+05	0
13	.300000E+08	.357708	.565071	-.718740E-04	-.847661E-03	-.254298E+05	0
14	.300000E+08	.417598	.628562	-.836240E-04	-.101216E-02	-.303648E+05	0
15	.300000E+08	.413701	.625353	-.918740E-04	-.112766E-02	-.338298E+05	0
16	0.	.725292	.725292	-.983740E-04	-.121866E-02	-.354541E+05	3

HARD CORNER ELEMENT DATA

ELEMENT	MODULUS	INC. STRAIN	CUM. STRAIN	CUM. STRESS
1	.300000E+08	.555010E-04	.111597E-02	.334790E+05
2	.300000E+08	.528510E-04	.107092E-02	.321275E+05
3	.300000E+08	.505010E-04	.103097E-02	.309290E+05
4	.300000E+08	.448760E-04	.935340E-03	.280602E+05
5	.300000E+08	.490010E-04	.100547E-02	.301640E+05
6	0.	-.101874E-03	-.155941E-02	-.450000E+05
7	.300000E+08	-.934790E-04	-.141669E-02	-.425008E+05

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .337764E+03 N.A. LOCATION = 224.232 MOMENT OF INERTIA = .432841E+07
CUMULATIVE CURVATURE = .70000E-05 CUMULATIVE MOMENT = .15873E+10 UNBALANCED FORCE = -.37843E+03

LOAD RANGE 3 INCREMENT 1 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 240.843

GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	1.000000	1.000000	.148314E-04	.950420E-03	.285126E+05	0
2	.300000E+08	1.000000	1.000000	.147314E-04	.946820E-03	.284046E+05	0
3	.300000E+08	1.000000	1.000000	.145814E-04	.941420E-03	.282426E+05	0
4	.300000E+08	1.000000	1.000000	.143314E-04	.932420E-03	.279726E+05	0
5	.300000E+08	1.000000	1.000000	.136814E-04	.909020E-03	.272706E+05	0

6	.300000E+08	1.000000	1.000000	.533139E-05	.608420E-03	.182526E+05	0
7	.300000E+08	1.000000	1.000000	-.141861E-05	.365420E-03	.109626E+05	0
8	.300000E+08	1.000000	1.000000	-.786861E-05	.133220E-03	.399661E+04	0
9	.300000E+08	.850775	.850775	-.139686E-04	-.863796E-04	-.259139E+04	0
10	.300000E+08	.528988	.731111	-.198186E-04	-.296980E-03	-.890939E+04	0
11	.300000E+08	.404666	.618119	-.254186E-04	-.498580E-03	-.149574E+05	0
12	.300000E+08	.453510	.663539	-.308186E-04	-.692980E-03	-.207894E+05	0
13	.300000E+08	.350322	.556444	-.361186E-04	-.883780E-03	-.265134E+05	0
14	.300000E+08	.409424	.620224	-.408186E-04	-.105298E-02	-.315894E+05	0
15	.300000E+08	.405838	.617235	-.441186E-04	-.117178E-02	-.351534E+05	0
16	0.	.725292	.725292	-.467186E-04	-.126538E-02	-.354541E+05	3

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .321843E+03 N.A. LOCATION = 235.108 MOMENT OF INERTIA = .351448E+07
CUMULATIVE CURVATURE = .72000E-05 CUMULATIVE MOMENT = .16234E+10 UNBALANCED FORCE = -.88259E+02

LOAD RANGE 3 INCREMENT 2 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 236.338
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	1.000000	1.000000	.157323E-04	.966153E-03	.289846E+05	0
2	.300000E+08	1.000000	1.000000	.156323E-04	.962453E-03	.288736E+05	0
3	.300000E+08	1.000000	1.000000	.154823E-04	.956903E-03	.287071E+05	0
4	.300000E+08	1.000000	1.000000	.152323E-04	.947653E-03	.284296E+05	0
5	.300000E+08	1.000000	1.000000	.145823E-04	.923603E-03	.277081E+05	0
6	.300000E+08	1.000000	1.000000	.623234E-05	.614653E-03	.184396E+05	0
7	.300000E+08	1.000000	1.000000	-.517661E-06	.364903E-03	.109471E+05	0
8	.300000E+08	1.000000	1.000000	-.696766E-05	.126253E-03	.378758E+04	0
9	.300000E+08	.850775	.850775	-.130677E-04	-.994473E-04	-.298342E+04	0
10	.300000E+08	.512904	.718518	-.189177E-04	-.315897E-03	-.947692E+04	0
11	.300000E+08	.395069	.607886	-.245177E-04	-.523097E-03	-.156929E+05	0
12	.300000E+08	.444026	.654648	-.299177E-04	-.722897E-03	-.216869E+05	0
13	.300000E+08	.343544	.548414	-.352177E-04	-.918997E-03	-.275699E+05	0
14	.300000E+08	.401877	.612386	-.399177E-04	-.109290E-02	-.327869E+05	0
15	.300000E+08	.398555	.609584	-.432177E-04	-.121500E-02	-.364499E+05	0
16	0.	.725292	.725292	-.458177E-04	-.131120E-02	-.354541E+05	3

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .310651E+03 N.A. LOCATION = 242.820 MOMENT OF INERTIA = .297863E+07
CUMULATIVE CURVATURE = .74000E-05 CUMULATIVE MOMENT = .16440E+10 UNBALANCED FORCE = -.39564E+03

LOAD RANGE 3 INCREMENT 3 CYCLE 15
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 590.427
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	1.000000	1.000000	-.550855E-04	.911067E-02	.273320E+05	0
2	.300000E+08	1.000000	1.000000	-.551855E-04	.907367E-02	.272180E+05	0
3	.300000E+08	1.000000	1.000000	-.553355E-04	.901867E-02	.270470E+05	0
4	.300000E+08	1.000000	1.000000	-.555855E-04	.892067E-02	.267620E+05	0
5	.300000E+08	1.000000	1.000000	-.562355E-04	.867367E-02	.260210E+05	0
6	.300000E+08	1.000000	1.000000	-.645855E-04	.530067E-02	.165020E+05	0
7	.300000E+08	1.000000	1.000000	-.713355E-04	.293567E-02	.880702E+04	0
8	.300000E+08	1.000000	1.000000	-.777855E-04	.484672E-04	.145402E+04	0
9	.300000E+08	.774738	.843979	-.838855E-04	-.183333E-03	-.549998E+04	0
10	.300000E+08	.452629	.665948	-.897355E-04	-.405633E-03	-.121690E+05	0
11	.300000E+08	.363344	.572532	-.953355E-04	-.618433E-03	-.185530E+05	0
12	.300000E+08	.415987	.627117	-.100735E-03	-.823633E-03	-.247090E+05	0
13	.300000E+08	.325290	.526251	-.106035E-03	-.102503E-02	-.307510E+05	0
14	0.	.600998	.600998	-.110735E-03	-.120363E-02	-.346122E+05	3

15	.300000E+08	.381073	.590711	-.114035E-03	-.132903E-02	-.398710E+05	0
16	-.572913E+08	.725292	.725292	-.116635E-03	-.142793E-02	-.266752E+05	3

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .159156E+03 N.A. LOCATION = 462.859 MOMENT OF INERTIA = -.128730E+08
CUMULATIVE CURVATURE = .76000E-05 CUMULATIVE MOMENT = .15099E+10 UNBALANCED FORCE = .19922E+03

LOAD RANGE 3 INCREMENT 4 CYCLE 11
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 417.332
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	1.000000	1.000000	-.204663E-04	.890601E-03	.267180E+05	0
2	.300000E+08	1.000000	1.000000	-.205663E-04	.886701E-03	.266010E+05	0
3	.300000E+08	1.000000	1.000000	-.207163E-04	.880851E-03	.264255E+05	0
4	.300000E+08	1.000000	1.000000	-.209663E-04	.871101E-03	.261330E+05	0
5	.300000E+08	1.000000	1.000000	-.216163E-04	.845751E-03	.253725E+05	0
6	.300000E+08	1.000000	1.000000	-.299663E-04	.520101E-03	.156030E+05	0
7	.300000E+08	1.000000	1.000000	-.367163E-04	.256851E-03	.770553E+04	0
8	.300000E+08	1.000000	1.000000	-.431663E-04	.530091E-05	.159027E+03	0
9	.300000E+08	.687814	.819561	-.492663E-04	-.232599E-03	-.697797E+04	0
10	.300000E+08	.424695	.638706	-.551163E-04	-.460749E-03	-.138225E+05	0
11	.300000E+08	.346722	.553070	-.607163E-04	-.679149E-03	-.203745E+05	0
12	.300000E+08	.400233	.610832	-.661163E-04	-.889749E-03	-.266925E+05	0
13	.300000E+08	.314518	.512805	-.714163E-04	-.109645E-02	-.328935E+05	0
14	0.	.600998	.600998	-.761163E-04	-.127975E-02	-.346122E+05	3
15	0.	.585257	.585257	-.794163E-04	-.140845E-02	-.409232E+05	3
16	-.364293E+08	.725292	.725292	-.820163E-04	-.150985E-02	-.229390E+05	3

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .189232E+03 N.A. LOCATION = 387.964 MOMENT OF INERTIA = -.730086E+07
CUMULATIVE CURVATURE = .78000E-05 CUMULATIVE MOMENT = .14530E+10 UNBALANCED FORCE = .21829E+03

LOAD RANGE 3 INCREMENT 5 CYCLE 15
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 682.047
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	1.000000	1.000000	-.734093E-04	.817192E-03	.245157E+05	0
2	.300000E+08	1.000000	1.000000	-.735093E-04	.813192E-03	.243957E+05	0
3	.300000E+08	1.000000	1.000000	-.736593E-04	.807192E-03	.242157E+05	0
4	.300000E+08	1.000000	1.000000	-.739093E-04	.797192E-03	.239157E+05	0
5	.300000E+08	1.000000	1.000000	-.745593E-04	.771192E-03	.231357E+05	0
6	.300000E+08	1.000000	1.000000	-.829093E-04	.437192E-03	.131157E+05	0
7	.300000E+08	1.000000	1.000000	-.896593E-04	.167192E-03	.501575E+04	0
8	.300000E+08	.851612	.851612	-.961093E-04	-.908084E-04	-.272425E+04	0
9	.300000E+08	.573293	.760274	-.102209E-03	-.334808E-03	-.100443E+05	0
10	.300000E+08	.382231	.593803	-.108059E-03	-.568808E-03	-.170643E+05	0
11	.300000E+08	.320907	.521565	-.113659E-03	-.792808E-03	-.237843E+05	0
12	.300000E+08	.375874	.584494	-.119059E-03	-.100881E-02	-.302643E+05	0
13	0.	.502759	.502759	-.124359E-03	-.122081E-02	-.346122E+05	3
14	-.551092E+08	.600998	.600998	-.129059E-03	-.140881E-02	-.265682E+05	3
15	-.887614E+08	.585257	.585257	-.132359E-03	-.154081E-02	-.297198E+05	3
16	-.213311E+08	.725292	.725292	-.134959E-03	-.164481E-02	-.191918E+05	3

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .114778E+03 N.A. LOCATION = 609.982 MOMENT OF INERTIA = -.217438E+08
CUMULATIVE CURVATURE = .80000E-05 CUMULATIVE MOMENT = .12917E+10 UNBALANCED FORCE = .10535E+03

LOAD RANGE 3 INCREMENT 6 CYCLE 13

INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 480.783

GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	1.000000	1.000000	-.331566E-04	.784035E-03	.235210E+05	0
2	.300000E+08	1.000000	1.000000	-.332566E-04	.779935E-03	.233980E+05	0
3	.300000E+08	1.000000	1.000000	-.334066E-04	.773785E-03	.232135E+05	0
4	.300000E+08	1.000000	1.000000	-.336566E-04	.763535E-03	.229060E+05	0
5	.300000E+08	1.000000	1.000000	-.343066E-04	.736885E-03	.221065E+05	0
6	.300000E+08	1.000000	1.000000	-.426566E-04	.394535E-03	.118360E+05	0
7	.300000E+08	1.000000	1.000000	-.494066E-04	.117785E-03	.353355E+04	0
8	.300000E+08	.848880	.851604	-.558566E-04	-.146665E-03	-.439995E+04	0
9	.300000E+08	.526633	.727278	-.619566E-04	-.396765E-03	-.119030E+05	0
10	.300000E+08	.361302	.570123	-.678066E-04	-.636615E-03	-.190985E+05	0
11	.300000E+08	.307009	.503959	-.734066E-04	-.866215E-03	-.259865E+05	0
12	.300000E+08	.362001	.568866	-.788066E-04	-.108762E-02	-.326285E+05	3
13	0.	.502759	.502759	-.841066E-04	-.130492E-02	-.346122E+05	3
14	-.344244E+08	.600998	.600998	-.888066E-04	-.149762E-02	-.227120E+05	3
15	-.459859E+08	.585257	.585257	-.921066E-04	-.163292E-02	-.238704E+05	3
16	-.160146E+08	.725292	.725292	-.947066E-04	-.173952E-02	-.174433E+05	3

INSTANTANEOUS SECTION CHARACTERISTICS

AREA = .170594E+03 N.A. LOCATION = 416.445 MOMENT OF INERTIA = -.861582E+07

CUMULATIVE CURVATURE = .82000E-05 CUMULATIVE MOMENT = .12138E+10 UNBALANCED FORCE = .11519E+03

LOAD RANGE 3 INCREMENT 7 CYCLE 2

INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 414.693

GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	1.000000	1.000000	-.199386E-04	.764096E-03	.229229E+05	0
2	.300000E+08	1.000000	1.000000	-.200386E-04	.759896E-03	.227969E+05	0
3	.300000E+08	1.000000	1.000000	-.201886E-04	.753596E-03	.226079E+05	0
4	.300000E+08	1.000000	1.000000	-.204386E-04	.743096E-03	.222929E+05	0
5	.300000E+08	1.000000	1.000000	-.210886E-04	.715796E-03	.214739E+05	0
6	.300000E+08	1.000000	1.000000	-.294386E-04	.365096E-03	.109529E+05	0
7	.300000E+08	1.000000	1.000000	-.361886E-04	.815964E-04	.244789E+04	0
8	.300000E+08	.747188	.838808	-.426386E-04	-.189304E-03	-.567911E+04	0
9	.300000E+08	.496992	.703659	-.487386E-04	-.445504E-03	-.133651E+05	0
10	.300000E+08	.346742	.553044	-.545886E-04	-.691204E-03	-.207361E+05	0
11	.300000E+08	.296868	.490828	-.601886E-04	-.926404E-03	-.277921E+05	0
12	.300000E+08	.351555	.556799	-.655886E-04	-.115320E-02	-.345961E+05	3
13	-.687328E+08	.502759	.502759	-.708886E-04	-.137580E-02	-.285981E+05	3
14	-.252602E+08	.600998	.600998	-.755886E-04	-.157320E-02	-.204860E+05	3
15	-.308818E+08	.585257	.585257	-.788886E-04	-.171180E-02	-.209041E+05	3
16	-.129912E+08	.725292	.725292	-.814886E-04	-.182100E-02	-.162687E+05	3

INSTANTANEOUS SECTION CHARACTERISTICS

AREA = .168785E+03 N.A. LOCATION = 413.238 MOMENT OF INERTIA = -.799021E+07

CUMULATIVE CURVATURE = .84000E-05 CUMULATIVE MOMENT = .11603E+10 UNBALANCED FORCE = .35009E+05

LOAD RANGE 3 INCREMENT 8 CYCLE 9

INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 432.925

GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	1.000000	1.000000	-.235850E-04	.740511E-03	.222153E+05	0
2	.300000E+08	1.000000	1.000000	-.236850E-04	.736211E-03	.220863E+05	0
3	.300000E+08	1.000000	1.000000	-.238350E-04	.729761E-03	.218928E+05	0
4	.300000E+08	1.000000	1.000000	-.240850E-04	.719011E-03	.215703E+05	0
5	.300000E+08	1.000000	1.000000	-.247350E-04	.691061E-03	.207318E+05	0

6	.300000E+08	1.000000	1.000000	-.330850E-04	.332011E-03	.996034E+04	0
7	.300000E+08	1.000000	1.000000	-.398350E-04	.417614E-04	.125284E+04	0
8	.300000E+08	.669780	.812788	-.462850E-04	-.235589E-03	-.706766E+04	0
9	.300000E+08	.470120	.680462	-.523850E-04	-.497889E-03	-.149367E+05	0
10	.300000E+08	.332997	.536469	-.582350E-04	-.749439E-03	-.224832E+05	0
11	.300000E+08	.287140	.478006	-.638350E-04	-.990239E-03	-.297072E+05	0
12	0.	.556704	.556704	-.692350E-04	-.122244E-02	-.346122E+05	3
13	-.434166E+08	.502759	.502759	-.745350E-04	-.145034E-02	-.245384E+05	3
14	-.193258E+08	.600998	.600998	-.792350E-04	-.165244E-02	-.187371E+05	3
15	-.222595E+08	.585257	.585257	-.825350E-04	-.179434E-02	-.187433E+05	3
16	-.107292E+08	.725292	.725292	-.851350E-04	-.190614E-02	-.152641E+05	3

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .184164E+03 N.A. LOCATION = 378.355 MOMENT OF INERTIA = -.559567E+07
CUMULATIVE CURVATURE = .86000E-05 CUMULATIVE MOMENT = .11106E+10 UNBALANCED FORCE = -.25478E+03

LOAD RANGE 3 INCREMENT 9 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 366.666
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	1.000000	1.000000	-.103331E-04	.730178E-03	.219053E+05	0
2	.300000E+08	1.000000	1.000000	-.104331E-04	.725778E-03	.217733E+05	0
3	.300000E+08	1.000000	1.000000	-.105831E-04	.719178E-03	.215753E+05	0
4	.300000E+08	1.000000	1.000000	-.108331E-04	.708178E-03	.212453E+05	0
5	.300000E+08	1.000000	1.000000	-.114831E-04	.679578E-03	.203873E+05	0
6	.300000E+08	1.000000	1.000000	-.198331E-04	.312178E-03	.936535E+04	0
7	.300000E+08	1.000000	1.000000	-.265831E-04	.151783E-04	.455349E+03	0
8	.300000E+08	.627248	.792501	-.330331E-04	-.268622E-03	-.805865E+04	0
9	.300000E+08	.452667	.664486	-.391331E-04	-.537022E-03	-.161107E+05	0
10	.300000E+08	.323432	.524673	-.449831E-04	-.794422E-03	-.238327E+05	0
11	.300000E+08	.280076	.468556	-.505831E-04	-.104082E-02	-.312247E+05	3
12	0.	.556704	.556704	-.559831E-04	-.127842E-02	-.346122E+05	3
13	-.323424E+08	.502759	.502759	-.612831E-04	-.151162E-02	-.222447E+05	3
14	-.159580E+08	.600998	.600998	-.659831E-04	-.171842E-02	-.175789E+05	3
15	-.177111E+08	.585257	.585257	-.692831E-04	-.186362E-02	-.173687E+05	3
16	-.928589E+07	.725292	.725292	-.718831E-04	-.197802E-02	-.145468E+05	3

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .195969E+03 N.A. LOCATION = 356.808 MOMENT OF INERTIA = -.419146E+07
CUMULATIVE CURVATURE = .88000E-05 CUMULATIVE MOMENT = .108[illegible]5E+10 UNBALANCED FORCE = -.34543E+03

LOAD RANGE 3 INCREMENT 10 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 373.419
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	1.000000	1.000000	-.116838E-04	.716494E-03	.215548E+05	0
2	.300000E+08	1.000000	1.000000	-.117838E-04	.713994E-03	.214198E+05	0
3	.300000E+08	1.000000	1.000000	-.119338E-04	.707244E-03	.212173E+05	0
4	.300000E+08	1.000000	1.000000	-.121838E-04	.695994E-03	.208798E+05	0
5	.300000E+08	1.000000	1.000000	-.128338E-04	.666744E-03	.200023E+05	0
6	.300000E+08	1.000000	1.000000	-.211838E-04	.290994E-03	.872983E+04	0
7	.300000E+08	.866643	.866643	-.279338E-04	-.127555E-04	-.382666E+03	0
8	.300000E+08	.590589	.771606	-.343838E-04	-.303006E-03	-.909017E+04	0
9	.300000E+08	.436513	.649061	-.404838E-04	-.577506E-03	-.173252E+05	0
10	.300000E+08	.314394	.513330	-.463338E-04	-.840756E-03	-.252227E+05	0
11	.300000E+08	.273339	.459436	-.519338E-04	-.109276E-02	-.327827E+05	3
12	-.947269E+08	.556704	.556704	-.573338E-04	-.133576E-02	-.318250E+05	3
13	-.251622E+08	.502759	.502759	-.626338E-04	-.157426E-02	-.204595E+05	3
14	-.134220E+08	.600998	.600998	-.673338E-04	-.178576E-02	-.165939E+05	3

15	-.144727E+08	.585257	.585257	-.706338E-04	-.193426E-02	-.162385E+05	3
16	-.812021E+07	.725292	.725292	-.732338E-04	-.205126E-02	-.139110E+05	3

HARD CORNER ELEMENT DATA

ELEMENT	MODULUS	INC. STRAIN	CUM. STRAIN	CUM. STRESS
1	.300000E+08	-.116838E-04	.887187E-03	.266156E+05
2	.300000E+08	-.127438E-04	.830477E-03	.249143E+05
3	.300000E+08	-.136838E-04	.780187E-03	.234056E+05
4	.300000E+08	-.159338E-04	.659812E-03	.197944E+05
5	.300000E+08	-.142838E-04	.748087E-03	.224426E+05
6	0.	-.746338E-04	-.248064E-02	-.450000E+05
7	0.	-.712758E-04	-.230099E-02	-.450000E+05

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .169801E+03 N.A. LOCATION = 392.516 MOMENT OF INERTIA = -.580934E+07
CUMULATIVE CURVATURE = .90000E-05 CUMULATIVE MOMENT = .10519E+10 UNBALANCED FORCE = -.24522E+03

ULTIMATE STRENGTH OF HULL A (NO ILS, AET=68.0) - SAGGING

INPUT DATA

NUMBER OF GROSS PANEL ELEMENTS	16
NUMBER OF HARD CORNERS	7
NUMBER OF DIFFERENT STIFFENERS	7
NUMBER OF DIFFERENT MATERIALS	1
MAXIMUM NUMBER OF ITERATIONS	20

SHIP CHARACTERISTICS

COMPARTMENT LENGTH	480.00
TRANSVERSE FRAME SPACING	96.00

GROSS PANEL ELEMENT DATA

COORDINATE DATA

ELEMENT	Y1	Z1	Y2	Z2	YAVE	ZAVE	WIDTH	SIN	COS
1	315.000	14.500	315.000	43.000	315.000	28.750	28.5000	0.00000	1.00000
2	315.000	43.000	314.000	72.500	314.500	57.750	29.5169	-.03388	.99943
3	314.000	72.500	313.500	101.000	313.750	86.750	28.5044	-.01754	.99985
4	313.500	101.000	311.500	171.000	312.500	136.000	70.0286	-.02856	.99959
5	311.500	171.000	309.000	242.000	309.250	206.500	71.1425	-.06325	.99800
6	284.500	267.500	250.500	267.500	267.500	267.500	34.0000	-1.00000	0.00000
7	250.500	267.500	217.000	267.000	233.750	267.250	33.5037	-.99989	-.01492
8	217.000	267.000	186.000	265.000	201.500	266.000	31.0644	-.99793	-.06438
9	186.000	265.000	156.000	260.000	171.000	262.500	30.4138	-.98639	-.16440
10	156.000	260.000	127.500	253.000	141.750	256.500	29.3471	-.97114	-.23852
11	127.500	253.000	100.000	242.000	113.750	247.500	29.6184	-.92848	-.37139
12	100.000	242.000	73.500	226.000	86.750	234.000	30.9556	-.85606	-.51687
13	73.500	226.000	47.000	202.000	60.250	214.000	35.7526	-.74120	-.67128
14	47.000	202.000	26.500	168.000	36.750	185.000	39.7020	-.51635	-.85638
15	26.500	168.000	14.000	132.000	20.250	150.000	38.1084	-.32801	-.94467
16	14.000	132.000	.500	20.000	7.250	76.000	112.8107	-.11967	-.99281

GEOMETRY

ELEMENT	PLATE THICK.	STIFF. SPACING	NO. OF STIFF.	STIFF. REF. NO.	MATERIAL REF. NO.	TRIPPING EFF.LEN.	G.I. CODE	PROP. LIMIT	RES.STR. FACTOR
1	.37500	28.5000	1	1	1	68.0000	0	.5000	3.0000
2	.50000	29.5169	1	1	1	68.0000	0	.5000	3.0000
3	.50000	28.5044	1	2	1	68.0000	0	.5000	3.0000
4	.50000	35.0143	2	2	1	68.0000	0	.5000	3.0000
5	.62500	35.5712	2	2	1	68.0000	0	.5000	3.0000
6	.62500	34.0000	1	3	1	68.0000	0	.5000	3.0000
7	.62500	33.5037	1	3	1	68.0000	0	.5000	3.0000
8	.37500	31.0644	1	4	1	68.0000	0	.5000	3.0000
9	.37500	30.4138	1	3	1	68.0000	0	.5000	3.0000
10	.31250	29.3471	1	3	1	68.0000	0	.5000	3.0000
11	.31250	29.6184	1	3	1	68.0000	0	.5000	3.0000
12	.43750	30.9556	1	5	1	68.0000	0	.5000	3.0000
13	.43750	35.7526	1	5	1	68.0000	0	.5000	3.0000
14	.62500	39.7020	1	5	1	68.0000	0	.5000	3.0000
15	.62500	38.1084	1	6	1	68.0000	0	.5000	3.0000
16	.75000	37.6036	3	7	1	68.0000	0	.5000	3.0000

PRESSURE LOADING AND INITIAL DISTORTION

ELEMENT	PRESSURE LOAD	INITIAL DISTORT.	PRE-STRAIN

1	0.000	0.000000	0.
2	0.000	0.000000	0.
3	0.000	0.000000	0.
4	0.000	0.000000	0.
5	0.000	0.000000	0.
6	0.000	0.000000	0.
7	0.000	0.000000	0.
8	0.000	0.000000	0.
9	0.000	0.000000	0.
10	0.000	0.000000	0.
11	0.000	0.000000	0.
12	0.000	0.000000	0.
13	0.000	0.000000	0.
14	0.000	0.000000	0.
15	0.000	0.000000	0.
16	0.000	0.000000	0.

HARD CORNER ELEMENT DATA

ELEMENT	AREA	Y-COORD	MOM. IN.	MAT.REF.	PRE-STRAIN
1	5.4375	315.000	.064	1	0.
2	1.1000	309.700	7.800	1	0.
3	16.1324	305.000	22.022	1	0.
4	11.5625	293.750	329.772	1	0.
5	6.2500	302.000	0.000	1	0.
6	15.0047	.250	1.016	1	0.
7	10.3600	17.040	661.500	1	0.

