REPORT ON
POLYMER CONCRETE APPLICATIONS DEVELOPMENT
FOR THE
BUREAU OF PUBLIC ROADS

Design Studies on Highway Bridge Decking
and Luminaire Supports: Jan., 1969-June, 1970

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I. INTRODUCTION

A preliminary survey of the use of concrete-polymer materials for luminaire support structures has been completed and a study of highway bridge decking has been started. These studies were carried out in the period January, 1969 to June, 1970. A summary of the effort and the pertinent results are given in this report.

The impregnation of concrete with monomer followed by treatment of the monomer with radiation originated with a suggestion by the U.S. Bureau of Reclamation (USBR) to the Division of Isotopes Development of the U.S. Atomic Energy Commission in 1965.

The AEC at the time was supporting a program on the development of wood-plastic combinations. The idea was transmitted to the Radiation Division, Department of Applied Science, Brookhaven National Laboratory (BNL) by the USBR and AEC, and late in 1965 and early in 1966 exploratory experiments were carried out. Results of these initial exploratory experiments, completed early in 1967, were that the compressive strength was increased by a factor of 2 to 2.4, the absorption was decreased 80 to 98%, and the hardness was increased by a factor of 1.4 to 1.9.

Later work has shown that the compressive strength can be increased by a factor of 4 or more, and that water absorption can

be reduced essentially to zero. The later work has also shown that thermal or catalytic polymerization can be utilized, in place of radiation. A series of annual reports by USBR and BNL gives details of the development work.

In view of the promising characteristics of the concrete-polymer materials, a joint program supported by several Federal agencies was established at USBR and BNL. The joint inter-agency program is organized under seven general activity headings or tasks:

1. Monomer Evaluation
2. Process Technology
3. Fundamental Studies
4. Applications Development
5. Cost Benefit Analysis
6. Structural Analysis and Testing
7. Administration

Work on a given project for an agency may be carried out under several (perhaps all) of the general activity headings.

The design studies reported here have been carried out under Task 4, Applications Development, Subtask 4.6, Roads. The work was supported by the Bureau of Public Roads of the U.S. Department of Transportation.

II. LUMINAIRE SUPPORT STRUCTURE STUDY

A. INTRODUCTION

This section of the report covers a preliminary investigation of the use of concrete-polymer materials⁽¹⁻³⁾ for highway luminaire support structures. At this stage of the study it is appropriate to use simplified engineering assumptions, making use of the investigations for metal supports as reported by Edwards⁽⁴⁾ and others.⁽⁵⁾ It should be understood that a full calculation of the time-dependent energy exchange in a collision between a moving vehicle and a collapsible luminaire support is quite complex. Shape, impact velocity, sliding friction, vibrations induced by impact, and the timing of these vibrations are some of the factors that determine the energy transfer which culminates in the collapse of the luminaire support structure. Thus, a comprehensive parametric study will eventually be needed to arrive at a final design for the luminaire support structures.

We begin the investigation by noting that the support structure must satisfy conflicting design criteria. On one hand, the structure must be strong enough to withstand normal service loads, including winds of storm force, while on the other hand, it is also required that in a collision the vehicle velocity change (ΔV) due to impact be small, in the 2 to 4 mph range. The former requires a large section for moment resistance while the latter calls for a small section to minimize energy absorption.

Figure 1 shows the proposed design. Before going into the engineering analysis, however, it is important to point out the assumptions in the design, and some of the difficulties and unknowns associated with luminaire design incorporating polymer concrete.

B. GENERAL REMARKS ON MATERIAL STRENGTH AND ALLOWABLE STRESSES

When a brittle material undergoes a spectrum of stress histories, as in the case of cyclic wind forces acting on the luminaire support, failure does not always occur at a time when the computed stress in the most highly stressed region is at a maximum. Failure depends not only on the stress but also on the probability that a flaw exists in the material in the particular region of high stress. Thus, the stress may be high

at one instant but concentrated in a flaw-free volume of material, whereas at a later time the maximum stress may be lower, but concentrated in a volume containing a flaw. The probability of failure may be greater in the latter case due to the flaw.

For the concrete-polymer material, not only is the allowable flexure stress (S_f) unknown for cyclic loadings, but even the values for the ultimate tensile stress (S_t) already obtained from static tests on the concrete polymer may not be valid for the cyclic loading envisioned for this design.

To reduce the problem to quantitative terms, the relative importance of stress and volume in producing failure must be stipulated. The concept of risk of rupture, R , can be used. (6)
We define R as

$$R = \int_V f(S_i) dV_i \quad (1)$$

where S_i = stress in an element of volume dV_i , and the integral is taken over the entire volume of the part under stress. In this concept, flaws are assumed to be uniformly distributed through the volume of the material in question. Every element of volume which is under stress contributes to the risk of rupture. One form for $f(S_i)$, appropriate for brittle materials, is

$$f(S_i) = \left(\frac{S_i}{S_o}\right)^m. \quad (2)$$

Here

S_o = a material constant relating to some inherent strength property, and

m = a constant relating to material homogeneity.

Substituting Eq. (1) into (2) we have

$$R = \frac{1}{S_o^m} \int_v S^m dv. \quad (3)$$

Equation (3) is used in the comparison of two specimens having different volumes or stress distributions. If the risks of rupture for the two specimens are equated, relations between the maximum stresses at the conditions of rupture can be obtained.

As an example let us consider two tensile specimens having volumes V_1 and V_2 . Denoting the failure stresses as S_1 and S_2 , respectively, we have after applying Eq. (3),

$$\left(\frac{1}{S_o^m}\right) S_1^m \int_{V_1} dv_1 = \left(\frac{1}{S_o^m}\right) S_2^m \int_{V_2} dv_2.$$

Upon simplification, this yields

$$\frac{s_1}{s_2} = \left(\frac{v_2}{v_1} \right)^{1/m} \quad (3A)$$

Thus, the stresses at fracture are inversely proportional to the m root of the volume ratio. The larger the volume, the lower the fracture stress. This explains the commonly observed "size effect."

Taking the procedure somewhat further, we can compare the fracture stress in pure bending with that in tension in the following manner. Let V be the volume and S_t the ultimate tensile strength of this volume. As in the previous case the risk of rupture is $\left(\frac{S_t}{S_o} \right)^m V$. For the bending specimen we define l , w , and $2h$ as the length, width, and height, respectively. If the surface bending stress at rupture is S'_f then the stress at any distance x from the neutral axis is $\left(\frac{x}{h} \right) S'_f$. The volume dV under this stress is $l w dx$. Then, if Eq. (3) is integrated over the region of positive stresses, we have

$$R = \frac{1}{S_o^m} \int_0^h S^m dV = \frac{1}{S_o^m} \int_0^h \left(\frac{x}{h} S'_f \right)^m l w dx.$$

Upon integration, the above yields

$$\frac{\ell w h}{m + 1} \left(\frac{S_f}{S_o} \right)^m = R.$$

Equating the risks of tensile rupture to those of bending gives

$$\frac{\ell w h}{m + 1} \left(\frac{S'_f}{S_o} \right)^m = \left(\frac{S_t}{S_o} \right)^m V. \quad (4)$$

Noting that $2\ell w h = V$, the last expression becomes

$$\frac{V}{2(m+1)} \left(\frac{S'_f}{S_o} \right)^m = \left(\frac{S_t}{S_o} \right)^m V,$$

or

$$\frac{S'_f}{S_t} = [2(m+1)]^{1/m}. \quad (5)$$

For detailed designs using polymer concrete, it is necessary to determine the value of m . This can, of course, be accomplished by applying Eq. (5) when the values of S'_f and S_t are obtained from experimental tensile and bending tests on equal volume specimens. In fact, if a series of tensile and bending tests are conducted on specimens over a range of volumes, the value of $1/m$ can be determined as the slope of a logarithmic plot of stress ratio against volume ratio with

Eq. (3A). Similar means can also be devised to determine the constant S_0 used in Eqs. (1) through (3). These material property measurements will definitely be necessary if comprehensive studies of this design are desired.

C. CALCULATION OF THE CROSS SECTIONS FOR THE DESIGN

Turning to the design problem at hand, we obtain a value for the allowable flexural stress, S_f , in the luminaire support as follows. We take the ultimate tensile strength, S_t , to be 1,600 psi from previous tests of the concrete-polymer material.⁽¹⁻³⁾ In taking this value for S_t we are assuming that the static tensile strength and the cyclic loading tensile strength are equal, an assumption which, as previously noted, may not be valid. In the absence of the pertinent data, however, there is little other choice. Next, we assume a value of 3 for the constant m , based on the work of Weibull⁽⁶⁾ on brittle materials. Then, from Eq. (5),

$$S'_f = 2S_t \text{ or } S'_f = 2,400 \text{ psi.}$$

We recall that S'_f is the bending moment extreme fiber stress giving an equal risk of rupture as the ultimate tensile stress, S_t , in a specimen in pure tension. Applying a safety factor

of 2.4, we arrive at an allowable working stress,

$$s_f = \frac{s'_f}{2.4} = 1,000 \text{ psi.}$$

This value is the maximum allowable flexural stress magnitude for the design shown in Fig. 1.

We continue our calculations of the design by noting that the magnitude of the wind-drag forces acting on the luminaire support structure is obtained from the expression

$$F_D = C_D (\frac{1}{2} \rho V^2) A, \quad (6)$$

where

F_D = The force in lb,

C_D = the drag coefficient, (dimensionless),

ρ = the density of air, slugs/ft³,

V = the wind velocity, ft/sec, and

A = the cross-sectional area of the body exposed to the wind forces, ft².

Assuming an air mass density at sea level equal to 0.00238 slugs/ft³, a drag coefficient $C_D = 1.0$, and a maximum wind velocity of 120 miles/hr, Eq. (6) yields

$$F_D = 36.0A, \quad (6A)$$

where the units of F_D and A are lb, and ft^2 , respectively.

Next, we note, that the bending moment stresses can be obtained from the equation,

$$S_f = \frac{M}{Z}, \quad (7)$$

where

S_f = the extreme fiber stress in psi,

M = the bending moment in in.-lb, and

Z = the section modulus of the material, in.^3 .

Restricting our analysis to circular cross sections with wall thickness equal to 0.1 R , we have, from strength of materials

$$Z = \frac{\pi}{4R}(R^4 - r^4),$$

or

$$Z = .270 R^3, \quad (8)$$

where

R = the outer radii, and

r = the inner radii (in this case .9 R).

Returning to Fig. 1, calculating the moments for the lantern and its 10 ft long x 3 in. diameter x .065 in. thick stainless steel support arm, we have the following:

lantern moment = 20 lb x 10 ft = 200 lb-ft

arm moment = 36 lb x 5 ft = 180 lb-ft

vertical wind directed downward = $2.5 \times 36 \times 5 + .5 \times 36 \times 9.5$
= 620 lb-ft for a total moment of 1,000 lb-ft.

Recalling our previous restriction of 1,000 psi maximum allowable flexure stress (S_f) and inserting the above calculated moment (1,000 lb-ft) into Eq. (7) yields

$$Z = \frac{830 \times 12}{1,000} = 12 \text{ in.}^3.$$

Substituting this value of Z into Eq. (8), gives the minimum required outer radius,

$$R = \left(\frac{12}{.27} \right)^{1/3} \approx 3.6 \text{ in.}$$

Thus, the o.d. at elevation 34 ft (the top of the concrete-polymer portion of the luminaire support structure) is 7.2 in., and the wall thickness, t, is about .36 in.

Turning now to the lower portions of the luminaire support structure, we note that the area exposed to the wind forces is generally trapezoidal in geometry, and hence its area and centroidal height are defined, respectively, by

$$A = \frac{h}{2}(D_2 + D_1) \quad (9)$$

and

$$\bar{h} = h \frac{2D_1 + D_2}{3(D_1 + D_2)} \quad (10)$$

where

A = the area (ft^2),

$\bar{h}$ = the centroidal height, ft,

D_1 = the smaller diameter of the trapezoidal section, ft,
 D_2 = the larger diameter of the trapezoidal section, ft, and
 h = the total height of the trapezoidal section, ft.

Substituting Eq. (9) into Eq. (6A) and multiplying the resultant force (F_D) by the centroidal height obtained from Eq. (10), gives the bending moment magnitude (in lb-ft) for the section of the luminaire support structure. This bending moment, supplemented with the moments caused by the lantern and its supporting arm are then multiplied by 12 and inserted into Eqs. (7) and (8), finally yielding the required radius at the lower portion of the assumed section.

As far as the structure shown in Fig. 1 is concerned, it was found that smaller volumes would be needed if the support structure contour consisted of several sections of right circular cones rather than one continuous right circular cone 34 ft in height. For the shape shown in Fig. 1, four sections were considered, giving somewhat smaller results for the lower radii than those of a single continuous cone. Table I summarizes the results of the individual calculations for each of the sections considered in the design.

Although the procedure for the calculations involving each section was as outlined above, it should be noted that analysis

was carried out by first assuming a value for D_2 in the section considered. If the assumed value of D_2 was different than the value $2 R$ obtained from Eqs. (7) and (8), the calculations had to be repeated with a different assumed value for D_2 . The rest of the calculations for the subsequent sections are basically repetitive in nature with only the physical dimensions of h , D_2 , and $\bar{h}$ changing for the individual calculations.

Before leaving the calculations for the Fig. 1 design, we should check the magnitude of the torsional shear effects caused by wind forces acting on the lantern and its support arm. Rather than going into a lengthy discussion on this subject, let us simply examine the shear stresses caused by torsional effects at the junction of the lantern arm and the support structure. The equations for torsional shear and maximum normal stresses are defined, respectively, as

$$\tau = \frac{2T r_o}{\pi (r_o^4 - r_i^4)} \quad (11)$$

and

$$\sigma_{\max} = \frac{\sigma_f}{2} + \frac{1}{2} \sqrt{\sigma_f^2 + 4\tau^2} \quad (12)$$

σ_f = the maximum flexural stress, (1,000 psi),

τ = the shear stress, (psi),

T = the torque, (in.-lb),

r_o = the outer radii, (in.),

r_i = the inner radii, (in.), and

σ_{max} = the maximum normal stress.

Recalling that r_o and r_i are 3.6 and 3.24 in., respectively, assuming the maximum wind torques as 570 lb-ft, and applying Eqs. (11) and (12), we have

$$\tau = \frac{2 \times 570 \times 12 \times 3.6}{\pi(3.6^4 - 3.24^4)} \approx 270 \text{ psi}$$

and

$$\sigma_{max} = 500 + \frac{1}{2} \sqrt{1 \times 10^6 + .2908 \times 10^6} = 1,067 \text{ psi.}$$

Thus, the shear stresses from torsion, even at 120 mph, add only a few percent to the flexural stress, and hence, can be neglected for the general engineering approach outlined in this paper.

Incidentally, similar investigations with respect to the flexure stresses in the straight and curved portions of the metal lantern arm will reveal that the resultant stresses are much below the prescribed endurance levels for the assumed materials. Thus, it was felt that discussions pertaining to these subjects should not be included in this paper.

Finally, it should also be pointed out that the ground and arm attachment details, as shown in Fig. 1, are quite arbitrary at this juncture, and some considerations with respect to possible changes or improvements upon their design should be undertaken before any support structure details are finalized.

D. GENERAL REMARKS ABOUT ENERGY ABSORPTION

Thus far, in terms of the broad engineering viewpoints outlined at the introduction of this paper, we have satisfied the first design criteria by outlining a method that permits the evaluation of the required cross-sectional dimensions for the proposed polymer-concrete luminaire support structure. Our next investigation involves the determination of the possible modes of energy absorption for collisions between automobiles and the design shown in Fig. 1. However, before discussing this design specifically, let us examine some general aspects associated with energy absorption in collapsible structures.

Figure 2 depicts an ideal load deflection curve for an energy absorber. The curve consists of an initial steep slope representing the elastic phase, followed by a uniform load

maintained over the major portion of the deflection, and terminated by a final elastic recovery portion. The energy dissipated is equal to the area under the curve and is expressed by

$$E_d = \bar{P} \left[l_s - \frac{1}{2}(\delta_e + \delta'_e) \right], \quad (13)$$

where

$\bar{P}$ = the sustained load,

l_s = the maximum displacement of load,

δ_e = the initial elastic deflection, and

δ'_e = the terminal elastic deflection.

The stroke, l_s , is, of course, always smaller than the initial length, l , while, δ'_e , the elastic recovery portion, is usually smaller than the initial elastic part δ_e .

As mentioned above, Fig. 2 represents an idealized material. For actual or real materials, it is obvious that it would indeed, be rare to obtain a load deflection curve of the type shown in Fig. 2. Usually, the load oscillates about some average value $\bar{P}$ as indicated in Fig. 3. One could assume that oscillations would occur with greater deviations during dynamic impact. Acceptability of the oscillations depicted in Fig. 3 depends on whether the components being decelerated can safely tolerate the combination of steady and vibratory loading.

Equation (15) has some drawbacks. These are due to the fact that the load displacement curves are usually obtained from static tests. Thus, the proper equations for the assessment of dynamic problems require some further study. On the other hand, with proper instrumentation, it is reasonable to assume that valid dynamic load vs. deflection plots can be obtained.

Besides load-displacement curves there are several other parameters useful as indices for energy-absorption performance. Introducing these in the order of their importance:

- a) The specific energy, defined as

$$K_e \approx \frac{\bar{\sigma}_0}{\rho} \beta \text{ lb-ft/lb,}$$

where

$\bar{\sigma}_0$ = the average stress based on the initial cross-sectional area, lb/ft^2 ,

ρ = the density, lb/ft^3 , and

β = the maximum displacement of load per initial load (i.e., $\beta = l_s/l$).

- b) The energy dissipation density,

$$K_v \approx \sigma_0 \beta \text{ lb-ft/ft}^3.$$

c) The load intensity, i.e., the ratio of the maximum load to the average load.

d) The operating pressure or stress at which the energy dissipator functions.

These parameters, when plotted with respect to impact velocity, yield important and valuable data. Thus, for instance, a plot of the specific energy, K_e , or the energy dissipation density, K_v vs. velocity of impact could look like Fig. 4. K_e is obviously an important parameter for studies pertaining to energy absorption and its value for the concrete-polymer materials contemplated for the luminaire support structure should be measured.

As far as the other parameters are concerned, the value of c) can be considered as a measure of smoothness of deceleration for the specific dissipated energy. The lowest possible ratio produces the smoothest deceleration for a given amount of energy dissipated. Finally, parameter d) can be explained in the following manner. Stopping high-density vehicles requires higher operating pressures, for example, than stopping low-density vehicles, for the same deceleration. The specific pressure levels required are determined from vehicle weight, size, deceleration tolerance, and initial-impact velocity. Thus, for final designs with concrete-polymer materials some of the parameters discussed above will have to be evaluated.

E. ENERGY ABSORPTION BY HONEYCOMB MATERIALS

Thus far, our discussions with regard to energy absorption are general in nature and are applicable to a broad spectrum of materials. At this point of our discussion, since honeycomb polymerized materials are available for luminaire support structures, we divert our attention towards the understanding of the energy absorption phenomena associated with this specialized group of materials.

Basically, one can compare a honeycomb structure to a group of mutually attached structures of various geometrical configurations. Thus, for instance, metal honeycombs can be compared to a group of mutually attached cylindrical shells. For polymerized honeycomb structures the analysis is similar, however, in this case the assumed conditions are those of mutually attached spheres. In both the metal or polymerized honeycomb structures the failure mode should follow a process of buckling and collapse similar to that of a single shell or sphere supported by internal spokes, which in our case represent the support provided by the mutually attached cells. This support should act throughout the entire process of collapse, producing a buckling pattern dependent on the support structure. Thus, as an example, the buckling pattern produced by the six

walls of a hexagonal honeycomb would, by virtue of its structural composition, produce six circumferential waves in each of its hexagonal cells. Similar collapse phenomena would also apply for the spherical structures assumed for the polymerized honeycomb structure. Initially, we can expect the load to rise in the usual linear manner with peak values occurring when initial buckling takes place. Beyond this point the load should decrease somewhat and remain essentially constant giving the appearance of an elastic-perfectly plastic material. The smooth deceleration offered by the behavior of this material is certainly an advantageous property for the structures under investigation in this paper. Further study of polymerized honeycomb static and cyclic material properties, coupled with investigations leading to a greater understanding of their energy absorption characteristics is certainly warranted, and is highly recommended.

F. ENERGY ABSORPTION ESTIMATE FOR THE DESIGN

The above discussions with respect to the properties pertaining to polymerized honeycomb materials completes our review of the hypothesis and unknowns associated with luminaire designs incorporating polymerized structures. We can now return

to Fig. 1 and proceed with the engineering analysis of the energy absorption characteristics of the concrete-polymer support structure.

As mentioned previously in this paper the energy absorbing characteristics of the polymerized material will have to be investigated. In order to arrive at some figure for our preliminary engineering design, however, let us assume that the auto is able to completely drive through the post, smashing out as much height of the pole as needed. Furthermore, let us assume that the stress-strain relationship for the concrete polymer remains linear up to the point of failure. For this case the energy absorption would be

$$\epsilon = \frac{1}{2} \frac{\sigma_u^2}{E} , \quad (14)$$

where

σ_u = the failure stress in ~~compression, and~~

E = the modulus of elasticity.

With σ_u equal to 20,000 psi, from static tests on the material⁽¹⁻³⁾ and E equal 6.2×10^6 psi, we have

$$\epsilon = 32 \frac{\text{lb-in.}}{\text{in.}^3} ,$$

or for the assumed base area of .54 in.²,

$$e = \frac{54 \times 32 \times 12}{12} = 1,728 \frac{\text{lb-ft}}{\text{ft}} .$$

Assuming a 60-in.-high auto we obtain a total energy dissipation of 8,640 lb-ft. This total dissipated energy of 8,460 lb-ft should be equal to the change of kinetic energy experienced by the automobile. Expressing this in equation form, we have,

$$\Delta K.E. = mV\Delta v, \quad (15)$$

where

$\Delta K.E.$ = the change in kinetic energy,

m = the mass of the car,

V = the velocity, and

Δv = the velocity change.