STIFFENER DATA

NUMBER	AREA	IZZ	IYY	DEPTH	TWEB	WFLG	TFLG	MAT.REF.
1	2.0970	14.145	1.023	7.9000	.17000	3.9400	.20000	1
2	2.7625	19.177	1.341	8.0000	.23000	4.0000	.25000	1
3	2.0214	7.560	1.151	5.9600	.20000	3.9700	.22000	1
4	3.7779	58.706	1.452	12.0000	.23000	4.0000	.27000	1
5	2.5288	26.727	1.032	9.8600	.18000	3.9500	.20000	1
6	8.6600	319.415	12.621	18.4400	.31000	7.0000	.44000	1
7	3.3179	35.874	1.450	10.0000	.23000	4.0000	.27000	1

MATERIAL CHARACTERISTICS

MATERIAL	YOUNGS MODULUS	POISSON RATIO	YIELD STRESS	SHEAR MODULUS	PROP.LIM RATIO	YIELD STRAIN
1	.30000E+08	.3000	45000.0	.11538E+08	1.0000	.15000E-02

FULLY EFFECTIVE CROSS SECTION CHARACTERISTICS

CROSS SECTION AREA	489.310
HEIGHT OF N.A. ABOVE BASE LINE	163.427
SECTION MOMENT OF INERTIA	8572474.0

CURVATURE INCREMENT DATA

LOAD RANGE	NUMBER OF INCREMENTS	INCREMENT SIZE
1	6	-.1000E-05
2	3	-.5000E-06
3	10	-.2000E-06

CRITICAL STRAIN (MEAN STRESS) VALUES

ELEMENT	PLATE YIELD STRAIN	STIFF YIELD STRAIN	EULER COLUMN BUCKLING	STIFFENER TRIPPING

1	.15000E-02	.15000E-02	-.14270E-02	-.11959E-02
	(.45000E+05)	(.45000E+05)	(-.42810E+05)	(-.35877E+05)
2	.15000E-02	.15000E-02	-.14079E-02	-.11959E-02
	(.45000E+05)	(.45000E+05)	(-.42237E+05)	(-.35877E+05)
3	.15000E-02	.15000E-02	-.14217E-02	-.12115E-02
	(.45000E+05)	(.45000E+05)	(-.42651E+05)	(-.36344E+05)
4	.15000E-02	.15000E-02	-.14189E-02	-.12115E-02
	(.45000E+05)	(.45000E+05)	(-.42567E+05)	(-.36344E+05)
5	.15000E-02	.15000E-02	-.14002E-02	-.12115E-02
	(.45000E+05)	(.45000E+05)	(-.42006E+05)	(-.36344E+05)
6	.15000E-02	.15000E-02	-.12958E-02	-.12397E-02
	(.45000E+05)	(.45000E+05)	(-.38873E+05)	(-.37191E+05)
7	.15000E-02	.15000E-02	-.12962E-02	-.12397E-02
	(.45000E+05)	(.45000E+05)	(-.38887E+05)	(-.37191E+05)
8	.15000E-02	.15000E-02	-.14707E-02	-.11416E-02
	(.45000E+05)	(.45000E+05)	(-.44120E+05)	(-.34248E+05)
9	.15000E-02	.15000E-02	-.13749E-02	-.12397E-02
	(.45000E+05)	(.45000E+05)	(-.41246E+05)	(-.37191E+05)
10	.15000E-02	.15000E-02	-.13874E-02	-.12397E-02
	(.45000E+05)	(.45000E+05)	(-.41622E+05)	(-.37191E+05)
11	.15000E-02	.15000E-02	-.13873E-02	-.12397E-02
	(.45000E+05)	(.45000E+05)	(-.41618E+05)	(-.37191E+05)
12	.15000E-02	.15000E-02	-.14481E-02	-.11537E-02
	(.45000E+05)	(.45000E+05)	(-.43443E+05)	(-.34612E+05)
13	.15000E-02	.15000E-02	-.14467E-02	-.11537E-02
	(.45000E+05)	(.45000E+05)	(-.43402E+05)	(-.34612E+05)
14	.15000E-02	.15000E-02	-.14251E-02	-.11537E-02
	(.45000E+05)	(.45000E+05)	(-.42752E+05)	(-.34612E+05)
15	.15000E-02	.15000E-02	-.14884E-02	-.13641E-02
	(.45000E+05)	(.45000E+05)	(-.44652E+05)	(-.40923E+05)
16	.15000E-02	.15000E-02	-.14264E-02	-.11818E-02
	(.45000E+05)	(.45000E+05)	(-.42791E+05)	(-.35454E+05)

INITIAL (UNLOADED) CROSS SECTION CHARACTERISTICS

CROSS SECTION AREA	462.452
HEIGHT OF N.A. ABOVE BASE LINE	156.483
SECTION MOMENT OF INERTIA	8108865.2

MOMENT-CURVATURE HISTORY

LOAD RANGE 1 INCREMENT 1 CYCLE 1
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 156.483
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	.848038	.848038	-.158517E-03	-.158617E-03	-.475550E+04	0
2	.300000E+08	.850730	.850730	-.158017E-03	-.158017E-03	-.474050E+04	0
3	.300000E+08	.855730	.855730	-.157267E-03	-.157267E-03	-.471800E+04	0
4	.300000E+08	.844201	.844201	-.156017E-03	-.156017E-03	-.468050E+04	0
5	.300000E+08	.855993	.855993	-.152767E-03	-.152767E-03	-.458300E+04	0
6	.300000E+08	.863835	.863835	-.111017E-03	-.111017E-03	-.333050E+04	0
7	.300000E+08	.866643	.866643	-.772666E-04	-.772666E-04	-.231800E+04	0
8	.300000E+08	.851612	.851612	-.450166E-04	-.450166E-04	-.135050E+04	0
9	.300000E+08	.850775	.850775	-.145166E-04	-.145166E-04	-.435499E+03	0
10	.300000E+08	1.000000	1.000000	.147334E-04	.147334E-04	.442001E+03	0
11	.300000E+08	1.000000	1.000000	.427334E-04	.427334E-04	.128200E+04	0
12	.300000E+08	1.000000	1.000000	.697334E-04	.697334E-04	.209200E+04	0
13	.300000E+08	1.000000	1.000000	.962334E-04	.962334E-04	.288700E+04	0
14	.300000E+08	1.000000	1.000000	.119733E-03	.119733E-03	.359200E+04	0
15	.300000E+08	1.000000	1.000000	.136233E-03	.136233E-03	.408700E+04	0
16	.300000E+08	1.000000	1.000000	.149233E-03	.149233E-03	.447700E+04	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .462452E+03 N.A. LOCATION = 156.483 MOMENT OF INERTIA = .810887E+07
CUMULATIVE CURVATURE = -.10000E-05 CUMULATIVE MOMENT = -.24294E+09 UNBALANCED FORCE = .11288E+01

LOAD RANGE 1 INCREMENT 2 CYCLE 2
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 154.970
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	.625195	.789480	-.160030E-03	-.318547E-03	-.955640E+04	0
2	.300000E+08	.808698	.848653	-.159530E-03	-.317547E-03	-.952640E+04	0
3	.300000E+08	.844345	.855579	-.158780E-03	-.316047E-03	-.948140E+04	0
4	.300000E+08	.680800	.812573	-.157530E-03	-.313547E-03	-.940640E+04	0
5	.300000E+08	.855993	.855993	-.154280E-03	-.307047E-03	-.921140E+04	0
6	.300000E+08	.863835	.863835	-.112530E-03	-.223547E-03	-.670640E+04	0
7	.300000E+08	.866643	.866643	-.787799E-04	-.156047E-03	-.468140E+04	0
8	.300000E+08	.851612	.851612	-.465299E-04	-.915465E-04	-.274640E+04	0
9	.300000E+08	.850775	.850775	-.160299E-04	-.305465E-04	-.916395E+03	0
10	.300000E+08	1.000000	1.000000	.132201E-04	.279535E-04	.838605E+03	0
11	.300000E+08	1.000000	1.000000	.412201E-04	.839535E-04	.251860E+04	0
12	.300000E+08	1.000000	1.000000	.682201E-04	.137953E-03	.413860E+04	0
13	.300000E+08	1.000000	1.000000	.947201E-04	.190953E-03	.572860E+04	0
14	.300000E+08	1.000000	1.000000	.118220E-03	.237953E-03	.713860E+04	0
15	.300000E+08	1.000000	1.000000	.134720E-03	.270953E-03	.812860E+04	0
16	.300000E+08	1.000000	1.000000	.147720E-03	.296953E-03	.890860E+04	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .453567E+03 N.A. LOCATION = 153.411 MOMENT OF INERTIA = .788597E+07
CUMULATIVE CURVATURE = -.20000E-05 CUMULATIVE MOMENT = -.48326E+09 UNBALANCED FORCE = -.42819E+04

LOAD RANGE 1 INCREMENT 3 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 150.334
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE

1	.300000E+08	.507613	.711382	-.164666E-03	-.483212E-03	-.144964E+05	0
2	.300000E+08	.656593	.806428	-.164166E-03	-.481712E-03	-.144514E+05	0
3	.300000E+08	.685517	.821873	-.163416E-03	-.479462E-03	-.143839E+05	0
4	.300000E+08	.552711	.743554	-.162166E-03	-.475712E-03	-.142714E+05	0
5	.300000E+08	.696748	.826368	-.158916E-03	-.465962E-03	-.139789E+05	0
6	.300000E+08	.860277	.863821	-.117166E-03	-.340712E-03	-.102214E+05	0
7	.300000E+08	.866643	.866643	-.834156E-04	-.239462E-03	-.718396E+04	0
8	.300000E+08	.851612	.851612	-.511656E-04	-.142712E-03	-.428136E+04	0
9	.300000E+08	.850775	.850775	-.206656E-04	-.512121E-04	-.153636E+04	0
10	.300000E+08	1.000000	1.000000	.858445E-05	.365379E-04	.109614E+04	0
11	.300000E+08	1.000000	1.000000	.365844E-04	.120538E-03	.361614E+04	0
12	.300000E+08	1.000000	1.000000	.635844E-04	.201538E-03	.604614E+04	0
13	.300000E+08	1.000000	1.000000	.900844E-04	.281038E-03	.843114E+04	0
14	.300000E+08	1.000000	1.000000	.113584E-03	.351538E-03	.105461E+05	0
15	.300000E+08	1.000000	1.000000	.130084E-03	.401038E-03	.120311E+05	0
16	.300000E+08	1.000000	1.000000	.143084E-03	.440038E-03	.132011E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .436160E+03 N.A. LOCATION = 147.098 MOMENT OF INERTIA = .743284E+07
CUMULATIVE CURVATURE = -.30000E-05 CUMULATIVE MOMENT = -.71222E+09 UNBALANCED FORCE = -.26521E+02

LOAD RANGE 1 INCREMENT 4 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 144.637
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	.436470	.648296	-.170363E-03	-.653575E-03	-.196072E+05	0
2	.300000E+08	.564557	.754466	-.169863E-03	-.651575E-03	-.195472E+05	0
3	.300000E+08	.589407	.772844	-.169113E-03	-.648575E-03	-.194572E+05	0
4	.300000E+08	.475194	.682905	-.167863E-03	-.643575E-03	-.193072E+05	0
5	.300000E+08	.598940	.778800	-.164613E-03	-.630575E-03	-.189172E+05	0
6	.300000E+08	.737517	.845364	-.122863E-03	-.463575E-03	-.139072E+05	0
7	.300000E+08	.866643	.866643	-.891127E-04	-.328575E-03	-.985724E+04	0
8	.300000E+08	.727707	.833585	-.568627E-04	-.199575E-03	-.598724E+04	0
9	.300000E+08	.850775	.850775	-.263627E-04	-.775748E-04	-.232724E+04	0
10	.300000E+08	1.000000	1.000000	.288730E-05	.394252E-04	.118276E+04	0
11	.300000E+08	1.000000	1.000000	.308873E-04	.151425E-03	.454276E+04	0
12	.300000E+08	1.000000	1.000000	.578873E-04	.259425E-03	.778276E+04	0
13	.300000E+08	1.000000	1.000000	.843873E-04	.365425E-03	.109628E+05	0
14	.300000E+08	1.000000	1.000000	.107887E-03	.459425E-03	.137828E+05	0
15	.300000E+08	1.000000	1.000000	.124387E-03	.525425E-03	.157628E+05	0
16	.300000E+08	1.000000	1.000000	.137387E-03	.577425E-03	.173228E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .421557E+03 N.A. LOCATION = 142.045 MOMENT OF INERTIA = .709314E+07
CUMULATIVE CURVATURE = -.40000E-05 CUMULATIVE MOMENT = -.92953E+09 UNBALANCED FORCE = .26545E+04

LOAD RANGE 1 INCREMENT 5 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 139.584
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	.387549	.597990	-.175416E-03	-.828990E-03	-.248697E+05	0
2	.300000E+08	.501269	.707179	-.174916E-03	-.826490E-03	-.247947E+05	0
3	.300000E+08	.523316	.726602	-.174166E-03	-.822740E-03	-.246822E+05	0
4	.300000E+08	.421886	.632936	-.172916E-03	-.816490E-03	-.244947E+05	0
5	.300000E+08	.531669	.733111	-.169666E-03	-.800240E-03	-.240072E+05	0
6	.300000E+08	.652917	.812337	-.127916E-03	-.591490E-03	-.177447E+05	0
7	.300000E+08	.786304	.859196	-.941655E-04	-.422740E-03	-.126822E+05	0
8	.300000E+08	.635743	.796893	-.619155E-04	-.261490E-03	-.784471E+04	0
9	.300000E+08	.850775	.850775	-.314155E-04	-.108990E-03	-.326971E+04	0

10	.300000E+08	1.000000	1.000000	-.216554E-05	.372597E-04	.111779E+04	0
11	.300000E+08	1.000000	1.000000	.258345E-04	.177260E-03	.531779E+04	0
12	.300000E+08	1.000000	1.000000	.528345E-04	.312260E-03	.936779E+04	0
13	.300000E+08	1.000000	1.000000	.793345E-04	.444760E-03	.133428E+05	0
14	.300000E+08	1.000000	1.000000	.102834E-03	.562260E-03	.168678E+05	0
15	.300000E+08	1.000000	1.000000	.119334E-03	.644760E-03	.193428E+05	0
16	.300000E+08	1.000000	1.000000	.132334E-03	.709760E-03	.212928E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .409749E+03 N.A. LOCATION = 137.957 MOMENT OF INERTIA = .683031E+07
CUMULATIVE CURVATURE = -.50000E-05 CUMULATIVE MOMENT = -.11379E+10 UNBALANCED FORCE = -.19131E+04

LOAD RANGE 1 INCREMENT 6 CYCLE 2
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 136.345
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	.351518	.557329	-.178655E-03	-.100765E-02	-.302294E+05	0
2	.300000E+08	.454657	.666331	-.178155E-03	-.100465E-02	-.301394E+05	0
3	.300000E+08	.474639	.686015	-.177405E-03	-.100015E-02	-.300044E+05	0
4	.300000E+08	.382625	.591829	-.176155E-03	-.992645E-03	-.297794E+05	0
5	.300000E+08	.482128	.692703	-.172905E-03	-.973145E-03	-.291944E+05	0
6	.300000E+08	.590703	.777475	-.131155E-03	-.722645E-03	-.216794E+05	0
7	.300000E+08	.708867	.837920	-.974051E-04	-.520145E-03	-.156044E+05	0
8	.300000E+08	.568815	.757703	-.651551E-04	-.326645E-03	-.979936E+04	0
9	.300000E+08	.850775	.850775	-.346551E-04	-.143645E-03	-.430936E+04	0
10	.300000E+08	1.000000	1.000000	-.540509E-05	.318546E-04	.955638E+03	0
11	.300000E+08	1.000000	1.000000	.225949E-04	.199855E-03	.599564E+04	0
12	.300000E+08	1.000000	1.000000	.495949E-04	.361855E-03	.108556E+05	0
13	.300000E+08	1.000000	1.000000	.760949E-04	.520855E-03	.156256E+05	0
14	.300000E+08	1.000000	1.000000	.995949E-04	.661855E-03	.198556E+05	0
15	.300000E+08	1.000000	1.000000	.116095E-03	.760855E-03	.228256E+05	0
16	.300000E+08	1.000000	1.000000	.129095E-03	.838855E-03	.251656E+05	0

HARD CORNER ELEMENT DATA

ELEMENT	MODULUS	INC. STRAIN	CUM. STRAIN	CUM. STRESS
1	.300000E+08	-.178655E-03	-.118630E-02	-.355890E+05
2	.300000E+08	-.173355E-03	-.114920E-02	-.344760E+05
3	.300000E+08	-.168655E-03	-.111630E-02	-.334890E+05
4	.300000E+08	-.157405E-03	-.103755E-02	-.311265E+05
5	.300000E+08	-.165655E-03	-.109530E-02	-.328590E+05
6	.300000E+08	.136095E-03	.101695E-02	.305085E+05
7	.300000E+08	.119305E-03	.899420E-03	.269826E+05

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .400681E+03 N.A. LOCATION = 134.701 MOMENT OF INERTIA = .662391E+07
CUMULATIVE CURVATURE = -.60000E-05 CUMULATIVE MOMENT = -.13393E+10 UNBALANCED FORCE = -.95825E+03

LOAD RANGE 2 INCREMENT 1 CYCLE 2
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 134.000
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	.336722	.539745	-.905001E-04	-.109815E-02	-.329444E+05	0
2	.300000E+08	.435516	.648077	-.902501E-04	-.109490E-02	-.328469E+05	0
3	.300000E+08	.454651	.667745	-.898751E-04	-.109002E-02	-.327006E+05	0
4	.300000E+08	.366503	.573892	-.892501E-04	-.108190E-02	-.324569E+05	0
5	.300000E+08	.461786	.674450	-.876251E-04	-.106077E-02	-.318231E+05	0
6	.300000E+08	.565177	.760579	-.667501E-04	-.789396E-03	-.236819E+05	0
7	.300000E+08	.677148	.825208	-.498751E-04	-.570021E-03	-.171006E+05	0

8	.300000E+08	.541527	.738705	-.337501E-04	-.360396E-03	-.108119E+05	0
9	.300000E+08	.823801	.849919	-.185001E-04	-.162146E-03	-.486437E+04	0
10	.300000E+08	1.000000	1.000000	-.387514E-05	.279795E-04	.839384E+03	0
11	.300000E+08	1.000000	1.000000	.101249E-04	.209979E-03	.629938E+04	0
12	.300000E+08	1.000000	1.000000	.236249E-04	.385479E-03	.115644E+05	0
13	.300000E+08	1.000000	1.000000	.368749E-04	.557729E-03	.167319E+05	0
14	.300000E+08	1.000000	1.000000	.486249E-04	.710479E-03	.213144E+05	0
15	.300000E+08	1.000000	1.000000	.568749E-04	.817729E-03	.245319E+05	0
16	.300000E+08	1.000000	1.000000	.633749E-04	.902229E-03	.270669E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .396655E+03 N.A. LOCATION = 133.292 MOMENT OF INERTIA = .653619E+07
CUMULATIVE CURVATURE = -.65000E-05 CUMULATIVE MOMENT = -.14822E+10 UNBALANCED FORCE = -.10471E+06

LOAD RANGE 2 INCREMENT 2 CYCLE 2
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 132.645

GROSS PANEL ELEMENT DATA ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	.323558	.523666	-.911777E-04	-.118932E-02	-.356797E+05	0
2	.300000E+08	.418485	.631112	-.909277E-04	-.118582E-02	-.355747E+05	0
3	.300000E+08	.436867	.650704	-.905527E-04	-.118057E-02	-.354172E+05	0
4	.300000E+08	.352159	.557415	-.899277E-04	-.117182E-02	-.351547E+05	0
5	.300000E+08	.443688	.657398	-.883027E-04	-.114907E-02	-.344722E+05	0
6	.300000E+08	.542483	.744290	-.674277E-04	-.856823E-03	-.257047E+05	0
7	.300000E+08	.648979	.811975	-.505527E-04	-.620573E-03	-.186172E+05	0
8	.300000E+08	.517378	.720435	-.344277E-04	-.394823E-03	-.118447E+05	0
9	.300000E+08	.779019	.844723	-.191777E-04	-.181323E-03	-.543970E+04	0
10	.300000E+08	1.000000	1.000000	-.455274E-05	.234267E-04	.702802E+03	0
11	.300000E+08	1.000000	1.000000	.944726E-05	.219427E-03	.658280E+04	0
12	.300000E+08	1.000000	1.000000	.229473E-04	.408427E-03	.122528E+05	0
13	.300000E+08	1.000000	1.000000	.361973E-04	.593927E-03	.178178E+05	0
14	.300000E+08	1.000000	1.000000	.479473E-04	.758427E-03	.227526E+05	0
15	.300000E+08	1.000000	1.000000	.561973E-04	.873927E-03	.262178E+05	0
16	.300000E+08	1.000000	1.000000	.626973E-04	.964927E-03	.289478E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .392838E+03 N.A. LOCATION = 131.991 MOMENT OF INERTIA = .645645E+07
CUMULATIVE CURVATURE = -.70000E-05 CUMULATIVE MOMENT = -.15796E+10 UNBALANCED FORCE = -.10463E+06

LOAD RANGE 2 INCREMENT 3 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 133.222

GROSS PANEL ELEMENT DATA ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	0.	.522565	.522565	-.908891E-04	-.128021E-02	-.358766E+05	3
2	0.	.629315	.629315	-.905391E-04	-.127646E-02	-.358766E+05	3
3	0.	.645181	.645181	-.902641E-04	-.127084E-02	-.363437E+05	3
4	0.	.550604	.550604	-.896391E-04	-.126146E-02	-.363437E+05	3
5	0.	.646092	.646092	-.880141E-04	-.123709E-02	-.363437E+05	0
6	.300000E+08	.522402	.728883	-.671391E-04	-.923962E-03	-.277189E+05	0
7	.300000E+08	.624193	.798816	-.502641E-04	-.670837E-03	-.201251E+05	0
8	.300000E+08	.496364	.703421	-.341391E-04	-.428962E-03	-.128689E+05	0
9	.300000E+08	.741361	.836703	-.188891E-04	-.200212E-03	-.600637E+04	0
10	.300000E+08	1.000000	1.000000	-.426411E-05	.191626E-04	.574879E+03	0
11	.300000E+08	1.000000	1.000000	.973589E-05	.229163E-03	.687488E+04	0
12	.300000E+08	1.000000	1.000000	.232359E-04	.431663E-03	.129499E+05	0
13	.300000E+08	1.000000	1.000000	.364859E-04	.630413E-03	.189124E+05	0
14	.300000E+08	1.000000	1.000000	.482359E-04	.806663E-03	.241999E+05	0
15	.300000E+08	1.000000	1.000000	.564859E-04	.930413E-03	.279124E+05	0
16	.300000E+08	1.000000	1.000000	.629859E-04	.102791E-02	.308374E+05	0

HARD CORNER ELEMENT DATA

ELEMENT	MODULUS	INC. STRAIN	CUM. STRAIN	CUM. STRESS
1	0.	-.908891E-04	-.154976E-02	-.450000E+05
2	0.	-.882391E-04	-.150206E-02	-.450000E+05
3	.300000E+08	-.858891E-04	-.145976E-02	-.437927E+05
4	.300000E+08	-.802641E-04	-.135851E-02	-.407552E+05
5	.300000E+08	-.843891E-04	-.143276E-02	-.429827E+05
6	.300000E+08	.664859E-04	.128299E-02	.384898E+05
7	.300000E+08	.580909E-04	.113188E-02	.339565E+05

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .325192E+03 N.A. LOCATION = 95.022 MOMENT OF INERTIA = .385956E+07
CUMULATIVE CURVATURE = -.75000E-05 CUMULATIVE MOMENT = -.16612E+10 UNBALANCED FORCE = .75460E+03

LOAD RANGE 3 INCREMENT 1 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 114.710
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	0.	.522565	.522565	-.400581E-04	-.132027E-02	-.358766E+05	3
2	0.	.629315	.629315	-.399581E-04	-.131642E-02	-.358766E+05	3
3	0.	.645181	.645181	-.398081E-04	-.131065E-02	-.363437E+05	3
4	0.	.550604	.550604	-.395581E-04	-.130102E-02	-.363437E+05	3
5	0.	.646092	.646092	-.389081E-04	-.127600E-02	-.363437E+05	3
6	.300000E+08	.513572	.722137	-.305581E-04	-.954520E-03	-.286356E+05	0
7	.300000E+08	.613403	.792644	-.238081E-04	-.694645E-03	-.208394E+05	0
8	.300000E+08	.486616	.695177	-.173581E-04	-.446320E-03	-.133896E+05	0
9	.300000E+08	.721357	.831088	-.112581E-04	-.211470E-03	-.634411E+04	0
10	.300000E+08	1.000000	1.000000	-.540810E-05	.137545E-04	.412636E+03	0
11	.300000E+08	1.000000	1.000000	.191902E-06	.229355E-03	.688064E+04	0
12	.300000E+08	1.000000	1.000000	.559190E-05	.437255E-03	.131176E+05	0
13	.300000E+08	1.000000	1.000000	.108919E-04	.641305E-03	.192391E+05	0
14	.300000E+08	1.000000	1.000000	.155919E-04	.822255E-03	.246676E+05	0
15	.300000E+08	1.000000	1.000000	.188919E-04	.949305E-03	.284791E+05	0
16	.300000E+08	1.000000	1.000000	.214919E-04	.104940E-02	.314821E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .317908E+03 N.A. LOCATION = 90.228 MOMENT OF INERTIA = .352607E+07
CUMULATIVE CURVATURE = -.77000E-05 CUMULATIVE MOMENT = -.17064E+10 UNBALANCED FORCE = .41902E+03

LOAD RANGE 3 INCREMENT 2 CYCLE 15
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = -462.867
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	-.458948E+08	.522565	.522565	-.155573E-03	-.147584E-02	-.244652E+05	3
2	-.469344E+08	.629315	.629315	-.155473E-03	-.147189E-02	-.246486E+05	3
3	-.518555E+08	.645181	.645181	-.155323E-03	-.146597E-02	-.251297E+05	3
4	-.551956E+08	.550604	.550604	-.155073E-03	-.145609E-02	-.256580E+05	3
5	-.657918E+08	.646092	.646092	-.154423E-03	-.143042E-02	-.272045E+05	3
6	.300000E+08	.478650	.692081	-.146073E-03	-.110059E-02	-.330178E+05	0
7	.300000E+08	.559825	.758020	-.139323E-03	-.833969E-03	-.250191E+05	0
8	.300000E+08	.427167	.640068	-.132873E-03	-.579194E-03	-.173758E+05	0
9	.300000E+08	.570374	.758360	-.126773E-03	-.338244E-03	-.101473E+05	0
10	.300000E+08	.856098	.856098	-.120923E-03	-.107169E-03	-.321507E+04	0
11	.300000E+08	1.000000	1.000000	-.115323E-03	.114031E-03	.342093E+04	0
12	.300000E+08	1.000000	1.000000	-.109923E-03	.327331E-03	.981993E+04	0
13	.300000E+08	1.000000	1.000000	-.104623E-03	.536681E-03	.161004E+05	0
14	.300000E+08	1.000000	1.000000	-.999235E-04	.722331E-03	.216699E+05	0

15	.300000E+08	1.000000	1.000000	-.966235E-04	.852681E-03	.255804E+05	0
16	.300000E+08	1.000000	1.000000	-.940235E-04	.955381E-03	.286614E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .107174E+03 N.A. LOCATION = -335.391 MOMENT OF INERTIA = -.258533E+08
CUMULATIVE CURVATURE = -.79000E-05 CUMULATIVE MOMENT = -.14962E+10 UNBALANCED FORCE = -.16884E+03

LOAD RANGE 3 INCREMENT 3 CYCLE 13
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = -163.125
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	-.289742E+08	.522565	.522565	-.956251E-04	-.157147E-02	-.209884E+05	3
2	-.294672E+08	.629315	.629315	-.955251E-04	-.156742E-02	-.211067E+05	3
3	-.315172E+08	.645181	.645181	-.953751E-04	-.156134E-02	-.212872E+05	3
4	-.329900E+08	.550604	.550604	-.951251E-04	-.155122E-02	-.216137E+05	3
5	-.374084E+08	.646092	.646092	-.944751E-04	-.152489E-02	-.225383E+05	3
6	.300000E+08	.460955	.675937	-.861251E-04	-.118672E-02	-.356016E+05	0
7	.300000E+08	.534946	.739690	-.793751E-04	-.913344E-03	-.274003E+05	0
8	.300000E+08	.402574	.614844	-.729251E-04	-.652119E-03	-.195636E+05	0
9	.300000E+08	.521207	.723109	-.668251E-04	-.405069E-03	-.121521E+05	0
10	.300000E+08	.703021	.828727	-.609751E-04	-.168144E-03	-.504432E+04	0
11	.300000E+08	1.000000	1.000000	-.553751E-04	.586560E-04	.175968E+04	0
12	.300000E+08	1.000000	1.000000	-.499751E-04	.277356E-03	.832068E+04	0
13	.300000E+08	1.000000	1.000000	-.446751E-04	.492006E-03	.147602E+05	0
14	.300000E+08	1.000000	1.000000	-.399751E-04	.682356E-03	.204707E+05	0
15	.300000E+08	1.000000	1.000000	-.366751E-04	.816006E-03	.244802E+05	0
16	.300000E+08	1.000000	1.000000	-.340751E-04	.921306E-03	.276392E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .173942E+03 N.A. LOCATION = -84.756 MOMENT OF INERTIA = -.837526E+07
CUMULATIVE CURVATURE = -.81000E-05 CUMULATIVE MOMENT = -.14131E+10 UNBALANCED FORCE = -.12858E+03

LOAD RANGE 3 INCREMENT 4 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = -58.916
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	-.218628E+08	.522565	.522565	-.747833E-04	-.164625E-02	-.191083E+05	3
2	-.221780E+08	.629315	.629315	-.746833E-04	-.164210E-02	-.191997E+05	3
3	-.233671E+08	.645181	.645181	-.745333E-04	-.163588E-02	-.192670E+05	3
4	-.242780E+08	.550604	.550504	-.742833E-04	-.162550E-02	-.195142E+05	3
5	-.269455E+08	.646092	.646092	-.736333E-04	-.159853E-02	-.202040E+05	3
6	0.	.666534	.666534	-.652833E-04	-.125200E-02	-.371912E+05	0
7	.300000E+08	.518587	.726859	-.585333E-04	-.971877E-03	-.291563E+05	0
8	.300000E+08	.387401	.598572	-.520833E-04	-.704202E-03	-.211261E+05	0
9	.300000E+08	.493926	.701098	-.459833E-04	-.451052E-03	-.135316E+05	0
10	.300000E+08	.631667	.797262	-.401333E-04	-.208277E-03	-.624832E+04	0
11	.300000E+08	1.000000	1.000000	-.345333E-04	.241227E-04	.723680E+03	0
12	.300000E+08	1.000000	1.000000	-.291333E-04	.248223E-03	.744668E+04	0
13	.300000E+08	1.000000	1.000000	-.238333E-04	.468173E-03	.140452E+05	0
14	.300000E+08	1.000000	1.000000	-.191333E-04	.663223E-03	.198967E+05	0
15	.300000E+08	1.000000	1.000000	-.158333E-04	.800173E-03	.240052E+05	0
16	.300000E+08	1.000000	1.000000	-.132333E-04	.908073E-03	.272422E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .187656E+03 N.A. LOCATION = -51.944 MOMENT OF INERTIA = -.590303E+07
CUMULATIVE CURVATURE = -.83000E-05 CUMULATIVE MOMENT = -.13739E+10 UNBALANCED FORCE = -.16731E+03

LOAD RANGE 3 INCREMENT 5 CYCLE 9

INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = -38.563

GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	-.174778E+08	.522565	.522565	-.703125E-04	-.171656E-02	-.177348E+05	3
2	-.176999E+08	.629315	.629315	-.702125E-04	-.171231E-02	-.178095E+05	3
3	-.184642E+08	.645181	.645181	-.700625E-04	-.170594E-02	-.178129E+05	3
4	-.190917E+08	.550604	.550604	-.698125E-04	-.169531E-02	-.180123E+05	3
5	-.209010E+08	.646092	.646092	-.691625E-04	-.166769E-02	-.185641E+05	3
6	0.	.666534	.666534	-.608125E-04	-.131281E-02	-.371912E+05	3
7	.300000E+08	.504738	.715514	-.540625E-04	-.102594E-02	-.307782E+05	0
8	.300000E+08	.374933	.584797	-.476125E-04	-.751815E-03	-.225544E+05	0
9	.300000E+08	.472651	.682722	-.415125E-04	-.492565E-03	-.147769E+05	0
10	.300000E+08	.583670	.769406	-.356625E-04	-.243940E-03	-.731820E+04	0
11	.300000E+08	.856398	.856398	-.300625E-04	-.593988E-05	-.178196E+03	0
12	.300000E+08	1.000000	1.000000	-.246625E-04	.223560E-03	.670680E+04	0
13	.300000E+08	1.000000	1.000000	-.193625E-04	.448810E-03	.134643E+05	0
14	.300000E+08	1.000000	1.000000	-.146625E-04	.648560E-03	.194568E+05	0
15	.300000E+08	1.000000	1.000000	-.113625E-04	.788810E-03	.236643E+05	0
16	.300000E+08	1.000000	1.000000	-.876255E-05	.899310E-03	.269793E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .201193E+03 N.A. LOCATION = -25.440 MOMENT OF INERTIA = -.402964E+07
CUMULATIVE CURVATURE = -.85000E-05 CUMULATIVE MOMENT = -.13448E+10 UNBALANCED FORCE = .30877E+03

LOAD RANGE 3 INCREMENT 6 CYCLE 11
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = -91.270

GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM STRAIN	CUM. STRESS	FAILURE CODE
1	-.139857E+08	.522565	.522565	-.812541E-04	-.179782E-02	-.164653E+05	3
2	-.141422E+08	.629315	.629315	-.811541E-04	-.179347E-02	-.165265E+05	3
3	-.146276E+08	.645181	.645181	-.810041E-04	-.178694E-02	-.164826E+05	3
4	-.150617E+08	.550604	.550604	-.807541E-04	-.177607E-02	-.166440E+05	3
5	-.162970E+08	.646092	.646092	-.801041E-04	-.174779E-02	-.170870E+05	3
6	-.117300E+09	.666534	.666534	-.717541E-04	-.138457E-02	-.313706E+05	3
7	.300000E+08	.489470	.702493	-.650041E-04	-.109094E-02	-.327283E+05	0
8	.300000E+08	.361134	.569126	-.585541E-04	-.810369E-03	-.243111E+05	0
9	.300000E+08	.449334	.661354	-.524541E-04	-.545019E-03	-.163506E+05	0
10	.300000E+08	.534814	.735524	-.466041E-04	-.290544E-03	-.871632E+04	0
11	.300000E+08	.856398	.856398	-.410041E-04	-.469439E-04	-.140832E+04	0
12	.300000E+08	1.000000	1.000000	-.356041E-04	.187956E-03	.563868E+04	0
13	.300000E+08	1.000000	1.000000	-.303041E-04	.418506E-03	.125552E+05	0
14	.300000E+08	1.000000	1.000000	-.256041E-04	.622956E-03	.186887E+05	0
15	.300000E+08	1.000000	1.000000	-.223041E-04	.766506E-03	.229952E+05	0
16	.300000E+08	1.000000	1.000000	-.197041E-04	.879606E-03	.263882E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .149090E+03 N.A. LOCATION = -123.454 MOMENT OF INERTIA = -.954100E+07
CUMULATIVE CURVATURE = -.87000E-05 CUMULATIVE MOMENT = -.12981E+10 UNBALANCED FORCE = .98304E+02

LOAD RANGE 3 INCREMENT 7 CYCLE 11
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = -74.235

GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	-.116075E+08	.522565	.522565	-.778470E-04	-.187567E-02	-.154739E+05	3
2	-.117248E+08	.629315	.629315	-.777470E-04	-.187122E-02	-.155258E+05	3
3	-.120527E+08	.645181	.645181	-.775970E-04	-.186454E-02	-.154528E+05	3
4	-.123735E+08	.550604	.550604	-.773470E-04	-.185342E-02	-.155887E+05	3
5	-.132779E+08	.646092	.646092	-.766970E-04	-.182449E-02	-.159594E+05	3

6	-.631433E+08	.666534	.666534	-.683470E-04	-.145292E-02	-.255196E+05	3
7	.300000E+08	.476211	.690749	-.615970E-04	-.115254E-02	-.345762E+05	0
8	.300000E+08	.349440	.555495	-.551470E-04	-.865516E-03	-.259655E+05	0
9	.300000E+08	.430385	.643050	-.490470E-04	-.594066E-03	-.176220E+05	0
10	.300000E+08	.499004	.707148	-.431970E-04	-.333741E-03	-.100122E+05	0
11	.300000E+08	.856398	.856398	-.375970E-04	-.845410E-04	-.253623E+04	0
12	.300000E+08	1.000000	1.000000	-.321970E-04	.155759E-03	.467277E+04	0
13	.300000E+08	1.000000	1.000000	-.268970E-04	.391609E-03	.117483E+05	0
14	.300000E+08	1.000000	1.000000	-.221970E-04	.600759E-03	.180228E+05	0
15	.300000E+08	1.000000	1.000000	-.188970E-04	.747609E-03	.224283E+05	0
16	.300000E+08	1.000000	1.000000	-.162970E-04	.863309E-03	.258993E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .185582E+03 N.A. LOCATION = -44.185 MOMENT OF INERTIA = -.477305E+07
CUMULATIVE CURVATURE = -.89000E-05 CUMULATIVE MOMENT = -.12586E+10 UNBALANCED FORCE = -.23095E+03

LOAD RANGE 3 INCREMENT 8 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = -29.419
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	-.100149E+08	.522565	.522565	-.688839E-04	-.194455E-02	-.147314E+05	3
2	-.101086E+08	.629315	.629315	-.687839E-04	-.194000E-02	-.147772E+05	3
3	-.103466E+08	.645181	.645181	-.686339E-04	-.193317E-02	-.146866E+05	3
4	-.106005E+08	.550604	.550604	-.683839E-04	-.192180E-02	-.148058E+05	3
5	-.113118E+08	.646092	.646092	-.677339E-04	-.189222E-02	-.151296E+05	3
6	-.429014E+08	.666534	.666534	-.593839E-04	-.151230E-02	-.224353E+05	0
7	.300000E+08	.465696	.681147	-.526339E-04	-.120517E-02	-.361552E+05	0
8	.300000E+08	.340474	.544826	-.461839E-04	-.911700E-03	-.273510E+05	0
9	.300000E+08	.416561	.629163	-.400839E-04	-.634150E-03	-.190245E+05	0
10	.300000E+08	.475226	.686650	-.342339E-04	-.367975E-03	-.110392E+05	0
11	.300000E+08	.849354	.856340	-.286339E-04	-.113175E-03	-.339524E+04	0
12	.300000E+08	1.000000	1.000000	-.232339E-04	.132525E-03	.397576E+04	0
13	.300000E+08	1.000000	1.000000	-.179339E-04	.373675E-03	.112103E+05	0
14	.300000E+08	1.000000	1.000000	-.132339E-04	.587525E-03	.176258E+05	0
15	.300000E+08	1.000000	1.000000	-.993387E-05	.737675E-03	.221303E+05	0
16	.300000E+08	1.000000	1.000000	-.733387E-05	.855975E-03	.256793E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .201155E+03 N.A. LOCATION = -18.531 MOMENT OF INERTIA = -.319759E+07
CUMULATIVE CURVATURE = -.91000E-05 CUMULATIVE MOMENT = -.12353E+10 UNBALANCED FORCE = .11997E+03

LOAD RANGE 3 INCREMENT 9 CYCLE 2
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = -18.758
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	-.879073E+07	.522565	.522565	-.667516E-04	-.201130E-02	-.141053E+05	3
2	-.886775E+07	.629315	.629315	-.666516E-04	-.200665E-02	-.141463E+05	3
3	-.904530E+07	.645181	.645181	-.665016E-04	-.199968E-02	-.140435E+05	3
4	-.925246E+07	.550604	.550604	-.662516E-04	-.198805E-02	-.141498E+05	3
5	-.982978E+07	.646092	.646092	-.656016E-04	-.195783E-02	-.144380E+05	3
6	-.318763E+08	.666534	.666534	-.572516E-04	-.156955E-02	-.203207E+05	3
7	0.	.675054	.675054	-.505016E-04	-.125568E-02	-.371912E+05	0
8	.300000E+08	.332535	.535222	-.440516E-04	-.955751E-03	-.286725E+05	0
9	.300000E+08	.404629	.616817	-.379516E-04	-.672101E-03	-.201630E+05	0
10	.300000E+08	.455761	.668889	-.321016E-04	-.400076E-03	-.120023E+05	0
11	.300000E+08	.764544	.846546	-.265016E-04	-.139676E-03	-.419029E+04	0
12	.300000E+08	1.000000	1.000000	-.211016E-04	.111424E-03	.334271E+04	0
13	.300000E+08	1.000000	1.000000	-.158016E-04	.357874E-03	.107362E+05	0
14	.300000E+08	1.000000	1.000000	-.111016E-04	.576424E-03	.172927E+05	0

15	.300000E+08	1.000000	1.000000	-.780160E-05	.729874E-03	.218962E+05	0
16	.300000E+08	1.000000	1.000000	-.520160E-05	.850774E-03	.255232E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .198252E+03 N.A. LOCATION = -18.977 MOMENT OF INERTIA = -.303926E+07
CUMULATIVE CURVATURE = -.93000E-05 CUMULATIVE MOMENT = -.12169E+10 UNBALANCED FORCE = -.36484E+04

LOAD RANGE 3 INCREMENT 10 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = -10.979
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	-.781810E+07	.522565	.522565	-.651958E-04	-.207650E-02	-.135649E+05	3
2	-.788279E+07	.629315	.629315	-.650958E-04	-.207175E-02	-.136022E+05	3
3	-.801780E+07	.645181	.645181	-.649458E-04	-.206462E-02	-.134905E+05	3
4	-.819071E+07	.550604	.550604	-.646958E-04	-.205275E-02	-.135867E+05	3
5	-.867059E+07	.646092	.646092	-.640458E-04	-.202187E-02	-.138469E+05	3
6	-.250343E+08	.666534	.666534	-.556958E-04	-.162525E-02	-.187486E+05	3
7	0.	.675054	.675054	-.489458E-04	-.130462E-02	-.371912E+05	3
8	.300000E+08	.325080	.526440	-.424958E-04	-.998247E-03	-.299474E+05	0
9	.300000E+08	.394099	.605643	-.363958E-04	-.708497E-03	-.212549E+05	0
10	.300000E+08	.439300	.653176	-.305458E-04	-.430622E-03	-.129187E+05	0
11	.300000E+08	.704238	.829363	-.249458E-04	-.164622E-03	-.493867E+04	0
12	.300000E+08	1.000000	1.000000	-.195458E-04	.918778E-04	.275633E+04	0
13	.300000E+08	1.000000	1.000000	-.142458E-04	.343628E-03	.103088E+05	0
14	.300000E+08	1.000000	1.000000	-.954581E-05	.566878E-03	.170063E+05	0
15	.300000E+08	1.000000	1.000000	-.624581E-05	.723628E-03	.217088E+05	0
16	.300000E+08	1.000000	1.000000	-.364581E-05	.847128E-03	.254138E+05	0

HARD CORNER ELEMENT DATA

ELEMENT	MODULUS	INC. STRAIN	CUM. STRAIN	CUM. STRESS
1	0.	-.651958E-04	-.241124E-02	-.450000E+05
2	0.	-.641358E-04	-.235188E-02	-.450000E+05
3	0.	-.631958E-04	-.229924E-02	-.450000E+05
4	0.	-.609458E-04	-.217324E-02	-.450000E+05
5	0.	-.625958E-04	-.226564E-02	-.450000E+05
6	.300000E+08	-.224581E-05	.111396E-02	.334189E+05
7	.300000E+08	-.560381E-05	.925915E-03	.277774E+05

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .204268E+03 N.A. LOCATION = -9.242 MOMENT OF INERTIA = -.242360E+07
CUMULATIVE CURVATURE = -.95000E-05 CUMULATIVE MOMENT = -.12011E+10 UNBALANCED FORCE = -.25798E+03

ULTIMATE STRENGTH OF HULL B (NO ILS, AET=68.0) - HOGGING

INPUT DATA

NUMBER OF GROSS PANEL ELEMENTS	23
NUMBER OF HARD CORNERS	26
NUMBER OF DIFFERENT STIFFENERS	8
NUMBER OF DIFFERENT MATERIALS	4
MAXIMUM NUMBER OF ITERATIONS	20

TOLERANCE FACTORS
FAKK = 50.00 EPSH = .5000E-02 EPSA = .2500E-02 EPSB = .2500E-01

SHIP CHARACTERISTICS

COMPARTMENT LENGTH	480.00
TRANSVERSE FRAME SPACING	96.00

GROSS PANEL ELEMENT DATA
COORDINATE DATA

ELEMENT	Y1	Z1	Y2	Z2	YAVE	ZAVE	WIDTH	SIN	COS
1	369.000	13.500	369.000	94.500	369.000	54.000	81.0000	0.00000	1.00000
2	368.000	130.000	367.000	229.000	367.500	179.500	99.0051	-.01010	.99995
3	367.000	229.000	364.000	295.000	365.500	262.000	66.0681	-.04541	.99897
4	345.000	310.000	309.000	310.000	327.000	310.000	36.0000	-1.00000	0.00000
5	309.000	310.000	273.000	310.000	291.000	310.000	36.0000	-1.00000	0.00000
6	255.000	262.000	255.000	288.000	255.000	275.000	26.0000	0.00000	1.00000
7	242.500	307.000	213.500	304.000	228.000	305.500	29.1548	-.99469	-.10290
8	213.500	304.000	186.500	298.000	200.000	301.000	27.6586	-.97619	-.21693
9	186.500	298.000	159.000	291.000	172.750	294.500	28.3769	-.96910	-.24668
10	147.000	238.000	147.000	276.000	147.000	257.000	38.0000	0.00000	1.00000
11	134.000	280.000	108.000	265.000	121.000	272.500	30.0167	-.86619	-.49972
12	108.000	265.000	85.000	245.000	96.500	255.000	30.4795	-.75461	-.65618
13	85.000	245.000	65.000	222.000	75.000	233.500	30.4795	-.65618	-.75461
14	49.000	198.000	35.000	173.000	42.000	185.500	28.6531	-.48860	-.87251
15	23.500	145.000	15.000	112.500	19.250	128.750	33.5932	-.25303	-.96746
16	8.000	80.000	3.000	48.000	5.500	64.000	32.3883	-.15438	-.98801
17	77.000	197.000	63.000	206.000	70.000	201.500	16.6433	-.84118	.54076
18	53.000	152.000	38.000	157.000	45.500	154.500	15.8114	-.94868	.31623
19	43.000	91.000	22.000	94.500	32.500	92.750	21.2897	-.98639	.16440
20	41.000	28.000	15.000	30.000	28.000	29.000	26.0768	-.99705	07670
21	77.000	182.000	65.000	160.000	71.000	171.000	25.0599	-.47885	-.87790
22	56.000	135.000	54.000	105.000	55.000	120.000	30.0666	-.06652	-.99779
23	54.000	73.000	54.000	43.000	54.000	58.000	30.0000	0.00000	-1.00000

GEOMETRY ELEMENT	PLATE THICK.	STIFF. SPACING	NO. OF STIFF.	STIFF. REF. NO.	MATERIAL REF. NO.	TRIPPING EFF.LEN.	G.I. CODE	PROP. LIMIT	RES.STR. FACTOR
1	.50000	27.0000	3	1	1	68.0000	0	.5000	3.0000
2	.62500	33.0017	3	1	1	68.0000	0	.5000	3.0000
3	.75000	33.0341	2	1	1	68.0000	0	.5000	3.0000
4	.75000	36.0000	1	2	1	68.0000	0	.5000	3.0000
5	.75000	36.0000	1	2	1	68.0000	0	.5000	3.0000
6	.25000	26.0000	1	3	3	68.0000	0	.5000	3.0000
7	.62500	29.1548	1	4	1	68.0000	0	.5000	3.0000
8	.62500	27.6586	1	4	1	68.0000	0	.5000	3.0000
9	.62500	28.3769	1	4	1	68.0000	0	.5000	3.0000
10	.25000	38.0000	1	5	3	68.0000	0	.5000	3.0000

11	.62500	30.0167	1	6	1	68.0000	0	.5000	3.0000
12	.62500	30.4795	1	6	1	68.0000	0	.5000	3.0000
13	.62500	30.4795	1	6	1	68.0000	0	.5000	3.0000
14	.62500	28.6531	1	6	1	68.0000	0	.5000	3.0000
15	.62500	33.5932	1	6	1	68.0000	0	.5000	3.0000
16	.62500	32.3883	1	6	1	68.0000	0	.5000	3.0000
17	.37500	16.6433	1	7	2	68.0000	0	.5000	3.0000
18	.37500	15.8114	1	7	2	68.0000	0	.5000	3.0000
19	.37500	21.2897	1	7	2	68.0000	0	.5000	3.0000
20	.37500	26.0768	1	7	2	68.0000	0	.5000	3.0000
21	.43750	25.0599	1	8	2	68.0000	0	.5000	3.0000
22	.43750	30.0666	1	8	2	68.0000	0	.5000	3.0000
23	.43750	30.0000	1	8	2	68.0000	0	.5000	3.0000

PRESSURE LOADING AND INITIAL DISTORTION

ELEMENT	PRESSURE LOAD	INITIAL DISTORT.	PRE-STRAIN
1	0.000	0.000000	0.
2	0.000	0.000000	0.
3	0.000	0.000000	0.
4	0.000	0.000000	0.
5	0.000	0.000000	0.
6	0.000	0.000000	0.
7	0.000	0.000000	0.
8	0.000	0.000000	0.
9	0.000	0.000000	0.
10	0.000	0.000000	0.
11	0.000	0.000000	0.
12	0.000	0.000000	0.
13	0.000	0.000000	0.
14	0.000	0.000000	0.
15	0.000	0.000000	0.
16	0.000	0.000000	0.
17	0.000	0.000000	0.
18	0.000	0.000000	0.
19	0.000	0.000000	0.
20	0.000	0.000000	0.
21	0.000	0.000000	0.
22	0.000	0.000000	0.
23	0.000	0.000000	0.

HARD CORNER ELEMENT DATA

ELEMENT	AREA	Y-COORD	MOM. IN.	MAT.REF.	PRE-STRAIN
1	6.7500	369.000	.141	1	0.
2	1.6200	364.500	11.700	2	0.
3	11.2750	363.500	1.466	1	0.
4	13.5000	354.000	364.500	1	0.
5	19.1545	257.750	1484.878	1	0.
6	5.1250	255.000	.027	3	0.
7	17.0706	146.500	889.185	1	0.
8	2.5000	147.000	.013	3	0.
9	18.0278	57.000	384.998	1	0.
10	2.7042	60.000	8.122	2	0.
11	18.9185	29.250	209.025	1	0.
12	3.4573	33.500	23.339	2	0.
13	20.7783	11.500	85.491	1	0.
14	3.9775	16.750	36.544	2	0.
15	15.1167	1.500	11.822	1	0.
16	4.8894	8.500	68.859	2	0.
17	15.0000	0.000	.488	1	0.
18	13.5000	27.000	3280.500	4	0.

19	2.8621	80.250	10.086	2	0.
20	5.5899	80.250	39.747	2	0.
21	2.8559	56.500	11.667	2	0.
22	11.6247	60.500	78.631	2	0.
23	4.1926	48.500	42.277	2	0.
24	14.0000	54.000	.223	2	0.
25	4.8894	47.500	66.859	2	0.
26	21.5000	54.000	.448	2	0.

STIFFENER DATA

NUMBER	AREA	IZZ	IYY	DEPTH	TWEB	WFLG	TFLG	MAT.REF.
1	3.1850	11.646	2.299	6.1600	.26000	4.0300	.42000	2
2	2.7825	19.177	1.341	8.0000	.23000	4.0000	.25000	2
3	1.3040	3.449	.322	5.0000	.16000	2.6800	.20000	3
4	3.3179	35.874	1.450	10.0000	.23000	4.0000	.27000	2
5	2.0970	14.145	1.023	7.9000	.17000	3.9400	.20000	3
6	4.2379	67.659	1.894	12.1600	.24000	4.0100	.35000	2
7	.8060	1.011	.136	3.5000	.13000	2.0800	.18000	2
8	3.3179	35.874	1.450	10.0000	.23000	4.0000	.27000	2

MATERIAL CHARACTERISTICS

MATERIAL	YOUNGS MODULUS	POISSON RATIO	YIELD STRESS	SHEAR MODULUS	PROP.LIM RATIO	YIELD STRAIN
1	.30000E+08	.3000	80000.0	.11538E+08	1.0000	.26667E-02
2	.30000E+08	.3000	45000.0	.11538E+08	1.0000	.15000E-02
3	.30000E+08	.3000	33000.0	.11538E+08	1.0000	.11000E-02
4	.30000E+08	.3000	11000.0	.11538E+08	1.0000	.36667E-03

MOMENT OF INERTIA CALCULATION

ELEMENT	ET/E	(ET/E)AREA	LEVER	MOM1	MOM2	IO
1GP(P)	1.00000	40.500	369.000	.149445E+05	.551452E+07	.843750E+00
1GP(S)	1.00000	9.555	369.000	.352580E+04	.130102E+07	.349385E+02
2GP(P)	1.00000	20.626	367.167	.757320E+04	.278063E+07	.862334E+00
2GP(S)	1.00000	3.185	367.167	.116943E+04	.429374E+06	.116452E+02
2GP(P)	1.00000	20.626	367.500	.758007E+04	.278568E+07	.862334E+00
2GP(S)	1.00000	3.185	367.500	.117049E+04	.430154E+06	.116452E+02
2GP(P)	1.00000	20.626	367.833	.758695E+04	.279073E+07	.862334E+00
2GP(S)	1.00000	3.185	367.833	.117155E+04	.430935E+06	.116452E+02
3GP(P)	1.00000	24.776	364.750	.903688E+04	.329620E+07	.580438E+01
3GP(S)	1.00000	3.185	364.750	.116173E+04	.423741E+06	.116269E+02
3GP(P)	1.00000	24.776	366.250	.907405E+04	.332337E+07	.580438E+01
3GP(S)	1.00000	3.185	366.250	.116651E+04	.427233E+06	.116269E+02
4GP(P)	1.00000	27.000	327.000	.882900E+04	.288708E+07	.291600E+04
4GP(S)	1.00000	2.783	327.000	.909877E+03	.297530E+06	.134119E+01
5GP(P)	1.00000	27.000	291.000	.785700E+04	.228639E+07	.291600E+04
5GP(S)	1.00000	2.783	291.000	.809708E+03	.235625E+06	.134119E+01
6GP(P)	1.00000	6.500	255.000	.165750E+04	.422663E+06	.338542E-01
6GP(S)	1.00000	1.294	255.000	.332520E+03	.847926E+05	.344935E+01
7GP(P)	1.00000	18.222	228.000	.415455E+04	.947238E+06	.127705E+04
7GP(S)	1.00000	3.318	228.000	.756481E+03	.172478E+06	.181435E+01
8GP(P)	1.00000	17.287	200.000	.345733E+04	.691466E+06	.105019E+04
8GP(S)	1.00000	3.318	200.000	.663580E+03	.132716E+06	.306980E+01
9GP(P)	1.00000	17.736	172.750	.306382E+04	.529275E+06	.111775E+04
9GP(S)	1.00000	3.318	172.750	.573167E+03	.990146E+05	.354457E+01
10GP(P)	1.00000	9.500	147.000	.139650E+04	205286E+06	.494792E-01
10GP(S)	1.00000	2.097	147.000	.308259E+03	.453141E+05	.141449E+02
11GP(P)	1.00000	18.760	121.000	.227001E+04	.274671E+06	.105699E+04
11GP(S)	1.00000	4.238	121.000	.512786E+03	.620471E+05	.183171E+02
12GP(P)	1.00000	19.050	96.500	.183829E+04	.177395E+06	.840041E+03
12GP(S)	1.00000	4.238	96.500	.408957E+03	.394644E+05	.302105E+02

13GP(P)	1.00000	19.050	75.000	.142873E+04	.107154E+06	.635343E+03
13GP(S)	1.00000	4.238	75.000	.317843E+03	.238382E+05	.393424E+02
14GP(P)	1.00000	17.906	42.000	.752144E+03	.315900E+05	.292944E+03
14GP(S)	1.00000	4.238	42.000	.177992E+03	.747566E+04	.519585E+02
15GP(P)	1.00000	20.996	19.250	.404168E+03	.778023E+04	.127051E+03
15GP(S)	1.00000	4.238	19.250	.815796E+02	.157041E+04	.634482E+02
16GP(P)	1.00000	20.243	5.500	.111335E+03	.612341E+03	.428155E+02
16GP(S)	1.00000	4.238	5.500	.233085E+02	.128196E+03	.660913E+02
17GP(P)	1.00000	6.241	70.000	.436887E+03	.305821E+05	.101962E+03
17GP(S)	1.00000	.806	70.000	.564200E+02	.394940E+04	.391705E+00
18GP(P)	1.00000	5.929	45.500	.269782E+03	.122751E+05	.111181E+03
18GP(S)	1.00000	.806	45.500	.366730E+02	.166802E+04	.223176E+00
19GP(P)	1.00000	7.984	32.500	.259468E+03	.843270E+04	.293401E+03
19GP(S)	1.00000	.806	32.500	.261950E+02	.851337E+03	.159263E+00
20GP(P)	1.00000	9.779	28.000	.273807E+03	.766658E+04	.550873E+03
20GP(S)	1.00000	.806	28.000	.225680E+02	.631904E+03	.140744E+00
21GP(P)	1.00000	10.964	71.000	.778424E+03	.552681E+05	.131699E+03
21GP(S)	1.00000	3.318	71.000	.235571E+03	.167255E+05	.279802E+02
22GP(P)	1.00000	13.154	55.000	.723477E+03	.397913E+05	.459360E+01
22GP(S)	1.00000	3.318	55.000	.182485E+03	.100366E+05	.357213E+02
23GP(P)	1.00000	13.125	54.000	.708750E+03	.382725E+05	.209351E+00
23GP(S)	1.00000	3.318	54.000	.179167E+03	.967500E+04	.358736E+02
1HDCNR	1.00000	6.750	369.000	.249075E+04	.919087E+06	.140625E+00
2HDCNR	1.00000	1.620	364.500	.590490E+03	.215234E+06	.117000E+02
3HDCNR	1.00000	11.275	363.500	.409845E+04	.148979E+07	.146576E+01
4HDCNR	1.00000	13.500	354.000	.477900E+04	.169177E+07	.364500E+03
5HDCNR	1.00000	19.154	257.750	.493707E+04	.127253E+07	.148488E+04
6HDCNR	1.00000	5.125	255.000	.130688E+04	.333253E+06	.266927E-01
7HDCNR	1.00000	17.071	146.500	.250085E+04	.366374E+06	.889185E+03
8HDCNR	1.00000	2.500	147.000	.367500E+03	.540225E+05	.130208E-01
9HDCNR	1.00000	18.028	57.000	.102758E+04	.585722E+05	.384998E+03
10HDCNR	1.00000	2.704	60.000	.162250E+03	.973499E+04	.812224E+01
11HDCNR	1.00000	18.919	29.250	.553367E+03	.161860E+05	.209025E+03
12HDCNR	1.00000	3.457	33.500	.115821E+03	.387999E+04	.233389E+02
13HDCNR	1.00000	20.778	11.500	.238951E+03	.274793E+04	.854912E+02
14HDCNR	1.00000	3.977	16.750	.666227E+02	.111593E+04	.365440E+02
15HDCNR	1.00000	15.117	1.500	.226751E+02	.340126E+02	.118221E+02
16HDCNR	1.00000	4.889	8.500	.415599E+02	.353259E+03	.688594E+02
17HDCNR	1.00000	15.000	0.000	0.	0.	.488281E+00
18HDCNR	1.00000	13.500	27.000	.364500E+03	.984150E+04	.328050E+04
19HDCNR	1.00000	2.862	80.250	.229681E+03	.184319E+05	.100861E+02
20HDCNR	1.00000	5.590	80.250	.448590E+03	.359994E+05	.197472E+02
21HDCNR	1.00000	2.856	56.500	.161359E+03	.911679E+04	.116668E+02
22HDCNR	1.00000	11.625	60.500	.703292E+03	.425492E+05	.786306E+02
23HDCNR	1.00000	4.193	48.500	.203342E+03	.986211E+04	.422772E+02
24HDCNR	1.00000	14.000	54.000	.756000E+03	.408240E+05	.223307E+00
25HDCNR	1.00000	4.889	47.500	.232247E+03	.110317E+05	.688594E+02
26HDCNR	1.00000	21.500	54.000	.116100E+04	.626940E+05	.447917E+00