Inserting the numbers in Eq. (15) for a 2,500 lb auto moving at 35 mph yields

$$\Delta v = \frac{8,640 \times 32}{2,500 \times 51.3} = 2.1557 \frac{\text{ft}}{\text{sec}} ,$$

or

$$\Delta v = 1.5 \text{ mph}$$

a figure well within the desired safe limits for automobile collisions. (4)

It is worth noting that even this small velocity change in the collision is a gross over-estimate. We have required all of the concrete polymer to fail in compression for the full height of the auto in obtaining the total dissipated energy, and this estimate is probably too high by a factor of 2 to 4. Further, the velocity change, Δv , is inversely proportional to the vehicle initial velocity, and we have chosen a fairly low initial velocity.

G. CONCLUSION

At this point we have completed the preliminary engineering analysis for the proposed concrete-polymer luminaire support structure. Summerizing our discussion, we can say the following. From simple engineering principles, and using data from static tests of the concrete-polymer materials, it seems highly likely that a luminaire structure of the type shown in Fig. 1 can be advantageously used along our highways. It will safely withstand wind forces of 120 mph and should, in the event of a collision, cause a change in automobile velocity well within the prescribed safety limits. As pointed out, however, experimental determinations of the cyclic loading values of S'_f and S_t based on the risk of rupture concept, together

with evaluations of the energy absorption indices mentioned for the concrete-polymer materials are necessary prerequisites before detailed design work is undertaken.

The Fig. 1 design is based upon Type II cement concrete-polymer material, with a density of about 150 lb/ft³. The resulting weight of the above-grade concrete-polymer structure is 760 lbs, compared to steel pole weights of about 420 lbs. It is likely that light-weight concrete-polymer materials of the necessary strength can be developed, and the structure weight decreased by as much as a factor of 3.

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TABLE I

DIMENSIONS AND OTHER PROPERTIES OF THE DESIGN OF FIGURE 1

Section	1	2	3	4
Small diameter D_1 (in.)	7.20	7.68	11.80	16.02
Large diameter D_2 (in.)	7.68	11.80	16.02	18.10
Elevation at lower end of section (ft)	25.0	15.0	5.0	0.0
Length of section (ft)	9	10	10	5
Area subjected to wind force (ft^2)	5.58	8.10	11.60	7.94
Wind force (lb)	201	292	418	285
Centroid height of area (ft)	4.45	4.65	4.74	2.20
Moment at lower end of section (lb-ft)	1,274	4,639	11,543	16,718
Volume of section (ft^3)	.52	1.00	2.02	1.52
Density (lb/ ft^3) (based on heavy aggregate)	150.0	150.0	150.0	150.0
Weight of section	78	150	303	228
Maximum tensile stress in outer fibers (psi)	1,000	1,000	1,000	1,000

FIGURE 1

Figure 2

Figure 3

Figure 4

III. HIGHWAY BRIDGE DECKING STUDY

A. INTRODUCTION

Failures of recently constructed bridge decks have been reported by several investigators.^(1,2) For highway officials, especially those involved with the interstate system, these failures represent substantial future budgetary commitments. To be more specific in terms of dollars and cents, a 1968 survey indicates that bridge deck replacement costs were as high as \$1,000 per cubic yard. Presumably, current costs are even higher. When compared with the original construction cost of \$60 to \$100 per cubic yard, the importance of durability in bridge deck design is apparent.

Brookhaven National Laboratory has been engaged during the last few years in a research program aimed at developing concrete-polymer composites for improved materials of construction. Remarkable improvements in permeability and strength properties were observed and reported in the literature.⁽³⁻⁵⁾ Early in 1970, the Engineering Division of the Applied Science Department at BNL was given the task of investigating the use of concrete-polymer materials as a possible solution for bridge deck durability problems.

The basic approach in this investigation has been to study crack formation phenomena in concrete and to develop more powerful

analytical methods than have been available in the past. The bridge deck elements, even in the uncracked state, are, by virtue of geometry, loadings, and boundary conditions, stressed in three dimensions. A satisfactory design approach thus requires a full three-dimensional analysis. Since the general three-dimensional equations in elasticity theory are solvable only by finite difference - finite element methods, this is the analytical approach that has been adopted. Further, since many of the failures reported in the literature⁽⁶⁾ have been due to freeze-thaw effects in primary and secondary cracks in the decking, it was deemed important to investigate the general phenomena of cracking in concrete. It is also likely that salt solution intrusion into primary and secondary cracks is a factor in deck failures, again emphasizing the importance of understanding the cracking phenomena.

The use of polymer concrete, with its high tensile strength and low water permeability, may offer a solution to the bridge deck durability problem. Primary cracking should be more easily controlled with the polymer concrete, and it may even be possible to eliminate it altogether. In either case, the three-dimensional analysis should point the way to designs in polymer concrete which can withstand all of the service conditions of bridge decking.

B. GENERAL DESCRIPTION OF CRACKING

It is appropriate to commence this discussion by noting that the development of cracks in concrete structures takes place in three distinct stages. According to E. E. Reis, Jr. et al.,⁽⁷⁾ the first or primary cracking stage takes place during the consolidation phase when the concrete structure is still relatively plastic. The stresses involved here are usually caused by shrinkage, and are generally accompanied by relatively low flexural stresses. In reinforced structures, the steel stresses for this type of cracking are well below 13 ksi. Although sometimes relatively insignificant at formation, these cracks usually become wider with further loadings and age.

To understand the significance of the last statement, it should suffice to point out that if one stands on a bridge having a reasonably long span at the moment that a heavy vehicle passes, he will notice that the resulting deflections and vibrations are impressive. Even if the structure is reinforced or prestressed in a manner that should resist the nominal vehicle loading, it is entirely conceivable that further bridge deck deterioration will take place due to the cyclic nature of the loading and to the complicated stress patterns which occur. In the colder parts of the U.S., during the winter months, there are additional pressures due to the expansion of ice crystals in

the primary cracks.⁽⁸⁾ Usually, the combined effect of these stresses will cause deepening of the primary (and widening) until the cracks reach the imbedded steel. Then corrosion of reinforcement and/or preload bars occurs with subsequent total destruction of the structure. Thus, the prevention of primary cracks is indeed an important matter to consider. As stated by J. P. Callahan et al.,⁽⁹⁾ "if water can be prevented from entering concrete, there will be no durability problem associated with freezing and thawing."

The growth of primary cracks caused by the combination of vehicle loadings and freeze-thaw loadings are not the only events going on in the structure. Usually, the primary crack growth is accompanied by the nucleation of new secondary cracks. By definition, any structure in the process of secondary crack formation is experiencing what is known as phase two of the concrete crack phenomena.

An interesting theory with respect to secondary cracking due to flexural stresses in reinforced beams has been postulated by Broms.⁽¹⁰⁾ According to this hypothesis, the cracking pattern of a typical beam takes place in the manner depicted in Figs. 1 and 2. Tensile stressed portions of the structure are located inside the circles, while those in compression are situated outside the circles. The surfaces on the circumference of the circles shown in the figures are areas with zero stress.

Secondary cracks can be fairly numerous. Those reaching the surface are known as first order secondary cracks, while those not reaching the surface are designated as second order secondary cracks. According to Broms, the theory has been substantiated by experimental results.

Although Broms original work dealt primarily with reinforced, flexurally loaded structures, the theory nevertheless applies for all structures with similar stress distributions. Whenever stress patterns of the type shown in Figs. 1 and 2 appear, secondary cracking will take place. Stress trajectories can be calculated by finite element methods and should be examined for the conditions responsible for secondary cracking.

In the final phase of the crack phenomena no additional cracks appear. As loads are increased the existing cracks widen. For nonreinforced structures, complete failure results. This is not necessarily true for reinforced structures, however. Failure here usually depends on the remaining strength of the corroded reinforcement steel. Presumably, some structural integrity could still be expected if corrosion of the reinforcement could be prevented. In considering the use of polymer concrete for bridge decks, the role of the monomer coating on the reinforcing steel may be very important in protecting the steel from corrosion even if cracking occurs. Corrosion tests on cracked specimens of reinforced polymer concrete are recommended.

C. CALCULATION OF CRACK WIDTH AND SPACING

One of the first theoretical investigations on cracking in reinforced concrete was reported by Watstein and Parson⁽¹¹⁾ in 1943. They used the simple axially loaded model in Fig. 3, and assumed that:

1. The stress in the concrete is uniformly distributed across the cross section.
2. The strain in the concrete is proportional to the stress.
3. The steel stresses do not exceed the proportional limit.

Watstein and Parson concluded that the tensile stress in the concrete at a distance x from the crack, $S_c(x)$, is expressed by:

$$S_c(x) = \frac{N\pi D}{A_c} \int_0^x u(x) dx, \quad (1)$$

where

D = the diameter of the steel reinforcement,

A_c = the area of the concrete,

$u(x)$ = the bond stress distribution, and

N = the number of bars in the concrete cross-sectional area A_c .

Basically, the above equation postulates that the concrete stress at a distance x from a crack is equal to the force transmitted by the bond divided by the concrete area. With

this in mind the steel stress at a distance x from the crack, $S_s(x)$, will be

$$S_s(x) = S_s - \frac{N\pi D}{A_s} \int_0^x u(x)$$

where

S_s = the steel stress at the crack, and

A_s = the area of the steel,

since $A_s = N\pi D^2/4$, the above becomes

$$S_s(x) = S_s - \frac{4}{D} \int_0^x u(x)dx. \quad (2)$$

Unfortunately, the function $u(x)$ in the equations derived by Watstein and Parson was not known, hence it was not possible to apply the theory to actual reinforced structures in any meaningful way. The accumulation of experimental results on bond stresses in recent times provides a way to circumvent this difficulty. In particular, Murray⁽¹²⁾ has applied a statistical nonlinear regression analysis⁽¹³⁾ to his data on bond stresses to obtain an equation for $u(x)$.

Since the regression method is applicable to the analysis of a variety of experiments, and may be useful in dealing with some of the concrete-polymer program results, it is worthwhile to attempt at least a brief explanation of what is involved in this approach. We therefore digress to a discussion of the regression analysis.

Fundamentally the aim of this method is to take a set of data and fit it into the form

$$Y = a_0 + X_1^{a_1} \cdot X_2^{a_2} \cdot X_3^{a_3} \dots X_n^{a_n} \quad (3)$$

where

Y = the dependent variable,

X_i = the independent variables, and

a_i = the determined coefficients for best fit.

To be more specific, assume that many tests with reinforced beams were carried out yielding results for values of u (the bond stress) versus the variations of concrete cover and steel stress in the reinforcement (S_s). Hence, for the example under consideration there are only three independent parameters, with a basic equation of the form,

$$u - a_0 = (S_s)^{a_1} \cdot (\text{cover})^{a_2} \cdot (X)^{a_3} \quad (4)$$

The first step in the application of the method consists of a log transformation that allows for the application of linear regression techniques for the evaluation of the a_i coefficients.

Returning to the sample problem and applying the transformation to eq. (4):

$$\log(u - a_0) = a_1 \log(S_s) + a_2 \log(\text{cover}) + a_3 \log X \quad (5)$$

which for convenience is rewritten as

$$Y' = a_1 b_1 + a_2 b_2 + a_3 b_3 \quad (6)$$

The algorithm now begins by testing independently each of the right-hand terms of the linearized expression to determine which best represents the term Y' . For illustration, assume that a_2b_2 is best.

Next, defining a'_i as coefficients different in value than a_i , the algorithm takes $a'_2b_2 + a'_1b_1$ and $a'_2b_2 + a'_3b_3$ and again independently checks which of the two pairs best represent the term Y' .

Assuming that $a'_2b_2 + a'_3b_3$ is best, the third step for the regression is rather obvious. The combination $a''_2b_2 + a''_3b_3 + a''_1b_1$ is tested for fit and compared with the previous best fit $(a'_2b_2 + a'_3b_3)$ to see if there is any improvement by the inclusion of the b_1 parameter. If there is no improvement, then b_1 is not a statistically important parameter. Thus, for the sample discussed above the expression becomes,

$$Y' = a_2b_2 + a_3b_3 \quad (7)$$

where the primes for the coefficients are dropped.

The last and final step in the approach is an iterative procedure that utilizes the values of the coefficients obtained from the linear analysis as first approximations for the non-linear solution. Even the simplest problem can hardly be handled without the use of a computer.

Returning to the discussion of the bond stress function, $u(x)$, Murray concluded that the bond stress at a distance x from a crack can be expressed by the formula

$$u(x) = 0.000539 s_s^{1.36} x^{-0.245} \quad (8)$$

Furthermore, experiments with axially loaded specimens of the type shown in Fig. 3 indicated that, as one expects, the maximum concrete tensile stress between two existing cracks occurs midway between them.

The integral in eqs. (1) and (2) can now be evaluated:

$$\int_0^x u(x) dx = \frac{s_s^{1.36}}{1400} x^{0.755} \quad (9)$$

Equations (1) and (2), giving the concrete and steel stresses as functions of distance from a crack, can thus be written

$$s_c(x) = \frac{N\pi D}{1400 A_c} s_s^{1.36} x^{0.755} \quad (10)$$

$$s_s(x) = s_s \left[1 - \frac{s_s^{0.36} x^{0.755}}{350 D} \right] \quad (11)$$

The steel stress at the crack, s_s , one notes, is just

$$s_s = \frac{4P}{N\pi D^2} \quad (12)$$

where P is the axial load in the section of interest.

The concrete stress must be zero at a crack and must increase with distance from the crack according to Eq. (10) to some maximum value at a distance $x = l/2$, where l is the spacing between cracks. Thereafter, the concrete stress decreases to zero at the next crack. The maximum crack spacing, L , can be determined from Eq. (10) by noting that the largest value the concrete stress can have between cracks is just the concrete tensile strength, S'_{ct} . Thus,

$$S'_{ct} = \frac{N\pi D}{1400 A_c} S_s^{1.36} \left(\frac{L}{2}\right)^{0.755} \quad (13)$$

Finally, solving for the maximum crack spacing yields

$$L = 2 \left\{ \frac{1400 A_c S'_{ct}}{N\pi D S_s^{1.36}} \right\}^{1.324} \quad (14)$$

Taking the theory somewhat further, we define the slip per unit length between the concrete and steel as the difference between the strains in the steel and concrete:

$$\tau(x) = \frac{S_s(x) - mS_c(x)}{E_s} \quad (15)$$

where

$\tau(x)$ = the slip per unit length, and

m = the modulus ratio (E_s/E_c).

Now the crack width, W , can be determined from the summation of all the unit slips from zero to L . Because of symmetry, the mathematical expression for W takes the form

$$W = 2 \int_0^{L/2} \tau(x) dx. \quad (16)$$

Inserting the expression for $S_s(x)$ and $S_c(x)$ from eqs. (10) and (11)

$$W = \frac{2}{E_s} \int_0^{L/2} \left[S_s \left(1 - \frac{S_s^{0.36} x^{0.755}}{350 D} \right) - \frac{mN\pi D}{1400 A_c} S_s^{1.36} x^{0.755} \right] dx.$$

After integrating and rearranging terms, we obtain the crack width equation:

$$W = \frac{S_s L}{E_s} \left[1 - \left(\frac{4}{D} + \frac{mN\pi D}{A_c} \right) \frac{S_s^{0.36}}{2460} \left(\frac{L}{2} \right)^{0.755} \right]. \quad (17)$$

We note that S_s/E_s is just the unit strain in the steel due to the axial load, so that $S_s L/E_s$ is the total strain of the reinforcement over the distance between cracks if the steel carries all of the axial load. The actual crack width is less than $S_s L/E_s$ by virtue of the sharing of the load between steel and concrete, with the bond stress being the mechanism for load transfer from steel to concrete.

The maximum crack spacing, L , and the crack width, W , are given in eqs. (14) and (17) in terms of known quantities which

are geometrical properties of the section under consideration (N , D , A_c), properties of the materials used (E_s , E_c , S'_{ct}), or properties readily determinable from the applied load (S_s , given by eq. (12)). The use of these expressions, as they stand, is limited to sections which are simply loaded along the direction of the reinforcing steel. The extension of the crack analysis to two- and three-dimensional stress fields will not be a simple matter, and will require a statistically significant body of experimental data to guide and confirm the results. The importance of the analysis presented above lies not so much in the expressions for L and W but with the technique used to develop the expressions. The three-dimensional computer code being developed for bridge deck design is described in the following sections. Like all new formulations in the sciences, however, experimental verification of the computer results must be made. Furthermore, as will be shown below, the finite element method as applied for the bridge deck structure will yield stresses and strains but will not indicate when cracking will commence. At the present time no valid theory exists that allows the prediction of cracks in three-dimensional arbitrarily loaded structures. Thus, by duplicating some of the methods employed above it may yet be possible to check the finite element results, and at the same time arrive at some conclusion about the initiation of cracking in arbitrarily loaded structures.

D. DESCRIPTION OF THE THREE-DIMENSIONAL ANALYSIS

The idealization of continuous elastic structures as an assemblage of finite elements is not a new idea. The framework method of Hrennikoff⁽¹⁴⁾ and the lattice analogy postulated by McHenry⁽¹⁵⁾ were presented in the early 1940's. Levy⁽¹⁶⁾ introduced the idea of replacing the continuous structure by many finite structures. Two-dimensional finite element methods in elastic structures were perfected and coded for computer use by Clough⁽¹⁷⁾ and Wilson.⁽¹⁸⁾ Finally, based on the previous work, Rashid⁽¹⁹⁾ extended the method to include three-dimensional elements.

The basic theoretical constructs involved in the finite element method are amply described in the literature. It would only be a repetitive exercise to derive expressions already extensively detailed by others. Thus, the discussions that follow will concentrate on those aspects of the derivations which are directly involved with the development of the three-dimensional finite element code for bridge deck designs. A brief review of the basic equations and concepts of the mechanics of elastic solids is included for continuity and clarity of discussion. These remarks, however, will be confined mostly to the first few introductory pages that follow.

The concepts of compatibility, equilibrium, stresses and strains, and other relations pertaining to the behavior of

elastic solids will be continuously referred to in the discussions that follow. Thus, it is only proper to start this section with an outline describing the intertwined relationships between the finite element concepts and the theories of elasticity.

In general, from the standpoint of the infinitesimal theory of elasticity, the response of any structure to either dynamic or static forces or displacements, including those due to changing thermal conditions is governed by the relationships of stress and strain, compatibility, equilibrium, and conditions along the surface or boundary of the body. In equation form these relationships are expressed, respectively, as: (20)

$$\epsilon_{ij} = \frac{1}{2}(u_{i,j} + u_{j,i}), \quad (\text{strain-displacement}) \quad (1)$$

$$\sigma_{ij} = \lambda \epsilon_{kk} \delta_{ij} + 2\mu \epsilon_{ij}, \quad (\text{stress-strain}) \quad (2)$$

$$\epsilon_{kj,kl} + \epsilon_{kl,ij} - \epsilon_{ik,jl} - \epsilon_{jl,ik} = 0 \quad (\text{compatibility}) \quad (3)$$

$$\sigma_{ij,j} + F_i = 0 \quad (\text{force equilibrium}) \quad (4)$$

$$\sigma_{ij} n_j = T_i \text{ on } \Sigma_1 \quad (\text{boundary conditions}) \quad (5)$$

$$u_i = u_i^0 \text{ on } \Sigma_2$$

where

i, j, k , and $l = 1, 2, 3$ corresponding to the three spatial coordinates,

u_i = i^{th} displacement component,

ϵ_{ij} = ij^{th} strain component,

σ_{ij} = ij th stress component,

λ and μ are the Lamé constants,

$\delta_{ij} = 0, i \neq j; \delta_{ii} = 1,$

F_i = i th body force component,

T_i = i th surface traction component,

n_j = j th direction cosine of the normal to a surface,

Σ_1 = surface on which stresses and tractions are specified,

Σ_2 = surface on which the displacements are specified,

and the notation $u_{i,j} = \frac{\partial u_i}{\partial x_j},$

$$\epsilon_{ij,kl} = \frac{\partial^2 \epsilon_{ij}}{\partial x_k \partial x_l},$$

etc.

An examination of the equation set reveals that either the displacements, u_i , or the stresses, σ_{ij} , can be chosen as the primary unknowns. It should be emphasized, however, that if the stresses (σ_{ij}) are chosen as the unknowns, then they must satisfy eqs. (4) and (3) throughout the entire elastic structure, and eq. (5) on the surfaces of the structure. However, if we substitute the displacement terms from (1) into (2) we obtain

$$\sigma_{ij} = \lambda u_{k,k} \delta_{ij} + \mu (u_{i,j} + u_{j,i}) \quad (6)$$

and this expression, inserted into eq. (4) results in

$$\mu \nabla^2 u_i + (\lambda + \mu) u_{j,j} + F_i = 0, \quad (7)$$

an equation dealing only with displacements and body forces.

Thus, if the displacements are chosen as the unknowns, they must only satisfy eq. (7) throughout the entire body and eq. (5) on the surfaces of the body. Compatibility is automatically satisfied when conditions (5) and (7) are met.

In the finite element representation of the elastic solid, the relationships corresponding to the equilibrium equations are uniquely defined by the force-deflection relationship (in matrix notation)

$$\{F\} = [K]\{R\}, \quad (8)$$

where $\{F\}$ and $\{R\}$ are column matrices representing the elastic force components and nodal displacements, respectively, and $[K]$ is a matrix representing the "stiffness" of the finite element system. Returning to eq. (7), and defining

$$L_{ij} = (\lambda + \mu) \frac{\partial^2}{\partial x_i \partial x_j} + \mu \delta_{ij} \frac{\partial^2}{\partial x_k \partial x_k}, \quad (9)$$

the expression becomes $L_{ij} u_j = -F_i$. Comparing the last expression with the eq. (8) relationship, it is apparent that the two equations show a remarkable resemblance to each other. Obviously, if L_{ij} is equivalent to $[K]$, the link between basic elasticity and the finite element matrix method is established.