AREA = 802.240 MOM1 = 140007.08 MOM2+IO = 40636100.3

FULLY EFFECTIVE CROSS SECTION CHARACTERISTICS

CROSS SECTION AREA	802.240
HEIGHT OF N.A. ABOVE BASE LINE	174.520
SECTION MOMENT OF INERTIA	16202023.3

CURVATURE INCREMENT DATA

LOAD RANGE	NUMBER OF INCREMENTS	INCREMENT SIZE
1	7	.1000E-05

2 20 .4000E-06

CRITICAL STRAIN (MEAN STRESS) VALUES

ELEMENT	PLATE YIELD STRAIN	STIFF YIELD STRAIN	EULER COLUMN BUCKLING	STIFFENER TRIPPING
1	.26667E-02	.15000E-02	-.15000E-02	-.12973E-02
	(.80000E+05)	(.45000E+05)	(-.45000E+05)	(-.38918E+05)
2	.26667E-02	.15000E-02	-.15000E-02	-.12973E-02
	(.80000E+05)	(.45000E+05)	(-.45000E+05)	(-.38918E+05)
3	.26667E-02	.15000E-02	-.15000E-02	-.14108E-02
	(.80000E+05)	(.45000E+05)	(-.45000E+05)	(-.42324E+05)
4	.26667E-02	.15000E-02	-.15000E-02	-.13462E-02
	(.80000E+05)	(.45000E+05)	(-.45000E+05)	(-.40387E+05)
5	.26667E-02	.15000E-02	-.15000E-02	-.13462E-02
	(.80000E+05)	(.45000E+05)	(-.45000E+05)	(-.40387E+05)
6	.11000E-02	.11000E-02	-.10068E-02	-.83105E-03
	(.33000E+05)	(.33000E+05)	(-.30205E+05)	(-.24931E+05)
7	.26667E-02	.15000E-02	-.15000E-02	-.12956E-02
	(.80000E+05)	(.45000E+05)	(-.45000E+05)	(-.38869E+05)
8	.26667E-02	.15000E-02	-.15000E-02	-.13016E-02
	(.80000E+05)	(.45000E+05)	(-.45000E+05)	(-.39047E+05)
9	.26667E-02	.15000E-02	-.15000E-02	-.12990E-02
	(.80000E+05)	(.45000E+05)	(-.45000E+05)	(-.38969E+05)
10	.11000E-02	.11000E-02	-.10655E-02	-.93646E-03
	(.33000E+05)	(.33000E+05)	(-.31964E+05)	(-.28094E+05)
11	.26667E-02	.15000E-02	-.15000E-02	-.12608E-02
	(.80000E+05)	(.45000E+05)	(-.45000E+05)	(-.37825E+05)
12	.26667E-02	.15000E-02	-.15000E-02	-.12590E-02
	(.80000E+05)	(.45000E+05)	(-.45000E+05)	(-.37769E+05)
13	.26667E-02	.15000E-02	-.15000E-02	-.12590E-02
	(.80000E+05)	(.45000E+05)	(-.45000E+05)	(-.37769E+05)
14	.26667E-02	.15000E-02	-.15000E-02	-.12663E-02
	(.80000E+05)	(.45000E+05)	(-.45000E+05)	(-.37989E+05)
15	.26667E-02	.15000E-02	-.15000E-02	-.12138E-02
	(.80000E+05)	(.45000E+05)	(-.45000E+05)	(-.36414E+05)
16	.26667E-02	.15000E-02	-.15000E-02	-.12406E-02
	(.80000E+05)	(.45000E+05)	(-.45000E+05)	(-.37219E+05)
17	.15000E-02	.15000E-02	-.95505E-03	-.11882E-02
	(.45000E+05)	(.45000E+05)	(-.28651E+05)	(-.35645E+05)
18	.15000E-02	.15000E-02	-.96545E-03	-.12133E-02
	(.45000E+05)	(.45000E+05)	(-.28964E+05)	(-.36400E+05)
19	.15000E-02	.15000E-02	-.91637E-03	-.99860E-03
	(.45000E+05)	(.45000E+05)	(-.27491E+05)	(-.29958E+05)
20	.15000E-02	.15000E-02	-.87876E-03	-.90865E-03
	(.45000E+05)	(.45000E+05)	(-.26363E+05)	(-.27259E+05)
21	.15000E-02	.15000E-02	-.14566E-02	-.11818E-02
	(.45000E+05)	(.45000E+05)	(-.43698E+05)	(-.35454E+05)
22	.15000E-02	.15000E-02	-.14554E-02	-.11818E-02
	(.45000E+05)	(.45000E+05)	(-.43662E+05)	(-.35454E+05)
23	.15000E-02	.15000E-02	-.14554E-02	-.11818E-02
	(.45000E+05)	(.45000E+05)	(-.43662E+05)	(-.35454E+05)

INITIAL (UNLOADED) CROSS SECTION CHARACTERISTICS

CROSS SECTION AREA	763.031
HEIGHT OF N.A. ABOVE BASE LINE	179.879
SECTION MOMENT OF INERTIA	15653471.4

MOMENT-CURVATURE HISTORY

LOAD RANGE 1 INCREMENT 1 CYCLE 1
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 179.879
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	1.000000	1.000000	.189121E-03	.189121E-03	.567363E+04	0
2	.300000E+08	1.000000	1.000000	.187621E-03	.187621E-03	.562863E+04	0
3	.300000E+08	1.000000	1.000000	.185621E-03	.185621E-03	.556863E+04	0
4	.300000E+08	1.000000	1.000000	.147121E-03	.147121E-03	.441363E+04	0
5	.300000E+08	1.000000	1.000000	.111121E-03	.111121E-03	.333363E+04	0
6	.300000E+08	1.000000	1.000000	.751209E-04	.751209E-04	.225363E+04	0
7	.300000E+08	1.000000	1.000000	.481209E-04	.481209E-04	.144363E+04	0
8	.300000E+08	1.000000	1.000000	.201209E-04	.201209E-04	.603628E+03	0
9	.300000E+08	.789329	.789329	-.712908E-05	-.712908E-05	-.213872E+03	0
10	.300000E+08	.885007	.885007	-.328791E-04	-.328791E-04	-.986372E+03	0
11	.300000E+08	.783959	.783959	-.588791E-04	-.588791E-04	-.176637E+04	0
12	.300000E+08	.783330	.783330	-.833791E-04	-.833791E-04	-.250137E+04	0
13	.300000E+08	.783330	.783330	-.104879E-03	-.104879E-03	-.314637E+04	0
14	.300000E+08	.788075	.788075	-.137879E-03	-.137879E-03	-.413637E+04	0
15	.300000E+08	.787297	.787297	-.160629E-03	-.160629E-03	-.481887E+04	0
16	.300000E+08	.784557	.784557	-.174379E-03	-.174379E-03	-.523137E+04	0
17	.300000E+08	.907074	.907074	-.109879E-03	-.109879E-03	-.329637E+04	0
18	.300000E+08	.917685	.917685	-.134379E-03	-.134379E-03	-.403137E+04	0
19	.300000E+08	.856390	.856390	-.147379E-03	-.147379E-03	-.442137E+04	0
20	.300000E+08	.843849	.843849	-.151879E-03	-.151879E-03	-.455637E+04	0
21	.300000E+08	.854993	.854993	-.108879E-03	-.108879E-03	-.326637E+04	0
22	.300000E+08	.843315	.843315	-.124879E-03	-.124879E-03	-.374637E+04	0
23	.300000E+08	.843233	.843233	-.125879E-03	-.125879E-03	-.377637E+04	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .763031E+03 N.A. LOCATION = 179.879 MOMENT OF INERTIA = .156535E+08
CUMULATIVE CURVATURE = .10000E-05 CUMULATIVE MOMENT = .46905E+09 UNBALANCED FORCE = -.94529E-07

LOAD RANGE 1 INCREMENT 2 CYCLE 2
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 180.205
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	1.000000	1.000000	.188795E-03	.377916E-03	.113375E+05	0
2	.300000E+08	1.000000	1.000000	.187295E-03	.374916E-03	.112475E+05	0
3	.300000E+08	1.000000	1.000000	.185295E-03	.370916E-03	.111275E+05	0
4	.300000E+08	1.000000	1.000000	.146795E-03	.293916E-03	.881749E+04	0
5	.300000E+08	1.000000	1.000000	.110795E-03	.221916E-03	.665749E+04	0
6	.300000E+08	1.000000	1.000000	.747953E-04	.149916E-03	.449749E+04	0
7	.300000E+08	1.000000	1.000000	.477953E-04	.959162E-04	.287749E+04	0
8	.300000E+08	1.000000	1.000000	.197953E-04	.399162E-04	.119749E+04	0
9	.300000E+08	.789329	.789329	-.745474E-05	-.145838E-04	-.437515E+03	0
10	.300000E+08	.716235	.852822	-.332047E-04	-.660838E-04	-.198251E+04	0
11	.300000E+08	.783959	.783959	-.592047E-04	-.118084E-03	-.354251E+04	0
12	.300000E+08	.783330	.783330	-.837047E-04	-.167084E-03	-.501251E+04	0
13	.300000E+08	.783330	.783330	-.105205E-03	-.210084E-03	-.630251E+04	0
14	.300000E+08	.788075	.788075	-.138205E-03	-.276084E-03	-.828251E+04	0
15	.300000E+08	.787297	.787297	-.160955E-03	-.321584E-03	-.964751E+04	0
16	.300000E+08	.784557	.784557	-.174705E-03	-.349084E-03	-.104725E+05	0
17	.300000E+08	.907074	.907074	-.110205E-03	-.220084E-03	-.660251E+04	0
18	.300000E+08	.917685	.917685	-.134705E-03	-.269084E-03	-.807251E+04	0
19	.300000E+08	.856390	.856390	-.147705E-03	-.295084E-03	-.885251E+04	0
20	.300000E+08	.695897	.817908	-.152205E-03	-.304084E-03	-.912251E+04	0

21	.300000E+08	.854993	.854993	-.109205E-03	-.218084E-03	-.654251E+04	0
22	.300000E+08	.775963	.837936	-.125205E-03	-.250084E-03	-.750251E+04	0
23	.300000E+08	.774519	.837634	-.126205E-03	-.252084E-03	-.756251E+04	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .758193E+03 N.A. LOCATION = 180.534 MOMENT OF INERTIA = .155898E+08
CUMULATIVE CURVATURE = .20000E-05 CUMULATIVE MOMENT = .93759E+09 UNBALANCED FORCE = -.34478E+04

LOAD RANGE 1 INCREMENT 3 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 183.417
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	1.000000	1.000000	.185583E-03	.563499E-03	.169050E+05	0
2	.300000E+08	1.000000	1.000000	.184083E-03	.558999E-03	.167700E+05	0
3	.300000E+08	1.000000	1.000000	.182083E-03	.552999E-03	.165900E+05	0
4	.300000E+08	1.000000	1.000000	.143583E-03	.437499E-03	.131250E+05	0
5	.300000E+08	1.000000	1.000000	.107583E-03	.329499E-03	.988498E+04	0
6	.300000E+08	1.000000	1.000000	.715831E-04	.221499E-03	.664498E+04	0
7	.300000E+08	1.000000	1.000000	.445831E-04	.140499E-03	.421498E+04	0
8	.300000E+08	1.000000	1.000000	.165831E-04	.564993E-04	.169498E+04	0
9	.300000E+08	.789329	.789329	-.106669E-04	-.252507E-04	-.757522E+03	0
10	.300000E+08	.575095	.776482	-.364169E-04	-.102501E-03	-.307502E+04	0
11	.300000E+08	.783959	.783959	-.624169E-04	-.180501E-03	-.541502E+04	0
12	.300000E+08	.783330	.783330	-.869169E-04	-.254001E-03	-.762002E+04	0
13	.300000E+08	.783330	.783330	-.108417E-03	-.318501E-03	-.955502E+04	0
14	.300000E+08	.788075	.788075	-.141417E-03	-.417501E-03	-.125250E+05	0
15	.300000E+08	.664601	.768176	-.164167E-03	-.485751E-03	-.145725E+05	0
16	.300000E+08	.659495	.764621	-.177917E-03	-.527001E-03	-.158100E+05	0
17	.300000E+08	.907074	.907074	-.113417E-03	-.333501E-03	-.100050E+05	0
18	.300000E+08	.917685	.917685	-.137917E-03	-.407001E-03	-.122100E+05	0
19	.300000E+08	.714276	.832807	-.150917E-03	-.446001E-03	-.133800E+05	0
20	.300000E+08	.566107	.752433	-.155417E-03	-.459501E-03	-.137850E+05	0
21	.300000E+08	.821060	.853646	-.112417E-03	-.330501E-03	-.991502E+04	0
22	.300000E+08	.630740	.799731	-.128417E-03	-.378501E-03	-.113550E+05	0
23	.300000E+08	.629588	.789103	-.129417E-03	-.381501E-03	-.114450E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .731656E+03 N.A. LOCATION = 185.809 MOMENT OF INERTIA = .149822E+08
CUMULATIVE CURVATURE = .30000E-05 CUMULATIVE MOMENT = .13948E+10 UNBALANCED FORCE = -.31018E+04

LOAD RANGE 1 INCREMENT 4 CYCLE 2
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 186.877
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	1.000000	1.000000	.182123E-03	.745622E-03	.223687E+05	0
2	.300000E+08	1.000000	1.000000	.180623E-03	.739622E-03	.221887E+05	0
3	.300000E+08	1.000000	1.000000	.178623E-03	.731622E-03	.219487E+05	0
4	.300000E+08	1.000000	1.000000	.140123E-03	.577622E-03	.173287E+05	0
5	.300000E+08	1.000000	1.000000	.104123E-03	.433622E-03	.130087E+05	0
6	.300000E+08	1.000000	1.000000	.681229E-04	.289622E-03	.868866E+04	0
7	.300000E+08	1.000000	1.000000	.411229E-04	.181622E-03	.544866E+04	0
8	.300000E+08	1.000000	1.000000	.131229E-04	.696222E-04	.208866E+04	0
9	.300000E+08	.789329	.789329	-.141271E-04	-.393778E-04	-.118134E+04	0
10	.300000E+08	.487957	.706875	-.398771E-04	-.142378E-03	-.427134E+04	0
11	.300000E+08	.783959	.783959	-.658771E-04	-.246378E-03	-.739134E+04	0
12	.300000E+08	.783330	.783330	-.903771E-04	-.344378E-03	-.103313E+05	0
13	.300000E+08	.774269	.783225	-.111877E-03	-.430378E-03	-.129113E+05	0
14	.300000E+08	.724873	.783006	-.144877E-03	-.562378E-03	-.168713E+05	0
15	.300000E+08	.573041	.728989	-.167627E-03	-.653378E-03	-.196013E+05	0

16	.300000E+08	.568832	.725241	-.181377E-03	-.708378E-03	-.212513E+05	0
17	.300000E+08	.907074	.907074	-.116877E-03	-.450378E-03	-.135113E+05	0
18	.300000E+08	.917685	.917685	-.141377E-03	-.548378E-03	-.164513E+05	0
19	.300000E+08	.615632	.788705	-.154377E-03	-.600378E-03	-.180113E+05	0
20	.300000E+08	.487994	.693783	-.158877E-03	-.618378E-03	-.185513E+05	0
21	.300000E+08	.706496	.829202	-.115677E-03	-.446378E-03	-.133913E+05	0
22	.300000E+08	.543173	.736492	-.131877E-03	-.510378E-03	-.153113E+05	0
23	.300000E+08	.542205	.735768	-.132877E-03	-.514378E-03	-.154313E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .720660E+03 N.A. LOCATION = 187.963 MOMENT OF INERTIA = .147452E+08
CUMULATIVE CURVATURE = .40000E-05 CUMULATIVE MOMENT = .18402E+10 UNBALANCED FORCE = -.27453E+04

LOAD RANGE 1 INCREMENT 5 CYCLE 2
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 188.998
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	1.000000	1.000000	.180002E-03	.925624E-03	.277687E+05	0
2	.300000E+08	1.000000	1.000000	.178502E-03	.918124E-03	.275437E+05	0
3	.300000E+08	1.000000	1.000000	.176502E-03	.908124E-03	.272437E+05	0
4	.300000E+08	1.000000	1.000000	.138002E-03	.715624E-03	.214687E+05	0
5	.300000E+08	1.000000	1.000000	.102002E-03	.535624E-03	.160687E+05	0
6	.300000E+08	1.000000	1.000000	.660018E-04	.355624E-03	.106687E+05	0
7	.300000E+08	1.000000	1.000000	.390018E-04	.220624E-03	.661872E+04	0
8	.300000E+08	1.000000	1.000000	.110018E-04	.806240E-04	.241872E+04	0
9	.300000E+08	.789329	.789329	-.162482E-04	-.556260E-04	-.166878E+04	0
10	.300000E+08	.428796	.649836	-.419982E-04	-.184376E-03	-.553128E+04	0
11	.300000E+08	.783959	.783959	-.679982E-04	-.314376E-03	-.943128E+04	0
12	.300000E+08	.768489	.783049	-.924982E-04	-.436876E-03	-.131063E+05	0
13	.300000E+08	.688442	.771836	-.113998E-03	-.544376E-03	-.163313E+05	0
14	.300000E+08	.645413	.762249	-.146998E-03	-.709376E-03	-.212813E+05	0
15	.300000E+08	.510546	.690013	-.169748E-03	-.823126E-03	-.246938E+05	0
16	.300000E+08	.506949	.686328	-.183498E-03	-.891876E-03	-.267563E+05	0
17	.300000E+08	.856514	.904256	-.118998E-03	-.569376E-03	-.170813E+05	0
18	.300000E+08	.827448	.908812	-.143498E-03	-.691876E-03	-.207563E+05	0
19	.300000E+08	.548304	.745556	-.156498E-03	-.756876E-03	-.227063E+05	0
20	.300000E+08	.434678	.645448	-.160998E-03	-.779376E-03	-.233813E+05	0
21	.300000E+08	.628314	.794895	-.117998E-03	-.564376E-03	-.169313E+05	0
22	.300000E+08	.483408	.689716	-.133998E-03	-.644376E-03	-.193313E+05	0
23	.300000E+08	.482566	.688968	-.134998E-03	-.649376E-03	-.194813E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .709857E+03 N.A. LOCATION = 190.049 MOMENT OF INERTIA = .145271E+08
CUMULATIVE CURVATURE = .50000E-05 CUMULATIVE MOMENT = .22788E+10 UNBALANCED FORCE = -.22103E+04

LOAD RANGE 1 INCREMENT 6 CYCLE 2
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 191.491
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	1.000000	1.000000	.177509E-03	.110313E-02	.330940E+05	0
2	.300000E+08	1.000000	1.000000	.176009E-03	.109413E-02	.328240E+05	0
3	.300000E+08	1.000000	1.000000	.174009E-03	.108213E-02	.324640E+05	0
4	.300000E+08	1.000000	1.000000	.135509E-03	.851132E-03	.255340E+05	0
5	.300000E+08	1.000000	1.000000	.995085E-04	.635132E-03	.190540E+05	0
6	.300000E+08	1.000000	1.000000	.635085E-04	.419132E-03	.125740E+05	0
7	.300000E+08	1.000000	1.000000	.365085E-04	.257132E-03	.771397E+04	0
8	.300000E+08	1.000000	1.000000	.850851E-05	.891325E-04	.267397E+04	0
9	.300000E+08	.789329	.789329	-.187415E-04	-.743675E-04	-.223103E+04	0
10	.300000E+08	.384867	.602366	-.444915E-04	-.228868E-03	-.686603E+04	0

11	.300000E+08	.783959	.783959	-.704915E-04	-.384868E-03	-.115460E+05	0
12	.300000E+08	.696491	.773703	-.949915E-04	-.531868E-03	-.159560E+05	0
13	.300000E+08	.624827	.751258	-.116491E-03	-.660868E-03	-.198260E+05	0
14	.300000E+08	.586560	.736547	-.149491E-03	-.858868E-03	-.257660E+05	0
15	.300000E+08	.464276	.654764	-.172241E-03	-.995368E-03	-.298610E+05	0
16	.300000E+08	.461141	.651236	-.185991E-03	-.107787E-02	-.323360E+05	0
17	.300000E+08	.777565	.888583	-.121491E-03	-.690868E-03	-.207260E+05	0
18	.300000E+08	.751912	.887739	-.145991E-03	-.837868E-03	-.251360E+05	0
19	.300000E+08	.498445	.706780	-.158991E-03	-.915868E-03	-.274760E+05	0
20	0.	.620137	.620137	-.163491E-03	-.942868E-03	-.263627E+05	2
21	.300000E+08	.570371	.760244	-.120491E-03	-.684868E-03	-.205460E+05	0
22	.300000E+08	.439132	.649599	-.136491E-03	-.780868E-03	-.234260E+05	0
23	.300000E+08	.438383	.648858	-.137491E-03	-.786868E-03	-.236060E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .695710E+03 N.A. LOCATION = 192.950 MOMENT OF INERTIA = .142196E+08
CUMULATIVE CURVATURE = .60000E-05 CUMULATIVE MOMENT = .27098E+10 UNBALANCED FORCE = -.37651E+04

LOAD RANGE 1 INCREMENT 7 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 200.878
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	1.000000	1.000000	.168122E-03	.127125E-02	.381376E+05	0
2	.300000E+08	1.000000	1.000000	.166622E-03	.126075E-02	.378226E+05	0
3	.300000E+08	1.000000	1.000000	.164622E-03	.124675E-02	.374026E+05	0
4	.300000E+08	1.000000	1.000000	.126122E-03	.977255E-03	.293176E+05	0
5	.300000E+08	1.000000	1.000000	.901222E-04	.725255E-03	.217576E+05	0
6	.300000E+08	1.000000	1.000000	.541222E-04	.473255E-03	.141976E+05	0
7	.300000E+08	1.000000	1.000000	.271222E-04	.284255E-03	.852764E+04	0
8	.300000E+08	1.000000	1.000000	-.877806E-06	.882547E-04	.264764E+04	0
9	.300000E+08	.789329	.789329	-.281278E-04	-.102495E-03	-.307486E+04	0
10	.300000E+08	.346263	.557048	-.538778E-04	-.282745E-03	-.848236E+04	0
11	.300000E+08	.757187	.783044	-.798778E-04	-.464745E-03	-.139424E+05	0
12	.300000E+08	.636802	.755921	-.104378E-03	-.636245E-03	-.190874E+05	0
13	.300000E+08	.572664	.726674	-.125878E-03	-.780745E-03	-.236024E+05	0
14	.300000E+08	.538836	.709250	-.158878E-03	-.101775E-02	-.305324E+05	0
15	.300000E+08	.426954	.622369	-.181628E-03	-.117700E-02	-.353099E+05	0
16	0.	.624169	.624169	-.195378E-03	-.127325E-02	-.372193E+05	3
17	.300000E+08	.712960	.865534	-.130878E-03	-.821745E-03	-.246524E+05	0
18	0.	.866270	.866270	-.155378E-03	-.993245E-03	-.289636E+05	2
19	-.679571E+08	.706665	.706665	-.168378E-03	-.108425E-02	-.202598E+05	2
20	-.367127E+08	.620137	.620137	-.172878E-03	-.111575E-02	-.160258E+05	2
21	.300000E+08	.522938	.726032	-.129678E-03	-.814745E-03	-.244424E+05	0
22	.300000E+08	.403092	.613512	-.145878E-03	-.926745E-03	-.278024E+05	0
23	.300000E+08	.402430	.612802	-.146878E-03	-.933745E-03	-.280124E+05	0

HARD CORNER ELEMENT DATA

ELEMENT	MODULUS	INC. STRAIN	CUM. STRAIN	CUM. STRESS
1	.300000E+08	.168122E-03	.143938E-02	.431813E+05
2	.300000E+08	.163622E-03	.140338E-02	.421013E+05
3	.300000E+08	.162622E-03	.139538E-02	.418613E+05
4	.300000E+08	.153122E-03	.131938E-02	.395813E+05
5	.300000E+08	.568722E-04	.549377E-03	.164813E+05
6	.300000E+08	.541222E-04	.527377E-03	.158213E+05
7	.300000E+08	-.543778E-04	-.340623E-03	-.102187E+05
8	.300000E+08	-.538778E-04	-.336623E-03	-.100987E+05
9	.300000E+08	-.143878E-03	-.105662E-02	-.316987E+05
10	.300000E+08	-.140878E-03	-.103262E-02	-.309787E+05
11	.300000E+08	-.171628E-03	-.127862E-02	-.383587E+05
12	.300000E+08	-.167378E-03	-.124462E-02	-.373387E+05

13	.300000E+08	-.189378E-03	-.142062E-02	-.426187E+05
14	.300000E+08	-.184128E-03	-.137862E-02	-.413587E+05
15	.300000E+08	-.199378E-03	-.150062E-02	-.450187E+05
16	.300000E+08	-.192378E-03	-.144462E-02	-.433387E+05
17	.300000E+08	-.200878E-03	-.151262E-02	-.453787E+05
18	0.	-.173878E-03	-.129662E-02	-.110000E+05
19	.300000E+08	-.120628E-03	-.870623E-03	-.261187E+05
20	.300000E+08	-.120628E-03	-.870623E-03	-.261187E+05
21	.300000E+08	-.144378E-03	-.106062E-02	-.318187E+05
22	.300000E+08	-.140378E-03	-.102862E-02	-.308587E+05
23	.300000E+08	-.152378E-03	-.112462E-02	-.337387E+05
24	.300000E+08	-.146878E-03	-.108062E-02	-.324187E+05
25	.300000E+08	-.153378E-03	-.113262E-02	-.339787E+05
26	.300000E+08	-.146878E-03	-.108062E-02	-.324187E+05

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .642568E+03 N.A. LOCATION = 208.345 MOMENT OF INERTIA = .126814E+08
CUMULATIVE CURVATURE = .70000E-05 CUMULATIVE MOMENT = .31078E+10 UNBALANCED FORCE = .51502E+04

LOAD RANGE 2 INCREMENT 1 CYCLE 2
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 208.002
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	1.000000	1.000000	.643994E-04	.133565E-02	.400696E+05	0
2	.300000E+08	1.000000	1.000000	.637994E-04	.132455E-02	.397366E+05	0
3	.300000E+08	1.000000	1.000000	.629994E-04	.130975E-02	.392926E+05	0
4	.300000E+08	1.000000	1.000000	.475994E-04	.102485E-02	.307456E+05	0
5	.300000E+08	1.000000	1.000000	.331994E-04	.758454E-03	.227536E+05	0
6	.300000E+08	1.000000	1.000000	.187994E-04	.492054E-03	.147616E+05	0
7	.300000E+08	1.000000	1.000000	.799938E-05	.292254E-03	.876762E+04	0
8	.300000E+08	1.000000	1.000000	-.320062E-05	.850541E-04	.255162E+04	0
9	.300000E+08	.789329	.789329	-.141006E-04	-.116596E-03	-.349788E+04	0
10	.300000E+08	.332224	.539734	-.244006E-04	-.307146E-03	-.921438E+04	0
11	.300000E+08	.730337	.780291	-.348006E-04	-.499546E-03	-.149864E+05	0
12	.300000E+08	.615591	.747411	-.446006E-04	-.680846E-03	-.204254E+05	0
13	.300000E+08	.554232	.716326	-.532006E-04	-.839946E-03	-.251984E+05	0
14	.300000E+08	.522074	.698291	-.664006E-04	-.108415E-02	-.325244E+05	0
15	0.	.616345	.616345	-.755006E-04	-.125250E-02	-.364138E+05	3
16	0.	.624169	.624169	-.810006E-04	-.135425E-02	-.372193E+05	3
17	.300000E+08	.690157	.855200	-.552006E-04	-.876946E-03	-.263084E+05	0
18	0.	.866270	.866270	-.650006E-04	-.105825E-02	-.289636E+05	2
19	-.380905E+08	.706665	.706665	-.702006E-04	-.115445E-02	-.167048E+05	2
20	-.239370E+08	.620137	.620137	-.720006E-04	-.118775E-02	-.138968E+05	2
21	.300000E+08	.506191	.712696	-.548006E-04	-.869546E-03	-.260864E+05	0
22	.300000E+08	.390407	.600078	-.612006E-04	-.987946E-03	-.296384E+05	0
23	.300000E+08	.389778	.599384	-.616006E-04	-.995346E-03	-.298604E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .631470E+03 N.A. LOCATION = 209.648 MOMENT OF INERTIA = .122711E+08
CUMULATIVE CURVATURE = .74000E-05 CUMULATIVE MOMENT = .34154E+10 UNBALANCED FORCE = -.67317E+06

LOAD RANGE 2 INCREMENT 2 CYCLE 11
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 142.622
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	1.000000	1.000000	.905511E-04	.142621E-02	.427862E+05	0
2	.300000E+08	1.000000	1.000000	.899511E-04	.141451E-02	.424352E+05	0
3	.300000E+08	1.000000	1.000000	.891511E-04	.139891E-02	.419672E+05	0
4	.300000E+08	1.000000	1.000000	.737511E-04	.109861E-02	.329582E+05	0

5	.300000E+08	1.000000	1.000000	.593511E-04	.817805E-03	.245342E+05	0
6	.300000E+08	1.000000	1.000000	.449511E-04	.537005E-03	.161102E+05	0
7	.300000E+08	1.000000	1.000000	.341511E-04	.326405E-03	.979215E+04	0
8	.300000E+08	1.000000	1.000000	.229511E-04	.108005E-03	.324015E+04	0
9	.300000E+08	.789329	.789329	.120511E-04	-.104545E-03	-.313635E+04	0
10	.300000E+08	.333175	.540921	.175108E-05	-.305395E-03	-.916185E+04	0
11	.300000E+08	.724095	.779387	-.864892E-05	-.508195E-03	-.152458E+05	0
12	.300000E+08	.607417	.743825	-.184489E-04	-.699295E-03	-.209788E+05	0
13	.300000E+08	.545518	.711132	-.270489E-04	-.866995E-03	-.260098E+05	0
14	.300000E+08	.512645	.691813	-.402489E-04	-.112439E-02	-.337318E+05	0
15	0.	.616345	.616345	-.493489E-04	-.130184E-02	-.364138E+05	3
16	-.907133E+08	.624169	.624169	-.548489E-04	-.140909E-02	-.288140E+05	3
17	.300000E+08	.679002	.849728	-.290489E-04	-.905995E-03	-.271798E+05	0
18	-.109575E+09	.866270	.866270	-.388489E-04	-.109709E-02	-.246836E+05	2
19	-.289434E+08	.706665	.706665	-.440489E-04	-.119849E-02	-.152437E+05	2
20	-.192096E+08	.620137	.620137	-.458489E-04	-.123359E-02	-.129143E+05	2
21	.300000E+08	.498053	.705979	-.286489E-04	-.898195E-03	-.269458E+05	0
22	.300000E+08	.383661	.592777	-.350489E-04	-.102299E-02	-.306898E+05	0
23	.300000E+08	.383017	.592059	-.354489E-04	-.103079E-02	-.309238E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .555262E+03 N.A. LOCATION = 235.000 MOMENT OF INERTIA = .909520E+07
CUMULATIVE CURVATURE = .78000E-05 CUMULATIVE MOMENT = .35491E+10 UNBALANCED FORCE = -.18198E+04

LOAD RANGE 2 INCREMENT 3 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 242.207
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	1.000000	1.000000	.507170E-04	.147692E-02	.443077E+05	0
2	.300000E+08	1.000000	1.000000	.501170E-04	.146462E-02	.439387E+05	0
3	.300000E+08	1.000000	1.000000	.493170E-04	.144822E-02	.434467E+05	0
4	.300000E+08	1.000000	1.000000	.339170E-04	.113252E-02	.339757E+05	0
5	.300000E+08	1.000000	1.000000	.195170E-04	.837322E-03	.251197E+05	0
6	.300000E+08	1.000000	1.000000	.511702E-05	.542122E-03	.162637E+05	0
7	.300000E+08	1.000000	1.000000	-.568298E-05	.320722E-03	.962167E+04	0
8	.300000E+08	1.000000	1.000000	-.168830E-04	.911222E-04	.273367E+04	0
9	.300000E+08	.789329	.789329	-.277830E-04	-.132328E-03	-.396983E+04	0
10	.300000E+08	.314162	.516802	-.380830E-04	-.343478E-03	-.103043E+05	0
11	.300000E+08	.691845	.773135	-.484830E-04	-.556678E-03	-.167003E+05	0
12	.300000E+08	.583584	.732396	-.582830E-04	-.757578E-03	-.227273E+05	0
13	.300000E+08	.525620	.698545	-.668830E-04	-.933878E-03	-.280163E+05	0
14	.300000E+08	.495309	.679314	-.800830E-04	-.120448E-02	-.361343E+05	0
15	-.903677E+08	.616345	.616345	-.891830E-04	-.134103E-02	-.299767E+05	3
16	-.449803E+08	.624169	.624169	-.946830E-04	-.150378E-02	-.228070E+05	3
17	0.	.840500	.840500	-.688830E-04	-.974878E-03	-.286514E+05	2
18	-.494948E+08	.866270	.866270	-.786830E-04	-.117578E-02	-.189395E+05	2
19	-.191153E+08	.706665	.706665	-.838830E-04	-.128238E-02	-.132754E+05	2
20	-.136638E+08	.620137	.620137	-.856830E-04	-.131928E-02	-.115284E+05	0
21	.300000E+08	.480087	.690601	-.684830E-04	-.966678E-03	-.290003E+05	0
22	.300000E+08	.370345	.578052	-.748830E-04	-.109788E-02	-.329363E+05	0
23	.300000E+08	.369753	.577371	-.752830E-04	-.110608E-02	-.331823E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .537001E+03 N.A. LOCATION = 241.539 MOMENT OF INERTIA = .839338E+07
CUMULATIVE CURVATURE = .82000E-05 CUMULATIVE MOMENT = .38478E+10 UNBALANCED FORCE = .74042E+03

LOAD RANGE 2 INCREMENT 4 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 232.170
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE

1	.242733E+08	1.000000	1.000000	.547320E-04	.153165E-02	.457684E+05	0
2	.259872E+08	1.000000	1.000000	.541320E-04	.151875E-02	.454874E+05	0
3	.265827E+08	1.000000	1.000000	.533320E-04	.150155E-02	.450413E+05	0
4	.300000E+08	1.000000	1.000000	.379320E-04	.117045E-02	.351136E+05	0
5	.300000E+08	1.000000	1.000000	.235320E-04	.860854E-03	.258256E+05	0
6	.300000E+08	1.000000	1.000000	.913202E-05	.551254E-03	.165376E+05	0
7	.300000E+08	1.000000	1.000000	-.166798E-05	.319054E-03	.957163E+04	0
8	.300000E+08	1.000000	1.000000	-.128680E-04	.782542E-04	.234763E+04	0
9	.300000E+08	.789329	.789329	-.237680E-04	-.156096E-03	-.468297E+04	0
10	.300000E+08	.299653	.497847	-.340680E-04	-.377546E-03	-.113264E+05	0
11	.300000E+08	.865765	.766139	-.444680E-04	-.601146E-03	-.180344E+05	0
12	.300000E+08	.563742	.721774	-.542680E-04	-.811846E-03	-.243554E+05	0
13	.300000E+08	.508774	.687099	-.628680E-04	-.996746E-03	-.299024E+05	3
14	0.	.670029	.670029	-.760680E-04	-.128055E-02	-.379889E+05	3
15	-.485305E+08	.616345	.616345	-.851680E-04	-.147620E-02	-.443667E+05	3
16	-.284326E+08	.624169	.624169	-.906680E-04	-.159445E-02	-.195740E+05	2
17	0.	.840500	.840500	-.648680E-04	-.103975E-02	-.286514E+05	2
18	-.301918E+08	.866270	.866270	-.746680E-04	-.125045E-02	-.160629E+05	2
19	-.140117E+08	.706665	.706665	-.798680E-04	-.136225E-02	-.119700E+05	2
20	-.104775E+08	.620137	.620137	-.816680E-04	-.140095E-02	-.105522E+05	0
21	.300000E+08	.464837	.676955	-.644680E-04	-.103115E-02	-.309344E+05	0
22	.300000E+08	.358942	.565106	-.708680E-04	-.116675E-02	-.350624E+05	0
23	.300000E+08	.358367	.564454	-.712680E-04	-.117735E-02	-.353204E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .532077E+03 N.A. LOCATION = 228.999 MOMENT OF INERTIA = .907852E+07
CUMULATIVE CURVATURE = .86000E-05 CUMULATIVE MOMENT = .37573E+10 UNBALANCED FORCE = -.14857E+04

LOAD RANGE 2 INCREMENT 5 CYCLE 2
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 228.091
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.242733E+08	1.000000	1.000000	.563638E-04	.158802E-02	.471355E+05	0
2	.259872E+08	1.000000	1.000000	.557638E-04	.157452E-02	.469365E+05	0
3	.265827E+08	1.000000	1.000000	.549638E-04	.155652E-02	.465024E+05	0
4	.300000E+08	1.000000	1.000000	.395638E-04	.121002E-02	.363005E+05	0
5	.300000E+08	1.000000	1.000000	.251638E-04	.886018E-03	.265805E+05	0
6	.300000E+08	1.000000	1.000000	.107638E-04	.562018E-03	.168605E+05	0
7	.300000E+08	1.000000	1.000000	-.362059E-07	.319018E-03	.957054E+04	0
8	.300000E+08	1.000000	1.000000	-.112362E-04	.670180E-04	.201054E+04	0
9	.300000E+08	.789329	.789329	-.221362E-04	-.178232E-03	-.534696E+04	0
10	.300000E+08	.287555	.481678	-.324362E-04	-.409982E-03	-.122995E+05	0
11	.300000E+08	.643241	.758700	-.428362E-04	-.643982E-03	-.193195E+05	0
12	.300000E+08	.546310	.711612	-.526362E-04	-.864482E-03	-.259345E+05	0
13	.300000E+08	.493830	.676338	-.612362E-04	-.105798E-02	-.317395E+05	0
14	0.	.670029	.670029	-.744362E-04	-.135498E-02	-.379889E+05	3
15	-.315399E+08	.616345	.616345	-.835362E-04	-.155973E-02	-.211069E+05	3
16	-.201335E+08	.624169	.624169	-.890362E-04	-.168348E-02	-.174472E+05	3
17	-.882228E+08	.840500	.840500	-.632362E-04	-.110298E-02	-.227639E+05	2
18	-.209809E+08	.866270	.866270	-.730362E-04	-.132348E-02	-.142280E+05	2
19	-.108867E+08	.706665	.706665	-.782362E-04	-.144048E-02	-.110046E+05	2
20	-.839723E+07	.620137	.620137	-.800362E-04	-.148098E-02	-.980198E+04	2
21	.300000E+08	.451290	.664376	-.628362E-04	-.109398E-02	-.328195E+05	0
22	0.	.562817	.562817	-.692362E-04	-.123798E-02	-.354541E+05	3
23	0.	.563675	.563675	-.696362E-04	-.124698E-02	-.354541E+05	3

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .514285E+03 N.A. LOCATION = 230.081 MOMENT OF INERTIA = .888935E+07
CUMULATIVE CURVATURE = .90000E-05 CUMULATIVE MOMENT = .38617E+10 UNBALANCED FORCE = .26915E+05

LOAD RANGE 2 INCREMENT 6 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 263.233

GROSS PANEL ELEMENT	ELEMENT MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.242733E+08	1.000000	1.000000	.423068E-04	.163032E-02	.481634E+05	0
2	.259872E+08	1.000000	1.000000	.417068E-04	.161622E-02	.480204E+05	0
3	.265827E+08	1.000000	1.000000	.409068E-04	.159742E-02	.475898E+05	0
4	.300000E+08	1.000000	1.000000	.255068E-04	.123552E-02	.370657E+05	0
5	.300000E+08	1.000000	1.000000	.111068E-04	.897125E-03	.269137E+05	0
6	.300000E+08	1.000000	1.000000	-.329322E-05	.558725E-03	.167617E+05	0
7	.300000E+08	1.000000	1.000000	-.140932E-04	.304925E-03	.914774E+04	0
8	.300000E+08	1.000000	1.000000	-.252932E-04	.417248E-04	.125174E+04	0
9	.300000E+08	.789329	.789329	-.361932E-04	-.214425E-03	-.643276E+04	0
10	.300000E+08	.272518	.461120	-.464932E-04	-.456475E-03	-.136943E+05	0
11	.300000E+08	.616581	.748223	-.568932E-04	-.700875E-03	-.210263E+05	0
12	.300000E+08	.526382	.699046	-.666932E-04	-.931175E-03	-.279353E+05	0
13	.300000E+08	.477144	.663649	-.752932E-04	-.113328E-02	-.339983E+05	0
14	-.769728E+08	.670029	.670029	-.884932E-04	-.144348E-02	-.260387E+05	3
15	-.214832E+08	.616345	.616345	-.975932E-04	-.165733E-02	-.185717E+05	3
16	-.146162E+08	.624169	.624169	-.103093E-03	-.178658E-02	-.156812E+05	3
17	-.436255E+08	.840500	.840500	-.772932E-04	-.118028E-02	-.180016E+05	2
18	-.148889E+08	.866270	.866270	-.870932E-04	-.141058E-02	-.126912E+05	2
19	-.846443E+07	.706665	.706665	-.922932E-04	-.153278E-02	-.101194E+05	2
20	-.671011E+07	.620137	.620137	-.940932E-04	-.157508E-02	-.909617E+04	2
21	.300000E+08	.436220	.649879	-.768932E-04	-.117088E-02	-.351263E+05	0
22	0.	.562817	.562817	-.832932E-04	-.132128E-02	-.354541E+05	3
23	0.	.563675	.563675	-.836932E-04	-.133068E-02	-.354541E+05	3

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .482009E+03 N.A. LOCATION = 242.378 MOMENT OF INERTIA = .773586E+07
CUMULATIVE CURVATURE = .94000E-05 CUMULATIVE MOMENT = .39338E+10 UNBALANCED FORCE = -.12431E+04

LOAD RANGE 2 INCREMENT 7 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 279.854

GROSS PANEL ELEMENT	ELEMENT MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.242733E+08	1.000000	1.000000	.356582E-04	.166598E-02	.490290E+05	0
2	.259872E+08	1.000000	1.000000	.350582E-04	.165128E-02	.489314E+05	0
3	.265827E+08	1.000000	1.000000	.342582E-04	.163168E-02	.485005E+05	0
4	.300000E+08	1.000000	1.000000	.188582E-04	.125438E-02	.376315E+05	0
5	.300000E+08	1.000000	1.000000	.445821E-05	.901583E-03	.270475E+05	0
6	.300000E+08	1.000000	1.000000	-.994179E-05	.548783E-03	.164635E+05	0
7	.300000E+08	1.000000	1.000000	-.207418E-04	.284183E-03	.852549E+04	0
8	.300000E+08	1.000000	1.000000	-.319418E-04	.978297E-05	.293489E+03	0
9	.300000E+08	.789329	.789329	-.428418E-04	-.257267E-03	-.771801E+04	0
10	.300000E+08	.257918	.440670	-.531418E-04	-.509617E-03	-.152885E+05	0
11	.300000E+08	.590399	.736159	-.635418E-04	-.764417E-03	-.229325E+05	0
12	.300000E+08	.506802	.685711	-.733418E-04	-.100452E-02	-.301355E+05	0
13	.300000E+08	.460776	.650511	-.819418E-04	-.121522E-02	-.364565E+05	0
14	-.394075E+08	.670029	.670029	-.951418E-04	-.153862E-02	-.208312E+05	3
15	-.155351E+08	.616345	.616345	-.104242E-03	-.176157E-02	-.166701E+05	3
16	-.110546E+08	.624169	.624169	-.109742E-03	-.189632E-02	-.142878E+05	3
17	-.261420E+08	.840500	.840500	-.839418E-04	-.126422E-02	-.151772E+05	2
18	-.110488E+08	.866270	.866270	-.937418E-04	-.150432E-02	-.114904E+05	2
19	-.672635E+07	.706665	.706665	-.989418E-04	-.163172E-02	-.937339E+04	2
20	-.545028E+07	.620137	.620137	-.100742E-03	-.167582E-02	-.848730E+04	2
21	0.	.647894	.647894	-.835418E-04	-.125442E-02	-.354541E+05	3
22	-.640227E+08	.562817	.562817	-.899418E-04	-.141122E-02	-.276814E+05	3
23	-.589030E+08	.563675	.563675	-.903418E-04	-.142102E-02	-.270745E+05	3

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .417946E+03 N.A. LOCATION = 269.632 MOMENT OF INERTIA = .541360E+07
CUMULATIVE CURVATURE = .98000E-05 CUMULATIVE MOMENT = .39868E+10 UNBALANCED FORCE = -.75648E+03

LOAD RANGE 2 INCREMENT 8 CYCLE 2
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 267.866
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.242733E+08	1.000000	1.000000	.404535E-04	.170644E-02	.500109E+05	0
2	.259872E+08	1.000000	1.000000	.398535E-04	.169114E-02	.499671E+05	0
3	.265827E+08	1.000000	1.000000	.390535E-04	.167074E-02	.495386E+05	0
4	.300009E+08	1.000000	1.000000	.236535E-04	.127804E-02	.383411E+05	0
5	.300000E+08	1.000000	1.000000	.925349E-05	.910836E-03	.273251E+05	0
6	.300000E+08	1.000000	1.000000	-.514651E-05	.543036E-03	.163091E+05	0
7	.300000E+08	1.000000	1.000000	-.159465E-04	.269236E-03	.804709E+04	0
8	.300000E+08	.793256	.793256	-.271465E-04	-.173635E-04	-.520906E+03	0
9	.300000E+08	.789329	.789329	-.380465E-04	-.295314E-03	-.885941E+04	0
10	.300000E+08	.246491	.424329	-.483465E-04	-.557964E-03	-.167389E+05	0
11	.300000E+08	.568942	.724986	-.587465E-04	-.823164E-03	-.246949E+05	0
12	.300000E+08	.490348	.673749	-.685465E-04	-.107306E-02	-.321919E+05	0
13	0.	.643775	.643775	-.771465E-04	-.129236E-02	-.377693E+05	3
14	-.253514E+08	.670029	.670029	-.903465E-04	-.162896E-02	-.179833E+05	3
15	-.120367E+08	.616345	.616345	-.994465E-04	-.186101E-02	-.153114E+05	3
16	-.882002E+07	.624169	.624169	-.104947E-03	-.200126E-02	-.132522E+05	3
17	-.182073E+08	.840500	.840500	-.791465E-04	-.134336E-02	-.134536E+05	2
18	-.871794E+07	.866270	.866270	-.889465E-04	-.159326E-02	-.106181E+05	2
19	-.556134E+07	.706665	.706665	-.941465E-04	-.172586E-02	-.879787E+04	2
20	-.457803E+07	.620137	.620137	-.959465E-04	-.177176E-02	-.800823E+04	3
21	0.	.647894	.647894	-.787465E-04	-.133316E-02	-.354541E+05	3
22	-.389023E+08	.562817	.562817	-.851465E-04	-.149636E-02	-.234466E+05	3
23	-.370072E+08	.563675	.563675	-.855465E-04	-.150656E-02	-.230596E+05	3

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .419444E+03 N.A. LOCATION = 268.185 MOMENT OF INERTIA = .588335E+07
CUMULATIVE CURVATURE = .10200E-04 CUMULATIVE MOMENT = .40537E+10 UNBALANCED FORCE = .67687E+04

LOAD RANGE 2 INCREMENT 9 CYCLE 8
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 297.176
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.242733E+08	1.000000	1.000000	.287297E-04	.173517E-02	.507083E+05	0
2	.259872E+08	1.000000	1.000000	.281297E-04	.171927E-02	.506981E+05	0
3	.265827E+08	1.000000	1.000000	.273297E-04	.169807E-02	.502651E+05	0
4	.300000E+08	1.000000	1.000000	.119297E-04	.128997E-02	.386990E+05	0
5	.300000E+08	1.000000	1.000000	-.247026E-05	.908366E-03	.272510E+05	0
6	.300000E+08	1.000000	1.000000	-.168703E-04	.526766E-03	.158030E+05	0
7	.300000E+08	1.000000	1.000000	-.276703E-04	.240566E-03	.721699E+04	0
8	.300000E+08	.793256	.793256	-.388703E-04	-.562338E-04	-.168701E+04	0
9	.300000E+08	.789329	.789329	-.497703E-04	-.345084E-03	-.103525E+05	0
10	.300000E+08	.234205	.406432	-.600703E-04	-.618034E-03	-.185410E+05	0
11	.300000E+08	.546048	.711759	-.704703E-04	-.893634E-03	-.268090E+05	0
12	.300000E+08	.472976	.660369	-.802703E-04	-.115333E-02	-.346000E+05	0
13	-.142516E+09	.643775	.643775	-.888703E-04	-.138123E-02	-.324275E+05	3
14	-.173461E+08	.670029	.670029	-.102070E-03	-.173103E-02	-.158471E+05	3
15	-.945202E+07	.616345	.616345	-.111170E-03	-.197218E-02	-.141266E+05	3
16	-.710202E+07	.624169	.624169	-.116670E-03	-.211793E-02	-.123294E+05	3
17	-.130905E+08	.840500	.840500	-.908703E-04	-.143423E-02	-.120528E+05	2
18	-.882967E+07	.866270	.866270	-.100670E-03	-.169393E-02	-.983623E+04	2

19	-.460582E+07	.706665	.706665	-.105870E-03	-.183173E-02	-.826231E+04	2
20	-.384598E+07	.620137	.620137	-.107670E-03	-.187943E-02	-.755663E+04	2
21	-.388772E+08	.647894	.647894	-.904703E-04	-.142363E-02	-.269191E+05	3
22	-.256073E+08	.562817	.562817	-.968703E-04	-.159323E-02	-.203966E+05	3
23	-.246177E+08	.563675	.563675	-.972703E-04	-.160383E-02	-.201305E+05	3

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .337438E+03 N.A. LOCATION = 311.266 MOMENT OF INERTIA = .239427E+07
CUMULATIVE CURVATURE = .10000E-04 CUMULATIVE MOMENT = .40956E+10 UNBALANCED FORCE = -.52156E+03

LOAD RANGE 2 INCREMENT 10 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 288.925
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.242733E+08	1.000000	1.000000	.320301E-04	.176720E-02	.514857E+05	0
2	.259872E+08	1.000000	1.000000	.314301E-04	.175070E-02	.515149E+05	0
3	.265827E+08	1.000000	1.000000	.306301E-04	.172870E-02	.510794E+05	0
4	.300000E+08	1.000000	1.000000	.152301E-03	.130520E-02	.391559E+05	0
5	.300000E+08	1.000000	1.000000	.830131E-06	.909196E-03	.272759E+05	0
6	.300000E+08	1.000000	1.000000	-.135699E-04	.513196E-03	.153959E+05	0
7	.300000E+08	1.000000	1.000000	-.243699E-04	.216196E-03	.648589E+04	0
8	.300000E+08	.793256	.793256	-.355699E-04	-.918037E-04	-.275411E+04	0
9	.300000E+08	.789329	.789329	-.464699E-04	-.391554E-03	-.117466E+05	0
10	.300000E+08	.224137	.391510	-.567699E-04	-.674804E-03	-.202441E+05	0
11	.300000E+08	.526615	.699483	-.671699E-04	-.960804E-03	-.288241E+05	0
12	.300000E+08	.457942	.648167	-.769699E-04	-.123030E-02	-.369091E+05	0
13	-.614447E+08	.643775	.643775	-.855699E-04	-.146680E-02	-.244981E+05	3
14	-.129313E+08	.670029	.670029	-.987699E-04	-.182980E-02	-.143696E+05	3
15	-.772047E+07	.616345	.616345	-.107870E-03	-.208005E-02	-.132057E+05	3
16	-.590703E+07	.624169	.624169	-.113370E-03	-.223130E-02	-.115955E+05	3
17	-.100805E+08	.840500	.840500	-.875699E-04	-.152180E-02	-.110478E+05	2
18	-.571376E+07	.866270	.866270	-.973699E-04	-.179130E-02	-.922386E+04	2
19	-.391498E+07	.706665	.706665	-.102570E-03	-.193430E-02	-.782692E+04	2
20	-.330515E+07	.620137	.620137	-.104370E-03	-.198380E-02	-.718464E+04	2
21	-.362642E+08	.647894	.647894	-.871699E-04	-.151080E-02	-.229043E+05	3
22	-.186576E+08	.562817	.562817	-.935699E-04	-.168680E-02	-.183542E+05	3
23	-.180486E+08	.563675	.563675	-.939699E-04	-.169780E-02	-.181523E+05	3

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .390692E+03 N.A. LOCATION = 278.018 MOMENT OF INERTIA = .513859E+07
CUMULATIVE CURVATURE = .11000E-04 CUMULATIVE MOMENT = .41461E+10 UNBALANCED FORCE = .45392E+03

LOAD RANGE 2 INCREMENT 11 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 275.135
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.242733E+08	1.000000	1.000000	.375458E-04	.180474E-02	.523971E+05	0
2	.259872E+08	1.000000	1.000000	.369458E-04	.178764E-02	.524750E+05	0
3	.265827E+08	1.000000	1.000000	.361458E-04	.176484E-02	.520402E+05	0
4	.300000E+08	1.000000	1.000000	.207458E-04	.132594E-02	.397783E+05	0
5	.300000E+08	1.000000	1.000000	.634581E-05	.915542E-03	.274663E+05	0
6	.300000E+08	1.000000	1.000000	-.805419E-05	.505142E-03	.151543E+05	0
7	.300000E+08	1.000000	1.000000	-.188542E-04	.197342E-03	.592026E+04	0
8	.300000E+08	.793256	.793256	-.300542E-04	-.121858E-03	-.365574E+04	0
9	.300000E+08	.789329	.789329	-.409542E-04	-.432508E-03	-.129752E+05	0
10	.300000E+08	.216081	.379405	-.512542E-04	-.726058E-03	-.217817E+05	0
11	.300000E+08	.510491	.688565	-.616542E-04	-.102246E-02	-.306737E+05	0
12	0.	.643775	.643775	-.714542E-04	-.130176E-02	-.377693E+05	3
13	-.370282E+08	.643775	.643775	-.800542E-04	-.154686E-02	-.206932E+05	3

14	-.102455E+08	.670029	.670029	-.932542E-04	-.192306E-02	-.132970E+05	3
15	-.651572E+07	.616345	.616345	-.102354E-03	-.218241E-02	-.124800E+05	3
16	-.505135E+07	.624169	.624169	-.107854E-03	-.233916E-02	-.110065E+05	3
17	-.817619E+07	.840500	.840500	-.820542E-04	-.160386E-02	-.103033E+05	2
18	-.486043E+07	.866270	.866270	-.918542E-04	-.188316E-02	-.873998E+04	2
19	-.340664E+07	.706665	.706665	-.970542E-04	-.203136E-02	-.747258E+04	2
20	-.290030E+07	.620137	.620137	-.988542E-04	-.208266E-02	-.687865E+04	2
21	-.256824E+08	.647894	.647894	-.816542E-04	-.159246E-02	-.204165E+05	3
22	-.145727E+08	.562817	.562817	-.880542E-04	-.177486E-02	-.169035E+05	3
23	-.141572E+08	.563675	.563675	-.884542E-04	-.178626E-02	-.167398E+05	3

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .400689E+03 N.A. LOCATION = 271.688 MOMENT OF INERTIA = .574136E+07
CUMULATIVE CURVATURE = .11400E-04 CUMULATIVE MOMENT = .42113E+10 UNBALANCED FORCE = -.14909E+04

LOAD RANGE 2 INCREMENT 12 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 293.309
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.242733E+08	1.000000	1.000000	.302764E-04	.183502E-02	.531320E+05	0
2	.259872E+08	1.000000	1.000000	.296764E-04	.181732E-02	.532462E+05	0
3	.265827E+08	1.000000	1.000000	.288764E-04	.179372E-02	.528078E+05	0
4	.300000E+08	1.000000	1.000000	.134764E-04	.133942E-02	.401826E+05	0
5	.300000E+08	1.000000	1.000000	-.923559E-06	.914619E-03	.274386E+05	0
6	.300000E+08	1.000000	1.000000	-.153236E-04	.489819E-03	.146946E+05	0
7	.300000E+08	1.000000	1.000000	-.261236E-04	.171219E-03	.513656E+04	0
8	.300000E+08	.793256	.793256	-.373236E-04	-.159181E-03	-.477544E+04	0
9	.300000E+08	.789329	.789329	-.482236E-04	-.480731E-03	-.144219E+05	0
10	.300000E+08	.207866	.366910	-.585236E-04	-.784581E-03	-.235374E+05	0
11	.300000E+08	.494109	.676794	-.689236E-04	-.109138E-02	-.327414E+05	0
12	-.143942E+09	.643775	.643775	-.787236E-04	-.138048E-02	-.325353E+05	3
13	-.246233E+08	.643775	.643775	-.873236E-04	-.163418E-02	-.180625E+05	3
14	-.825413E+07	.670029	.670029	-.100524E-03	-.202358E-02	-.123732E+05	3
15	-.553755E+07	.616345	.616345	-.109624E-03	-.220203E-02	-.118218E+05	3
16	-.434433E+07	.624169	.624169	-.115124E-03	-.245428E-02	-.104674E+05	3
17	-.670117E+07	.840500	.840500	-.893236E-04	-.169318E-02	-.964250E+04	2
18	-.415437E+07	.866270	.866270	-.991236E-04	-.198228E-02	-.829471E+04	2
19	-.297229E+07	.706665	.706665	-.104324E-03	-.213568E-02	-.714070E+04	2
20	-.255014E+07	.620137	.620137	-.106124E-03	-.218678E-02	-.659010E+04	2
21	-.189705E+08	.647894	.647894	-.889236E-04	-.168138E-02	-.184562E+05	3
22	-.115977E+08	.562817	.562817	-.953236E-04	-.187018E-02	-.156651E+05	3
23	-.113001E+08	.563675	.563675	-.957236E-04	-.188198E-02	-.155300E+05	3

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .304894E+03 N.A. LOCATION = 334.647 MOMENT OF INERTIA = .488971E+06
CUMULATIVE CURVATURE = .11800E-04 CUMULATIVE MOMENT = .42586E+10 UNBALANCED FORCE = .33311E+02

LOAD RANGE 2 INCREMENT 13 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 315.188
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.242733E+08	1.000000	1.000000	.215249E-04	.185654E-02	.536545E+05	0
2	.259872E+08	1.000000	1.000000	.209249E-04	.183824E-02	.537900E+05	0
3	.265827E+08	1.000000	1.000000	.201249E-04	.181384E-02	.533428E+05	0
4	.300000E+08	1.000000	1.000000	.472488E-05	.134414E-02	.403243E+05	0
5	.300000E+08	1.000000	1.000000	-.967512E-05	.904943E-03	.271483E+05	0
6	.300000E+08	1.000000	1.000000	-.240751E-04	.465743E-03	.139723E+05	0
7	.300000E+08	1.000000	1.000000	-.348751E-04	.136343E-03	.409030E+04	0
8	.300000E+08	.793256	.793256	-.460751E-04	-.205257E-03	-.615770E+04	0

9	.300000E+08	.749721	.767341	-.569751E-04	-.537707E-03	-.161312E+05	0
10	.300000E+08	.199489	.354012	-.672751E-04	-.851857E-03	-.255557E+05	0
11	.300000E+08	.477412	.664091	-.776751E-04	-.116906E-02	-.350717E+05	0
12	-.609154E+08	.643775	.643775	-.874751E-04	-.146796E-02	-.244276E+05	3
13	-.173680E+08	.643775	.643775	-.960751E-04	-.173026E-02	-.160790E+05	3
14	-.672927E+07	.670029	.670029	-.109275E-03	-.213286E-02	-.115593E+05	3
15	-.472888E+07	.616345	.616345	-.118375E-03	-.241041E-02	-.112162E+05	3
16	-.375070E+07	.624169	.624169	-.123875E-03	-.257816E-02	-.396751E+04	3
17	-.553175E+07	.840500	.840500	-.980751E-04	-.179126E-02	-.904568E+04	2
18	-.356138E+07	.866270	.866270	-.107875E-03	-.209016E-02	-.787991E+04	2
19	-.259681E+07	.706665	.706665	-.113075E-03	-.224876E-02	-.682663E+04	2
20	-.22[illegible]04E+07	.620137	.620137	-.114875E-03	-.230366E-02	-.631536E+04	2
21	-.144158E+08	.647894	.647894	-.976751E-04	-.177906E-02	-.168426E+05	3
22	-.935329E+07	.562817	.562817	-.104075E-03	-.197426E-02	-.145819E+05	3
23	-.913781E+07	.563675	.563675	-.104475E-03	-.198646E-02	-.144691E+05	3