Before attempting to show the equivalence of $[K]$ and L_{ij} , it should be noted that the L_{ij} terms are quite complicated in their present form, thus any comparison of terms would be indeed cumbersome. To overcome this problem, it is necessary to return to the basic equations of elasticity and attempt to partition the L_{ij} terms into several simpler terms so that a better comparison between the $[K]$ and L_{ij} expressions will result.

As noted previously, eq. (7) was derived from combinations involving eqs. (1), (2), and (4). Thus, it is reasonable to expect that a similar transformation using matrix method will lead to a clearer form of L_{ij} .

Defining $[\ell_1]$ and $[\ell_2]$ as

$$[\ell_1] = \begin{bmatrix} \frac{\partial}{\partial x_1} & 0 & 0 \\ 0 & \frac{\partial}{\partial x_2} & 0 \\ 0 & 0 & \frac{\partial}{\partial x_3} \\ \frac{\partial}{\partial x_2} & \frac{\partial}{\partial x_1} & 0 \\ 0 & \frac{\partial}{\partial x_3} & \frac{\partial}{\partial x_2} \\ \frac{\partial}{\partial x_3} & 0 & \frac{\partial}{\partial x_1} \end{bmatrix} \quad (10)$$

$$[\ell_2] = \begin{bmatrix} (\lambda+2\mu) & \lambda & \lambda & 0 & 0 & 0 \\ \lambda & (\lambda+2\mu) & \lambda & 0 & 0 & 0 \\ \lambda & \lambda & (\lambda+2\mu) & 0 & 0 & 0 \\ 0 & 0 & 0 & 2\mu & 0 & 0 \\ 0 & 0 & 0 & 0 & 2\mu & 0 \\ 0 & 0 & 0 & 0 & 0 & 2\mu \end{bmatrix} \quad (11)$$

Equations (1) and (2) are transformed to the forms

$$\{\epsilon\} = [\ell_1]\{u\} \quad (12)$$

$$\{\sigma\} = [\ell_2]\{\epsilon\}$$

or

$$\{\sigma\} = [\ell_2][\ell_1]\{u\}. \quad (13)$$

Similarly, eq. (4), becomes,

$$-\{F\} = [\ell_3]\{\sigma\}$$

or

$$-\{F\} = [\ell_3][\ell_2][\ell_1]\{u\} \quad (14)$$

where

$$[\ell_3] = \begin{bmatrix} \frac{\partial}{\partial x_1} & 0 & 0 & \frac{\partial}{\partial x_2} & 0 & \frac{\partial}{\partial x_3} \\ 0 & \frac{\partial}{\partial x_2} & 0 & \frac{\partial}{\partial x_1} & \frac{\partial}{\partial x_3} & 0 \\ 0 & 0 & \frac{\partial}{\partial x_3} & 0 & \frac{\partial}{\partial x_2} & \frac{\partial}{\partial x_1} \end{bmatrix} \quad (15)$$

Since, the derivations of eqs. (14) and (9) are identical,

$$[\ell_3][\ell_2][\ell_1] = L_{ij} = [L]. \quad (16)$$

Unfortunately, except for very simple cases, it is almost impossible to solve eq. (9) directly for problems involving practical boundary conditions. For the finite element method, however, the above statement is not true; the differential operator $[\ell]$ can be approximated by a linear algebraic operator $[K]$. Furthermore, by inspecting the individual terms of $[L]$ as shown in eq. (16) it is apparent that $[\ell_3]^T = [\ell_1]$ ($[\ell_3]^T$ is the transport of the ℓ_3 matrix). Since $[\ell_2]$ is only a restatement of Hooke's law, in matrix form, it is only necessary to linearize $[\ell_1]$ to obtain a linearized algebraic operator $[K]$, that is equivalent to L_{ij} . Obviously, the link between the two methods is clearly established. In simple terms, the aim of the method is to find an alternate way of deriving equilibrium equations that are easier to solve than the original differential equations.

Linearization of $[K]$ is usually accomplished by assuming a displacement function which requires compatible element deformations. No gaps or overlaps between adjacent deformed elements are permitted in the idealized finite element structure. The functions are derived by applying the principles of virtual work, or by simply assuming a linear displacement function. The number

of unknown coefficients in these functions should be equal to the number of degrees of freedom in the system.

For the three-dimensional stress analysis of this study the assumed displacement function for an element

$$\begin{aligned} u(x,y,z) &= \alpha_1 + X\alpha_2 + Y\alpha_3 + Z\alpha_4 \\ v(x,y,z) &= \alpha_5 + X\alpha_6 + Y\alpha_7 + Z\alpha_8 \\ w(x,y,z) &= \alpha_9 + X\alpha_{10} + Y\alpha_{11} + Z\alpha_{12} \end{aligned} \quad (17)$$

where $X = x - x_I$, $Y = y - y_I$, $Z = z - z_I$, I is the reference node of the element, as shown in Fig. 4, and the coefficients $\alpha_1 \dots \alpha_{12}$ represent the generalized displacement coordinates of the element.

From this point on, the entire finite element procedure can be best outlined according to the steps shown in the flow diagram, Fig. 5. In step one, assumed element displacements are entered. Essentially, this step is equivalent to the matrix form of eq. (17) above,

$$\{U(x,y,z)\} = [M(x,y,z)]\{\alpha\}$$

or

$$\begin{Bmatrix} u(x,y,z) \\ v(x,y,z) \\ w(x,y,z) \end{Bmatrix} = \begin{bmatrix} 1 & X & Y & Z & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & X & Y & Z & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & X & Y & Z \end{bmatrix} \begin{Bmatrix} \alpha_1 \\ \alpha_2 \\ \vdots \\ \alpha_{12} \end{Bmatrix} \quad (18)$$

Next, the nodal point displacements $\{V\}$ are expressed in terms of the generalized coordinates. Thus,

$$\{V\} = [A]\{\alpha\}$$

or

$$\begin{Bmatrix} u_I \\ u_J \\ u_K \\ u_L \\ v_I \\ v_J \\ v_K \\ v_L \\ w_I \\ w_J \\ w_K \\ w_L \end{Bmatrix} = \begin{bmatrix} [\tilde{\phi}_O] & [0] & [0] \\ [0] & [\tilde{\phi}_O] & [0] \\ [0] & [0] & [\tilde{\phi}_O] \end{bmatrix} \begin{Bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \\ \alpha_4 \\ \alpha_5 \\ \alpha_6 \\ \alpha_7 \\ \alpha_8 \\ \alpha_9 \\ \alpha_{10} \\ \alpha_{11} \\ \alpha_{12} \end{Bmatrix} \quad (19)$$

where

$$[\tilde{\phi}_O] = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 1 & A_J & B_J & C_J \\ 1 & A_K & B_K & C_K \\ 1 & A_L & B_L & C_L \end{bmatrix}$$

The A_J , B_J , C_J , etc are defined as shown in Fig. 4.

Step three involves solving for the generalized coordinates in terms of the nodal displacements. Therefore:

$$\{\alpha\} = [A^{-1}]\{V\}. \quad (20)$$

Next, the element strains $\{\epsilon\}$ are expressed in terms of the generalized coordinates:

$$\{\epsilon\} = [B]\{\alpha\}$$

or

$$\begin{Bmatrix} \epsilon_{xx} \\ \epsilon_{yy} \\ \epsilon_{zz} \\ \epsilon_{xy} \\ \epsilon_{yz} \\ \epsilon_{xz} \end{Bmatrix} = \begin{bmatrix} 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{bmatrix} \begin{Bmatrix} \alpha_1 \\ \alpha_2 \\ . \\ . \\ . \\ \alpha_{12} \end{Bmatrix} \quad (21)$$

where $[B]$ is obtained by appropriate differentiation of the matrix $[M(x,y,z)]$ of eq. (18).

The analysis is now continued as in the previous step by expressing the element stresses in terms of the generalized coordinates. Thus

$$\{\sigma\} = [D]\{\epsilon\}$$

or

$$\begin{Bmatrix} \sigma_{xx} \\ \sigma_{yy} \\ \sigma_{zz} \\ \tau_{xy} \\ \tau_{yz} \\ \tau_{xz} \end{Bmatrix} = \lambda \begin{bmatrix} \frac{1-\nu}{\nu} & 1 & 1 & 0 & 0 & 0 \\ 1 & \frac{1-\nu}{\nu} & 1 & 0 & 0 & 0 \\ 1 & 1 & \frac{1-\nu}{\nu} & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{1-2\nu}{2\nu} & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{1-2\nu}{2\nu} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{1-2\nu}{2\nu} \end{bmatrix} \begin{Bmatrix} \epsilon_{xx} \\ \epsilon_{yy} \\ \epsilon_{zz} \\ \epsilon_{xy} \\ \epsilon_{yz} \\ \epsilon_{xz} \end{Bmatrix} \quad (23)$$

where $\lambda = \frac{\nu E}{(1+\nu)(1-2\nu)}$, with E = Young's modulus
and ν = Poisson's ratio

Inserting eq. (22) into the above yields

$$\{\sigma\} = [D][B][A^{-1}]\{V\}. \quad (24)$$

In passing it should be pointed out that the matrix [D] is dependent on the material properties of the solid under investigation. For this analysis the matrix [D] is taken to be isotropic and is represented by the terms shown in eq. (23). For orthotropic materials, a different matrix [D] would, of course, have to be used.

Returning to the equations derived thus far, it will be noted that the nodal point displacement vector {V} is unknown, hence the stresses and strains cannot, at this point, be evaluated.

To get around this problem, virtual work methods are employed to evaluate the stiffness matrix $[K]$. The method is quite involved, hence, only a brief outline of the techniques applied in the derivation will be shown.

For elements under stress subjected to a set of virtual generalized coordinates displacements $\{\bar{\alpha}\}$, the corresponding virtual strains $\{\bar{\epsilon}\}$ will do internal work in the element described by

$$W_I = \int_{vol} \{\bar{\epsilon}\}^T \{\sigma\} dv \quad (25)$$

which, because of eqs. (22) and (24), becomes

$$W_I = \{\bar{\alpha}\}^T \int_{vol} [B]^T [D] [B] dv \{\alpha\}. \quad (26)$$

Next, in equilibrium with the state of stress $\{\sigma\}$, there are generalized forces $\{\beta\}$ also acting on the virtual displacements $\{\bar{\alpha}\}$. These forces, however, do external virtual work, and can be described by

$$W_E = \{\bar{\alpha}\}^T \{\beta\}. \quad (27)$$

Equating the two virtual works and letting the arbitrary $\{\bar{\alpha}\}$ matrix take on unit values of each virtual displacement in succession, we finally obtain

$$[K] = [A^{-1}]^T [\bar{K}] [A^{-1}], \quad (28)$$

where

$$[\bar{K}] = \int_{\text{vol}} [B]^T [D] [B] dv.$$

Upon equating $[G]$ to $[B]^T [D] [B]$ this becomes

$$[K] = \int_x \int_y \int_z [G] dx dy dz. \quad (29)$$

Since $[G]$ is not a function of the coordinates, the integration is a trivial process and involves only the determination of the volume of the tetrahedron which is the basic element for the three-dimensional solid.

The next step in the analysis is the evaluation of the element nodal forces associated with the various kinds of loads acting on the body. Usually, this process is carried out in two steps. The first step expresses the applied loads as functions of position within or on the element, and the second step transforms the forces to the desired nodal positions. Step one is quite similar to the approach used previously in obtaining the stiffness matrix $[K]$. The theories of virtual work are again employed in conjunction with the virtual displacement patterns associated with each of the different types of loadings. After equating work expressions, the results obtained for the residual or temperature forces, and body and acceleration forces are

$$\{F_t\} = [A^{-1}]^T \int_{vol} [B]^T \{\sigma_t\} dv \quad (30a)$$

$$\{F_b\} = [A^{-1}]^T \int_{vol} [M]^T \left\{ \frac{\gamma a}{g} \right\} dv \quad (30b)$$

where $[B]$ and $[M]$ are related to the virtual strains and displacements by

$$\{\bar{\epsilon}(x,y,z)\} = [B(x,y,z)]\{\bar{\alpha}\}$$

$$\{\bar{U}(x,y,z)\} = [M(x,y,z)]\{\bar{\alpha}\},$$

and

$$\{\sigma_t\} = \{\sigma_t(x,y,z)\}, \text{ the thermal stress,}$$

$$\frac{\gamma}{g} = \text{the unit mass of the material, and}$$

$$a = \text{the accelerator field.}$$

The final step in the process is an evaluation of the surface forces acting on the exterior surfaces of the body. This evaluation again involves substantial mathematical manipulations, which differ in approach according to the boundary conditions of the problem under consideration.

Once the nodal forces are obtained, direct inversion of $[K]$ either by tridiagonalization or by iterative procedures results in the nodal point displacements for the entire body.

Subsequent evaluation of the element strains from the computed nodal displacements then allows the application of the stress-strain relationships, from which the element stresses are obtained.

E. PROGRESS IN THE CODE WORK

A considerable amount of time has been spent in preparing the three-dimensional program so that it could be used at Brookhaven's CDC 6600 computer facility.

In order to indicate the magnitude of the coding work, it should be mentioned that the program consists of more than 5000 source image cards. Even with a machine having as much as 157 K octal storage, the system was insufficient. Only by utilizing the newly available Extended Core System (ECS), a recent innovation of Brookhaven's Applied Mathematics Department, was it possible to obtain a working program. Even with this innovation, however, some portions of the code had to be written in COMPASS (the internal language of Brookhaven's computer) in order to facilitate greater speed and efficiency during the execution of the program.

The program itself consists of eight overlays or separate sections incorporating nine tapes, providing the user with a great deal of latitude during its application. Thus, for instance, the program can terminate in the middle of a run and be checked for errors in mesh generation, symmetry, boundary conditions, etc. If no errors are observed, the program can be resubmitted without calculating the data previously calculated and stored on the program tapes.

As set up thus far, the program is capable of handling a variety of problems. Pressure, point loadings, and all types of mixed boundary conditions, including those due to thermal conditions can be analyzed for stresses and strains for homogeneous or heterogeneous structures.

The basic element employed in the three-dimensional finite element model is the tetrahedral solid shown in Fig. 6. It is quite obvious, however, that it would be extremely difficult to represent a continuous solid by an assemblage of individual tetrahedrons. To overcome this difficulty, the scheme shown in Fig. 7 is used. In this approach, groups of three tetrahedrons are assembled to form a single element bounded by eight planes. Thus, the basic data needed for a single element consists of six rather than four nodal points.

The displacement equations mentioned elsewhere in this report must satisfy compatibility conditions wherever adjacent tetrahedrons have common nodal points. The sequence of nodal point identification in the programs plays an important role in assuring the congruence of adjacent surfaces. The technique used in this program involves a clockwise direction in one element and a counter-clockwise direction in the adjacent element. The scheme, however, is not unique and other means that achieve the same purpose could be used also.

The first successful computer results involving a sample solution employing all of the overlays and subroutines of the program were submitted and obtained late in July. This analysis involved a large heterogeneous structure undergoing pressure and thermal loadings. In addition, the structure contained several penetrations in a parallel direction to the z axis.

The importance of this result was not in the answers obtained, but rather in the indications that all overlays, subroutines, and the various tape storage techniques of the system were functioning as intended. Unfortunately, verification of the results could not be made since no known analytical solution for this type of structure exists.

Several additional computer runs for simple plate structures undergoing various simple loading conditions were recently made. The results of these are still being evaluated at Brookhaven and by our consultants. Once these evaluations are satisfactorily completed, more complicated heterogeneous structures with and without preloads will be attempted.

Figure 8 shows the mesh structure of one of the sample problems currently being evaluated. As shown in the figure, the structure is rectangular in shape with dimensions in the x, y, and z directions equal to 287.9, 168.0, and 12 in.,

respectively. In order not to complicate the analysis it was decided to describe the structure with equal volume octahedral elements, whose nodal coordinates and sequencing scheme are shown in Tables I and II, Appendix A. With this type of geometry the designer can analyze the various effects on the system of different loadings and restraint conditions. For the problem shown in Fig. 8, a concentrated one million-lb load was applied at nodal point 143, located at the midpoint of the structure. In addition, nodal points 1 through 45 were considered fully restrained while nodal points 271 through 315 were only restrained in the z direction. Thus, the assumptions made for this problem were one edge completely restrained, one edge simply supported and the remaining two edges (along x-z planes) completely free. Strain and stress results as calculated by the code for some of the nodal points and elements shown in Fig. 8 are given in Tables III and IV of Appendix A.

As mentioned before, several computer runs for simplified structures of the type shown in Fig. 8 with various boundary conditions are currently being evaluated. At this point, it is our feeling that any discussion of the results obtained thus far would be premature. The results shown in Tables III and IV are therefore presented without comment.

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FIG. I

FIG.2

FIG.3

FIG.4

Fig. 5

FIG.6

FIG.7

Fig. 8

APPENDIX A

This Appendix consists of four tables which are reproductions of portions of the computer printout for one of the trial bridge deck runs. The geometry of the bridge deck section is shown in Fig. 8, along with the subdivision of the deck into elements for the purpose of the computer analysis. The boundary conditions are also noted in Fig. 8. The load, for this problem, was a concentrated 1,000-kip load at node 43, at the midpoint of the deck.

Table I lists the nodal points in the structure with their coordinates in the Cartesian system shown in Fig. 8.

Table II lists the elements in the structure, with the nodal point numbers for each of the six vertices of an element. The material constants "E" (Young's modulus) and "NU" (Poisson's ratio) are also given for each element. Note there should be an appropriate space between the node number "N" and the Young's modulus value in this table.

Table III gives the x, y, and z displacement components for each nodal point. The units are inches.

Table IV lists the stresses and strains for each element. The element number in the left column of the table identifies the octahedral element in the structure. The first line, for each octahedral element, gives the average stresses and strains for the element. Stress and strain components are given in the

x, y, z coordinate system of Fig. 8. Stresses are in psi; normal strains are in microinches. The three remaining lines in the entry for each octahedral element give the stresses and strains in the three tetrahedrons which make up the octahedral element. The tetrahedron sequence is IJKL, JKLM, and KLMN.

[illegible]

I-2

60	46,000	168,000	12,000	105	144,000	168,000	6,000	270	240,000	168,000	0,000
61	46,000	168,000	6,000	166	144,000	168,000	0,000	271	240,000	168,000	0,000
62	46,000	12,000	6,000	167	144,000	12,000	0,000	272	240,000	12,000	0,000
63	46,000	24,000	6,000	168	144,000	24,000	0,000	273	240,000	24,000	0,000
64	46,000	36,000	6,000	169	144,000	36,000	0,000	274	240,000	36,000	0,000
65	46,000	48,000	6,000	170	144,000	48,000	0,000	275	240,000	48,000	0,000
66	46,000	60,000	6,000	171	144,000	60,000	0,000	276	240,000	60,000	0,000
67	46,000	72,000	6,000	172	144,000	72,000	0,000	277	240,000	72,000	0,000
68	46,000	84,000	6,000	173	144,000	84,000	0,000	278	240,000	84,000	0,000
69	46,000	96,000	6,000	174	144,000	96,000	0,000	279	240,000	96,000	0,000
70	46,000	108,000	6,000	175	144,000	108,000	0,000	280	240,000	108,000	0,000
71	46,000	120,000	6,000	176	144,000	120,000	0,000	281	240,000	120,000	0,000
72	46,000	132,000	6,000	177	144,000	132,000	0,000	282	240,000	132,000	0,000
73	46,000	144,000	6,000	178	144,000	144,000	0,000	283	240,000	144,000	0,000
74	46,000	156,000	6,000	179	144,000	156,000	0,000	284	240,000	156,000	0,000
75	46,000	168,000	6,000	180	144,000	168,000	0,000	285	240,000	168,000	0,000
76	46,000	180,000	6,000	181	144,000	180,000	0,000	286	240,000	180,000	0,000
77	46,000	192,000	6,000	182	144,000	192,000	0,000	287	240,000	192,000	0,000
78	46,000	204,000	6,000	183	144,000	204,000	0,000	288	240,000	204,000	0,000
79	46,000	216,000	6,000	184	144,000	216,000	0,000	289	240,000	216,000	0,000
80	46,000	228,000	6,000	185	144,000	228,000	0,000	290	240,000	228,000	0,000
81	46,000	240,000	6,000	186	144,000	240,000	0,000	291	240,000	240,000	0,000
82	46,000	252,000	6,000	187	144,000	252,000	0,000	292	240,000	252,000	0,000
83	46,000	264,000	6,000	188	144,000	264,000	0,000	293	240,000	264,000	0,000
84	46,000	276,000	6,000	189	144,000	276,000	0,000	294	240,000	276,000	0,000
85	46,000	288,000	6,000	190	144,000	288,000	0,000	295	240,000	288,000	0,000
86	46,000	300,000	6,000	191	144,000	300,000	0,000	296	240,000	300,000	0,000
87	46,000	312,000	6,000	192	144,000	312,000	0,000	297	240,000	312,000	0,000
88	46,000	324,000	6,000	193	144,000	324,000	0,000	298	240,000	324,000	0,000
89	46,000	336,000	6,000	194	144,000	336,000	0,000	299	240,000	336,000	0,000
90	46,000	348,000	6,000	195	144,000	348,000	0,000	300	240,000	348,000	0,000
91	46,000	360,000	6,000	196	144,000	360,000	0,000	301	240,000	360,000	0,000
92	46,000	372,000	6,000	197	144,000	372,000	0,000	302	240,000	372,000	0,000
93	46,000	384,000	6,000	198	144,000	384,000	0,000	303	240,000	384,000	0,000
94	46,000	396,000	6,000	199	144,000	396,000	0,000	304	240,000	396,000	0,000
95	46,000	408,000	6,000	200	144,000	408,000	0,000	305	240,000	408,000	0,000
96	46,000	420,000	6,000	201	144,000	420,000	0,000	306	240,000	420,000	0,000
97	46,000	432,000	6,000	202	144,000	432,000	0,000	307	240,000	432,000	0,000
98	46,000	444,000	6,000	203	144,000	444,000	0,000	308	240,000	444,000	0,000
99	46,000	456,000	6,000	204	144,000	456,000	0,000	309	240,000	456,000	0,000
100	46,000	468,000	6,000	205	144,000	468,000	0,000	310	240,000	468,000	0,000
101	46,000	480,000	6,000	206	144,000	480,000	0,000	311	240,000	480,000	0,000
102	46,000	492,000	6,000	207	144,000	492,000	0,000	312	240,000	492,000	0,000
103	46,000	504,000	6,000	208	144,000	504,000	0,000	313	240,000	504,000	0,000
104	46,000	516,000	6,000	209	144,000	516,000	0,000	314	240,000	516,000	0,000
105	46,000	528,000	6,000	210	144,000	528,000	0,000	315	240,000	528,000	0,000