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .337964E+03 N.A. LOCATION = 315.414 MOMENT OF INERTIA = .144517E+07
CUMULATIVE CURVATURE = .12200E-04 CUMULATIVE MOMENT = .42804E+10 UNBALANCED FORCE = .33495E+03

LOAD RANGE 2 INCREMENT 14 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 308.207
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.242733E+08	1.000000	1.000000	.243173E-04	.188086E-02	.542447E+05	0
2	.259872E+08	1.000000	1.000000	.237173E-04	.186196E-02	.544063E+05	0
3	.265827E+08	1.000000	1.000000	.229173E-04	.183676E-02	.539520E+05	0
4	.300000E+08	1.000000	1.000000	.751731E-05	.135166E-02	.405498E+05	0
5	.300000E+08	1.000000	1.000000	-.688269E-05	.898061E-03	.269418E+05	0
6	.300000E+08	1.000000	1.000000	-.212827E-04	.444461E-03	.133338E+05	0
7	.300000E+08	1.000000	1.000000	-.320827E-04	.104261E-03	.312782E+04	0
8	.300000E+08	.793256	.793256	-.432827E-04	-.248539E-03	-.745618E+04	0
9	.300000E+08	.[illegible]4582	.782251	-.541827E-04	-.591809E-03	-.177567E+05	0
10	.300000E+08	.[illegible]2342	.342882	-.644827E-04	-.916339E-03	-.274902E+05	0
11	.300000E+08	.462819	.652408	-.748827E-04	-.124394E-02	-.373182E+05	3
12	-.359079E+08	.643775	.643775	-.846827E-04	-.155264E-02	-.204824E+05	3
13	-.131861E+08	.643775	.643775	-.932827E-04	-.182354E-02	-.146688E+05	3
14	-.584662E+07	.670029	.670029	-.106483E-03	-.223934E-02	-.109032E+05	3
15	-.411270E+07	.616345	.616345	-.115583E-03	-.252599E-02	-.107066E+05	3
16	-.329042E+07	.624169	.624169	-.121083E-03	-.269924E-02	-.954224E+04	3
17	-.468829E+07	.840500	.840500	-.952827E-04	-.188654E-02	-.856063E+04	2
18	-.310787E+07	.866270	.866270	-.105083E-03	-.219524E-02	-.753040E+04	2
19	-.230096E+07	.706665	.706665	-.110283E-03	-.235904E-02	-.655711E+04	2
20	-.200013E+07	.620137	.620137	-.112083E-03	-.241574E-02	-.607795E+04	2
21	-.115018E+08	.647894	.647894	-.948827E-04	-.187394E-02	-.156217E+05	3
22	-.778656E+07	.562817	.562817	-.101283E-03	-.207554E-02	-.137179E+05	3
23	-.782233E+07	.563675	.563675	-.101683E-03	-.208814E-02	-.136208E+05	3

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .356745E+03 N.A. LOCATION = 303.107 MOMENT OF INERTIA = .242009E+07
CUMULATIVE CURVATURE = .12600E-04 CUMULATIVE MOMENT = .43044E+10 UNBALANCED FORCE = .97270E+03

LOAD RANGE 2 INCREMENT 15 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 308.152
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.242733E+08	1.000000	1.000000	.243393E-04	.190520E-02	.548355E+05	0
2	.259872E+08	1.000000	1.000000	.237393E-04	.188570E-02	.550232E+05	0
3	.265827E+08	1.000000	1.000000	.229393E-04	.185970E-02	.545618E+05	0

4	.300000E+08	1.000000	1.000000	.753931E-05	.135920E-02	.407760E+05	0
5	.300000E+08	1.000000	1.000000	-.686069E-05	.891200E-03	.267360E+05	0
6	.300000E+08	1.000000	1.000000	-.212607E-04	.423200E-03	.126960E+05	0
7	.300000E+08	1.000000	1.000000	-.320607E-04	.722001E-04	.216600E+04	0
8	.300000E+08	.793256	.793256	-.432607E-04	-.291800E-03	-.875400E+04	0
9	.300000E+08	.683974	.775267	-.541607E-04	- 646050E-03	-.193815E+05	0
10	0.	.339626	.339626	-.644607E-04	-.980800E-03	-.280937E+05	3
11	0.	.649846	.649846	-.748607E-04	-.131880E-02	-.378251E+05	3
12	-.243125E+08	.643775	.643775	-.846607E-04	-.163730E-02	-.179962E+05	3
13	-.104497E+08	.643775	.643775	-.932607E-04	-.191680E-02	-.135749E+05	3
14	-.482617E+07	.670029	.670029	-.106461E-03	-.234580E-02	-.103476E+05	3
15	-.361968E+07	.616345	.616345	-.115561E-03	-.264155E-02	-.102609E+05	3
16	-.291719E+07	.624169	.624169	-.121061E-03	-.282030E-02	-.916725E+04	3
17	-.403944E+07	.840500	.840500	-.952607E-04	-.198180E-02	-.814620E+04	2
18	-.274316E+07	.866270	.866270	-.105061E-03	-.230030E-02	-.722371E+04	2
19	-.205735E+07	.706665	.706665	-.110261E-03	-.246930E-02	-.631725E+04	2
20	-.179744E+07	.620137	.620137	-.112061E-03	-.252780E-02	-.586550E+04	2
21	-.945242E+07	.647894	.647894	-.948607E-04	-.196880E-02	-.146332E+05	3
22	-.661331E+07	.562817	.562817	-.101261E-03	-.217680E-02	-.129915E+05	3
23	-.648407E+07	.563675	.563675	-.101661E-03	-.218980E-02	-.129064E+05	3

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .331098E+03 N.A. LOCATION = 420.778 MOMENT OF INERTIA = .895080E+06
CUMULATIVE CURVATURE = .13000E-04 CUMULATIVE MOMENT = .43293E+10 UNBALANCED FORCE = .11867E+04

LOAD RANGE 2 INCREMENT 16 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 366.903
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.242733E+08	1.000000	1.000000	.838675E-06	.190604E-02	.548559E+05	0
2	.259872E+08	1.000000	1.000000	.238675E-06	.188594E-02	.550295E+05	0
3	.265827E+08	1.000000	1.000000	-.561325E-06	.185914E-02	.545469E+05	0
4	.300000E+08	1.000000	1.000000	-.159613E-04	.134324E-02	.402972E+05	0
5	.300000E+08	1.000000	1.000000	-.303613E-04	.860839E-03	.258252E+05	0
6	.300000E+08	1.000000	1.000000	-.447613E-04	.378439E-03	.113532E+05	0
7	.300000E+08	1.000000	1.000000	-.555613E-04	.166388E-04	.499163E+03	0
8	.300000E+08	.793256	.793256	-.667613E-04	-.358561E-03	-.107568E+05	0
9	.300000E+08	.646234	.763388	-.776613E-04	-.723711E-03	-.217113E+05	0
10	-.847611E+08	.339626	.339626	-.879613E-04	-.100876E-02	-.211304E+05	3
11	-.955920E+08	.649846	.649846	-.983613E-04	-.141719E-02	-.282863E+05	3
12	-.165459E+08	.643775	.643775	-.108161E-03	-.174546E-02	-.158213E+05	3
13	-.815393E+07	.643775	.643775	-.116761E-03	-.203356E-02	-.124991E+05	3
14	-.406452E+07	.670029	.670029	-.129961E-03	-.247576E-02	-.977222E+04	3
15	-.314516E+07	.616345	.616345	-.139061E-03	-.278061E-02	-.979179E+04	3
16	-.255605E+07	.624169	.624169	-.144561E-03	-.296486E-02	-.877260E+04	3
17	-.341774E+07	.840500	.840500	-.118761E-03	-.210056E-02	-.770510E+04	2
18	-.233507E+07	.866270	.866270	-.128561E-03	-.242886E-02	-.689496E+04	2
19	-.181483E+07	.706665	.706665	-.133761E-03	-.260306E-02	-.605884E+04	2
20	-.159443E+07	.620137	.620137	-.135561E-03	-.266335E-02	-.563606E+04	2
21	-.763487E+07	.647894	.647894	-.118361E-03	-.208716E-02	-.136283E+05	3
22	-.552678E+07	.562817	.562817	-.124761E-03	-.230156E-02	-.122376E+05	3
23	-.542787E+07	.563675	.563675	-.125161E-03	-.231496E-02	-.121642E+05	3

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .268652E+03 N.A. LOCATION = 364.088 MOMENT OF INERTIA = -.176021E+07
CUMULATIVE CURVATURE = .13400E-04 CUMULATIVE MOMENT = .43052E+10 UNBALANCED FORCE = -.98798E+03

LOAD RANGE 2 INCREMENT 17 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 345.350
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM STRAIN	CUM. STRESS	FAILURE CODE
1	.242733E+08	1.000000	1.000000	.946019E-05	.191550E-02	.550855E+05	0
2	.259872E+08	1.000000	1.000000	.886019E-05	.189480E-02	.552597E+05	0
3	.265827E+08	1.000000	1.000000	.806019E-05	.186720E-02	.547611E+05	0
4	.300000E+08	1.000000	1.000000	-.733981E-05	.133590E-02	.400770E+05	0
5	.300000E+08	1.000000	1.000000	-.217398E-04	.839099E-03	.251730E+05	0
6	.300000E+08	1.000000	1.000000	-.361398E-04	.342099E-03	.102690E+05	0
7	.300000E+08	.786161	.786161	-.469398E-04	-.303011E-04	-.909032E+03	0
8	.300000E+08	.793256	.793256	-.581398E-04	-.416701E-03	-.125010E+05	0
9	.300000E+08	.617453	.751903	-.690398E-04	-.792751E-03	-.237825E+05	0
10	-.404847E+08	.339626	.339626	-.793398E-04	-.114810E-02	-.165177E+05	3
11	-.469414E+08	.649846	.649846	-.897398E-04	-.150690E-02	-.223169E+05	3
12	-.124579E+08	.643775	.643775	-.995398E-04	-.184500E-02	-.143938E+05	3
13	-.668861E+07	.643775	.643775	-.108140E-03	-.214170E-02	-.116999E+05	3
14	-.351817E+07	.670029	.670029	-.121340E-03	-.259710E-02	-.931351E+04	3
15	-.278720E+07	.616345	.616345	-.130440E-03	-.291105E-02	-.940567E+04	3
16	-.227955E+07	.624169	.624169	-.135940E-03	-.310080E-02	-.844452E+04	3
17	-.297142E+07	.840500	.840500	-.110140E-03	-.221070E-02	-.735421E+04	2
18	-.211604E+07	.866270	.866270	-.119940E-03	-.254880E-02	-.662557E+04	2
19	-.162814E+07	.706665	.706665	-.125140E-03	-.272820E-02	-.584377E+04	2
20	-.143671E+07	.620137	.620137	-.126940E-03	-.279030E-02	-.544396E+04	2
21	-.641524E+07	.647894	.647894	-.109740E-03	-.219690E-02	-.128506E+05	3
22	-.475816E+07	.562817	.562817	-.116140E-03	-.241770E-02	-.116422E+05	3
23	-.467871E+07	.563675	.563675	-.116540E-03	-.243150E-02	-.115771E+05	3

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .303641E+03 N.A. LOCATION = 334.541 MOMENT OF INERTIA = .241858E+06
CUMULATIVE CURVATURE = .13800E-04 CUMULATIVE MOMENT = .42990E+10 UNBALANCED FORCE = .97411E+03

LOAD RANGE 2 INCREMENT 18 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 328.775
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.242733E+08	1.000000	1.000000	.160899E-04	.193159E-02	.554761E+05	0
2	.259872E+08	1.000000	1.000000	.154899E-04	.191029E-02	.556622E+05	0
3	.265827E+08	1.000000	1.000000	.146899E-04	.188189E-02	.551516E+05	0
4	.300000E+08	1.000000	1.000000	-.710118E-06	.133519E-02	.400557E+05	0
5	.300000E+08	1.000000	1.000000	-.151101E-04	.823989E-03	.247197E+05	0
6	.300000E+08	1.000000	1.000000	-.295101E-04	.312789E-03	.938366E+04	0
7	.300000E+08	.786161	.786161	-.403101E-04	-.706112E-04	-.211834E+04	0
8	.300000E+08	.793256	.793256	-.515101E-04	-.468211E-03	-.140463E+05	0
9	.300000E+08	.594495	.741237	-.624101E-04	-.855161E-03	-.256548E+05	0
10	-.256255E+08	.339626	.339626	-.727101E-04	-.122081E-02	-.141825E+05	3
11	-.299368E+08	.649846	.649846	-.831101E-04	-.159001E-02	-.192101E+05	3
12	-.995995E+07	.643775	.643775	-.929101E-04	-.193791E-02	-.133596E+05	3
13	-.567234E+07	.643775	.643775	-.101510E-03	-.224321E-02	-.110749E+05	3
14	-.310547E+07	.670029	.670029	-.114710E-03	-.271181E-02	-.893443E+04	3
15	-.250604E+07	.616345	.616345	-.123810E-03	-.303486E-02	-.907850E+04	3
16	-.205984E+07	.624169	.624169	-.129310E-03	-.323011E-02	-.816435E+04	3
17	-.283385E+07	.840500	.840500	-.103510E-03	-.231421E-02	-.706469E+04	2
18	-.190526E+07	.866270	.866270	-.113310E-03	-.266211E-02	-.639809E+04	2
19	-.147905E+07	.706665	.706665	-.118510E-03	-.284671E-02	-.565989E+04	2
20	-.130982E+07	.620137	.620137	-.120310E-03	-.291061E-02	-.527894E+04	2
21	-.553842E+07	.647894	.647894	-.103110E-03	-.230001E-02	-.122462E+05	3
22	-.418356E+07	.562817	.562817	-.109510E-03	-.252721E-02	-.111537E+05	3
23	-.411753E+07	.563675	.563675	-.109910E-03	-.254141E-02	-.110948E+05	3

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .318505E+03 N.A. LOCATION = 324.216 MOMENT OF INERTIA = .945711E+06
CUMULATIVE CURVATURE = .14200E-04 CUMULATIVE MOMENT = .43065E+10 UNBALANCED FORCE = .72637E+03

LOAD RANGE 2 INCREMENT 19 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 333.585
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.242733E+08	1.000000	1.000000	.141661E-04	.194575E-02	.558199E+05	0
2	.259872E+08	1.000000	1.000000	.135661E-04	.192385E-02	.560148E+05	0
3	.265827E+08	1.000000	1.000000	.127661E-04	.189465E-02	.554910E+05	0
4	.300000E+08	1.000000	1.000000	-.263386E-05	.133255E-02	.399766E+05	0
5	.300000E+08	1.000000	1.000000	-.170339E-04	.806955E-03	.242086E+05	0
6	.300000E+08	1.000000	1.000000	-.314339E-04	.281355E-03	.844065E+04	0
7	.300000E+08	.786161	.786161	-.422339E-04	-.112845E-03	-.338535E+04	0
8	.300000E+08	.784829	.793166	-.534339E-04	-.521645E-03	-.156494E+05	0
9	.300000E+08	.573321	.730216	-.643339E-04	-.919495E-03	-.275849E+05	3
10	-.179099E+08	.339626	.339626	-.746339E-04	-.129545E-02	-.125865E+05	3
11	-.210389E+08	.649846	.649846	-.850339E-04	-.167505E-02	-.170797E+05	3
12	-.816698E+07	.643775	.643775	-.948339E-04	-.203275E-02	-.125047E+05	3
13	-.487658E+07	.643775	.643775	-.103434E-03	-.234665E-02	-.105310E+05	3
14	-.276244E+07	.670029	.670029	-.116634E-03	-.282845E-02	-.859288E+04	3
15	-.226578E+07	.616345	.616345	-.125734E-03	-.316060E-02	-.877894E+04	3
16	-.187072E+07	.624169	.624169	-.131234E-03	-.336135E-02	-.790677E+04	3
17	-.235097E+07	.840500	.840500	-.105434E-03	-.241965E-02	-.680238E+04	2
18	-.172451E+07	.866270	.866270	-.115234E-03	-.277735E-02	-.618924E+04	2
19	-.134948E+07	.706665	.706665	-.120434E-03	-.296715E-02	-.548976E+04	2
20	-.119894E+07	.620137	.620137	-.122234E-03	-.303285E-02	-.512578E+04	2
21	-.483302E+07	.647894	.647894	-.105034E-03	-.240505E-02	-.117029E+05	3
22	-.370852E+07	.562817	.562817	-.111434E-03	-.263865E-02	-.107149E+05	3
23	-.365295E+07	.563675	.563675	-.111834E-03	-.265325E-02	-.106612E+05	3

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .308779E+03 N.A. LOCATION = 333.947 MOMENT OF INERTIA = .301943E+05
CUMULATIVE CURVATURE = .14600E-04 CUMULATIVE MOMENT = .43078E+10 UNBALANCED FORCE = -.57317E+03

LOAD RANGE 2 INCREMENT 20 CYCLE 2
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 332.104
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.242733E+08	1.000000	1.000000	.147585E-04	.196051E-02	.561782E+05	0
2	.259872E+08	1.000000	1.000000	.141585E-04	.193801E-02	.563827E+05	0
3	.265827E+08	1.000000	1.000000	.133585E-04	.190801E-02	.558461E+05	0
4	.300000E+08	1.000000	1.000000	-.204155E-05	.133051E-02	.399154E+05	0
5	.300000E+08	1.000000	1.000000	-.164415E-04	.790513E-03	.237154E+05	0
6	.300000E+08	1.000000	1.000000	-.308415E-04	.250513E-03	.751540E+04	0
7	.300000E+08	.786161	.786161	-.416415E-04	-.154487E-03	-.463460E+04	0
8	.300000E+08	.747864	.790658	-.528415E-04	-.574487E-03	-.172346E+05	0
9	.300000E+08	.554426	.719422	-.637415E-04	-.983237E-03	-.294971E+05	0
10	-.134432E+08	.339626	.339626	-.740415E-04	-.136949E-02	-.114389E+05	3
11	-.158443E+08	.649846	.649846	-.844415E-04	-.175949E-02	-.155397E+05	3
12	-.686113E+07	.643775	.643775	-.942415E-04	-.212699E-02	-.117996E+05	3
13	-.425408E+07	.643775	.643775	-.102842E-03	-.244949E-02	-.100627E+05	3
14	-.247952E+07	.670029	.670029	-.116042E-03	-.294449E-02	-.628923E+04	3
15	-.206247E+07	.616345	.616345	-.125142E-03	-.328574E-02	-.850845E+04	3
16	-.170954E+07	.624169	.624169	-.130642E-03	-.349199E-02	-.767317E+04	3
17	-.211654E+07	.840500	.840500	-.104842E-03	-.252449E-02	-.656854E+04	2
18	-.157136E+07	.866270	.866270	-.114642E-03	-.289199E-02	-.600054E+04	2
19	-.123829E+07	.706665	.706665	-.119842E-03	-.308699E-02	-.533486E+04	2
20	-.110330E+07	.620137	.620137	-.121642E-03	-.315449E-02	-.496589E+04	2
21	-.426848E+07	.647894	.647894	-.104442E-03	-.250949E-02	-.112286E+05	3
22	-.331892E+07	.562817	.562817	-.110842E-03	-.274949E-02	-.103261E+05	3

23	-.327144E+07	.563675	.563675	-.111242E-03	-.276449E-02	-.102767E+05

3

HARD CORNER ELEMENT DATA

ELEMENT	MODULUS	INC. STRAIN	CUM. STRAIN	CUM. STRESS
1	.300000E+08	.147585E-04	.214339E-02	.643018E+05
2	0.	.129585E-04	.206959E-02	.450000E+05
3	.300000E+08	.125585E-04	.205319E-02	.615958E+05
4	.300000E+08	.875845E-05	.189739E-02	.569218E+05
5	.300000E+08	-.297415E-04	.318894E-03	.956682E+04
6	.300000E+08	-.308415E-04	.273794E-03	.821382E+04
7	.300000E+08	-.742415E-04	-.150561E-02	-.451682E+05
8	0.	-.740415E-04	-.149741E-02	-.330000E+05
9	0.	-.110042E-03	-.297341E-02	-.800000E+05
10	0.	-.108842E-03	-.292421E-02	-.450000E+05
11	0.	-.121142E-03	-.342851E-02	-.800000E+05
12	0.	-.119442E-03	-.335881E-02	-.450000E+05
13	0.	-.128242E-03	-.371961E-02	-.800000E+05
14	0.	-.126142E-03	-.363351E-02	-.450000E+05
15	0.	-.132242E-03	-.388361E-02	-.800000E+05
16	0.	-.129442E-03	-.376881E-02	-.450000E+05
17	0.	-.132842E-03	-.390821E-02	-.800000E+05
18	0.	-.122042E-03	-.346541E-02	-.110000E+05
19	0.	-.100742E-03	-.259211E-02	-.450000E+05
20	0.	-.100742E-03	-.259211E-02	-.450000E+05
21	0.	-.110242E-03	-.298161E-02	-.450000E+05
22	0.	-.108642E-03	-.291601E-02	-.450000E+05
23	0.	-.113442E-03	-.311281E-02	-.450000E+05
24	0.	-.111242E-03	-.302261E-02	-.450000E+05
25	0.	-.113842E-03	-.312921E-02	-.450000E+05
26	0.	-.111242E-03	-.302261E-02	-.450000E+05

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .313458E+03 N.A. LOCATION = 330.283 MOMENT OF INERTIA = .305433E+06
CUMULATIVE CURVATURE = .15000E-04 CUMULATIVE MOMENT = .43097E+10 UNBALANCED FORCE = -.10369E+04

ULTIMATE STRENGTH OF HULL B (NO ILS, AET=68.0) - SAGGING

INPUT DATA

NUMBER OF GROSS PANEL ELEMENTS	23
NUMBER OF HARD CORNERS	26
NUMBER OF DIFFERENT STIFFENERS	8
NUMBER OF DIFFERENT MATERIALS	3
MAXIMUM NUMBER OF ITERATIONS	20

SHIP CHARACTERISTICS

COMPARTMENT LENGTH	480.00
TRANSVERSE FRAME SPACING	96.00

GROSS PANEL ELEMENT DATA

COORDINATE DATA

ELEMENT	Y1	Z1	Y2	Z2	YAVE	ZAVE	WIDTH	SIN	COS
1	369.000	13.500	369.000	94.500	369.000	54.000	81.0000	0.00000	1.00000
2	368.000	130.000	367.000	229.000	367.500	179.500	99.0051	-.01010	.99995
3	367.000	229.000	364.000	295.000	365.500	262.000	66.0681	-.04541	.99897
4	345.000	310.000	309.000	310.000	327.000	310.000	36.0000	-1.00000	0.00000
5	309.000	310.000	273.000	310.000	291.000	310.000	36.0000	-1.00000	0.00000
6	255.000	262.000	255.000	288.000	255.000	275.000	26.0000	0.00000	1.00000
7	242.500	307.000	213.500	304.000	228.000	305.500	29.1548	-.99469	-.10290
8	213.500	304.000	186.500	298.000	200.000	301.000	27.6586	-.97619	-.21693
9	186.500	298.000	159.000	291.000	172.750	294.500	28.3769	-.96910	-.24668
10	147.000	238.000	147.000	276.000	147.000	257.000	38.0000	0.00000	1.00000
11	134.000	280.000	108.000	265.000	121.000	272.500	30.0167	-.86619	-.49972
12	108.000	265.000	85.000	245.000	96.500	255.000	30.4795	-.75461	-.65618
13	85.000	245.000	65.000	222.000	75.000	233.500	30.4795	-.65618	-.75461
14	49.000	198.000	35.000	173.000	42.000	185.500	28.6531	-.48860	-.87251
15	23.500	145.000	15.000	112.500	19.250	128.750	33.5932	-.25303	-.96746
16	8.000	80.000	3.000	48.000	5.500	64.000	32.3883	-.15438	-.98801
17	77.000	197.000	63.000	206.000	70.000	201.500	16.6433	-.84118	.54076
18	53.000	152.000	38.000	157.000	45.500	154.500	15.8114	-.94868	.31623
19	43.000	91.000	22.000	94.500	32.500	92.750	21.2897	-.98639	.16440
20	41.000	28.000	15.000	30.000	28.000	29.000	26.0768	-.99705	.07670
21	77.000	182.000	65.000	160.000	71.000	171.000	25.0599	-.47885	-.87790
22	56.000	135.000	54.000	105.000	55.000	120.000	30.0666	-.06652	-.99779
23	54.000	73.000	54.000	43.000	54.000	58.000	30.0000	0.00000	-1.00000

GEOMETRY

ELEMENT	PLATE THICK.	STIFF. SPACING	NO. OF STIFF.	STIFF. REF. NO.	MATERIAL REF. NO.	TRIPPING EFF.LEN.	G.I. CODE	PROP. LIMIT	RES.STR. FACTOR
1	.50000	27.0000	3	1	1	68.0000	0	.5000	3.0000
2	.62500	33.0017	3	1	1	68.0000	0	.5000	3.0000
3	.75000	33.0341	2	1	1	68.0000	0	.5000	3.0000
4	.75000	36.0000	1	2	1	68.0000	0	.5000	3.0000
5	.75000	36.0000	1	2	1	68.0000	0	.5000	3.0000
6	.25000	26.0000	1	3	3	68.0000	0	.5000	3.0000
7	.62500	29.1548	1	4	1	68.0000	0	.5000	3.0000
8	.62500	27.6586	1	4	1	68.0000	0	.5000	3.0000
9	.62500	28.3769	1	4	1	68.0000	0	.5000	3.0000
10	.25000	38.0000	1	5	3	68.0000	0	.5000	3.0000
11	.62500	30.0167	1	6	1	68.0000	0	.5000	3.0000
12	.62500	30.4795	1	6	1	68.0000	0	.5000	3.0000
13	.62500	30.4795	1	6	1	68.0000	0	.5000	3.0000
14	.62500	28.6531	1	6	1	68.0000	0	.5000	3.0000

15	.62500	33.5932	1	6	1	68.0000	0	.5000	3.0000
16	.62500	32.3883	1	6	1	68.0000	0	.5000	3.0000
17	.37500	16.6433	1	7	2	68.0000	0	.5000	3.0000
18	.37500	15.8114	1	7	2	68.0000	0	.5000	3.0000
19	.37500	21.2897	1	7	2	68.0000	0	.5000	3.0000
20	.37500	26.0768	1	7	2	68.0000	0	.5000	3.0000
21	.43750	25.0599	1	8	2	68.0000	0	.5000	3.0000
22	.43750	30.0666	1	8	2	68.0000	0	.5000	3.0000
23	.43750	30.0000	1	8	2	68.0000	0	.5000	3.0000

PRESSURE LOADING AND INITIAL DISTORTION

ELEMENT	PRESSURE LOAD	INITIAL DISTORT.	PRE-STRAIN
1	0.000	0.000000	0.
2	0.000	0.000000	0.
3	0.000	0.000000	0.
4	0.000	0.000000	0.
5	0.000	0.000000	0.
6	0.000	0.000000	0.
7	0.000	0.000000	0.
8	0.000	0.000000	0.
9	0.000	0.000000	0.
10	0.000	0.000000	0.
11	0.000	0.000000	0.
12	0.000	0.000000	0.
13	0.000	0.000000	0.
14	0.000	0.000000	0.
15	0.000	0.000000	0.
16	0.000	0.000000	0.
17	0.000	0.000000	0.
18	0.000	0.000000	0.
19	0.000	0.000000	0.
20	0.000	0.000000	0.
21	0.000	0.000000	0.
22	0.000	0.000000	0.
23	0.000	0.000000	0.

HARD CORNER ELEMENT DATA

ELEMENT	AREA	Y-COORD	MOM. IN.	MAT.REF.	PRE-STRAIN
1	6.7500	369.000	.141	1	0.
2	1.6200	364.500	11.700	2	0.
3	11.2750	363.500	1.466	1	0.
4	13.5000	354.000	364.500	1	0.
5	19.1545	257.750	1484.878	1	0.
6	5.1250	255.000	.027	3	0.
7	17.0706	146.500	889.185	1	0.
8	2.5000	147.000	.013	3	0.
9	18.0278	57.000	384.998	1	0.
10	2.7042	60.000	8.122	2	0.
11	18.9185	29.250	209.025	1	0.
12	3.4573	33.500	23.339	2	0.
13	20.7783	11.500	85.491	1	0.
14	3.9775	16.750	36.544	2	0.
15	15.1167	1.500	11.822	1	0.
16	4.8894	8.500	68.859	2	0.
17	15.0000	0.000	.488	1	0.
18	13.5000	27.000	3280.500	2	0.
19	2.8621	80.250	10.086	2	0.
20	5.5899	80.250	19.747	2	0.
21	2.8559	56.500	11.667	2	0.
22	11.6247	60.500	78.631	2	0.

23	4.1926	48.500	42.277	2	0.
24	14.0000	54.000	.223	2	0.
25	4.8894	47.500	68.859	2	0.
26	21.5000	54.000	.448	2	0.