ELEMENT	I	J	A	M	L	N	E	NU	ELEMENT	I	J	A	M	L	N	E	NU
1	1	46	47	16	01	6230.00E+06	.300	.300	169	136	191	182	151	196	19730.00E+06	.300	
2	2	47	17	17	17	6230.00E+06	.300	.300	170	136	191	182	151	196	19730.00E+06	.300	
3	3	48	18	18	18	6230.00E+06	.300	.300	171	136	191	182	151	196	19730.00E+06	.300	
4	4	49	19	19	19	6230.00E+06	.300	.300	172	136	191	182	151	196	19730.00E+06	.300	
5	5	50	20	20	20	6230.00E+06	.300	.300	173	136	191	182	151	196	19730.00E+06	.300	
6	6	51	21	21	21	6230.00E+06	.300	.300	174	136	191	182	151	196	19730.00E+06	.300	
7	7	52	22	22	22	6230.00E+06	.300	.300	175	136	191	182	151	196	19730.00E+06	.300	
8	8	53	23	23	23	6230.00E+06	.300	.300	176	136	191	182	151	196	19730.00E+06	.300	
9	9	54	24	24	24	6230.00E+06	.300	.300	177	136	191	182	151	196	19730.00E+06	.300	
10	10	55	25	25	25	6230.00E+06	.300	.300	178	136	191	182	151	196	19730.00E+06	.300	
11	11	56	26	26	26	6230.00E+06	.300	.300	179	136	191	182	151	196	19730.00E+06	.300	
12	12	57	27	27	27	6230.00E+06	.300	.300	180	136	191	182	151	196	19730.00E+06	.300	
13	13	58	28	28	28	6230.00E+06	.300	.300	181	136	191	182	151	196	19730.00E+06	.300	
14	14	59	29	29	29	6230.00E+06	.300	.300	182	136	191	182	151	196	19730.00E+06	.300	
15	15	60	30	30	30	6230.00E+06	.300	.300	183	136	191	182	151	196	19730.00E+06	.300	
16	16	61	31	31	31	6230.00E+06	.300	.300	184	136	191	182	151	196	19730.00E+06	.300	
17	17	62	32	32	32	6230.00E+06	.300	.300	185	136	191	182	151	196	19730.00E+06	.300	
18	18	63	33	33	33	6230.00E+06	.300	.300	186	136	191	182	151	196	19730.00E+06	.300	
19	19	64	34	34	34	6230.00E+06	.300	.300	187	136	191	182	151	196	19730.00E+06	.300	
20	20	65	35	35	35	6230.00E+06	.300	.300	188	136	191	182	151	196	19730.00E+06	.300	
21	21	66	36	36	36	6230.00E+06	.300	.300	189	136	191	182	151	196	19730.00E+06	.300	
22	22	67	37	37	37	6230.00E+06	.300	.300	190	136	191	182	151	196	19730.00E+06	.300	
23	23	68	38	38	38	6230.00E+06	.300	.300	191	136	191	182	151	196	19730.00E+06	.300	
24	24	69	39	39	39	6230.00E+06	.300	.300	192	136	191	182	151	196	19730.00E+06	.300	
25	25	70	40	40	40	6230.00E+06	.300	.300	193	136	191	182	151	196	19730.00E+06	.300	
26	26	71	41	41	41	6230.00E+06	.300	.300	194	136	191	182	151	196	19730.00E+06	.300	
27	27	72	42	42	42	6230.00E+06	.300	.300	195	136	191	182	151	196	19730.00E+06	.300	
28	28	73	43	43	43	6230.00E+06	.300	.300	196	136	191	182	151	196	19730.00E+06	.300	
29	29	74	44	44	44	6230.00E+06	.300	.300	197	136	191	182	151	196	19730.00E+06	.300	
30	30	75	45	45	45	6230.00E+06	.300	.300	198	136	191	182	151	196	19730.00E+06	.300	
31	31	76	46	46	46	6230.00E+06	.300	.300	199	136	191	182	151	196	19730.00E+06	.300	
32	32	77	47	47	47	6230.00E+06	.300	.300	200	136	191	182	151	196	19730.00E+06	.300	
33	33	78	48	48	48	6230.00E+06	.300	.300	201	136	191	182	151	196	19730.00E+06	.300	
34	34	79	49	49	49	6230.00E+06	.300	.300	202	136	191	182	151	196	19730.00E+06	.300	
35	35	80	50	50	50	6230.00E+06	.300	.300	203	136	191	182	151	196	19730.00E+06	.300	
36	36	81	51	51	51	6230.00E+06	.300	.300	204	136	191	182	151	196	19730.00E+06	.300	
37	37	82	52	52	52	6230.00E+06	.300	.300	205	136	191	182	151	196	19730.00E+06	.300	
38	38	83	53	53	53	6230.00E+06	.300	.300	206	136	191	182	151	196	19730.00E+06	.300	
39	39	84	54	54	54	6230.00E+06	.300	.300	207	136	191	182	151	196	19730.00E+06	.300	
40	40	85	55	55	55	6230.00E+06	.300	.300	208	136	191	182	151	196	19730.00E+06	.300	
41	41	86	56	56	56	6230.00E+06	.300	.300	209	136	191	182	151	196	19730.00E+06	.300	
42	42	87	57	57	57	6230.00E+06	.300	.300	210	136	191	182	151	196	19730.00E+06	.300	
43	43	88	58	58	58	6230.00E+06	.300	.300	211	136	191	182	151	196	19730.00E+06	.300	
44	44	89	59	59	59	6230.00E+06	.300	.300	212	136	191	182	151	196	19730.00E+06	.300	
45	45	90	60	60	60	6230.00E+06	.300	.300	213	136	191	182	151	196	19730.00E+06	.300	
46	46	91	61	61	61	6230.00E+06	.300	.300	214	136	191	182	151	196	19730.00E+06	.300	
47	47	92	62	62	62	6230.00E+06	.300	.300	215	136	191	182	151	196	19730.00E+06	.300	
48	48	93	63	63	63	6230.00E+06	.300	.300	216	136	191	182	151	196	19730.00E+06	.300	
49	49	94	64	64	64	6230.00E+06	.300	.300	217	136	191	182	151	196	19730.00E+06	.300	
50	50	95	65	65	65	6230.00E+06	.300	.300	218	136	191	182	151	196	19730.00E+06	.300	
51	51	96	66	66	66	6230.00E+06	.300	.300	219	136	191	182	151	196	19730.00E+06	.300	
52	52	97	67	67	67	6230.00E+06	.300	.300	220	136	191	182	151	196	19730.00E+06	.300	
53	53	98	68	68	68	6230.00E+06	.300	.300	221	136	191	182	151	196	19730.00E+06	.300	
54	54	99	69	69	69	6230.00E+06	.300	.300	222	136	191	182	151	196	19730.00E+06	.300	
55	55	100	70	70	70	6230.00E+06	.300	.300	223	136	191	182	151	196	19730.00E+06	.300	
56	56	101	71	71	71	6230.00E+06	.300	.300	224	136	191	182	151	196	19730.00E+06	.300	
57	57	102	72	72	72	6230.00E+06	.300	.300	225	136	191	182	151	196	19730.00E+06	.300	
58	58	103	73	73	73	6230.00E+06	.300	.300	226	136	191	182	151	196	19730.00E+06	.300	
59	59	104	74	74	74	6230.00E+06	.300	.300	227	136	191	182	151	196	19730.00E+06	.300	
60	60	105	75	75	75	6230.00E+06	.300	.300	228	136	191	182	151	196	19730.00E+06	.300	
61	61	106	76	76	76	6230.00E+06	.300	.300	229	136	191	182	151	196	19730.00E+06	.300	
62	62	107	77	77	77	6230.00E+06	.300	.300	230	136	191	182	151	196	19730.00E+06	.300	
63	63	108	78	78	78	6230.00E+06	.300	.300	231	136	191	182	151	196	19730.00E+06	.300	
64	64	109	79	79	79	6230.00E+06	.300	.300	232	136	191	182	151	196	19730.00E+06	.300	
65	65	110	80	80	80	6230.00E+06	.300	.300	233	136	191	182	151	196	19730.00E+06	.300	
66	66	111	81	81	81	6230.00E+06	.300	.300	234	136	191	182	151	196	19730.00E+06	.300	
67	67	112	82	82	82	6230.00E+06	.300	.300	235	136	191	182	151	196	19730.00E+06	.300	
68	68	113	83	83	83	6230.00E+06	.300	.300	236	136	191	182	151	196	19730.00E+06	.300	
69	69	114	84	84	84	6230.00E+06	.300	.300	237	136	191	182	151	196	19730.00E+06	.300	
70	70	115	85	85	85	6230.00E+06	.300	.300	238	136	191	182	151	196	19730.00E+06	.300	
71	71	116	86	86	86	6230.00E+06	.300	.300	239	136	191	182	151	196	19730.00E+06	.300	
72	72	117	87	87	87	6230.00E+06	.300	.300	240	136	191	182	151	196	19730.00E+06	.300	
73	73	118	88	88	88	6230.00E+06	.300	.300	241	136	191	182	151	196	19730.00E+06	.300	
74	74	119	89	89	89	6230.00E+06	.300	.300	242	136	191	182	151	196	19730.00E+06	.300	
75	75	120	90	90	90	6230.00E+06	.300	.300	243	136	191	182	151	196	19730.00E+06	.300	
76	76	121	91	91	91	6230.00E+06	.300	.300	244	136	191	182	151	196	19730.00E+06	.300	
77	77	122	92	92	92	6230.00E+06	.300	.300	245	136	191	182	151	196	19730.00E+06	.300	
78	78	123	93	93	93	6230.00E+06	.300	.300	246	136	191	182	151	196	19730.00E+06	.300	
79	79	124	94	94	94	6230.00E+06	.300	.300	247	136	191	182	151	196	19730.00E+06	.300	
80	80	125	95	95	95	6230.00E+06	.300	.300	248	136	191	182	151	196	19730.00E+06		

00	48	03	47	63	108	6230.00E+06	.500	228	183	328	182	198	243	19730.00E+06	.500
01	49	04	48	64	109	10930.00E+06	.500	229	185	329	229	199	243	24430.00E+06	.500
02	50	05	49	65	110	10930.00E+06	.500	230	185	330	229	199	199	24430.00E+06	.500
03	51	06	50	66	111	10930.00E+06	.500	231	231	331	229	245	199	24430.00E+06	.500
04	52	07	51	67	112	10930.00E+06	.500	232	232	332	185	245	199	24430.00E+06	.500
05	53	08	52	68	113	10930.00E+06	.500	233	233	333	185	245	246	20030.00E+06	.500
06	54	09	53	69	114	10930.00E+06	.500	234	234	334	185	245	246	20030.00E+06	.500
07	55	10	54	70	115	10930.00E+06	.500	235	235	335	185	245	246	20030.00E+06	.500
08	56	11	55	71	116	10930.00E+06	.500	236	236	336	185	245	246	20030.00E+06	.500
09	57	12	56	72	117	10930.00E+06	.500	237	237	337	232	201	246	20030.00E+06	.500
10	58	13	57	73	118	10930.00E+06	.500	238	238	338	232	201	246	20030.00E+06	.500
11	59	14	58	74	119	10930.00E+06	.500	239	239	339	186	248	202	24730.00E+06	.500
12	60	15	59	75	120	10930.00E+06	.500	240	240	340	186	248	202	24730.00E+06	.500
13	61	16	60	76	121	10930.00E+06	.500	241	241	341	186	248	202	24730.00E+06	.500
14	62	17	61	77	122	10930.00E+06	.500	242	242	342	186	248	202	24730.00E+06	.500
15	63	18	62	78	123	10930.00E+06	.500	243	243	343	186	248	202	24730.00E+06	.500
16	64	19	63	79	124	10930.00E+06	.500	244	244	344	186	248	202	24730.00E+06	.500
17	65	20	64	80	125	10930.00E+06	.500	245	245	345	186	248	202	24730.00E+06	.500
18	66	21	65	81	126	10930.00E+06	.500	246	246	346	186	248	202	24730.00E+06	.500
19	67	22	66	82	127	10930.00E+06	.500	247	247	347	186	248	202	24730.00E+06	.500
20	68	23	67	83	128	10930.00E+06	.500	248	248	348	186	248	202	24730.00E+06	.500
21	69	24	68	84	129	10930.00E+06	.500	249	249	349	186	248	202	24730.00E+06	.500
22	70	25	69	85	130	10930.00E+06	.500	250	250	350	186	248	202	24730.00E+06	.500
23	71	26	70	86	131	10930.00E+06	.500	251	251	351	186	248	202	24730.00E+06	.500
24	72	27	71	87	132	10930.00E+06	.500	252	252	352	186	248	202	24730.00E+06	.500
25	73	28	72	88	133	10930.00E+06	.500	253	253	353	186	248	202	24730.00E+06	.500
26	74	29	73	89	134	10930.00E+06	.500	254	254	354	186	248	202	24730.00E+06	.500
27	75	30	74	90	135	10930.00E+06	.500	255	255	355	186	248	202	24730.00E+06	.500
28	76	31	75	91	136	10930.00E+06	.500	256	256	356	186	248	202	24730.00E+06	.500
29	77	32	76	92	137	10930.00E+06	.500	257	257	357	186	248	202	24730.00E+06	.500
30	78	33	77	93	138	10930.00E+06	.500	258	258	358	186	248	202	24730.00E+06	.500
31	79	34	78	94	139	10930.00E+06	.500	259	259	359	186	248	202	24730.00E+06	.500
32	80	35	79	95	140	10930.00E+06	.500	260	260	360	186	248	202	24730.00E+06	.500
33	81	36	80	96	141	10930.00E+06	.500	261	261	361	186	248	202	24730.00E+06	.500
34	82	37	81	97	142	10930.00E+06	.500	262	262	362	186	248	202	24730.00E+06	.500
35	83	38	82	98	143	10930.00E+06	.500	263	263	363	186	248	202	24730.00E+06	.500
36	84	39	83	99	144	10930.00E+06	.500	264	264	364	186	248	202	24730.00E+06	.500
37	85	40	84	00	145	10930.00E+06	.500	265	265	365	186	248	202	24730.00E+06	.500
38	86	41	85	01	146	10930.00E+06	.500	266	266	366	186	248	202	24730.00E+06	.500
39	87	42	86	02	147	10930.00E+06	.500	267	267	367	186	248	202	24730.00E+06	.500
40	88	43	87	03	148	10930.00E+06	.500	268	268	368	186	248	202	24730.00E+06	.500
41	89	44	88	04	149	10930.00E+06	.500	269	269	369	186	248	202	24730.00E+06	.500
42	90	45	89	05	150	10930.00E+06	.500	270	270	370	186	248	202	24730.00E+06	.500
43	91	46	90	06	151	10930.00E+06	.500	271	271	371	186	248	202	24730.00E+06	.500
44	92	47	91	07	152	10930.00E+06	.500	272	272	372	186	248	202	24730.00E+06	.500
45	93	48	92	08	153	10930.00E+06	.500	273	273	373	186	248	202	24730.00E+06	.500
46	94	49	93	09	154	10930.00E+06	.500	274	274	374	186	248	202	24730.00E+06	.500
47	95	50	94	10	155	10930.00E+06	.500	275	275	375	186	248	202	24730.00E+06	.500
48	96	51	95	11	156	10930.00E+06	.500	276	276	376	186	248	202	24730.00E+06	.500
49	97	52	96	12	157	10930.00E+06	.500	277	277	377	186	248	202	24730.00E+06	.500
50	98	53	97	13	158	10930.00E+06	.500	278	278	378	186	248	202	24730.00E+06	.500
51	99	54	98	14	159	10930.00E+06	.500	279	279	379	186	248	202	24730.00E+06	.500
52	00	55	99	15	160	10930.00E+06	.500	280	280	380	186	248	202	24730.00E+06	.500
53	01	56	00	16	161	10930.00E+06	.500	281	281	381	186	248	202	24730.00E+06	.500
54	02	57	01	17	162	10930.00E+06	.500	282	282	382	186	248	202	24730.00E+06	.500
55	03	58	02	18	163	10930.00E+06	.500	283	283	383	186	248	202	24730.00E+06	.500
56	04	59	03	19	164	10930.00E+06	.500	284	284	384	186	248	202	24730.00E+06	.500
57	05	60	04	20	165	10930.00E+06	.500	285	285	385	186	248	202	24730.00E+06	.500
58	06	61	05	21	166	10930.00E+06	.500	286	286	386	186	248	202	24730.00E+06	.500
59	07	62	06	22	167	10930.00E+06	.500	287	287	387	186	248	202	24730.00E+06	.500
60	08	63	07	23	168	10930.00E+06	.500	288	288	388	186	248	202	24730.00E+06	.500
61	09	64	08	24	169	10930.00E+06	.500	289	289	389	186	248	202	24730.00E+06	.500
62	10	65	09	25	170	10930.00E+06	.500	290	290	390	186	248	202	24730.00E+06	.500
63	11	66	10	26	171	10930.00E+06	.500	291	291	391	186	248	202	24730.00E+06	.500
64	12	67	11	27	172	10930.00E+06	.500	292	292	392	186	248	202	24730.00E+06	.500
65	13	68	12	28	173	10930.00E+06	.500	293	293	393	186	248	202	24730.00E+06	.500
66	14	69	13	29	174	10930.00E+06	.500	294	294	394	186	248	202	24730.00E+06	.500
67	15	70	14	30	175	10930.00E+06	.500	295	295	395	186	248	202	24730.00E+06	.500
68	16	71	15	31	176	10930.00E+06	.500	296	296	396	186	248	202	24730.00E+06	.500
69	17	72	16	32	177	10930.00E+06	.500	297	297	397	186	248	202	24730.00E+06	.500
70	18	73	17	33	178	10930.00E+06	.500	298	298	398	186	248	202	24730.00E+06	.500
71	19	74	18	34	179	10930.00E+06	.500	299	299	399	186	248	202	24730.00E+06	.500
72	20	75	19	35	180	10930.00E+06	.500	300	300	400	186	248	202	24730.00E+06	.500
73	21	76	20	36	181	10930.00E+06	.500	301	301	401	186	248	202	24730.00E+06	.500
74	22	77	21	37	182	10930.00E+06	.500	302	302	402	186	248	202	24730.00E+06	.500
75	23	78	22	38	183	10930.00E+06	.500	303	303	403	186	248	202	24730.00E+06	.500
76	24	79	23	39	184	10930.00E+06	.500	304	304	404	186	248	202	24730.00E+06	.500
77	25	80	24	40	185	10930.00E+06	.500	305	305	405	186	248	202	24730.00E+06	.500
78	26	81	25	41	186	10930.00E+06	.500	306	306	406	186	248	202	24730.00E+06	.500
79	27	82	26	42	187	10930.00E+06	.500	307	307	407	186	248	202	24730.00E+06	.500
80	28	83	27	43	188	10930.00E+06	.500	308	308	408	186	248	202	24730.00E+06	.500
81	29	84	28	44	189	10930.00E+06	.500	309	309	409	186	248	202	24730.00E+06	.500
82	30	85	29	45	190	10930.00E+06	.500	310	310	410	186	248	202	24730.00E+06	.500
83	31	86	30	46	191	10930.00E+06	.500	311	311	411	186	248	202	24730.00E+06	.500
84	32	87	31	47	192	10930.00E+06	.500	312	312	412	186	248	202	24730.00E+06	.500
85	33	88	32	48	193	10930.00E+0									

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122	95	06	141	130	121	1630.00E+06	.300	290	230	221	276	295	246	2930.00E+06	.300
123	107	76	141	137	121	1630.00E+06	.300	291	277	231	276	292	246	2930.00E+06	.300
124	142	06	147	157	121	1630.00E+06	.300	292	277	231	232	292	246	24730.00E+06	.300
125	143	143	147	157	154	11230.00E+06	.300	293	277	278	232	282	293	24730.00E+06	.300
126	98	143	27	117	154	11230.00E+06	.300	294	277	278	232	240	293	24730.00E+06	.300
127	98	143	144	113	154	1630.00E+06	.300	295	233	276	279	298	293	29730.00E+06	.300
128	98	143	144	113	154	1630.00E+06	.300	296	233	234	279	298	249	29730.00E+06	.300
129	145	09	144	107	114	1630.00E+06	.300	297	290	234	279	295	249	29730.00E+06	.300
130	145	09	144	107	114	1630.00E+06	.300	298	290	234	279	295	249	29730.00E+06	.300
131	145	146	170	106	114	1630.00E+06	.300	299	290	281	235	295	296	29730.00E+06	.300
132	101	146	140	116	161	11230.00E+06	.300	300	236	281	235	251	296	29730.00E+06	.300
133	101	146	147	116	161	1630.00E+06	.300	301	236	281	232	251	296	29730.00E+06	.300
134	101	102	147	116	117	1630.00E+06	.300	302	236	287	232	251	252	29730.00E+06	.300
135	148	102	147	103	117	1630.00E+06	.300	303	283	237	232	298	252	29730.00E+06	.300
136	148	102	145	103	117	11030.00E+06	.300	304	283	237	232	298	252	29730.00E+06	.300
137	148	149	143	103	104	11030.00E+06	.300	305	283	284	238	298	252	29730.00E+06	.300
138	148	149	143	110	164	11030.00E+06	.300	306	283	284	238	298	252	29730.00E+06	.300
139	174	149	150	120	164	11030.00E+06	.300	307	239	284	238	294	299	29730.00E+06	.300
140	151	152	140	110	129	1630.00E+06	.300	308	239	284	235	254	299	29730.00E+06	.300
141	152	152	140	105	167	12130.00E+06	.300	309	286	287	231	301	255	30030.00E+06	.300
142	107	152	140	120	167	12130.00E+06	.300	310	286	287	231	301	302	29630.00E+06	.300
143	107	152	140	120	167	12130.00E+06	.300	311	242	287	231	297	302	29630.00E+06	.300
144	107	152	140	120	167	12130.00E+06	.300	312	242	287	231	297	302	29630.00E+06	.300
145	154	154	143	100	123	16030.00E+06	.300	313	242	243	288	297	258	30330.00E+06	.300
146	154	155	143	100	123	16030.00E+06	.300	314	289	243	288	304	258	30330.00E+06	.300
147	154	155	143	100	123	16030.00E+06	.300	315	289	243	288	304	258	30330.00E+06	.300
148	144	155	143	100	174	1630.00E+06	.300	316	245	290	244	304	305	29730.00E+06	.300
149	144	155	143	100	174	1630.00E+06	.300	317	245	290	244	304	305	29730.00E+06	.300
150	144	155	143	100	174	1630.00E+06	.300	318	245	290	244	304	305	29730.00E+06	.300
151	157	111	150	125	124	17130.00E+06	.300	319	245	290	244	304	305	29730.00E+06	.300
152	157	111	150	125	124	17130.00E+06	.300	320	292	246	231	260	305	29730.00E+06	.300
153	157	154	142	172	126	17230.00E+06	.300	321	292	246	231	260	305	29730.00E+06	.300
154	113	154	142	172	173	12230.00E+06	.300	322	292	293	237	307	308	29730.00E+06	.300
155	143	154	142	172	173	12230.00E+06	.300	323	248	293	237	307	308	29730.00E+06	.300
156	123	114	149	128	173	17430.00E+06	.300	324	248	249	234	263	264	30930.00E+06	.300
157	100	114	149	125	129	17430.00E+06	.300	325	285	249	234	263	264	30930.00E+06	.300
158	100	114	145	125	129	17430.00E+06	.300	326	285	249	234	263	264	30930.00E+06	.300
159	100	162	145	125	129	13030.00E+06	.300	327	285	249	234	263	264	30930.00E+06	.300
160	144	161	145	125	174	13030.00E+06	.300	328	285	249	234	263	264	30930.00E+06	.300
161	144	141	142	131	174	17730.00E+06	.300	329	251	296	238	266	311	29730.00E+06	.300
162	144	141	142	131	174	17730.00E+06	.300	330	251	296	238	266	311	29730.00E+06	.300
163	107	142	142	178	132	17730.00E+06	.300	331	251	296	238	266	311	29730.00E+06	.300
164	107	142	142	178	132	17730.00E+06	.300	332	251	296	238	266	311	29730.00E+06	.300
165	107	142	142	178	132	17730.00E+06	.300	333	251	296	238	266	311	29730.00E+06	.300
166	107	142	142	178	132	17730.00E+06	.300	334	251	296	238	266	311	29730.00E+06	.300
167	107	142	142	178	132	17730.00E+06	.300	335	251	296	238	266	311	29730.00E+06	.300
168	107	142	142	178	132	17730.00E+06	.300	336	251	296	238	266	311	29730.00E+06	.300
169	107	142	142	178	132	17730.00E+06	.300	337	251	296	238	266	311	29730.00E+06	.300
170	107	142	142	178	132	17730.00E+06	.300	338	251	296	238	266	311	29730.00E+06	.300
171	107	142	142	178	132	17730.00E+06	.300	339	251	296	238	266	311	29730.00E+06	.300
172	107	142	142	178	132	17730.00E+06	.300	340	251	296	238	266	311	29730.00E+06	.300
173	107	142	142	178	132	17730.00E+06	.300	341	251	296	238	266	311	29730.00E+06	.300
174	107	142	142	178	132	17730.00E+06	.300	342	251	296	238	266	311	29730.00E+06	.300
175	107	142	142	178	132	17730.00E+06	.300	343	251	296	238	266	311	29730.00E+06	.300
176	107	142	142	178	132	17730.00E+06	.300	344	251	296	238	266	311	29730.00E+06	.300
177	107	142	142	178	132	17730.00E+06	.300	345	251	296	238	266	311	29730.00E+06	.300
178	107	142	142	178	132	17730.00E+06	.300	346	251	296	238	266	311	29730.00E+06	.300
179	107	142	142	178	132	17730.00E+06	.300	347	251	296	238	266	311	29730.00E+06	.300
180	107	142	142	178	132	17730.00E+06	.300	348	251	296	238	266	311	29730.00E+06	.300
181	107	142	142	178	132	17730.00E+06	.300	349	251	296	238	266	311	29730.00E+06	.300
182	107	142	142	178	132	17730.00E+06	.300	350	251	296	238	266	311	29730.00E+06	.300
183	107	142	142	178	132	17730.00E+06	.300	351	251	296	238	266	311	29730.00E+06	.300
184	107	142	142	178	132	17730.00E+06	.300	352	251	296	238	266	311	29730.00E+06	.300
185	107	142	142	178	132	17730.00E+06	.300	353	251	296	238	266	311	29730.00E+06	.300
186	107	142	142	178	132	17730.00E+06	.300	354	251	296	238	266	311	29730.00E+06	.300
187	107	142	142	178	132	17730.00E+06	.300	355	251	296	238	266	311	29730.00E+06	.300
188	107	142	142	178	132	17730.00E+06	.300	356	251	296	238	266	311	29730.00E+06	.300
189	107	142	142	178	132	17730.00E+06	.300	357	251	296	238	266	311	29730.00E+06	.300
190	107	142	142	178	132	17730.00E+06	.300	358	251	296	238	266	311	29730.00E+06	.300
191	107	142	142	178	132	17730.00E+06	.300	359	251	296	238	266	311	29730.00E+06	.300
192	107	142	142	178	132	17730.00E+06	.300	360	251	296	238	266	311	29730.00E+06	.300
193	107	142	142	178	132	17730.00E+06	.300	361	251	296	238	266	311	29730.00E+06	.300
194	107	142	142	178	132	17730.00E+06	.300	362	251	296	238	266	311	29730.00E+06	.300
195	107	142	142	178	132	17730.00E+06	.300	363	251	296	238	266	311	29730.00E+06	.300
196	107	142	142	178	132	17730.00E+06	.300	364	251	296	238	266	311	29730.00E+06	.300
197	107	142	142	178	132	17730.00E+06	.300	365	251	296	238	266	311	29730.00E+06	.300
198	107	142	142	178	132	17730.00E+06	.300	366	251	296	238	266	311	29730.00E+06	.300
199	107	142	142	178	132	17730.00E+06	.300	367	251	296	238	266	311	29730.00E+06	.300
200	107	142	142	178	132	17730.00E+06	.300	368	251	296	238	266	311	29730.00E+06	.300

HURAN

III - 1

... DISPLACEMENT COMPONENTS ...

... DISPLACEMENT COMPONENTS OF THE SEGMENT 1 ...

NO. OF POINTS	U-COMPONENT	V-COMPONENT	W-COMPONENT
1	0.	0.	0.
2	0.	0.	0.
3	0.	0.	0.
4	0.	0.	0.
5	0.	0.	0.
6	0.	0.	0.
7	0.	0.	0.
8	0.	0.	0.
9	0.	0.	0.
10	0.	0.	0.
11	0.	0.	0.
12	0.	0.	0.
13	0.	0.	0.
14	0.	0.	0.
15	0.	0.	0.
16	0.	0.	0.
17	0.	0.	0.
18	0.	0.	0.
19	0.	0.	0.
20	0.	0.	0.
21	0.	0.	0.
22	0.	0.	0.
23	0.	0.	0.
24	0.	0.	0.
25	0.	0.	0.
26	0.	0.	0.
27	0.	0.	0.
28	0.	0.	0.
29	0.	0.	0.
30	0.	0.	0.
31	0.	0.	0.
32	0.	0.	0.
33	0.	0.	0.
34	0.	0.	0.
35	0.	0.	0.
36	0.	0.	0.
37	0.	0.	0.
38	0.	0.	0.
39	0.	0.	0.
40	0.	0.	0.
41	0.	0.	0.
42	0.	0.	0.
43	0.	0.	0.
44	0.	0.	0.
45	0.	0.	0.

*** ISPLACEMENT COMPONENTS OF THE SEGMENT 2 ***

NO	COMPONENT	V-COMPONENT	W-COMPONENT
44	45.9067847E-05	14.0318440E-05	-11.726446E-04
45	45.5302020E-05	12.0432301E-05	-13.6481409E-04
46	45.6544641E-05	12.4422857E-05	-15.7865336E-04
47	45.3180212E-05	11.4940104E-05	-17.825437E-04
48	45.3003530E-05	11.7073484E-05	-20.2610640E-04
49	45.0224220E-05	11.4933150E-05	-22.929729E-04
50	45.1011742E-05	-11.101779E-05	-25.425392E-04
51	45.8162343E-05	-81.158748E-05	-28.653013E-04
52	45.7282743E-05	-12.017516E-05	-30.7348407E-04
53	45.3183771E-05	-11.490304E-05	-32.0371410E-04
54	45.6361644E-05	-11.140407E-05	-33.2121250E-04
55	45.9492714E-05	-11.124426E-05	-34.2448162E-04
56	45.3401111E-05	-9.1405936E-05	-35.0779216E-04
57	45.1197710E-05	-71.210179E-05	-36.373511E-04
58	45.9225545E-05	-65.2900061E-05	-38.3240831E-04
59	45.9324745E-05	15.7511331E-05	-41.8012594E-04
60	45.1064412E-05	14.7543711E-05	-43.0991507E-04
61	45.3423153E-05	13.1999590E-05	-45.6922286E-04
62	45.2185242E-05	71.438948E-05	-47.8592254E-04
63	45.4760845E-05	61.514970E-05	-50.309055E-04
64	45.3125644E-05	-10.227641E-05	-52.449923E-04
65	45.3201143E-05	-27.4897420E-05	-53.451310E-04
66	45.5356142E-05	-12.414113E-05	-54.656713E-04
67	45.5023145E-05	-77.9508291E-05	-58.5744411E-04
68	45.3621043E-05	-74.3310711E-05	-61.532257E-04
69	45.9417511E-05	-78.092210E-05	-65.236731E-04
70	45.7343007E-05	-81.348077E-05	-68.084782E-04
71	45.4795125E-05	-72.407443E-05	-70.5987710E-04
72	45.822444E-05	-11.4095472E-05	-73.301239E-04
73	45.2354952E-05	-10.1242574E-05	-75.657350E-04
74	45.1439574E-05	-10.080840E-05	-78.117028E-04
75	45.733706E-05	-39.206463E-05	-81.370201E-04
76	45.534515E-05	-9.0741452E-05	-83.982015E-04
77	45.1137371E-05	-12.1046371E-05	-86.611730E-04
78	45.345114E-05	-11.712014E-05	-89.4242140E-04
79	45.304790E-05	-22.846972E-05	-92.433927E-04
80	45.0475321E-05	-26.451820E-05	-95.4518170E-04
81	45.7322801E-05	15.911795E-05	-98.7646513E-04
82	45.6192244E-05	12.487802E-05	-101.50953E-04
83	45.7105515E-05	11.4036081E-05	-104.611456E-04
84	45.6025738E-05	39.493189E-05	-107.5718274E-04
85	45.0225977E-05	78.470182E-05	-110.113940E-04
86	45.0534291E-05	57.031329E-05	-112.594066E-04
87	45.6410612E-05	41.5848474E-05	-114.614753E-04

III-3

*** DISPLACEMENT COMPONENTS OF THE SEGMENT 3 ***

NO. OF P.A.	U-COMPONENT	V-COMPONENT	W-COMPONENT
91	35.0471591E-05	93.5359921E-06	-85.4971492E-04
92	48.8342990E-05	11.6052872E-05	-98.7421070E-04
93	47.6902845E-05	14.5636134E-05	-92.8798068E-04
94	51.8203759E-05	21.2256147E-05	-98.1521237E-04
95	42.6415743E-05	23.2269574E-05	-10.4136983E-03
96	64.0032636E-05	19.7438873E-05	11.428621E-03
97	60.5523547E-05	77.7418327E-06	-11.553377E-03
98	90.5397505E-05	-14.9500074E-05	-11.4926327E-03
99	72.8910717E-05	-31.4848234E-05	-13.0974624E-03
100	58.124003E-05	-36.0763754E-05	-10.4523150E-03
101	49.2497638E-05	-39.9386434E-05	-97.681057E-04
102	42.2732813E-05	-38.9708764E-05	-91.4594526E-04
103	59.5924245E-05	-27.9218024E-05	-86.4230213E-04
104	62.9496624E-05	-24.4670321E-05	-82.4861750E-04
105	54.2459200E-05	-20.9239414E-05	-75.3174310E-04
106	-12.2624504E-05	-72.6799261E-06	-65.4456443E-04
107	-58.4430718E-06	-64.3872334E-06	-88.7995926E-04
108	-58.0242041E-06	-59.1788334E-06	-92.8929793E-04
109	-58.9513528E-06	-69.3259290E-06	-99.1421553E-04
110	90.6510370E-06	-65.6091850E-06	-16.4294689E-03
111	-25.9149459E-06	-70.1799594E-06	-11.685324E-03
112	-56.0049207E-06	-50.4720440E-06	-11.5402547E-03
113	17.8353747E-06	-29.8677412E-06	-11.5539034E-03
114	14.1935942E-06	-53.5927214E-06	-11.1123679E-03
115	-14.3532249E-06	-53.5316504E-06	-10.4533815E-03
116	47.2305916E-06	-64.4132602E-06	-97.7341904E-04
117	74.0945344E-06	-61.1722004E-06	-91.5439027E-04
118	78.6257132E-06	-74.5777180E-06	-84.4543118E-04
119	44.5262443E-06	-92.7609081E-06	-82.5865504E-04
120	20.9411620E-06	-92.7453657E-06	-74.4272625E-04
121	-99.9495945E-05	-24.5251494E-05	-83.2753149E-04
122	-57.9573057E-05	-25.5823444E-05	-88.7968095E-04
123	-59.0456465E-05	-30.6163352E-05	-92.6789784E-04
124	-63.6495379E-05	-34.1746443E-05	-98.671723E-04
125	-62.1133564E-05	-34.4842704E-05	-10.4313276E-03
126	-58.7491088E-05	-34.1218954E-05	-11.620249E-03
127	-80.2590533E-05	-19.9858081E-05	-11.4712754E-03
128	-75.5570162E-05	82.7582920E-06	-11.5568456E-03
129	-73.0734472E-05	20.1833940E-05	-11.0963545E-03
130	-21.3443434E-05	25.2492734E-05	-16.4400729E-03
131	-59.7443511E-05	27.4325181E-05	-97.7588508E-04
132	-52.80177849E-05	14.252960E-05	-91.6411566E-04
133	-54.0736582E-05	12.1393442E-05	-86.5832818E-04
134	-46.0421663E-05	54.4339424E-06	-82.539473E-04
135	-46.1455855E-05	22.4806903E-06	-79.6624374E-04

*** DISPLACEMENT COMPONENTS OF THE SEGMENT ***

III-4

NORMAL PT.	W-COMPONENT	V-COMPONENT	M-COMPONENT
134	17.212794E-06	64.4067394E-04	-11.8696517E-03
135	18.9213627E-06	10.1398308E-05	-12.2809563E-03
136	16.475255E-05	14.2166335E-05	-12.8256120E-03
137	11.312208E-05	23.1248090E-05	-13.5673991E-03
138	99.411970E-06	33.4274461E-05	-14.5730898E-03
139	11.1333345E-05	34.1990474E-05	-15.1298102E-03
140	13.1167441E-05	20.6934781E-05	-16.8977826E-03
141	16.1337406E-05	84.3994514E-04	-18.2864138E-03
142	19.935387E-05	34.1918461E-05	-17.0169478E-03
143	22.662632E-05	50.8096400E-05	-15.6773334E-03
144	20.933475E-05	47.372334E-05	-14.445415E-03
145	21.480782E-05	44.3628334E-05	-13.909959E-03
146	22.277287E-05	39.067939E-05	-12.6758829E-03
147	21.3752307E-05	29.7844255E-05	-12.0825293E-03
148	20.382880E-05	27.3949073E-05	-11.6703730E-03
149	28.740273E-06	11.303307E-05	-11.865644E-03
150	17.831065E-06	10.406677E-05	-12.277235E-03
151	17.0825231E-07	12.2521024E-05	-12.8707500E-03
152	66.4279083E-07	11.3665200E-05	-13.5775140E-03
153	39.135730E-07	97.4846128E-04	-14.5587625E-03
154	48.137147E-07	10.4013312E-05	-15.7233164E-03
155	16.941805E-06	85.9703333E-04	-16.9793242E-03
156	52.5442541E-07	84.7833184E-06	-18.44562E-03
157	19.155037E-06	49.309900E-04	-18.9973843E-03
158	15.4331244E-07	44.4068589E-04	-15.777106E-03
159	16.897846E-06	75.0375704E-04	-14.5224731E-03
160	33.5395742E-06	10.1567592E-05	-13.4946296E-03
161	27.426683E-06	80.2827171E-04	-12.5908455E-03
162	30.585236E-06	92.9592303E-04	-12.015073E-03
163	15.933506E-06	28.8784424E-05	-11.6727031E-03
164	12.307402E-05	31.104894E-05	-11.8649173E-03
165	11.9325342E-05	40.642778E-05	-12.600122E-03
166	10.566716E-05	47.3861981E-05	-12.8051296E-03
167	10.699643E-05	50.795539E-05	-13.5740506E-03
168	13.1310411E-05	55.4320037E-05	-14.523880E-03
169	10.392595E-05	42.163359E-05	-15.4750594E-03
170	14.910298E-05	94.2095203E-05	-16.363266E-03
171	19.259440E-05	37.939747E-05	-17.3207868E-03
172	18.6961917E-05	40.0420341E-05	-16.9027897E-03
173	19.203200E-05	38.680914E-05	-17.2354642E-03
174	18.207568E-05	36.4588216E-05	-14.5367839E-03
175	15.524562E-05	18.489800E-05	-13.4846631E-03
176	15.827620E-05	13.262803E-05	-12.9957166E-03
177	22.7505301E-05	97.4841454E-04	-12.1862803E-03
178			-11.6003552E-03

*** DISPLACEMENT COMPONENTS OF THE SEGMENT ***

NODAL PT.	U-COMPONENT	V-COMPONENT	W-COMPONENT
181	35.2184805E-03	30.0935004E-07	-10.7129000E-03
182	30.2066130E-03	21.0638071E-06	-10.9917900E-03
183	34.4352212E-03	85.3654557E-06	-11.3685003E-03
184	37.1515182E-03	35.8990822E-03	-11.0971003E-03
185	39.7329771E-03	1A.7602474E-03	-12.5341265E-03
186	37.4805816E-03	21.2548473E-03	-13.2808501E-03
187	38.0375906E-03	1A.1244955E-03	-13.0959210E-03
188	39.9700609E-03	1A.7214082E-06	-14.3080330E-03
189	33.5033762E-03	-23.0150800E-08	-14.2123362E-03
190	35.5384498E-03	-36.3399685E-03	-13.7789990E-03
191	38.3339615E-03	-01.1208010E-03	-13.0905755E-03
192	36.7391878E-03	-39.4602987E-03	-12.1981339E-03
193	36.1201806E-03	-37.4247907E-03	-11.0443970E-03
194	33.6303475E-03	-30.9262830E-03	-11.2314958E-03
195	29.8245608E-03	-29.0551444E-03	-10.0179800E-03
196	77.0315524E-06	-21.5402041E-03	-10.8974511E-03
197	78.8543145E-06	-12.9553591E-03	-10.9655784E-03
198	44.5841431E-06	-12.3113353E-03	-11.1768320E-03
199	39.7571715E-06	-10.0576305E-03	-11.0940310E-03
200	55.4388560E-06	-21.5026210E-03	-12.2700351E-03
201	26.4819239E-06	-10.2779104E-03	-13.2366307E-03
202	34.7056382E-06	-10.2895179E-03	-13.0210950E-03
203	45.1602280E-06	-03.0635978E-06	-14.3723046E-03
204	14.4343281E-06	-04.9358314E-06	-14.2887913E-03
205	14.0676213E-06	-76.3955335E-04	-13.7879685E-03
206	26.0380025E-06	-01.0098099E-04	-13.0957070E-03
207	75.8233609E-07	-95.5709058E-04	-12.4129800E-03
208	17.0408250E-06	-80.8437197E-04	-11.0150390E-03
209	12.4378010E-06	-99.1005947E-06	-11.2321078E-03
210	11.5823079E-06	-18.5944273E-03	-10.5448395E-03
211	40.0674000E-05	-23.1246071E-03	-10.0713730E-03
212	44.3036479E-05	-28.1562327E-03	-10.9672070E-03
213	43.2702315E-05	-32.0016974E-03	-11.3744395E-03
214	44.9772500E-05	-35.0021094E-03	-11.0803006E-03
215	50.8064103E-05	-42.0345044E-03	-12.5899465E-03
216	52.5986356E-05	-42.6679808E-03	-13.52301940E-03
217	70.7193005E-05	-37.1693099E-03	-13.0027513E-03
218	43.0606014E-05	-19.4616331E-03	-14.2847104E-03
219	55.4556612E-05	82.2431109E-06	-14.2790755E-03
220	48.7321068E-05	20.5662832E-03	-13.7306580E-03
221	45.4078236E-05	24.4267080E-03	-13.0643042E-03
222	32.2842580E-05	20.2403271E-03	-12.1466650E-03
223	32.7446748E-05	17.0371867E-03	-11.0115984E-03
224	31.4231405E-05	10.8010129E-03	-11.3106096E-03
225	21.6453941E-05	71.0989064E-04	-10.9526500E-03

III-6

... DISPLACEMENT COMPONENTS OF THE SEGMENT 6 ...