STIFFENER DATA

NUMBER	AREA	IZZ	IYY	DEPTH	TWEB	WFLG	TFLG	MAT.REF.
1	3.1850	11.646	2.299	6.1600	.26000	4.0300	.42000	2
2	2.7825	19.177	1.341	8.0000	.23000	4.0000	.25000	2
3	1.3040	3.449	.322	5.0000	.16000	2.6800	.20000	3
4	3.3179	35.874	1.450	10.0000	.23000	4.0000	.27000	2
5	2.0970	14.145	1.023	7.9000	.17000	3.9400	.20000	3
6	4.2379	67.659	1.894	12.1600	.24000	4.0100	.35000	2
7	.8060	1.011	.136	3.5000	.13000	2.0800	.18000	2
8	3.3179	35.874	1.450	10.0000	.23000	4.0000	.27000	2

MATERIAL CHARACTERISTICS

MATERIAL	YOUNGS MODULUS	POISSON RATIO	YIELD STRESS	SHEAR MODULUS	PROP.LIM RATIO	YIELD STRAIN
1	.30000E+08	.3000	[illegible].0	.11538E+08	1.0000	.26667E-02
2	.30000E+08	.3000	[illegible].0	.11538E+08	1.0000	.15000E-02
3	.30000E+08	.3000	[illegible].0	.11538E+08	1.0000	.11000E-02

FULLY EFFECTIVE CROSS SECTION CHARACTERISTICS

CROSS SECTION AREA	802.240
HEIGHT OF N.A. ABOVE BASE LINE	174.520
SECTION MOMENT OF INERTIA	16202023.3

CURVATURE INCREMENT DATA

LOAD RANGE	NUMBER OF INCREMENTS	INCREMENT SIZE
1	5	-.1000E-05
2	2	-.5000E-06
3	10	-.2000E-06

CRITICAL STRAIN (MEAN STRESS) VALUES

ELEMENT	PLATE YIELD STRAIN	STIFF YIELD STRAIN	EULER COLUMN BUCKLING	STIFFENER TRIPPING
1	.26667E-02 (.80000E+05)	.15000E-02 (.45000E+05)	-.15000E-02 (-.45000E+05)	-.12973E-02 (-.38918E+05)
2	.26667E-02 (.80000E+05)	.15000E-02 (.45000E+05)	-.15000E-02 (-.45000E+05)	-.12973E-02 (-.38918E+05)
3	.26667E-02 (.80000E+05)	.15000E-02 (.45000E+05)	-.15000E-02 (-.45000E+05)	-.14108E-02 (-.42324E+05)
4	.26667E-02 (.80000E+05)	.15000E-02 (.45000E+05)	-.15000E-02 (-.45000E+05)	-.13462E-02 (-.40387E+05)
5	.26667E-02 (.80000E+05)	.15000E-02 (.45000E+05)	-.15000E-02 (-.45000E+05)	-.13462E-02 (-.40387E+05)
6	.11000E-02 (.33000E+05)	.11000E-02 (.33000E+05)	-.10068E-02 (-.30205E+05)	-.83105E-03 (-.24931E+05)
7	.26667E-02 (.80000E+05)	.15000E-02 (.45000E+05)	-.15000E-02 (-.45000E+05)	-.12956E-02 (-.38869E+05)
8	.26667E-02 (.80000E+05)	.15000E-02 (.45000E+05)	-.15000E-02 (-.45000E+05)	-.13016E-02 (-.39047E+05)
9	.26667E-02 (.80000E+05)	.15000E-02 (.45000E+05)	-.15000E-02 (-.45000E+05)	-.12990E-02 (-.38969E+05)
10	.11000E-02 (.33000E+05)	.11000E-02 (.33000E+05)	-.10655E-02 (-.31964E+05)	-.93646E-03 (-.28094E+05)

11	.26667E-02	.15000E-02	-.15000E-02	-.12608E-02
	(.80000E+05)	(.45000E+05)	(-.45000E+05)	(-.37825E+05)
12	.26667E-02	.15000E-02	-.15000E-02	-.12590E-02
	(.80000E+05)	(.45000E+05)	(-.45000E+05)	(-.37769E+05)
13	.26667E-02	.15000E-02	-.15000E-02	-.12590E-02
	(.80000E+05)	(.45000E+05)	(-.45000E+05)	(-.37769E+05)
14	.26667E-02	.15000E-02	-.15000E-02	-.12663E-02
	(.80000E+05)	(.45000E+05)	(-.45000E+05)	(-.37989E+05)
15	.26667E-02	.15000E-02	-.15000E-02	-.12138E-02
	(.90000E+05)	(.45000E+05)	(-.45000E+05)	(-.36414E+05)
16	.26667E-02	.15000E-02	-.15000E-02	-.12406E-02
	(.80000E+05)	(.45000E+05)	(-.45000E+05)	(-.37219E+05)
17	.15000E-02	.15000E-02	-.95505E-03	-.11982E-02
	(.45000E+05)	(.45000E+05)	(-.28651E+05)	(-.35645E+05)
18	.15000E-02	.15000E-02	-.96545E-03	-.12133E-02
	(.45000E+05)	(.45000E+05)	(-.28964E+05)	(-.36400E+05)
19	.15000E-02	.15000E-02	-.91637E-03	-.99880E-03
	(.45000E+05)	(.45000E+05)	(-.27491E+05)	(-.29958E+05)
20	.15000E-02	.15000E-02	-.87876E-03	-.90865E-03
	(.45000E+05)	(.45000E+05)	(-.26363E+05)	(-.27259E+05)
21	.15000E-02	.15000E-02	-.14566E-02	-.11818E-02
	(.45000E+05)	(.45000E+05)	(-.43698E+05)	(-.35454E+05)
22	.15000E-02	.15000E-02	-.14554E-02	-.11818E-02
	(.45000E+05)	(.45000E+05)	(-.43662E+05)	(-.35454E+05)
23	.15000E-02	.15000E-02	-.14554E-02	-.11818E-02
	(.45000E+05)	(.45000E+05)	(-.43662E+05)	(-.35454E+05)

INITIAL (UNLOADED) CROSS SECTION CHARACTERISTICS

CROSS SECTION AREA	746.517
HEIGHT OF N.A. ABOVE BASE LINE	163.666
SECTION MOMENT OF INERTIA	14685196.5

MOMENT-CURVATURE HISTORY

LOAD RANGE 1 INCREMENT 1 CYCLE 1
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 163.666
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	.787638	.787638	-.205334E-03	-.205334E-03	-.616003E+04	0
2	.300000E+08	.785974	.785974	-.203834E-03	-.203834E-03	-.611503E+04	0
3	.300000E+08	.794070	.794070	-.201834E-03	-.201834E-03	-.605503E+04	0
4	.300000E+08	.783988	.783988	-.163334E-03	-.163334E-03	-.490003E+04	0
5	.300000E+08	.783988	.783988	-.127334E-03	-.127334E-03	-.382003E+04	0
6	.300000E+08	.876508	.876508	-.913344E-04	-.913344E-04	-.274003E+04	0
7	.300000E+08	.786161	.786161	-.643344E-04	-.643344E-04	-.193003E+04	0
8	.300000E+08	.793256	.793256	-.363344E-04	-.363344E-04	-.109003E+04	0
9	.300000E+08	.789329	.789329	-.908443E-05	-.908443E-05	-.272533E+03	0
10	.300000E+08	1.000000	1.000000	.166656E-04	.166656E-04	.499967E+03	0
11	.300000E+08	1.000000	1.000000	.426656E-04	.426656E-04	.127997E+04	0
12	.300000E+08	1.000000	1.000000	.671656E-04	.671656E-04	.201497E+04	0
13	.300000E+08	1.000000	1.000000	.886656E-04	.886656E-04	.265997E+04	0
14	.300000E+08	1.000000	1.000000	.121666E-03	.121666E-03	.364997E+04	0
15	.300000E+08	1.000000	1.000000	.144416E-03	.144416E-03	.433247E+04	0
16	.300000E+08	1.000000	1.000000	.158166E-03	.158166E-03	.474497E+04	0
17	.300000E+08	1.000000	1.000000	.936656E-04	.936656E-04	.280997E+04	0
18	.300000E+08	1.000000	1.000000	.118166E-03	.118166E-03	.354497E+04	0
19	.300000E+08	1.000000	1.000000	.131166E-03	.131166E-03	.393497E+04	0
20	.300000E+08	1.000000	1.000000	.135666E-03	.135666E-03	.406997E+04	0
21	.300000E+08	1.000000	1.000000	.926656E-04	.926656E-04	.277997E+04	0
22	.300000E+08	1.000000	1.000000	.108666E-03	.108666E-03	.325997E+04	0
23	.300000E+08	1.000000	1.000000	.109666E-03	.109666E-03	.328997E+04	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .746517E+03 N.A. LOCATION = 163.666 MOMENT OF INERTIA = .146852E+08
CUMULATIVE CURVATURE = -.10000E-05 CUMULATIVE MOMENT = -.44007E+09 UNBALANCED FORCE = .81025E-07

LOAD RANGE 1 INCREMENT 2 CYCLE 2
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 162.766
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	.718972	.781652	-.206234E-03	-.411568E-03	-.123470E+05	0
2	.300000E+08	.736411	.782849	-.204734E-03	-.408568E-03	-.122570E+05	0
3	.300000E+08	.794070	.794070	-.202734E-03	-.404568E-03	-.121370E+05	0
4	.300000E+08	.783988	.783988	-.164234E-03	-.327568E-03	-.982705E+04	0
5	.300000E+08	.783988	.783988	-.128234E-03	-.255568E-03	-.766705E+04	0
6	.300000E+08	.622048	.802636	-.922339E-04	-.183568E-03	-.550705E+04	0
7	.300000E+08	.786161	.786161	-.652339E-04	-.129568E-03	-.388705E+04	0
8	.300000E+08	.793256	.793256	-.372339E-04	-.735683E-04	-.220705E+04	0
9	.300000E+08	.789329	.789329	-.998386E-05	-.190683E-04	-.572049E+03	0
10	.300000E+08	1.000000	1.000000	.157661E-04	.324317E-04	.972951E+03	0
11	.300000E+08	1.000000	1.000000	.417661E-04	.844317E-04	.253295E+04	0
12	.300000E+08	1.000000	1.000000	.662661E-04	.133432E-03	.400295E+04	0
13	.300000E+08	1.000000	1.000000	.877661E-04	.176432E-03	.529295E+04	0
14	.300000E+08	1.000000	1.000000	.120766E-03	.242432E-03	.727295E+04	0
15	.300000E+08	1.000000	1.000000	.143516E-03	.287932E-03	.863795E+04	0
16	.300000E+08	1.000000	1.000000	.157266E-03	.315432E-03	.946295E+04	0
17	.300000E+08	1.000000	1.000000	.927661E-04	.186432E-03	.559295E+04	0
18	.300000E+08	1.000000	1.000000	.117266E-03	.235432E-03	.706295E+04	0
19	.300000E+08	1.000000	1.000000	.130266E-03	.261432E-03	.784295E+04	0
20	.300000E+08	1.000000	1.000000	.134766E-03	.270432E-03	.811295E+04	0

21	.300000E+08	1.000000	1.000000	.917661E-04	.184432E-03	.553295E+04	0
22	.300000E+08	1.000000	1.000000	.107766E-03	.216432E-03	.649295E+04	0
23	.300000E+08	1.000000	1.000000	.108766E-03	.218432E-03	.655295E+04	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .739015E+03 N.A. LOCATION = 161.843 MOMENT OF INERTIA = .144243E+08
CUMULATIVE CURVATURE = -.20000E-05 CUMULATIVE MOMENT = -.87879E+09 UNBALANCED FORCE = -.12135E+05

LOAD RANGE 1 INCREMENT 3 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 159.680
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	.585365	.735692	-.209320E-03	-.620888E-03	-.186266E+05	0
2	.300000E+08	.599550	.741756	-.207820E-03	-.616388E-03	-.184916E+05	0
3	.300000E+08	.729718	.788855	-.205820E-03	-.610388E-03	-.183116E+05	0
4	.300000E+08	.734201	.780827	-.167320E-03	-.494888E-03	-.148466E+05	0
5	.300000E+08	.783988	.783988	-.131320E-03	-.386888E-03	-.116066E+05	0
6	.300000E+08	.504671	.718765	-.953196E-04	-.278888E-03	-.836664E+04	0
7	.300000E+08	.786161	.786161	-.683196E-04	-.197888E-03	-.593664E+04	0
8	.300000E+08	.793256	.793256	-.403196E-04	-.113888E-03	-.341664E+04	0
9	.300000E+08	.789329	.789329	-.130696E-04	-.321379E-04	-.964136E+03	0
10	.300000E+08	1.000000	1.000000	.126804E-04	.451121E-04	.135336E+04	0
11	.300000E+08	1.000000	1.000000	.386804E-04	.123112E-03	.369336E+04	0
12	.300000E+08	1.000000	1.000000	.631804E-04	.196612E-03	.589836E+04	0
13	.300000E+08	1.000000	1.000000	.846804E-04	.261112E-03	.783336E+04	0
14	.300000E+08	1.000000	1.000000	.117680E-03	.360112E-03	.108034E+05	0
15	.300000E+08	1.000000	1.000000	.140430E-03	.428362E-03	.128509E+05	0
16	.300000E+08	1.000000	1.000000	.154180E-03	.469612E-03	.140884E+05	0
17	.300000E+08	1.000000	1.000000	.896804E-04	.276112E-03	.828336E+04	0
18	.300000E+08	1.000000	1.000000	.114180E-03	.346612E-03	.104884E+05	0
19	.300000E+08	1.000000	1.000000	.127180E-03	.386112E-03	.116584E+05	0
20	.300000E+08	1.000000	1.000000	.131680E-03	.402112E-03	.120634E+05	0
21	.300000E+08	1.000000	1.000000	.886804E-04	.273112E-03	.819336E+04	0
22	.300000E+08	1.000000	1.000000	.104680E-03	.321112E-03	.963336E+04	0
23	.300000E+08	1.000000	1.000000	.105680E-03	.324112E-03	.972336E+04	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .719840E+03 N.A. LOCATION = 158.557 MOMENT OF INERTIA = .136380E+08
CUMULATIVE CURVATURE = -.30000E-05 CUMULATIVE MOMENT = -.12999E+10 UNBALANCED FORCE = -.50319E+04

LOAD RANGE 1 INCREMENT 4 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 154.394
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	.504617	.685940	-.214606E-03	-.835493E-03	-.250648E+05	0
2	.300000E+08	.516828	.693809	-.213106E-03	-.829493E-03	-.248848E+05	0
3	.300000E+08	.629007	.759758	-.211106E-03	-.821493E-03	-.246448E+05	0
4	.300000E+08	.632186	.754595	-.172606E-03	-.667493E-03	-.200248E+05	0
5	.300000E+08	.713860	.777715	-.136606E-03	-.523493E-03	-.157048E+05	0
6	.300000E+08	.432634	.651725	-.100606E-03	-.379493E-03	-.113648E+05	0
7	.300000E+08	.786161	.786161	-.736056E-04	-.271493E-03	-.814480E+04	0
8	.300000E+08	.793256	.793256	-.456056E-04	-.159493E-03	-.478480E+04	0
9	.300000E+08	.789329	.789329	-.183556E-04	-.504934E-04	-.151480E+04	0
10	.300000E+08	1.000000	1.000000	.739441E-05	.52[illegible]06E-04	.157520E+04	0
11	.300000E+08	1.000000	1.000000	.333944E-04	.156507E-03	.469520E+04	0
12	.300000E+08	1.000000	1.000000	.578944E-04	.254507E-03	.763520E+04	0
13	.300000E+08	1.000000	1.000000	.793944E-04	.340507E-03	.102152E+05	0
14	.300000E+08	1.000000	1.000000	.112394E-03	.472507E-03	.141752E+05	0
15	.300000E+08	1.000000	1.000000	.135144E-03	.563507E-03	.169052E+05	0

16	.300000E+08	1.000000	1.000000	.148894E-03	.618507E-03	.185552E+05	0
17	.300000E+08	1.000000	1.000000	.843944E-04	.360507E-03	.108152E+05	0
18	.300000E+08	1.000000	1.000000	.108894E-03	.458507E-03	.137552E+05	0
19	.300000E+08	1.000000	1.000000	.121894E-03	.510507E-03	.153152E+05	0
20	.300000E+08	1.000000	1.000000	.126394E-03	.528507E-03	.158552E+05	0
21	.300000E+08	1.000000	1.000000	.833944E-04	.356507E-03	.106952E+05	0
22	.300000E+08	1.000000	1.000000	.993944E-04	.420507E-03	.126152E+05	0
23	.300000E+08	1.000000	1.000000	.100394E-03	.424507E-03	.127352E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .701344E+03 N.A. LOCATION = 151.442 MOMENT OF INERTIA = .129068E+08
CUMULATIVE CURVATURE = -.40000E-05 CUMULATIVE MOMENT = -.16972E+10 UNBALANCED FORCE = .52171E+04

LOAD RANGE 1 INCREMENT 5 CYCLE 2
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 149.527

GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	.449070	.642104	-.219473E-03	-.105497E-02	-.316490E+05	0
2	.300000E+08	.459920	.650714	-.217973E-03	-.104747E-02	-.314240E+05	0
3	.300000E+08	.559720	.724907	-.215973E-03	-.103747E-02	-.311240E+05	0
4	.300000E+08	.561887	.721068	-.177473E-03	-.844966E-03	-.253490E+05	0
5	.300000E+08	.633386	.755058	-.141473E-03	-.664966E-03	-.199490E+05	0
6	.300000E+08	.382708	.598315	-.105473E-03	-.484966E-03	-.145490E+05	0
7	.300000E+08	.786161	.786161	-.784727E-04	-.349966E-03	-.104990E+05	0
8	.300000E+08	.793256	.793256	-.504727E-04	-.209966E-03	-.629899E+04	0
9	.300000E+08	.789329	.789329	-.232227E-04	-.737162E-04	-.221149E+04	0
10	.300000E+08	1.000000	1.000000	.252727E-05	.550338E-04	.165101E+04	0
11	.300000E+08	1.000000	1.000000	.285273E-04	.185034E-03	.555101E+04	0
12	.300000E+08	1.000000	1.000000	.530273E-04	.307534E-03	.922601E+04	0
13	.300000E+08	1.000000	1.000000	.745273E-04	.415034E-03	.124510E+05	0
14	.300000E+08	1.000000	1.000000	.107527E-03	.580034E-03	.174010E+05	0
15	.300000E+08	1.000000	1.000000	.130277E-03	.693784E-03	.208135E+05	0
16	.300000E+08	1.000000	1.000000	.144027E-03	.762534E-03	.228760E+05	0
17	.300000E+08	1.000000	1.000000	.795273E-04	.440034E-03	.132010E+05	0
18	.300000E+08	1.000000	1.000000	.104027E-03	.562534E-03	.168760E+05	0
19	.300000E+08	1.000000	1.000000	.117027E-03	.627534E-03	.188260E+05	0
20	.300000E+08	1.000000	1.000000	.121527E-03	.650034E-03	.195010E+05	0
21	.300000E+08	1.000000	1.000000	.785273E-04	.435034E-03	.130510E+05	0
22	.300000E+08	1.000000	1.000000	.945273E-04	.515034E-03	.154510E+05	0
23	.300000E+08	1.000000	1.000000	.955273E-04	.520034E-03	.156010E+05	0

HARD CORNER ELEMENT DATA

ELEMENT	MODULUS	INC. STRAIN	CUM. STRAIN	CUM. STRESS
1	.300000E+08	-.219473E-03	-.127444E-02	-.382332E+05
2	.300000E+08	-.214973E-03	-.124744E-02	-.374232E+05
3	.300000E+08	-.213973E-03	-.124144E-02	-.372432E+05
4	.300000E+08	-.204473E-03	-.118444E-02	-.355332E+05
5	.300000E+08	-.108223E-03	-.606939E-03	-.182082E+05
6	.300000E+08	-.105473E-03	-.590439E-03	-.177132E+05
7	.300000E+08	.302727E-05	.605611E-04	.181683E+04
8	.300000E+08	.252727E-05	.575611E-04	.172683E+04
9	.300000E+08	.925273E-04	.597561E-03	.179268E+05
10	.300000E+08	.895273E-04	.579561E-03	.173868E+05
11	.300000E+08	.120277E-03	.764061E-03	.229218E+05
12	.300000E+08	.116027E-03	.738561E-03	.221568E+05
13	.300000E+08	.138027E-03	.870561E-03	.261168E+05
14	.300000E+08	.132777E-03	.839061E-03	.251718E+05
15	.300000E+08	.148027E-03	.930561E-03	.279168E+05
16	.300000E+08	.141027E-03	.888561E-03	.266568E+05
17	.300000E+08	.149527E-03	.939561E-03	.281868E+05

18	.300000E+08	.122527E-03	.777561E-03	.233268E+05
19	.300000E+08	.692773E-04	.458061E-03	.137418E+05
20	.300000E+08	.692773E-04	.458061E-03	.137418E+05
21	.300000E+08	.930273E-04	.600561E-03	.180168E+05
22	.300000E+08	.890273E-04	.576561E-03	.172968E+05
23	.300000E+08	.101027E-03	.648561E-03	.194568E+05
24	.300000E+08	.955273E-04	.615561E-03	.184668E+05
25	.300000E+08	.102027E-03	.654561E-03	.196368E+05
26	.300000E+08	.955273E-04	.615561E-03	.184668E+05

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .687745E+03 N.A. LOCATION = 147.581 MOMENT OF INERTIA = .123636E+08
CUMULATIVE CURVATURE = -.50000E-05 CUMULATIVE MOMENT = -.20755E+10 UNBALANCED FORCE = .75132E+04

LOAD RANGE 2 INCREMENT 1 CYCLE 2
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 146.800
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	.427141	.622641	-.111100E-03	-.116607E-02	-.349820E+05	0
2	.300000E+08	.437454	.631432	-.110350E-03	-.115782E-02	-.347345E+05	0
3	.300000E+08	.532367	.707820	-.109350E-03	-.114682E-02	-.344045E+05	0
4	.300000E+08	.534130	.704358	-.900998E-04	-.935066E-03	-.280520E+05	0
5	.300000E+08	.601610	.741562	-.720998E-04	-.737066E-03	-.221120E+05	0
6	.300000E+08	.362996	.575661	-.540998E-04	-.539066E-03	-.161720E+05	0
7	.300000E+08	.786161	.786161	-.405998E-04	-.390566E-03	-.117170E+05	0
8	.300000E+08	.793256	.793256	-.265998E-04	-.236586E-03	-.709698E+04	0
9	.300000E+08	.789329	.789329	-.129748E-04	-.860910E-04	-.260073E+04	0
10	.300000E+08	1.000000	1.000000	-.998136E-07	.549340E-04	.164802E+04	0
11	.300000E+08	1.000000	1.000000	.129002E-04	.197934E-03	.593802E+04	0
12	.300000E+08	1.000000	1.000000	.251502E-04	.332684E-03	.998052E+04	0
13	.300000E+08	1.000000	1.000000	.359002E-04	.450934E-03	.135280E+05	0
14	.300000E+08	1.000000	1.000000	.524002E-04	.632434E-03	.189730E+05	0
15	.300000E+08	1.000000	1.000000	.637752E-04	.757559E-03	.227268E+05	0
16	.300000E+08	1.000000	1.000000	.706502E-04	.833184E-03	.249955E+05	0
17	.300000E+08	1.000000	1.000000	.384002E-04	.478434E-03	.143530E+05	0
18	.300000E+08	1.000000	1.000000	.506502E-04	.613184E-03	.183955E+05	0
19	.300000E+08	1.000000	1.000000	.571502E-04	.684684E-03	.205405E+05	0
20	.300000E+08	1.000000	1.000000	.594002E-04	.709434E-03	.212830E+05	0
21	.300000E+08	1.000000	1.000000	.379002E-04	.472934E-03	.141880E+05	0
22	.300000E+08	1.000000	1.000000	.459002E-04	.560934E-03	.168280E+05	0
23	.300000E+08	1.000000	1.000000	.464002E-04	.566434E-03	.169930E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .682375E+03 N.A. LOCATION = 148.014 MOMENT OF INERTIA = .121433E+08
CUMULATIVE CURVATURE = -.55000E-05 CUMULATIVE MOMENT = -.23919E+10 UNBALANCED FORCE = .35118E+06

LOAD RANGE 2 INCREMENT 2 CYCLE 2
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 145.323
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	.300000E+08	.408022	.604676	-.111838E-03	-.127790E-02	-.383371E+05	0
2	.300000E+08	.417867	.613573	-.111088E-03	-.126890E-02	-.380671E+05	0
3	.300000E+08	.508518	.691384	-.110088E-03	-.125690E-02	-.377071E+05	0
4	.300000E+08	.509935	.688190	-.908383E-04	-.102590E-02	-.307771E+05	0
5	.300000E+08	.573920	.727701	-.728383E-04	-.809904E-03	-.242971E+05	0
6	.300000E+08	.345832	.555213	-.548383E-04	-.593904E-03	-.178171E+05	0
7	.300000E+08	.786161	.786161	-.413383E-04	-.431904E-03	-.129571E+05	0
8	.300000E+08	.793256	.793256	-.273383E-04	-.263904E-03	-.791713E+04	0
9	.300000E+08	.789329	.789329	-.137133E-04	-.100404E-03	-.301213E+04	0

10	.300000E+08	1.000000	1.000000	-.838264E-06	.540958E-04	.162287E+04	0
11	.300000E+08	1.000000	1.000000	.121617E-04	.210096E-03	.630287E+04	0
12	.300000E+08	1.000000	1.000000	.244117E-04	.357096E-03	.107129E+05	0
13	.300000E+08	1.000000	1.000000	.351617E-04	.486096E-03	.145829E+05	0
14	.300000E+08	1.000000	1.000000	.516617E-04	.684096E-03	.205229E+05	0
15	.300000E+08	1.000000	1.000000	.630367E-04	.820596E-03	.246179E+05	0
16	.300000E+08	1.000000	1.000000	.699117E-04	.903096E-03	.270929E+05	0
17	.300000E+08	1.000000	1.000000	.376617E-04	.516096E-03	.154829E+05	0
18	.300000E+08	1.000000	1.000000	.499117E-04	.663096E-03	.198929E+05	0
19	.300000E+08	1.000000	1.000000	.564117E-04	.741096E-03	.222329E+05	0
20	.300000E+08	1.000000	1.000000	.586617E-04	.768096E-03	.230429E+05	0
21	.300000E+08	1.000000	1.000000	.371617E-04	.510096E-03	.153029E+05	0
22	.300000E+08	1.000000	1.000000	.451617E-04	.606096E-03	.181829E+05	0
23	.300000E+08	1.000000	1.000000	.456617E-04	.612096E-03	.183629E+05	0

HARD CORNER ELEMENT DATA

ELEMENT	MODULUS	INC. STRAIN	CUM. STRAIN	CUM. STRESS
1	.300000E+08	-.111838E-03	-.160922E-02	-.482765E+05
2	0.	-.109588E-03	-.157547E-02	-.450000E+05
3	.300000E+08	-.109088E-03	-.156797E-02	-.470390E+05
4	.300000E+08	-.104338E-03	-.149672E-02	-.449015E+05
5	.300000E+08	-.562133E-04	-.774840E-03	-.232452E+05
6	.300000E+08	-.548383E-04	-.754215E-03	-.226265E+05
7	.300000E+08	-.588264E-06	.595348E-04	.178604E+04
8	.300000E+08	-.838264E-06	.557848E-04	.167354E+04
9	.300000E+08	.441617E-04	.730785E-03	.219235E+05
10	.300000E+08	.426617E-04	.708285E-03	.212485E+05
11	.300000E+08	.580367E-04	.938310E-03	.281673E+05
12	.300000E+08	.559117E-04	.907035E-03	.272110E+05
13	.300000E+08	.669117E-04	.107203E-02	.321610E+05
14	.300000E+08	.642867E-04	.103266E-02	.309798E+05
15	.300000E+08	.719117E-04	.114703E-02	.344110E+05
16	.300000E+08	.684117E-04	.109453E-02	.328360E+05
17	.300000E+08	.726617E-04	.115828E-02	.347485E+05
18	.300000E+08	.591617E-04	.955785E-03	.286735E+05
19	.300000E+08	.325367E-04	.556410E-03	.166923E+05
20	.300000E+08	.325367E-04	.556410E-03	.166923E+05
21	.300000E+08	.444117E-04	.734535E-03	.220360E+05
22	.300000E+08	.424117E-04	.704535E-03	.211360E+05
23	.300000E+08	.484117E-04	.794535E-03	.238360E+05
24	.300000E+08	.456617E-04	.753285E-03	.225985E+05
25	.300000E+08	.489117E-04	.802035E-03	.240610E+05
26	.300000E+08	.456617E-04	.753285E-03	.225985E+05

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .677695E+03 N.A. LOCATION = 144.628 MOMENT OF INERTIA = .119485E+08
CUMULATIVE CURVATURE = -.60000E-05 CUMULATIVE MOMENT = -.25723E+10 UNBALANCED FORCE = .35134E+06

LOAD RANGE 3 INCREMENT 1 CYCLE 13
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = -5.278

GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	0.	.601715	.601715	-.748556E-04	-.135276E-02	-.389185E+05	3
2	0.	.609241	.609241	-.745556E-04	-.134340E-02	-.389185E+05	3
3	.300000E+08	.494150	.680790	-.741556E-04	-.133106E-02	-.399318E+05	0
4	.300000E+08	.494180	.676858	-.664556E-04	-.109236E-02	-.327708E+05	0
5	.300000E+08	.554011	.716526	-.592556E-04	-.869160E-03	-.260748E+05	0
6	.300000E+08	.331604	.537755	-.520556E-04	-.645960E-03	-.193788E+05	0
7	.300000E+08	.770396	.785845	-.466556E-04	-.478560E-03	-.143568E+05	0
8	.300000E+08	.793256	.793256	-.410556E-04	-.304960E-03	-.914880E+04	0