NODAL PT.	U-COMPONENT	V-COMPONENT	W-COMPONENT
226	-52.2717624E-05	-17.2108491E-07	-68.712680E-04
227	-55.0111409E-05	22.3589498E-04	-62.1104581E-04
228	-59.0520337E-05	59.0449643E-06	-64.1411102E-04
229	-62.9449184E-05	74.3322421E-06	-66.6973467E-04
230	-70.4946403E-05	94.0652530E-06	-66.6717556E-04
231	-74.385074E-05	11.3386521E-05	-73.0909503E-04
232	-78.2691044E-05	94.3711821E-06	-76.5446264E-04
233	-83.4093502E-05	17.5543139E-06	-76.7331294E-04
234	-82.1904740E-05	-84.5776268E-06	-78.7465825E-04
235	-79.3230774E-05	-14.0629242E-05	-78.4388261E-04
236	-78.9901043E-05	-18.4012494E-05	-75.3392762E-04
237	-75.224433E-05	-18.7968974E-05	-72.2689474E-04
238	-72.404440E-05	-17.4338248E-05	-68.1370918E-04
239	-74.1213170E-05	-14.7440131E-05	-66.1242060E-04
240	-70.0704366E-05	-14.8149833E-05	-63.8052088E-04
241	-15.1170718E-05	-52.5343972E-06	-60.6820648E-04
242	-10.7508915E-05	-51.1310938E-06	-62.1327270E-04
243	-16.5124228E-06	-42.7652284E-06	-64.11344963E-04
244	-12.2461783E-06	-52.1194484E-06	-66.6787161E-04
245	-45.526001E-06	-54.9672411E-06	-65.7371779E-04
246	-46.2396367E-06	-44.9943194E-06	-73.1716388E-04
247	-45.266495E-06	-49.1583567E-06	-76.5314034E-04
248	-19.654652E-06	-65.2680404E-06	-79.3821721E-04
249	-20.7211698E-06	-72.4438469E-06	-73.8771774E-04
250	-29.4231961E-06	-57.181967E-06	-78.3763940E-04
251	-36.8254195E-07	-33.84175492E-06	-75.5396378E-04
252	-16.0963198E-06	-24.8034198E-06	-72.2538417E-04
253	-15.8410420E-06	-24.0682349E-06	-69.1178953E-04
254	-65.8699144E-06	-17.4986942E-06	-66.3803901E-04
255	-83.2176257E-06	-62.2398589E-07	-63.835992E-04
256	-12.4021113E-05	-10.1607394E-05	-60.653764E-04
257	-77.058354E-05	-12.0594761E-05	-62.1189639E-04
258	-76.968019E-05	-14.4028998E-05	-66.0904959E-04
259	-79.4291643E-05	-17.6744461E-05	-66.6179431E-04
260	-79.505627E-05	-21.0106561E-05	-69.742664E-04
261	-82.452855E-05	-21.2221170E-05	-73.1533834E-04
262	-87.4222367E-05	-19.0778798E-05	-76.3243561E-04
263	-87.1250944E-05	-14.3479514E-05	-79.138771E-04
264	-86.2336247E-05	-45.164942E-06	-79.685334E-04
265	-85.523486E-05	44.9444038E-06	-78.0349229E-04
266	-76.710246E-05	11.5915069E-05	-75.5472344E-04
267	-72.05111072E-05	13.5293935E-05	-72.1241266E-04
268	-68.042748E-05	11.6014957E-05	-69.6019112E-04
269	-60.8662113E-05	11.3261099E-05	-66.481771E-04
270	-53.235441E-05	13.0900256E-05	-63.7276288E-04

... DISPLACEMENT COMPONENTS OF THE SEGMENT 7 ...

NODAL PT.	U-COMPONENT	V-COMPONENT	W-COMPONENT
271	-58.005546E-05	61.251092E-06	0.
272	-60.810727E-05	82.633120E-06	0.
273	-44.757304E-05	85.100640E-06	0.
274	-71.390160E-05	74.428880E-06	0.
275	-75.427655E-05	94.405738E-06	0.
276	-80.452414E-05	91.670383E-06	0.
277	-87.145200E-05	50.794626E-06	0.
278	-89.819726E-05	54.742093E-06	0.
279	-91.637004E-05	13.310887E-06	0.
280	-94.246968E-05	-14.632910E-06	0.
281	-92.248846E-05	-39.916429E-06	0.
282	-88.961684E-05	-45.471587E-06	0.
283	-89.304443E-05	-16.874698E-07	0.
284	-88.513443E-05	60.187727E-07	0.
285	-88.775420E-05	10.092170E-06	0.
286	15.631451E-05	55.650679E-06	0.
287	13.101057E-05	56.219218E-06	0.
288	11.464294E-05	47.793842E-06	0.
289	76.867563E-06	24.903841E-06	0.
290	64.752043E-06	34.542599E-06	0.
291	58.043768E-06	21.040045E-06	0.
292	30.140334E-06	-56.051212E-07	0.
293	10.106120E-06	-32.977841E-06	0.
294	27.245121E-06	95.370350E-06	0.
295	-48.320149E-07	10.169216E-06	0.
296	-18.718765E-06	19.707725E-06	0.
297	-17.898435E-06	21.794892E-06	0.
298	-40.923927E-06	62.034504E-06	0.
299	-87.146753E-06	74.093192E-06	0.
300	-10.265267E-05	71.197903E-06	0.
301	89.228850E-05	37.579011E-06	0.
302	86.821019E-05	27.246849E-06	0.
303	87.648196E-05	11.020890E-06	0.
304	86.717171E-05	-24.152806E-06	0.
305	88.375557E-05	-35.504302E-06	0.
306	92.118070E-05	-37.017735E-06	0.
307	93.065462E-05	-69.201643E-06	0.
308	95.675797E-05	-44.900740E-06	0.
309	97.167542E-05	-55.591720E-07	0.
310	93.034132E-05	40.762300E-06	0.
311	88.452303E-05	87.364800E-06	0.
312	85.432409E-05	90.558316E-06	0.
313	77.500051E-05	12.681561E-05	0.
314	71.045367E-05	13.991323E-05	0.
315	68.174655E-05	13.310249E-05	0.

IV-1

*** STRESSES OF SEGMENT | 1 ***

*** STRESS=PSI ***

*** STRAINS-MICRO INCHES ***

FLY EL5	X	Y	Z	XY	YZ	XZ	X	Y	Z	XY	YZ	XZ
PS,ESL,X,Y,ZUL RESPECTIVELY												
1	82.03	13.33	62.16	6.50	3.000E-01	0.	2	-1	1	1	-3	17
	350.73	134.10	19.72	19.72	-35.59	-80.03	10	-2	0	2	-16	-88
	-55.93	-52.82	04.88	-9.94	-184.89	764.20	2	-2	0	-1	-16	24
2	-57.71	-16.24	7.4	9.69	52.74	281.74	-2	0	1	1	2	21
	222.71	121.55	109.11	20.77	2.38	242.44	9	0	0	0	0	-71
	375.44	140.97	180.30	29.13	6.78	474.14	9	0	0	0	0	-70
	175.44	140.97	180.30	29.13	0.00	8610.54	9	0	0	0	0	-70
3	-52.76	-14.17	5.23	4.04	0.00	8610.54	9	0	0	0	0	-70
	332.21	128.27	13.10	-13.10	200.34	198.64	-2	0	0	0	0	17
	220.06	-211.65	40.48	18.90	-53.25	822.21	6	-3	1	-6	-15	-11
	-57.89	-20.13	5.2	-402.09	12.12	245.25	9	0	0	0	1	11
4	124.52	45.34	22.61	71.11	-186.57	8610.54	9	0	0	0	0	-80
	403.00	143.49	75.30	12.27	7.58	198.64	-2	0	0	0	0	17
	-2.72	-3.74	-1.74	30.45	21.73	193.74	11	0	0	1	14	-84
	-2.72	-3.74	-1.74	30.45	0.00	857.70	0	-3	0	0	19	-84
5	286.63	111.34	52.14	3.14	0.00	857.70	0	0	0	0	0	-84
	416.79	175.64	89.08	8.84	-56.07	146.52	0	0	0	0	0	-84
	480.71	192.81	99.95	25.36	21.69	193.74	11	-1	1	1	-5	-84
	-17.60	-24.45	-12.62	16.09	33.53	224.40	12	1	2	2	2	37
6	196.79	20.117	122.29	-14.97	-21.42	895.70	-3	-1	0	0	-19	39
	442.70	122.73	182.73	12.37	8.09	955.174	3	4	0	0	0	-84
	165.71	47.34	184.69	52.76	249.29	170.44	11	0	0	0	0	-70
	-24.63	-10.34	-10.56	1.71	0.00	1911.50	-1	11	0	0	22	35
7	134.19	51.05	65.23	25.80	-72.81	158.70	-1	0	0	0	0	-70
	442.40	175.88	185.21	62.15	-23.20	8911.10	3	-0	0	2	-4	-70
	-27.86	-33.43	-6.30	31.09	13.67	170.44	11	0	0	0	-20	-70
	-32.04	-7.1	20.17	-15.84	2.17	243.55	-1	0	0	0	0	32
8	308.17	154.64	140.1	2.54	7.59	857.829	0	0	0	0	0	-84
	475.46	203.78	303.70	31.55	0.00	8969.80	12	0	0	0	0	-84
	475.46	203.78	303.70	31.55	0.00	8969.80	12	0	0	0	0	-84
9	-26.43	-3.54	14.57	1.53	23.86	204.88	-1	0	0	0	0	-84
	233.74	-1.520	32.44	-6.08	-72.71	161.24	1	-6	0	0	21	-84
	387.71	15.19	106.25	14.40	-4.53	281.20	12	-4	0	0	-4	-84
	271.82	-25.42	-12	-4	-210.38	3962.80	12	0	0	0	-16	-84
10	-59.34	-9.34	-9.34	6.73	35.41	204.88	-1	0	0	0	0	-84
	197.11	82.84	70.01	4.54	56.23	505.75	5	-1	0	0	0	-84
	557.05	233.81	222.33	18.67	16.70	227.80	14	0	0	0	0	-84
	17.14	7.35	7.35	-2.46	0.00	-1022.50	0	0	0	0	15	-84
11	17.14	7.35	7.35	-2.46	0.00	-1022.50	0	0	0	0	0	-84
	322.29	22.74	102.66	-2.46	0.00	-1022.50	0	0	0	0	0	-84
	425.06	-71.77	91.36	-14.10	-29.04	187.61	9	-3	0	0	0	-84
	548.44	191.40	235.06	-4.8	72.77	227.80	14	0	0	0	-3	-84
	-8.00	-51.45	-17.65	-19.18	-6.61	231.27	14	0	0	0	0	-84
12	192.00	36.80	90.99	-2.64	-96.29	-1022.50	0	-1	0	0	-6	-84
	548.44	215.23	235.23	203.35	1.06	5628.74	5	0	0	0	0	-84
	27.68	55.67	37.60	-3.21	0.00	-1046.08	14	0	0	0	0	-84
	-55	0.24	37.60	62.93	3.17	206.52	0	1	0	0	0	-84
13	127.54	-53.94	27.00	-6.67	0.00	-1046.08	0	0	0	0	0	-84
	451.01	6.90	137.37	-32.37	42.66	201.43	5	0	0	0	0	-84
	-90.03	-221.00	-80.05	-55.28	72.87	1046.08	14	0	0	0	0	-84
	22.55	52.25	24.27	-3.10	10.87	206.52	0	0	0	0	0	-84
14	524.52	117.00	147.47	-14.03	-52.86	235.24	-0	0	0	0	0	-84
	520.52	226.94	226.94	-19.55	-4.06	599.69	6	-0	0	0	0	-84
	520.52	226.94	226.94	-19.55	0.00	-1026.97	13	0	0	0	-2	-84
	520.52	226.94	226.94	-19.55	0.00	-1026.97	13	0	0	0	0	-84

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15	15	-31.44	-12.07	-11.46	-21.99	-132.19	254.03	-1	0	0	-0	-11	22
		352.64	191.14	137.00	-16.65	72.28	883.33	0	1	1	-15	-16	
		426.97	49.35	62.68	2.53	-47.19	222.19	13	-3	0	-2	-16	
		645.52	497.60	342.94	-59.01	197.94	-1026.97	13	1	0	52	-19	
		-14.58	26.46	5.39	60.32	66.10	254.17	13	0	0	5	-69	
16	16	190.30	72.74	52.18	-9.77	-76.57	-562.31	1	0	1	-1	-18	
		524.53	198.95	135.65	-28.95	-229.78	267.82	14	0	0	-3	-23	
		23.19	9.94	9.94	-1.18	0.00	977.98	0	0	0	-20	-39	
17	17	331.68	98.51	84.90	-46.17	95.19	872.38	0	0	0	0	-35	
		497.96	136.37	110.09	-98.33	24.69	182.31	1	0	0	-4	-14	
		484.17	171.76	144.34	-39.69	267.82	267.82	14	-2	0	-6	-33	
		13.52	-12.63	1.27	-6.30	162.64	162.64	13	0	0	3	-16	
18	18	109.90	-78.77	-4.14	13.10	254.05	977.38	1	-1	0	-5	-36	
		516.98	221.54	221.54	-39.39	-87.44	-533.73	1	-4	0	-1	-39	
		-203.16	-44.77	-22.56	56.40	0.00	916.28	1	0	0	15	-38	
		16.07	6.80	6.89	-31.79	-262.31	228.63	13	0	0	-3	-79	
19	19	182.05	56.44	67.17	-5.68	94.57	813.74	0	1	0	49	-20	
		527.35	245.74	231.93	-87.54	262.82	916.28	0	0	0	-0	-79	
		-1.82	0.00	-23.34	-9.94	9.79	228.63	13	0	0	-5	-19	
		22.63	12.74	22.91	-32.56	11.89	182.38	0	1	0	-5	-20	
20	20	311.73	134.95	134.95	-23.73	-79.23	885.58	0	0	0	-2	-18	
		460.50	201.21	201.21	-31.65	0.00	850.62	12	0	0	-3	-42	
		469.50	201.21	201.21	-31.65	0.00	850.62	12	0	0	-3	-42	
		-3.61	2.42	11.89	-0.98	-237.68	244.58	0	0	0	-0	-74	
21	21	354.44	270.10	122.01	-15.73	68.36	139.58	0	0	0	-1	-31	
		426.33	152.93	65.61	-2.29	-32.78	187.37	12	2	0	-13	-32	
		647.28	616.04	479.00	-519.20	221.89	850.62	12	0	0	-0	-38	
		-4.29	1.31	11.41	-0.50	-13.83	244.58	0	0	0	5	-74	
22	22	170.51	59.87	29.06	-10.40	-67.39	450.08	0	0	0	-1	-31	
		427.67	143.67	51.24	-27.28	-202.15	237.13	12	0	0	-0	-39	
		41.03	17.97	17.97	-1.94	0.00	895.33	0	0	0	-10	-31	
		41.03	17.97	17.97	-1.94	0.00	895.33	0	0	0	-0	-39	
23	23	311.34	13.13	60.08	-32.26	77.48	133.68	1	0	0	-0	-49	
		435.03	215.82	81.64	-71.54	6.19	237.12	12	2	0	7	-32	
		435.03	170.55	42.25	-24.10	35.70	156.88	11	0	0	1	-31	
		40.31	14.12	16.35	-6.13	192.46	895.08	0	0	0	-2	-36	
24	24	131.04	-23.74	19.26	19.08	-55.69	829.41	1	0	0	-0	-39	
		454.20	196.37	196.37	-22.21	0.00	748.63	1	0	0	17	-37	
		-102.41	-244.74	-155.75	45.68	-167.17	207.11	11	0	0	-2	-37	
		46.03	17.14	17.14	-2.23	0.00	829.41	1	0	0	-14	-38	
25	25	186.39	108.30	74.63	-20.24	65.24	819.60	1	0	0	-0	-38	
		479.34	243.34	216.51	-43.62	164.48	819.60	11	1	0	-2	-30	
		37.32	41.30	-16.02	-23.65	5.63	287.13	1	1	0	-2	-38	
		43.51	16.51	29.39	-11.45	-42.53	182.72	1	0	0	-2	-38	
26	26	305.79	12.30	138.22	-13.48	0.00	107.79	1	0	0	-1	-34	
		439.42	148.32	188.32	-18.84	0.00	807.88	1	0	0	-2	-34	
		430.42	148.32	188.32	-18.84	0.00	807.88	11	0	0	-2	-34	
		38.52	20.26	20.02	-2.75	0.00	737.42	11	0	0	-2	-31	
27	27	311.05	178.78	106.29	-120.35	45.22	117.04	2	0	0	-3	-30	
		381.12	154.86	27.43	-13	11.52	134.82	11	1	0	-10	-30	
		524.65	377.10	273.55	-42.00	124.96	807.88	11	0	0	36	-32	
		27.38	-5.21	37.89	50.82	-29.68	221.47	1	0	0	5	-31	
28	28	184.54	64.31	30.11	-8.32	-29.68	197.28	1	0	0	-1	-34	
		379.11	118.51	15.02	-15.73	-84.79	159.95	11	0	0	-1	-34	
		84.40	77.20	37.20	-4.61	0.00	875.88	1	0	0	0	-34	
		86.66	77.20	37.20	-4.61	0.00	875.88	1	0	0	0	-34	
29	29	-127.59	-21.04	-59.13	-2.68	-35.01	-43.92	2	0	0	-0	-39	
		-72.49	-1.04	-31.04	9.69	-174.96	757.96	-9	0	0	-0	-37	
		-463.41	-159.74	-84.75	-10.65	51.29	274.01	-2	0	0	-1	-37	
		-444.49	-1.65	-64.20	-2.07	18.65	241.42	-13	0	0	-2	-34	
30	30	-194.33	-72.94	-64.48	-3.91	63.47	-75.03	-13	0	0	-0	-31	

[illegible]

46	44	-512.34	-203.77	-214.83	68.15	244.14	8976.82	-13	0	0	0	6	21	-08
		-374.63	-277.34	-182.32	210.34	-82.26	5533.25	-8	-4	0	0	16	21	-08
		16.07	6.80	6.89	0.00	0.00	9913.74	0	0	0	0	32	0	-08
		-653.90	-330.60	-345.55	602.73	-246.78	229.64	-12	11	1	1	52	-21	-08
47	47	-485.74	-208.30	-70.19	30.00	0.00	8915.65	-12	0	0	0	3	0	-10
		-292.63	-116.17	-4.46	79.87	249.57	165.26	-8	0	2	0	0	7	-10
		15.53	5.63	6.35	32.56	-4.67	5913.74	0	0	0	0	0	22	-10
		-463.62	-186.60	-135.26	-1.69	-4.67	229.64	-12	0	1	1	0	22	-10
48	48	-422.41	-147.52	-61.65	19.87	-5.09	188.51	-12	-1	1	1	0	22	-10
		-149.67	-51.25	-21.08	8.13	-79.90	485.05	-4	0	4	4	2	0	-08
		-18.91	-4.04	-4.68	-1.88	0.00	485.05	-4	0	1	1	1	0	-08
		-10.91	-4.68	-4.68	-1.88	0.00	485.05	-4	0	0	0	0	0	-10
		-427.17	-144.32	-53.90	28.14	-239.70	851.21	-0	0	0	0	0	0	-10
49	49	-117.27	44.34	14.66	28.14	85.36	247.29	-12	0	4	4	2	0	-10
		-17.59	-13.90	-24.30	58.38	19.19	140.98	-4	2	1	1	0	-21	-10
		142.41	353.07	148.64	-457.71	226.99	180.97	-0	0	0	0	5	2	-10
50	50	-553.03	-256.04	-80.36	124.40	9.89	851.21	-12	9	0	0	40	20	-10
		-362.48	-117.00	-15.16	-68.35	-205.10	247.29	-6	0	4	4	11	20	-10
		33.73	9.74	-1.18	-1.96	-205.10	450.52	-6	0	0	0	1	0	-10
		-410.59	-175.97	-175.97	23.73	0.00	237.15	-10	0	0	0	0	0	-10
51	51	-410.59	-175.97	-175.97	23.73	0.00	237.15	-10	0	0	0	0	0	-10
		-134.20	-59.93	-59.93	31.21	60.97	794.35	-10	-1	0	0	2	0	-10
		32.10	5.92	-2.80	-4.13	-12.21	130.55	-3	-1	0	0	3	0	-10
		9.07	-40.35	48.23	38.67	-16.87	237.15	-1	0	0	0	0	0	-10
52	52	-443.78	-253.42	-209.16	59.08	179.84	165.58	-10	-2	2	2	0	1	-10
		-269.38	-117.63	-117.63	176.90	-50.63	794.35	-6	-2	0	0	5	16	-10
		40.03	17.14	17.16	-2.33	0.00	429.53	-6	0	1	1	15	0	-10
		-464.58	-214.64	-202.35	496.74	-151.49	746.72	-9	0	0	0	0	0	-10
53	53	-379.59	-162.68	-162.68	16.14	53.64	207.63	-9	-7	2	2	43	-13	-10
		-218.96	-77.54	-45.06	5.11	0.00	207.63	-6	0	0	0	2	0	-10
		36.94	9.94	14.06	-11.45	154.68	746.72	-9	-1	2	2	0	0	-10
		-143.44	-176.64	-88.22	8.96	-8.29	207.63	-9	0	0	0	1	13	-10
54	54	-347.37	-145.94	-58.82	17.83	14.53	189.98	-9	0	2	2	1	0	-10
		-85.72	-25.53	.61	2.75	-43.87	396.47	-3	-2	3	3	2	0	-10
		31.95	13.69	13.69	-2.75	0.00	978.97	-3	0	1	1	0	0	-10
		-321.07	-13.69	-13.69	-2.75	0.00	978.97	-1	0	0	0	0	0	-10
55	55	-73.59	-8.24	-25.95	13.74	-131.62	226.52	-9	0	0	0	0	0	-10
		4.41	24.69	26.38	-60.03	53.37	114.50	-5	-0	3	3	1	11	-10
		11.27	198.77	93.01	59.82	7.55	137.74	-1	1	1	1	5	0	-10
		-240.46	-49.23	-44.94	-363.05	132.29	780.97	-1	-1	0	0	0	1	-10
56	56	-164.51	-72.87	-78.38	123.14	20.28	226.52	-9	-1	3	3	11	2	-10
		74.40	34.80	4.66	5.46	-40.20	393.20	-4	0	0	0	0	0	-10
		-283.97	-121.70	-121.70	-4.61	-120.50	169.88	-2	0	-1	-1	0	0	-10
		-283.07	-121.70	-121.70	10.50	0.00	674.83	-7	0	0	0	1	0	-10
					10.50	0.00	674.83	-7	0	0	0	1	0	-10

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*** STRESSES OF SEGMENT 2 ***

*** STRESS-PSI ***

*** STRAINS-MICRO INCHES ***

ELT ELS	X	Y	Z	XY	YZ	XZ	X	Y	Z	XY	YZ	XZ	Y2	X2	Y2	X2
57 1	-25.89	-25.60	1.08	81.77	-8.29	290.48	-2	-0	1	7	7	1	-1	1	7	12
	-35.16	57.84	35.50	92.56	43.57	283.38	-2	-3	1	8	8	1	4	1	8	28
	-94.13	-121.21	12.01	112.83	-65.32	242.04	-1	0	1	10	10	1	-6	1	10	38
	-39.19	-13.44	-41.55	39.92	-3.12	263.12	-1	0	1	3	3	1	-0	1	3	31
58 2	30.43	-8.04	50.57	-19.89	83.02	800.54	-1	-1	1	-2	-2	1	7	1	-2	26
	6.29	-41.13	14.29	-15.04	170.95	5315.18	0	-2	1	1	1	1	15	1	1	27
	51.98	-59.57	91.13	-29.82	52.74	272.33	0	-2	1	-3	-3	1	5	1	-3	24
59 3	31.01	22.67	49.29	-14.81	25.38	2314.11	0	0	1	1	1	1	5	1	1	27
	64.86	66.24	68.56	7.67	-62.51	308.87	1	2	1	0	0	1	2	1	0	27
	104.93	179.01	114.92	9.13	-42.50	315.18	1	1	1	1	1	1	-4	1	1	27
	41.36	68.16	32.99	9.93	38.72	296.78	1	1	0	1	1	0	3	1	1	28
60 4	44.30	53.61	55.58	-20.06	-193.25	2314.11	1	1	1	1	1	1	17	1	1	28
	2.31	193.77	13.03	69.23	91.28	343.88	1	1	1	2	2	1	8	1	2	27
	-95.19	-54.94	-133.69	99.19	12.12	316.64	1	3	1	9	9	1	8	1	9	27
	132.50	340.64	160.62	58.83	245.83	348.31	1	10	0	5	5	1	21	1	5	30
	-30.47	-14.34	12.16	42.68	16.70	360.80	-1	-6	0	4	4	1	1	1	4	30
61 5	-31.46	25.15	-22.59	17.77	-115.44	311.83	-1	-2	1	2	2	1	1	1	2	32
	-50.29	49.82	-84.79	49.22	-285.23	316.64	-1	3	1	2	2	1	10	1	2	32
	16.54	174.84	44.58	22.39	-74.65	348.31	-1	3	1	4	4	1	25	1	4	37
62 6	-57.64	-54.25	-34.55	-18.29	17.54	260.95	-1	-1	0	2	2	1	-8	0	2	30
	-34.42	-26.97	-47.45	-9.29	121.32	267.37	-1	-1	0	2	2	1	2	0	2	33
	-50.07	-24.43	-111.00	10.84	21.69	394.37	-1	-1	0	1	1	1	10	1	1	32
	-17.61	-22.14	-5.04	-2.22	33.53	160.22	0	-1	0	0	0	0	2	0	0	34
63 7	-34.77	-14.31	-26.31	-16.51	307.45	139.22	0	-1	0	0	0	0	2	0	0	32
	-19.60	-14.31	-21.84	72.91	-137.76	318.21	0	-1	0	0	0	0	2	0	0	34
	-19.60	-14.31	-21.84	72.91	-137.76	318.21	0	-1	0	0	0	0	2	0	0	34
	-19.60	-14.31	-21.84	72.91	-137.76	318.21	0	-1	0	0	0	0	2	0	0	34
64 8	-20.11	-44.02	-194.54	59.42	-341.35	246.02	0	0	0	0	0	0	2	0	0	32
	-27.53	-12.07	-12.07	19.20	-69.32	339.52	0	0	0	0	0	0	2	0	0	32
	-44.49	22.31	57.20	13.68	118.13	353.81	1	-1	0	1	1	1	10	1	1	39
	90.98	121.52	121.52	53.75	338.56	332.17	1	1	0	1	1	1	29	1	1	39
65 9	-3.62	-13.03	1.90	13.14	13.67	356.08	0	0	0	0	0	0	1	0	0	33
	51.50	28.71	44.17	-14.85	2.17	362.27	1	0	1	0	0	1	1	1	0	31
	83.26	20.79	104.14	-4.83	-168.91	315.58	1	1	1	0	0	1	15	1	0	37
	42.06	-49.07	74.53	37.31	-32.12	332.17	1	1	1	0	0	1	3	1	0	39
	154.08	35.79	203.31	-8.71	-90.79	252.28	1	1	1	0	0	1	3	1	0	39
66 10	47.71	15.64	42.58	-43.00	-374.43	362.27	1	0	1	0	0	1	2	1	0	31
	15.46	74.77	73.75	95.25	106.68	402.05	1	2	1	0	0	1	9	1	0	33
	-111.68	-179.70	-109.34	131.69	-44.55	342.24	1	2	1	0	0	1	11	1	0	33
	217.50	42.84	334.47	103.26	328.09	359.48	1	1	1	0	0	1	29	1	0	33
67 11	-40.23	-58.64	-8.87	93.70	35.81	464.43	-1	1	1	0	0	1	4	1	0	33
	-131.13	-252.34	-99.10	19.29	-168.33	318.85	-1	1	1	0	0	1	2	1	0	30
	-207.22	-422.62	-203.88	72.23	-322.18	382.24	-1	1	1	0	0	1	15	1	0	30
	-137.53	-365.52	-16.56	28.94	23.81	359.48	-1	1	1	0	0	1	28	1	0	33
	-42.63	1.12	-74.86	-41.34	-206.63	214.63	-1	1	1	0	0	1	2	1	0	31
68 12	-62.79	-122.40	-60.21	-7.08	53.27	422.18	-1	0	1	0	0	1	10	1	0	37
	-111.80	-311.84	-134.73	2.74	77.77	482.23	1	1	1	0	0	1	7	1	0	42
	11.06	-10.62	-13.48	1.71	-68.51	348.17	1	1	1	0	0	1	7	1	0	42
69 13	-100.62	-116.61	-13.48	-23.70	150.66	394.16	-1	1	1	0	0	1	6	1	0	42
	-101.04	-307.74	-34.08	71.14	17.56	311.82	-1	1	1	0	0	1	13	1	0	39
	-151.07	-642.90	68.14	141.29	-213.50	211.14	-1	1	1	0	0	1	2	1	0	38
	-97.90	-293.23	-104.34	6.77	24.64	348.17	-1	1	1	0	0	1	18	1	0	42
	-54.13	12.84	-77.99	65.44	235.43	304.16	-1	1	1	0	0	1	3	1	0	42
70 14	82.16	-19.77	119.26	-30.04	-47.57	394.95	-1	2	1	0	0	1	20	1	0	38
	231.45	13.73	173.93	-43.31	-192.72	215.59	-1	2	1	0	0	1	17	1	0	38
	-54.52	-215.92	-65.47	-6.23	103.47	406.73	-1	4	1	0	0	1	9	1	0	43
	70.53	72.82	44.43	-43.54	-55.56	473.53	-1	4	1	0	0	1	5	1	0	41

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71	15	80.33	-10.99	121.37	-62.39	108.71	344.54	2	4	5	9	31
		119.66	-247.05	966.14	-98.63	111.06	215.59	2	10	5	10	31
		107.79	4.21	108.13	-37.37	77.10	337.48	2	2	5	17	31
		13.55	-60.14	-12.15	-21.14	292.16	470.53	1	0	2	25	31
72	16	111.48	-234.27	-102.01	53.84	-90.12	332.59	1	0	2	25	31
		-58.90	-136.84	-145.55	120	-47.19	849.38	1	3	0	0	31
		-240.42	-574.45	-169.93	110.50	-289.18	204.42	1	2	0	25	31
		-5.11	70.52	9.45	50.73	60.10	413.91	1	0	4	4	31
73	17	-95.80	-143.97	-46.71	-58.86	183.73	303.50	1	0	4	10	31
		-64.93	-162.06	-158.48	-91.96	389.17	849.38	0	0	5	34	31
		-56.24	-121.37	24.25	-57.94	117.52	224.42	1	2	2	10	31
		-22.31	-6.47	-8.00	-26.69	42.11	356.92	1	0	2	4	31
74	18	-11.55	-88.64	-62.16	-85.17	-101.15	335.78	1	0	2	4	31
		-15.00	-83.47	-100.75	-114.79	29.69	339.39	1	3	0	9	31
		17.92	-28.03	-55.48	-61.53	14.3	455.92	1	2	5	3	31
		-37.57	-44.41	-21.26	-19.20	-336.17	262.82	1	0	2	0	31
75	19	99.07	122.62	75.73	-29.13	182.16	335.30	1	0	2	20	31
		75.23	44.91	62.61	-43.07	92.16	337.20	1	0	2	10	31
		265.56	549.79	192.16	-92.43	391.13	455.92	1	2	0	34	31
		-43.88	-49.14	-27.57	48.16	62.98	202.02	1	0	4	5	31
76	20	82.76	48.81	34.35	-74.33	-94.16	330.88	1	0	4	5	31
		136.07	88.50	95.11	-100.94	-384.5	277.99	2	0	6	0	31
		51.19	24.40	-29.77	-69.82	9.29	338.92	2	2	0	20	31
		57.18	27.54	37.72	-44.43	11.99	404.18	1	0	4	1	31
77	21	119.98	112.27	96.71	-68.23	188.19	332.88	1	0	0	1	31
		201.18	231.32	156.32	-122.84	31.46	277.99	1	1	0	3	31
		95.93	44.77	90.44	-56.34	117.67	336.59	2	1	0	10	31
		62.63	40.71	43.37	-26.29	357.14	404.18	1	0	2	31	31
78	22	-63.79	-131.05	-80.93	32.44	-88.12	336.88	0	0	2	0	31
		-13.20	3.76	-123.62	-15.85	-5.18	351.28	1	0	2	0	31
		-17.62	-43.20	-129.62	65.64	-248.14	275.20	1	0	0	22	31
		-6.54	35	10.45	47.54	-13.13	331.41	1	0	0	0	31
79	23	9.54	37.22	-4.79	-43.16	130.14	337.41	1	0	0	11	31
		2.61	45.29	-105.00	-73.80	282.18	351.39	1	0	0	24	31
		55.18	121.33	92.18	-38.26	8.18	275.20	0	1	0	0	31
		-59.18	-34.94	-9.74	-17.98	183.45	336.23	0	1	0	1	31
80	24	5.44	3.72	-45.34	-51.71	-51.26	335.70	1	0	0	4	31
		19.66	-7.72	-112.44	-89.21	6.19	292.42	1	0	0	1	31
		-8.55	-1.64	12.44	-47.18	331.6	376.59	1	0	0	1	31
81	25	81.12	146.63	64.01	-11.82	-193.18	222.10	0	1	0	17	31
		100.41	141.63	83.77	-12.30	98.12	302.11	1	0	0	0	31
		170.62	34.52	114.94	-59.78	66.14	281.63	1	0	0	7	31
		-27.67	-68.24	-6.68	37.14	-6.63	376.59	0	1	0	10	31
82	26	69.31	51.44	30.54	-45.01	-32.14	222.10	0	1	0	1	31
		114.03	22.63	74.36	-41.43	-127.65	300.35	1	0	0	11	31
		47.20	25.53	-11.79	-44.64	5.03	335.51	1	0	0	0	31
		43.71	16.17	20.05	-26.77	26.18	337.45	1	0	0	0	31
83	27	112.55	92.00	95.64	-22.08	81.1	292.42	1	0	0	2	31
		119.05	144.90	105.38	-27.55	12.53	222.11	2	0	0	2	31
		183.17	47.72	149.43	-25.31	67.54	222.28	2	0	0	2	31
		45.77	23.30	32.11	-13.59	162.19	337.45	2	0	0	0	31
84	28	-11.26	-57.15	-34.46	-46.82	-23.77	293.29	1	0	0	0	31
		27.45	3.29	-124.14	-15.63	11.12	330.35	1	0	0	2	31
		-46.55	-151.01	20.90	110.83	-82.58	174.69	0	0	0	1	31
		-14.67	-21.74	-14	44.86	-1.33	306.63	0	0	0	0	31
85	29	-45.74	-41.12	-26.09	29.44	-16.09	294.81	0	0	0	0	31
		-25.34	36	-6.75	39.92	36.15	285.42	0	0	0	0	31
		33.65	-162.72	-52.61	62.99	-73.10	229.12	1	0	0	0	31
		-41.23	-41.00	-121.03	-14.60	-12.11	339.66	1	0	0	0	31
86	30	77.79	76.41	110.42	-21.93	84.63	299.08	1	0	0	0	31
		17.22	6.61	4.45	-14.81	183.95	332.35	1	0	0	0	31

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102	46	-62.54	-66.55	-39.49	26.77	-110.64	335.63	1	0	0	2	13
		-44.53	-1.37	-37.59	-19.78	23.58	330.54	1	0	0	2	11
		3.77	30.29	49.84	20.36	-0.29	455.78	3	0	0	2	11
		-149.65	-68.55	-136.61	76.24	-35.120	250.64	3	2	2	6	30
103	47	55.67	100.44	2.75	2.75	101.47	335.83	1	0	0	4	10
		-36.96	-22.22	-11.42	48.10	90.146	336.124	1	0	0	4	10
		213.78	514.23	257.25	1.87	404.66	455.70	1	0	0	4	35
		-189.43	-178.60	-174.56	142.770	494.50	250.68	1	2	2	0	32
104	48	45.06	30.10	79.24	-61.22	-10.191	334.74	3	0	0	12	4
		37.28	27.55	37.76	-44.63	-35.3178	260.18	0	0	0	14	27
		31.72	25.60	27.83	-55.1	-1.807	333.32	1	0	0	1	0
		47.53	37.65	145.92	165.90	-5.109	330.72	0	1	1	1	0
105	49	11.06	-49.55	47.79	25.73	164.42	337.98	0	2	2	1	0
		62.85	40.73	43.48	-26.29	31.67	260.18	1	0	0	14	3
		-28.89	-11.81	0.16	36.99	112.74	363.00	1	0	0	2	10
		-3.59	-77.57	93.80	66.48	36.163	330.72	0	4	4	0	30
106	50	80.83	108.51	-27.32	90.14	-70.89	331.70	0	0	0	0	0
		-31.84	-14.96	-27.26	47.34	19.119	335.02	1	0	0	0	0
		-23.51	-47.72	-163.53	132.64	-23.135	225.06	1	2	2	0	2
		-16.84	-18.86	166.84	117.15	9.189	336.83	0	0	0	12	33
107	51	-74.91	-116.82	-39.26	11.26	134.68	331.78	1	0	0	10	27
		-46.32	-2.88	-46.75	-17.98	204.32	335.02	0	2	2	1	13
		-23.49	-22.92	-16.48	15.83	13.79	225.10	0	1	1	2	25
		-135.00	-22.97	-82.91	35.94	16.129	331.23	1	0	0	1	0
108	52	-45.58	-55.25	-7.62	15.60	-8.124	330.46	1	0	0	0	0
		-25.68	-16.79	-27.57	-18.78	-12.21	330.89	0	0	0	1	0
		-15.02	-1.01	17.56	18.74	16.107	335.94	0	2	2	2	33
		-95.22	-95.94	-32.87	46.83	-28.159	236.158	0	2	2	0	18
109	53	-29.84	-26.13	1.65	38.92	162.100	298.93	1	1	1	0	0
		-27.80	-46.30	-6.98	37.14	67.147	284.32	0	0	0	0	0
		93.05	213.83	146.44	-8.54	24.158	335.94	1	1	1	0	33
		-134.15	-235.80	-92.50	60.31	-6.146	236.55	0	4	4	1	31
110	54	32.62	12.37	71.70	-13.80	-31.54	293.80	1	2	2	1	1
		44.95	18.41	34.28	-28.17	-16.186	226.13	0	0	0	12	4
		28.29	25.43	74.18	-12.278	-8.129	331.72	1	0	0	0	20
		33.62	-9.94	100.97	1.68	14.53	333.32	0	0	0	1	1
111	55	20.22	-10.65	49.82	-8.13	66.65	257.44	0	2	2	0	28
		44.81	25.54	37.34	-13.39	-1.12	228.13	1	0	0	1	1
		45.88	-50.80	91.10	-11.41	55.09	210.88	0	2	2	1	0
		-5.73	-7.44	81.03	-1.17	14.98	333.32	0	0	0	1	5
112	56	-29.14	-39.44	7.82	104.27	-4.52	229.32	2	0	0	0	0
		-31.65	-2.71	-45.41	44.86	7.15	330.34	0	2	2	1	1
		-138.40	-194.23	-7.45	165.76	-71.47	3179.24	1	0	0	1	1
		-64.43	-11.34	72.03	164.31	20.28	3302.14	1	0	0	1	0