9	.300000E+08	.789329	.789329	-.356056E-04	-.136010E-03	-.408030E+04	0
10	.300000E+08	1.000000	1.000000	-.304556E-04	.236402E-04	.709205E+03	0
11	.300000E+08	1.000000	1.000000	-.252556E-04	.184840E-03	.554520E+04	0
12	.300000E+08	1.000000	1.000000	-.203556E-04	.336740E-03	.101022E+05	0
13	.300000E+08	1.000000	1.000000	-.160556E-04	.470040E-03	.141012E+05	0
14	.300000E+08	1.000000	1.000000	-.945560E-05	.674640E-03	.202392E+05	0
15	.300000E+08	1.000000	1.000000	-.490560E-05	.815640E-03	.244707E+05	0
16	.300000E+08	1.000000	1.000000	-.215560E-05	.900940E-03	.270282E+05	0
17	.300000E+08	1.000000	1.000000	-.150556E-04	.501040E-03	.150312E+05	0
18	.300000E+08	1.000000	1.000000	-.101556E-04	.652940E-03	.195882E+05	0
19	.300000E+08	1.000000	1.000000	-.755560E-05	.733540E-03	.220062E+05	0
20	.300000E+08	1.000000	1.000000	-.665560E-05	.761440E-03	.228432E+05	0
21	.300000E+08	1.000000	1.000000	-.152556E-04	.494840E-03	.148452E+05	0
22	.300000E+08	1.000000	1.000000	-.120556E-04	.594040E-03	.178212E+05	0
23	.300000E+08	1.000000	1.000000	-.118556E-04	.600240E-03	.180072E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .612528E+03 N.A. LOCATION = 121.041 MOMENT OF INERTIA = .839382E+07
CUMULATIVE CURVATURE = -.82000E-05 CUMULATIVE MOMENT = -.26771E+10 UNBALANCED FORCE = -.11682E+04

LOAD RANGE 3 INCREMENT 2 CYCLE 17
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = -697.678

GROSS PANEL ELEMENT DATA ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	-.348012E+08	.601715	.601715	-.213336E-03	-.156610E-02	-.181839E+05	3
2	-.368118E+08	.609241	.609241	-.213036E-03	-.155650E-02	-.185275E+05	3
3	-.464059E+08	.669834	.669834	-.212636E-03	-.154370E-02	-.121998E+05	3
4	.300000E+08	.453470	.644647	-.204936E-03	-.129730E-02	-.389189E+05	0
5	.300000E+08	.500043	.681149	-.197736E-03	-.106690E-02	-.320069E+05	0
6	0.	.487196	.487196	-.190536E-03	-.830495E-03	-.249314E+05	3
7	.300000E+08	.654181	.764004	-.185136E-03	-.663695E-03	-.199109E+05	0
8	.300000E+08	.793256	.793256	-.179536E-03	-.484495E-03	-.145349E+05	0
9	.300000E+08	.789329	.789329	-.174086E-03	-.310095E-03	-.930286E+04	0
10	.300000E+08	.483034	.702429	-.168936E-03	-.145295E-03	-.435986E+04	0
11	.300000E+08	1.000000	1.000000	-.163736E-03	.211046E-04	.633139E+03	0
12	.300000E+08	1.000000	1.000000	-.158836E-03	.177905E-03	.533714E+04	0
13	.300000E+08	1.000000	1.000000	-.154536E-03	.315505E-03	.946514E+04	0
14	.300000E+08	1.000000	1.000000	-.147936E-03	.526705E-03	.158011E+05	0
15	.300000E+08	1.000000	1.000000	-.143386E-03	.672305E-03	.201691E+05	0
16	.300000E+08	1.000000	1.000000	-.140636E-03	.760305E-03	.228091E+05	0
17	.300000E+08	1.000000	1.000000	-.153536E-03	.347505E-03	.104251E+05	0
18	.300000E+08	1.000000	1.000000	-.148636E-03	.504305E-03	.151291E+05	0
19	.300000E+08	1.000000	1.000000	-.146036E-03	.587505E-03	.176251E+05	0
20	.300000E+08	1.000000	1.000000	-.145136E-03	.616305E-03	.184891E+05	0
21	.300000E+08	1.000000	1.000000	-.153736E-03	.341105E-03	.102331E+05	0
22	.300000E+08	1.000000	1.000000	-.150536E-03	.443505E-03	.133051E+05	0
23	.300000E+08	1.000000	1.000000	-.150336E-03	.449905E-03	.134971E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .410096E+03 N.A. LOCATION = 4.379 MOMENT OF INERTIA = -.880921E+07
CUMULATIVE CURVATURE = -.64000E-05 CUMULATIVE MOMENT = -.19912E+10 UNBALANCED FORCE = .54372E+03

LOAD RANGE 3 INCREMENT 3 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 28.983

GROSS PANEL ELEMENT DATA ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	-.245935E+08	.601715	.601715	-.680234E-04	-.163412E-02	-.161972E+05	3
2	-.257460E+08	.609241	.609241	-.677234E-04	-.162422E-02	-.164463E+05	3
3	-.249545E+08	.669834	.669834	-.673234E-04	-.161102E-02	-.992093E+04	3

4	0.	.637543	.637543	-.596234E-04	-.135692E-02	-.403873E+05	3
5	.300000E+08	.488193	.672386	-.524234E-04	-.111932E-02	-.335796E+05	0
6	0.	.487196	.487196	-.452234E-04	-.881719E-03	-.249314E+05	3
7	.300000E+08	.635396	.757248	-.398234E-04	-.703519E-03	-.211056E+05	0
8	.300000E+08	.787039	.793207	-.342234E-04	-.518719E-03	-.15616E+05	0
9	.300000E+08	.789329	.789329	-.287734E-04	-.338869E-03	-.101661E+05	0
10	.300000E+08	.447986	.669204	-.236234E-04	-.168919E-03	-.506756E+04	0
11	.300000E+08	1.000000	1.000000	-.184234E-04	.268120E-05	.804359E+02	0
12	.300000E+08	1.000000	1.000000	-.135234E-04	.164381E-03	.493144E+04	0
13	.300000E+08	1.000000	1.000000	-.922344E-05	.306281E-03	.918844E+04	0
14	.300000E+08	1.000000	1.000000	-.262344E-05	.524081E-03	.157224E+05	0
15	.300000E+08	1.000000	1.000000	.192656E-05	.674231E-03	.202269E+05	0
16	.300000E+08	1.000000	1.000000	.467656E-05	.764481E-03	.229494E+05	0
17	.300000E+08	1.000000	1.000000	-.822344E-05	.339281E-03	.101784E+05	0
18	.300000E+08	1.000000	1.000000	-.332344E-05	.500981E-03	.150294E+05	0
19	.300000E+08	1.000000	1.000000	-.723442E-06	.586781E-03	.176034E+05	0
20	.300000E+08	1.000000	1.000000	.176558E-06	.616481E-03	.184944E+05	0
21	.300000E+08	1.000000	1.000000	-.842344E-05	.332681E-03	.998044E+04	0
22	.300000E+08	1.000000	1.000000	-.522344E-05	.438281E-03	.131484E+05	0
23	.300000E+08	1.000000	1.000000	-.502344E-05	.444881E-03	.133464E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .451228E+03 N.A. LOCATION = 39.104 MOMENT OF INERTIA = -.345000E+07
CUMULATIVE CURVATURE = -.68000E-05 CUMULATIVE MOMENT = -.19604E+10 UNBALANCED FORCE = .59926E+03

LOAD RANGE 3 INCREMENT 4 CYCLE 11
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = -49.543
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	-.175081E+08	.601715	.601715	-.837085E-04	-.171783E-02	-.144630E+05	3
2	-.181774E+08	.609241	.609241	-.834085E-04	-.170763E-02	-.146449E+05	3
3	-.147841E+08	.669834	.669834	-.830085E-04	-.169403E-02	-.803259E+04	3
4	-.163920E+09	.637543	.637543	-.753085E-04	-.143223E-02	-.269259E+05	0
5	.300000E+08	.473985	.661408	-.681085E-04	-.118743E-02	-.356228E+05	3
6	-.109288E+09	.487196	.487196	-.609085E-04	-.942627E-03	-.223466E+05	0
7	.300000E+08	.611721	.747455	-.555085E-04	-.759027E-03	-.227708E+05	0
8	.300000E+08	.751707	.791079	-.499085E-04	-.568627E-03	-.170588E+05	0
9	.300000E+08	.789329	.789329	-.444585E-04	-.383327E-03	-.114998E+05	0
10	.300000E+08	.403491	.623024	-.393085E-04	-.208227E-03	-.624682E+04	0
11	.300000E+08	.783959	.783959	-.341085E-04	-.314273E-04	-.942820E+03	0
12	.300000E+08	1.000000	1.000000	-.292085E-04	.135173E-03	.405518E+04	0
13	.300000E+08	1.000000	1.000000	-.249085E-04	.281373E-03	.844118E+04	0
14	.300000E+08	1.000000	1.000000	-.183085E-04	.505773E-03	.151732E+05	0
15	.300000E+08	1.000000	1.000000	-.137585E-04	.660473E-03	.198142E+05	0
16	.300000E+08	1.000000	1.000000	-.110085E-04	.753973E-03	.226192E+05	0
17	.300000E+08	1.000000	1.000000	-.239085E-04	.315373E-03	.946118E+04	0
18	.300000E+08	1.000000	1.000000	-.190085E-04	.481973E-03	.144592E+05	0
19	.300000E+08	1.000000	1.000000	-.164085E-04	.570373E-03	.171112E+05	0
20	.300000E+08	1.000000	1.000000	-.155085E-04	.600973E-03	.180292E+05	0
21	.300000E+08	1.000000	1.000000	-.241085E-04	.308573E-03	.925718E+04	0
22	.300000E+08	1.000000	1.000000	-.209085E-04	.417373E-03	.125212E+05	0
23	.300000E+08	1.000000	1.000000	-.207085E-04	.424173E-03	.127252E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .348001E+03 N.A. LOCATION = -35.023 MOMENT OF INERTIA = -.119220E+08
CUMULATIVE CURVATURE = -.68000E-05 CUMULATIVE MOMENT = -.18742E+10 UNBALANCED FORCE = .62803E+03

LOAD RANGE 3 INCREMENT 5 CYCLE 11
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 11.102
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	-.137752E+08	.601715	.601715	-.715795E-04	-.178941E-02	-.133523E+05	3
2	-.142354E+08	.609241	.609241	-.712795E-04	-.177891E-02	-.134993E+05	3
3	-.105588E+08	.669834	.669834	-.708795E-04	-.176491E-02	-.744840E+04	3
4	-.696513E+08	.637543	.637543	-.631795E-04	-.149541E-02	-.202432E+05	3
5	.300000E+08	.463193	.652724	-.559795E-04	-.124341E-02	-.373022E+05	0
6	-.608741E+08	.487196	.487196	-.487795E-04	-.991407E-03	-.183868E+05	3
7	.300000E+08	.594956	.739657	-.433795E-04	-.802407E-03	-.240722E+05	0
8	.300000E+08	.727914	.787873	-.377795E-04	-.606407E-03	-.181922E+05	0
9	.300000E+08	.789329	.789329	-.323795E-04	-.415607E-03	-.124697E+05	0
10	.300000E+08	.379484	.596248	-.271795E-04	-.234407E-03	-.706221E+04	0
11	.300000E+08	.783959	.783959	-.219795E-04	-.534068E-04	-.160221E+04	0
12	.300000E+08	1.000000	1.000000	-.170795E-04	.118093E-03	.354279E+04	0
13	.300000E+08	1.000000	1.000000	-.127795E-04	.268593E-03	.805779E+04	0
14	.300000E+08	1.000000	1.000000	-.617952E-05	.499593E-03	.149878E+05	0
15	.300000E+08	1.000000	1.000000	-.162952E-05	.658843E-03	.197653E+05	0
16	.300000E+08	1.000000	1.000000	.112048E-05	.753093E-03	.226528E+05	0
17	.300000E+08	1.000000	1.000000	-.117795E-04	.303593E-03	.910779E+04	0
18	.300000E+08	1.000000	1.000000	-.687952E-05	.475093E-03	.142528E+05	0
19	.300000E+08	1.000000	1.000000	-.427952E-05	.566093E-03	.169828E+05	0
20	.300000E+08	1.000000	1.000000	-.337952E-05	.597593E-03	.179278E+05	0
21	.300000E+08	1.000	1.000000	-.119795E-04	.296593E-03	.889779E+04	0
22	.300000E+08	1.00	1.000000	-.877952E-05	.408593E-03	.122578E+05	0
23	.300000E+08	1.000000	1.000000	-.857952E-05	.415593E-03	.124678E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .432816E+03 N.A. LOCATION = 38.515 MOMENT OF INERTIA = -.278628E+07
CUMULATIVE CURVATURE = -.70000E-05 CUMULATIVE MOMENT = -.18380E+10 UNBALANCED FORCE = -.26890E+03

LOAD RANGE 3 INCREMENT 6 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 47.326
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	-.114254E+08	.601715	.601715	-.643349E-04	-.165374E-02	-.125455E+05	3
2	-.117712E+08	.609241	.609241	-.640349E-04	-.164294E-02	-.126708E+05	3
3	-.823259E+07	.669834	.669834	-.636349E-04	-.162854E-02	-.685562E+04	3
4	-.427342E+08	.637543	.637543	-.559349E-04	-.135134E-02	-.172016E+05	3
5	.300000E+08	.454374	.645408	-.487349E-04	-.124214E-02	-.387643E+05	0
6	-.422805E+08	.487196	.487196	-.415349E-04	-.103294E-02	-.162835E+05	3
7	.300000E+08	.581996	.733140	-.361349E-04	-.838542E-03	-.251563E+05	0
8	.300000E+08	.710252	.784570	-.305349E-04	-.636942E-03	-.191083E+05	0
9	.300000E+08	.789329	.789329	-.250849E-04	-.440742E-03	-.132223E+05	0
10	.300000E+08	.364270	.578723	-.199349E-04	-.255342E-03	-.766025E+04	0
11	.300000E+08	.783959	.783959	-.147349E-04	-.681417E-04	-.204425E+04	0
12	.300000E+08	1.000000	1.000000	-.983489E-05	.108256E-03	.324775E+04	0
13	.300000E+08	1.000000	1.000000	-.553489E-05	.263058E-03	.789175E+04	0
14	.300000E+08	1.000000	1.000000	.106511E-05	.500658E-03	.150197E+05	0
15	.300000E+08	1.000000	1.000000	.561511E-05	.664458E-03	.199337E+05	0
16	.300000E+08	1.000000	1.000000	.836511E-05	.763458E-03	.229037E+05	0
17	.300000E+08	1.000000	1.000000	-.453489E-05	.299058E-03	.897175E+04	0
18	.300000E+08	1.000000	1.000000	.365108E-06	.475458E-03	.142637E+05	0
19	.300000E+08	1.000000	1.000000	.296511E-05	.569058E-03	.170717E+05	0
20	.300000E+08	1.000000	1.000000	.386511E-05	.601458E-03	.180437E+05	0
21	.300000E+08	1.000000	1.000000	-.473489E-05	.291858E-03	.875575E+04	0
22	.300000E+08	1.000000	1.000000	-.153489E-05	.407058E-03	.122117E+05	0
23	.300000E+08	1.000000	1.000000	-.133489E-05	.414258E-03	.124277E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .462211E+03 N.A. LOCATION = 55.603 MOMENT OF INERTIA = -.290913E+06
CUMULATIVE CURVATURE = -.72000E-05 CUMULATIVE MOMENT = -.18297E+10 UNBALANCED FORCE = -.44146E+03

LOAD RANGE 3 INCREMENT 7 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 60.648

GROSS PANEL ELEMENT	ELEMENT DATA MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	-.973864E+07	.601715	.601715	-.616704E-04	-.191541E-02	-.118952E+05	3
2	-.100104E+08	.609241	.609241	-.613704E-04	-.190431E-02	-.120048E+05	3
3	-.670640E+07	.669834	.669834	-.609704E-04	-.188951E-02	-.640285E+04	3
4	-.300459E+08	.637543	.637543	-.532704E-04	-.160461E-02	-.152961E+05	3
5	.300000E+08	.446484	.638694	-.460704E-04	-.133821E-02	-.401464E+05	0
6	-.320883E+08	.487196	.487196	-.388704E-04	-.107181E-02	-.148533E+05	3
7	.300000E+08	.570717	.727120	-.334704E-04	-.872012E-03	-.261[illegible]E+05	0
8	.300000E+08	.695205	.781136	-.278704E-04	-.664812E-03	-.199444E+05	0
9	.300000E+08	.789329	.789329	-.224204E-04	-.463162E-03	-.138949E+05	0
10	.300000E+08	.352639	.564766	-.172704E-04	-.272612E-03	-.817836E+04	0
11	.300000E+08	.783959	.783959	-.120704E-04	-.802121E-04	-.240636E+04	0
12	.300000E+08	1.000000	1.000000	-.717036E-05	.101088E-03	.303264E+04	0
13	.300000E+08	1.000000	1.000000	-.287036E-05	.260188E-03	.780564E+04	0
14	.300000E+08	1.000000	1.000000	.372964E-05	.504388E-03	.151316E+05	0
15	.300000E+08	1.000000	1.000000	.827964E-05	.672738E-03	.201821E+05	0
16	.300000E+08	1.000000	1.000000	.110296E-04	.774488E-03	.232346E+05	0
17	.300000E+08	1.000000	1.000000	-.187036E-05	.297188E-03	.891564E+04	0
18	.300000E+08	1.000000	1.000000	.302964E-05	.478488E-03	.143546E+05	0
19	.300000E+08	1.000000	1.000000	.562964E-05	.574688E-03	.172406E+05	0
20	.300000E+08	1.000000	1.000000	.852964E-05	.607988E-03	.182396E+05	0
21	.300000E+08	1.000000	1.000000	-.207036E-05	.289788E-03	.869364E+04	0
22	.300000E+08	1.000000	1.000000	.112964E-05	.408188E-03	.122456E+05	0
23	300000E+08	1.000000	1.000000	.132964E-05	.415588E-03	.124676E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .478091E+03 N.A. LOCATION = 65.123 MOMENT OF INERTIA = .975513E+06
CUMULATIVE CURVATURE = -.74000E-05 CUMULATIVE MOMENT = -.18320E+10 UNBALANCED FORCE = -.88507E+03

LOAD RANGE 3 INCREMENT 8 CYCLE 2
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 64.662

GROSS PANEL ELEMENT	ELEMENT DATA MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	-.844469E+07	.601715	.601715	-.608675E-04	-.197628E-02	-.113434E+05	3
2	-.866444E+07	.609241	.609241	-.605675E-04	-.196488E-02	-.114409E+05	3
3	-.581222E+07	.669834	.669834	-.601675E-04	-.194968E-02	-.603389E+04	3
4	-.226818E+08	.637543	.637543	-.524675E-04	-.165708E-02	-.139279E+05	3
5	0.	.637543	.637543	-.452675E-04	-.138348E-02	-.403873E+05	3
6	-.255349E+08	.487196	.487196	-.380675E-04	-.110988E-02	-.137644E+05	0
7	.300000E+08	.560318	.721283	-.326675E-04	-.904680E-03	-.271404E+05	0
8	.300000E+08	.681471	.777503	-.270675E-04	-.691880E-03	-.207564E+05	0
9	.300000E+08	.789329	.789329	-.216175E-04	-.484780E-03	-.145434E+05	0
10	.300000E+08	.342448	.552388	-.164675E-04	-.289080E-03	-.867239E+04	0
11	.300000E+08	.783959	.783959	-.112675E-04	-.914796E-04	-.274439E+04	0
12	.300000E+08	1.000000	1.000000	-.636750E-05	.947204E-04	.284161E+04	0
13	.300000E+08	1.000000	1.000000	-.206750E-05	.258120E-03	.774361E+04	0
14	.300000E+08	1.000000	1.000000	.453250E-05	.508920E-03	.152676E+05	0
15	.300000E+08	1.000000	1.000000	.908250E-05	.681820E-03	.204546E+05	0
16	.300000E+08	1.000000	1.000000	.118325E-04	.786320E-03	.235896E+05	0
17	.300000E+08	1.000000	1.000000	-.106750E-05	.296120E-03	.888361E+04	0
18	.300000E+08	1.000000	1.000000	.383250E-05	.482320E-03	.144696E+05	0
19	.300000E+08	1.000000	1.000000	.643250E-05	.581120E-03	.174336E+05	0
20	.300000E+08	1.000000	1.000000	.733250E-05	.615320E-03	.184596E+05	0
21	.300000E+08	1.000000	1.000000	-.126750E-05	.288520E-03	.865561E+04	0
22	.300000E+08	1.000000	1.000000	.193250E-05	.410120E-03	.123036E+05	0

23	.300000E+08	1.000000	1.000000	.213250E-05	.417720E-03	.125316E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .473641E+03 N.A. LOCATION = 64.210 MOMENT OF INERTIA = .103898E+07
CUMULATIVE CURVATURE = -.76000E-05 CUMULATIVE MOMENT = -.18372E+10 UNBALANCED FORCE = .50718E+04

LOAD RANGE 3 INCREMENT 9 CYCLE 11
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = -46.778
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	-.708778E+07	.601715	.601715	-.831556E-04	-.205944E-02	-.107004E+05	3
2	-.725590E+07	.609241	.609241	-.828556E-04	-.204774E-02	-.107843E+05	3
3	-.453044E+07	.669834	.669834	-.824556E-04	-.203214E-02	-.561838E+04	3
4	-.163569E+08	.637543	.637543	-.747556E-04	-.173184E-02	-.124901E+05	3
5	-.120309E+09	.637543	.637543	-.675556E-04	-.145104E-02	-.242882E+05	3
6	-.188570E+08	.487196	.487196	-.603556E-04	-.117024E-02	-.124417E+05	3
7	.300000E+08	.544038	.711591	-.549556E-04	-.959635E-03	-.287891E+05	0
8	.300000E+08	.658392	.770327	-.493556E-04	-.741235E-03	-.222371E+05	0
9	.300000E+08	.756091	.787929	-.439056E-04	-.528685E-03	-.158606E+05	0
10	.300000E+08	.321570	.526296	-.387556E-04	-.327835E-03	-.983506E+04	0
11	.300000E+08	.783959	.783959	-.335556E-04	-.125035E-03	-.375106E+04	0
12	.300000E+08	1.000000	1.000000	-.286556E-04	.660648E-04	.198194E+04	0
13	.300000E+08	1.000000	1.000000	-.243556E-04	.233765E-03	.701294E+04	0
14	.300000E+08	1.000000	1.000000	-.177556E-04	.491165E-03	.147349E+05	0
15	.300000E+08	1.000000	1.000000	-.132056E-04	.688615E-03	.200584E+05	0
16	.300000E+08	1.000000	1.000000	-.104556E-04	.775865E-03	.232759E+05	0
17	.300000E+08	1.000000	1.000000	-.233556E-04	.272765E-03	.818294E+04	0
18	.300000E+08	1.000000	1.000000	-.184556E-04	.463865E-03	.139159E+05	0
19	.300000E+08	1.000000	1.000000	-.138556E-04	.565265E-03	.169579E+05	0
20	.300000E+08	1.000000	1.000000	-.149556E-04	.600365E-03	.180109E+05	0
21	.300000E+08	1.000000	1.000000	-.235556E-04	.264965E-03	.794894E+04	0
22	.300000E+08	1.000000	1.000000	-.203556E-04	.389765E-03	.116929E+05	0
23	.300000E+08	1.000000	1.000000	-.201556E-04	.397565E-03	.119269E+05	0

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .402357E+03 N.A. LOCATION = 25.684 MOMENT OF INERTIA = -.290583E+07
CUMULATIVE CURVATURE = -.78000E-05 CUMULATIVE MOMENT = -.17733E+10 UNBALANCED FORCE = -.25880E+03

LOAD RANGE 3 INCREMENT 10 CYCLE 9
INSTANTANEOUS N.A. LOCATION (STARTING VALUE) = 40.819
GROSS PANEL ELEMENT DATA

ELEMENT	MODULUS	BEP/B	BE/B	INC. STRAIN	CUM. STRAIN	CUM. STRESS	FAILURE CODE
1	-.625413E+07	.601715	.601715	-.656363E-04	-.212507E-02	-.102634E+05	3
2	-.639396E+07	.609241	.609241	-.653363E-04	-.211307E-02	-.103393E+05	3
3	-.390151E+07	.669834	.669834	-.649363E-04	-.209707E-02	-.534545E+04	3
4	-.132640E+08	.637543	.637543	-.572363E-04	-.178907E-02	-.116476E+05	3
5	-.857681E+08	.637543	.637543	-.500363E-04	-.150107E-02	-.198598E+05	3
6	-.157010E+08	.487196	.487196	-.428363E-04	-.121307E-02	-.117049E+05	3
7	.300000E+08	.533727	.705105	-.374363E-04	-.997071E-03	-.299121E+05	0
8	.300000E+08	.644692	.765432	-.318363E-04	-.773071E-03	-.231921E+05	0
9	.300000E+08	.737901	.785978	-.263863E-04	-.555071E-03	-.166521E+05	0
10	.300000E+08	.311635	.513535	-.212363E-04	-.349071E-03	-.104721E+05	0
11	.300000E+08	.783959	.783959	-.160363E-04	-.141071E-03	-.423214E+04	0
12	.300000E+08	1.000000	1.000000	-.111363E-04	.549285E-04	.16478SE+04	0
13	.300000E+08	1.000000	1.000000	-.683627E-05	.226929E-03	.680786E+04	0
14	.300000E+08	1.000000	1.000000	-.236266E-06	.490929E-03	.147279E+05	0
15	.300000E+08	1.000000	1.000000	.431373E-05	.672929E-03	.201879E+05	0
16	.300000E+08	1.000000	1.000000	.706373E-05	.782929E-03	.234879E+05	0
17	.300000E+08	1.000000	1.000000	-.583627E-05	.266929E-03	.800786E+04	0

18	.300000E+08	1.000000	1.000000	-.936266E-06	.462929E-03	.138879E+05	0
19	.300000E+08	1.000000	1.000000	.166373E-05	.566929E-03	.170079E+05	0
20	.300000E+08	1.000000	1.000000	.256373E-05	.602929E-03	.180879E+05	0
21	.300000E+08	1.000000	1.000000	-.603627E-05	.258929E-03	.776786E+04	0
22	.300000E+08	1.000000	1.000000	-.283627E-05	.386929E-03	.116079E+05	0
23	.300000E+08	1.000000	1.000000	-.263627E-05	.394929E-03	.118479E+05	0

HARD CORNER ELEMENT DATA

ELEMENT	MODULUS	INC. STRAIN	CUM. STRAIN	CUM. STRESS
1	.300000E+08	-.656363E-04	-.252202E-02	-.756606E+05
2	0.	-.647363E-04	-.247837E-02	-.450000E+05
3	.300000E+08	-.645363E-04	-.246867E-02	-.740601E+05
4	.300000E+08	-.626363E-04	-.237652E-02	-.712956E+05
5	.300000E+08	-.433863E-04	-.144289E-02	-.432868E+05
6	0.	-.428363E-04	-.141622E-02	-.330000E+05
7	.300000E+08	-.211363E-04	-.363769E-03	-.109131E+05
8	.300000E+08	-.212363E-04	-.368619E-03	-.110586E+05
9	.300000E+08	-.323627E-05	.504381E-03	.151314E+05
10	.300000E+08	-.383627E-05	.475281E-03	.142584E+05
11	.300000E+08	.231373E-05	.773556E-03	.232067E+05
12	.300000E+08	.146373E-05	.732331E-03	.219699E+05
13	.300000E+08	.586373E-05	.945731E-03	.283719E+05
14	.300000E+08	.481373E-05	.891806E-03	.268442E+05
15	.300000E+08	.786373E-05	.104273E-02	.312819E+05
16	.300000E+08	.646373E-05	.974831E-03	.292449E+05
17	.300000E+08	.816373E-05	.105728E-02	.317184E+05
18	.300000E+08	.276373E-05	.795381E-03	.238614E+05
19	.300000E+08	-.788627E-05	.278856E-03	.836569E+04
20	.300000E+08	-.788627E-05	.278856E-03	.836569E+04
21	.300000E+08	-.313627E-05	.509231E-03	.152769E+05
22	.300000E+08	-.393627E-05	.470431E-03	.141129E+05
23	.300000E+08	-.153627E-05	.586831E-03	.176049E+05
24	.300000E+08	-.263627E-05	.533481E-03	.160044E+05
25	.300000E+08	-.133627E-05	.596531E-03	.178959E+05
26	.300000E+08	-.263627E-05	.533481E-03	.160044E+05

INSTANTANEOUS SECTION CHARACTERISTICS
AREA = .443531E+03 N.A. LOCATION = 51.174 MOMENT OF INERTIA = -.794504E+05
CUMULATIVE CURVATURE = -.80000E-05 CUMULATIVE MOMENT = -.17659E+10 UNBALANCED FORCE = -.53227E+03

REFERENCES

1. Evans, J.H., editor, "Ship Structural Design Concepts," Cornell Maritime Press (1975).

2. Faulkner, D., J. Adamchak, G. Snyder, and M. Vetter, "Synthesis of Welded Grillages to Withstand Compression and Normal Loads," Computers and Structures, Vol. 3, pp. 221-246 (1973).

3. Adamchak, J.C., "A Rapid Technique for Predicting the General Instability of Ship Grillages with Elastically Constrained Edges," NSRDC Report 4604 (Feb 1975).

4. Adamchak, J.C., "Design Equations for Tripping of Stiffeners Under Inplane and Lateral Loads," DTNSRDC Report 79/064 (Oct 1979).

5. Dow, R.S., R.C. Hugill, J.D. Clark, and C.S. Smith, "Evaluation of Ultimate Ship Hull Strength," Joint Society of Naval Architects and Marine Engineers/ Ship Structures Committee Extreme Loads Response Symposium, Arlington, Va. (Oct 1981).

6. Ostapenko, Alexis, "Strength of Ship Hull Girders under Moment, Shear, and Torque," Joint Society of Naval Architects and Marine Engineers/Ship Structures Committee Extreme Loads Response Symposium, Arlington, Va. (Oct 1981).

7. Clarkson, J., "The Elastic Analysis of Flat Grillages with Particular Reference to Ship Structure," Cambridge University Press (1965).

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