*** STRESSES OF SEGMENT 3 ***

*** STRESS-REL ***

*** STRAINS-MICRO INCHES ***

ELT	ELS	X	Y	Z	XY	YZ	XZ	X	Y	Z	XY	YZ	XZ
113	1	-112.54	2.79	-19.54	20.57	-29.46	339.19	-4	1	0	0	3	3
		-185.15	49.71	43.93	61.93	-54.60	721.08	-7	3	3	5	-5	-3
		-231.49	-86.04	-113.92	4.02	23.52	597.62	-6	1	1	0	5	-5
		70.02	44.60	11.36	-51.04	-58.30	121.13	2	1	-1	0	-5	5
114	2	-51.14	42.94	-7.57	-51.67	38.17	810.38	2	2	-0	-4	3	-3
		-267.59	-41.64	-64.03	190.09	43.57	190.28	-8	2	1	0	7	7
		88.71	156.37	54.66	-307.47	77.07	661.24	1	4	-1	0	7	7
		25.46	14.22	-13.05	52.37	-3.12	107.84	1	0	-1	5	-5	-5
115	3	-59.22	23.75	-15.36	6.42	-95.79	340.78	-2	0	-1	1	0	0
		-241.87	18.37	-38.31	11.63	-167.86	190.23	-8	2	1	1	-15	-15
		82.44	141.73	48.56	6.30	-125.24	861.24	1	3	-1	0	-11	-11
		-18.24	-56.84	-54.43	1.38	3.74	660.32	1	-2	-1	0	0	0
116	4	-159.84	-5.35	-44.92	-5.99	43.83	-98.63	-5	2	0	-1	4	4
		-225.77	47.29	-24.00	4.51	-42.00	158.60	-8	4	1	0	-4	-4
		-295.87	-99.29	-11.90	-5.24	35.22	178.32	-8	1	1	0	3	3
		42.11	35.34	-1.07	-17.24	13.77	-633.57	1	1	-1	-1	-12	-12
117	5	-14.44	31.81	-21.52	-17.59	-166.73	316.31	-5	3	0	2	12	12
		-126.49	262.14	91.27	2.96	-13.50	644.20	-8	0	2	0	-14	-14
		-353.92	-234.72	-169.94	414.26	-289.39	178.31	-8	-3	0	0	-25	-25
		56.10	60.00	12.92	-4.43	-198.30	633.57	1	2	0	26	-17	-17
118	6	-48.13	42.84	14.84	39.30	45.90	121.94	-2	2	1	4	4	4
		-258.30	6.58	-24.64	31.57	194.79	695.60	-8	3	1	2	17	17
		76.25	135.47	70.16	17.89	-73.65	124.63	1	3	0	2	-6	-6
		37.66	-13.40	2.29	-11.55	1.74	205.43	-5	1	-1	1	2	2
119	7	-159.08	34.62	-46.12	-2.94	-270.10	399.80	-5	3	0	0	-24	-24
		-207.79	199.10	27.57	-2.09	-264.25	695.60	-8	4	2	0	-23	-23
		-354.32	-17.24	-213.12	14.09	-142.35	709.18	-9	2	-2	0	-32	-32
		82.86	92.04	47.49	-20.81	-42.23	205.63	1	2	-2	-2	-37	-37
120	8	-82.33	140.77	23.28	-75.74	41.70	8137.60	-4	3	0	7	4	4
		-334.79	-43.60	-40.66	126.28	-28.62	203.43	-11	12	0	11	17	17
		169.37	458.02	116.58	-40.460	19.805	793.94	-5	10	-2	35	-35	-35
		-1.57	7.80	-3.09	91.10	-63.32	117.45	-0	1	0	4	17	17
121	9	-144.78	-44.58	-65.21	13.83	-371.31	459.13	-4	1	0	3	16	16
		-173.82	-86.02	-59.70	34.07	-53.38	203.43	-0	1	0	3	-32	-32
		21.13	12.53	73.92	5.49	-31.276	793.94	-0	1	-2	0	-47	-47
		-39.30	-54.24	-62.01	1.93	36.52	227.44	-7	-1	1	0	-23	-23
122	10	-275.20	-138.99	-65.99	7.43	-32.12	75.62	-0	-1	2	1	2	2
		-449.17	-242.14	-134.54	47.40	-32.12	75.62	-11	-3	0	4	-3	-3
		-377.00	-131.81	-24.29	6.74	-99.79	154.13	-11	-0	4	1	9	9
		56	-23.01	-39.15	-33.92	241.40	913.13	-7	-0	-1	-3	21	21
123	11	-276.59	-231.21	14.94	233.44	-464.92	855.34	-7	-5	0	16	-40	-40
		-268.60	-93.77	299.00	53.12	-38.03	907.00	-11	-5	14	5	-33	-33
		-600.34	-652.95	-247.63	593.68	-662.19	154.13	-11	13	4	51	-57	-57
		31.17	53.10	-6.54	3.53	-351.73	913.13	-3	2	-1	0	-30	-30
124	12	-150.83	-214.34	47.27	42.59	22.81	321.48	-3	-6	5	0	2	2
		-403.61	-347.44	174.39	967.80	25.25	-765.05	-12	-10	14	0	22	22
		-100.53	-329.65	-7.71	68.37	23.81	-17.35	-0	10	4	6	2	2
		51.66	54.11	-33.89	-17.42	-208.63	117.97	-7	2	-2	-3	-16	-16
125	13	-53.54	-625.11	-470.40	4.00	-766.21	8661.90	-7	11	-2	0	-66	-66
		-788.15	-1244.74	-208.16	92.28	-496.04	-1065.05	-12	32	14	7	-82	-82
		-841.11	-506.32	-1130.86	-50.50	-102.65	-1048.61	-11	-0	24	-4	-69	-69
		22.35	-14.29	-63.19	-19.72	-77.744	117.97	-11	-0	-2	-2	-67	-67
126	14	-436.06	-544.77	-451.11	-102.97	-33.57	-494.07	-5	-9	-5	-9	-3	-3
		-725.27	-849.07	-177.05	19.37	-218.50	-86.85	-14	-21	10	12	-10	-10
		-573.77	-773.58	-112.83	-505.56	-130.04	-1260.51	-0	-9	-24	-4	-12	-12
		-18.14	28.30	-69.57	57.27	233.83	-134.85	-0	2	-2	5	20	20

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127	15	-496.70	-671.16	-514.36	227.00	787.74	9844.22	-5	.12	-6	2	60	-73
		-736.76	-915.80	-109.44	57.01	855.58	-86.88	.14	.21	10	5	74	8
		-787.50	-1272.23	-1326.56	23.31	1125.22	-1260.52	.70	.21	24	2	98	119
		34.16	174.65	-34.57	-14.31	382.41	-1185.28	-0	6	3	-1	53	-115
128	16	-334.22	-289.54	-92.57	-18.46	-54.59	320.63	.7	-5	3	3	5	-28
		-478.19	-503.37	11.61	-63.82	111.06	99.28	-11	.12	10	-7	10	1
		-437.23	-329.37	-125.45	-23.44	-77.30	-21.47	-11	-2	2	-2	-17	-2
		-87.23	-135.94	-164.18	-6.11	-199.94	-1039.78	0	-2	2	-1	-17	-80
129	17	-326.96	-358.66	-99.20	188.04	583.97	8654.58	-7	.14	3	16	51	-80
		-536.20	-596.75	-87.97	20.50	403.32	-1022.08	-11	.14	3	2	35	-80
		-351.16	-261.99	-20.58	520.76	752.12	-21.47	-11	3	3	4	65	-2
		-93.34	-150.23	-170.29	22.45	596.46	-1039.78	0	-2	2	2	32	-80
130	18	-80.63	-82.40	61.02	-1.31	-35.02	8215.51	-2	-3	4	-4	32	-80
		-303.08	-172.94	109.10	-79.93	-265.39	8854.82	-9	-4	6	-7	-23	-80
		32.31	-47.78	57.91	-32.07	117.52	337.18	1	-4	2	-3	10	32
		28.69	13.64	13.04	-11.94	42.61	71.18	1	0	2	-3	10	32
131	19	-148.47	11.83	104.31	-12.58	389.16	8552.12	-6	1	3	1	34	-80
		-191.17	18.17	221.02	-32.39	262.15	8854.82	-9	1	3	2	23	-80
		-280.93	-61.05	87.06	-37.09	337.26	8872.62	-10	-0	6	-3	29	-80
		26.70	6.34	10.86	-8.24	563.06	71.18	1	-0	2	-1	49	-80
132	20	-183.28	-293.04	-37.89	-132.16	7189	9150.19	-4	-4	0	-1	1	-80
		-389.29	-154.16	-136.47	-17.16	92.08	107.52	-10	0	2	-1	1	-80
		-112.20	-345.19	52.29	-42.87	-131.39	8735.49	-1	.11	1	-1	1	-80
		-48.34	-51.05	-29.48	63.54	62.98	197.37	-1	-1	0	6	-11	-80
133	21	-102.64	-77.85	-47.46	-0.07	263.48	1469.68	-4	1	3	0	5	-80
		-356.58	-11.4	-103.76	-22.23	388.65	107.52	-10	2	3	-2	34	-80
		111.63	176.58	76.12	9.02	133.42	6755.49	-1	2	4	1	12	-80
		-62.96	-99.24	-29.99	12.40	267.96	8761.01	-1	-2	1	1	23	-80
134	22	-189.54	-19.68	-33.61	-44.38	7.80	1128.13	-8	2	1	-3	1	-80
		-254.30	15.24	-30.74	-100.90	31.46	196.83	-8	4	1	0	1	-80
		-313.74	-110.61	-85.14	-46.26	117.87	67.54	-8	0	1	-4	10	-80
		1.42	16.49	24.05	-35.99	-125.13	8662.73	-0	0	1	-1	-11	-80
135	23	-144.11	73.90	34.24	14.88	193.16	4418.95	-6	0	2	10	17	-80
		-214.92	94.55	38.60	-26.07	22.172	8680.74	-8	5	3	2	28	-80
		-175.46	211.85	53.14	39.07	299.25	37.54	-8	6	3	3	2	-80
		-41.96	-44.71	-19.32	12.64	52.52	8662.73	-0	-2	1	1	2	-80
136	24	-42.42	33.40	39.44	-35.41	12.58	108.85	-8	1	3	-3	1	-80
		-226.78	11.30	10.37	-52.57	-73.74	3605.88	-8	3	3	-5	-6	-80
		90.42	136.44	110.28	-42.84	6.10	160.83	1	3	1	-4	1	-80
		-11.68	-47.52	-2.33	-10.83	103.15	118.51	0	1	1	-1	10	-80
137	25	-107.96	98.21	58.87	-23.77	11.38	3692.89	-3	-1	2	-2	10	-80
		-136.86	271.12	100.29	-35.37	1.51	8605.88	-8	4	3	2	1	-80
		-230.87	-9.03	22.92	-15.49	148.18	8610.31	-8	0	3	-3	13	-80
		43.85	82.53	53.41	-11.46	180.44	118.51	0	2	3	-1	14	-80
138	26	-130.65	-52.70	-14.99	-77.64	18.60	-91.68	-4	-3	1	-7	2	-80
		-294.85	-77.34	-85.19	19.88	8.544	127.17	-9	0	1	2	7	-80
		-38.24	-70.70	62.21	-19.55	-23.62	3367.31	-1	-3	3	2	2	-80
		-59.65	-40.05	-20.48	56.76	-6.83	165.38	-1	1	1	5	-2	-80
139	27	-108.27	-63.17	6.00	43.66	47.46	292.98	-4	1	1	5	1	-80
		-309.20	-63.17	-100.55	54.56	104.17	127.17	-9	2	1	4	4	-80
		41.17	114.59	141.62	70.36	-22.19	3567.31	-1	2	3	0	0	-80
		-56.79	-49.96	-20.36	6.07	60.41	438.73	-1	2	0	6	2	-80
140	28	-181.59	-14.04	-30.33	-1.96	6.53	-31.92	-5	-1	1	1	1	-80
		-244.51	-3.07	-63.29	3.10	12.85	150.08	-7	3	0	0	1	-80
		-255.69	-83.31	-21.59	-9.39	67.55	162.07	-7	1	0	0	1	-80
		-44.09	-15.13	-6.12	6.61	-60.49	4408.50	-1	0	0	1	5	-80
141	29	165.53	7.68	-7.85	-43.16	-16.40	4404.68	6	-1	0	-4	-1	-80
		80.13	54.80	34.94	-5.04	-47.58	7720.38	2	1	2	-0	-1	-80
		46.88	-83.24	-56.06	-26.145	33.34	804.84	3	-2	3	-5	3	-80
		368.59	51.20	38.46	-44.96	-34.97	111.07	1	-2	3	-6	3	-80
142	30	240.97	97.25	43.61	-98.02	26.22	110.42	1	0	2	-0	2	-80
		39.30	28.07	18.45	52.37	36.15	185.52	1	0	2	5	2	-80

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143	31	367.19	191.41	81.52	-392.33	59.32	7610.33	10	2	-3	31	5	-53
		314.43	72.26	31.45	5.90	-12.81	105.54	10	-1	-3	1	-1	-53
		104.11	-43.91	-31.25	-3.86	-90.51	3340.52	7	-4	-2	0	-8	-50
		-5.22	-75.82	-26.07	1.33	-163.71	105.52	1	-2	-0	0	-14	-55
		294.10	25.57	10.43	-3.09	-123.51	6510.52	10	-2	-3	0	-11	-55
144	32	201.45	-291.44	-78.10	-9.87	2.48	8590.70	10	-0	-3	1	0	-52
		118.44	-7.40	4.29	-8.24	47.79	3100.48	4	-1	-1	1	4	-52
		55.13	48.37	29.29	-17.24	-34.68	153.27	1	-1	-0	1	4	-52
		-6.22	-30.50	-36.24	-8.11	43.98	175.05	1	-3	-3	2	4	-52
		106.40	30.02	19.62	-19.37	134.08	829.68	10	-3	-3	0	2	-52
145	33	42.85	-133.10	-55.28	129.71	-175.07	8365.81	4	-3	-1	1	12	-52
		60.13	72.01	27.53	-4.43	-37.32	5642.78	11	2	-1	0	-16	-52
		-125.49	-369.81	-154.91	44.43	-289.19	175.00	1	-10	-0	-0	-23	-52
		254.32	-101.52	-32.76	-10.86	-212.72	8629.68	10	-6	-3	3	-18	-52
146	34	250.97	35.24	69.43	-43.68	47.48	5124.48	10	-2	-1	1	4	-52
		30.55	-20.52	-14.71	-1.55	18.61	8698.47	1	-1	-0	1	4	-52
		324.14	138.05	152.04	-3.53	-68.20	119.70	10	-1	-0	-4	16	-52
		355.22	-12.41	69.95	-25.97	25.00	205.32	12	-5	-1	2	6	-52
147	35	12.19	-16.36	-43.43	-20.74	-25.64	402.37	5	-2	-2	2	2	-52
		75.74	44.94	30.68	-30.81	-25.17	698.47	1	-3	-1	-2	-22	-52
		-90.27	-193.61	-261.58	-3.52	-114.41	5713.97	1	-2	-0	-2	-22	-52
		381.08	39.61	100.82	-37.88	-389.34	205.32	11	-3	-1	0	-34	-52
148	36	287.47	197.92	82.92	-148.42	2.48	254.68	7	0	-2	13	2	-52
		4.67	10.13	16.33	91.10	-10.14	203.62	0	3	0	4	2	-52
		504.86	488.29	123.55	-475.04	171.97	8785.58	11	10	-0	41	15	-52
149	37	174.42	-35.54	-93.00	-37.62	-367.97	128.87	11	-2	-1	-2	-7	-52
		115.12	-35.14	-5.66	1.93	-544.31	4453.70	7	-2	-5	0	-32	-52
		221.25	45.97	-65.02	-6.00	-32.48	7285.58	11	-1	-0	0	-47	-52
150	38	151.20	-117.42	-209.53	-9.20	-230.70	779.10	4	-4	-0	-2	-28	-52
		24.62	74.81	-20.37	-33.92	-48.51	8224.55	1	-1	-3	-6	-21	-52
		41.16	1.04	17.00	-33.92	-30.03	77.30	1	0	0	-6	7	-52
151	39	387.82	151.56	1.35	-1.94	-8.121	153.32	1	2	-1	-6	-7	-52
		184.08	148.85	15.18	-15.56	26.07	904.20	12	-8	-3	-10	23	-52
		61.26	43.18	65.66	5.53	-563.71	8808.23	1	2	-1	0	-48	-52
152	40	549.68	526.92	81.50	-33.14	-68.52	153.32	1	1	-0	14	-49	-52
		411.71	311.44	97.72	-5.52	-387.69	5004.20	12	-4	-1	45	-60	-52
		100.89	103.34	80.98	-37.42	44.48	3334.63	10	5	-4	07	-34	-52
153	41	525.42	268.47	205.93	-52.00	191.41	-1078.78	2	2	-1	05	4	-52
		407.83	562.62	14.54	-16.24	-125.84	110.58	15	13	-1	14	11	-52
		384.93	657.62	51.69	-49.72	-37.425	568.38	6	10	-0	27	-55	-52
		71.58	74.95	51.69	-19.72	-37.425	-1078.78	2	-0	-1	0	-33	-52
		227.72	797.41	-261.57	-120.65	-888.95	-1038.95	15	27	-19	11	-77	-52
		895.50	1140.50	325.90	-64.95	-54.42	110.58	15	27	-19	09	-56	-52
154	42	377.35	456.11	-41.86	-19.63	-54.42	467.88	12	12	-12	05	-4	-52
		36.85	83.20	64.52	97.27	-229.33	-72.97	13	2	-19	5	-20	-52
		390.73	377.69	334.52	-567.76	-106.23	-1234.62	13	12	-19	0	-29	-52
155	43	704.47	977.34	147.59	1.41	188.50	-95.90	13	23	-11	0	16	-52
		411.01	577.66	41.19	-47.92	71.48	819.98	16	6	-1	1	62	-52
		107.39	247.88	134.59	-4.31	790.70	-72.97	8	16	-1	4	60	-52
		282.52	125.39	-447.13	-44.10	1029.03	-1234.63	13	6	-19	-1	89	-52
156	44	443.13	1359.79	167.28	-65.34	334.63	-1152.15	13	35	-16	2	29	-52
		154.78	203.49	67.25	25.87	-34.04	5317.89	4	6	-6	2	-1	-52
		-14.00	-42.74	6.68	-0.14	208.35	72.62	0	-2	-1	1	18	-52
		128.19	353.48	64.43	32.76	-20.35	-1016.45	11	10	-3	5	-4	-52
157	45	156.26	206.31	-372.07	52.94	-20.35	-1016.45	11	10	-3	5	-4	-52
		350.14	318.87	-63.36	144.92	514.35	1681.30	4	6	-2	17	45	-52
		-14.90	-71.80	127.59	527.42	364.71	-1016.45	0	-2	-3	2	32	-52
		191.35	500.05	127.59	527.42	707.86	-9.10	0	14	-1	46	-52	
		292.31	193.93	-330.70	344.48	470.87	-1016.45	11	7	-10	3	41	-52

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158	46	318.26	172.72	111.34	24.52	-13.63	5222.42	0	1	1	1	2	-1	-13
		51.04	15.63	64.74	-11.94	-23.00	871.47	1	0	0	0	1	-1	-76
		24.00	150.30	94.02	33.86	133.80	131.98	12	0	0	0	3	12	11
159	47	479.74	326.22	175.24	51.63	41.70	72.30	11	4	4	4	4	12	1
		154.09	36.17	75.59	7.93	397.57	559.77	1	1	1	1	1	1	1
		44.86	30.53	62.56	-6.24	322.35	871.47	1	0	0	0	1	34	-49
		42.52	-8.24	91.84	1.51	325.14	580.13	1	2	2	2	0	34	-76
160	48	376.89	56.23	72.39	30.53	561.31	72.38	11	2	2	2	0	29	-76
		134.79	-104.98	18.06	-39.71	4.87	5153.68	5	5	5	5	3	49	4
		-41.42	-44.13	-13.34	63.54	90.46	98.18	1	1	1	1	3	-0	-13
		7.52	-22.84	46.37	-33.123	-154.39	2759.25	1	12	12	12	6	8	9
161	49	767.24	35.02	21.13	148.50	49.30	200.30	9	2	2	2	29	-13	-66
		160.94	-46.25	48.49	34.41	291.82	2474.48	5	2	2	2	13	4	17
		-66.62	-102.92	-38.53	12.40	424.96	98.18	1	2	2	2	3	35	-41
		346.90	97.16	214.79	44.67	168.40	8759.25	1	2	2	2	1	37	9
162	50	202.46	-138.90	-30.78	46.14	283.69	5762.28	6	6	6	6	4	14	-66
		58.55	-42.59	6.83	247.48	1.02	8122.58	2	2	2	2	4	25	-66
		-2.24	16.83	15.51	-15.99	31.87	196.43	1	0	0	0	3	9	-11
		-47.41	-120.0	-2.12	36.32	12.74	91.81	1	3	3	3	1	3	17
163	51	225.30	-35.51	7.11	68.11	-11.55	6555.97	0	4	4	4	6	10	8
		34.61	-77.10	-10.02	155.19	182.17	2414.81	2	2	2	2	6	-12	-37
		-38.68	-1.43	-11.66	12.64	215.64	2680.20	2	2	2	2	13	16	-36
		16.26	75.14	81.55	398.60	311.85	21.81	0	2	2	2	1	19	-59
164	52	118.25	-25.28	-99.93	54.23	28.72	2655.97	0	1	1	1	35	26	8
		195.16	4.87	92.53	6.34	17.41	2107.70	6	10	10	10	5	2	-37
		-4.77	-12.41	9.60	-10.83	-67.84	8609.41	0	2	2	2	1	2	-9
		344.73	116.07	186.37	-0.03	13.79	163.83	8	1	1	1	0	-6	-83
165	53	247.53	-59.03	81.04	30.47	106.29	122.48	0	5	5	5	3	1	14
		48.96	-22.78	-47.49	3.22	109.79	8367.27	3	2	2	2	0	10	11
		52.13	87.64	65.34	-11.46	9.45	2609.41	0	2	2	2	1	1	-32
		-43.47	-144.44	-24.27	8.40	142.74	2614.89	0	4	4	4	1	12	-83
166	54	267.89	-11.53	101.39	12.71	177.20	122.48	0	4	4	4	1	15	11
		90.44	-176.50	21.51	-39.93	14.10	-92.64	4	4	4	4	1	1	11
		-59.98	-60.18	-20.78	56.76	8.87	123.11	1	1	1	1	5	1	-8
		155.44	-148.23	36.07	-272.74	-35.11	123.11	1	1	1	1	5	1	11
167	55	175.85	-33.34	49.23	96.17	-6.46	123.11	6	6	6	6	4	-3	-89
		120.85	-7.52	29.61	-6.26	58.80	166.38	4	5	5	5	2	-1	-89
		-54.70	-47.67	15.50	6.07	120.78	292.17	4	2	2	2	1	5	15
		284.64	75.57	-15.50	22.39	120.78	123.11	1	1	1	1	1	10	-39
168	56	158.62	-47.26	-34.33	-47.23	66.41	2569.42	1	1	1	1	2	1	11
		5.54	-59.34	-7.85	7.96	-10.24	243.18	6	6	6	6	4	-1	-89
		-42.00	-11.03	-1.24	6.61	-12	23.81	1	1	1	1	1	6	-37
		-50.05	-93.11	49.99	-17	55.09	153.38	1	1	1	1	1	-1	-23
		195.66	-73.88	-51.30	17.43	-85.70	391.68	1	3	3	3	2	5	13

... STRESS-PSI ...										... STRESSES OF SEGMENT 4 ...										... STRAINS-MICRO INCHES ...											
ELT	ELS	X	Y	Z	XY	YZ	XZ	X	Y	Z	XY	YZ	XZ	X	Y	Z	XY	YZ	XZ	X	Y	Z	XY	YZ	XZ	X	Y	Z	XY	YZ	XZ
169	1	-34.49	55.23	-14.04	23.64	11.59	8208.29	-1	1	0	0	0	0	-1	1	0	0	0	0	-1	1	0	0	0	0	-1	1	0	0	0	0
		-226.14	16.14	16.14	31.14	72.15	355.14	-8	2	2	2	2	2	-8	2	2	2	2	2	-8	2	2	2	2	2	-8	2	2	2	2	2
		74.77	76.15	-20.39	46.79	-52.79	-540.79	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
170	2	-44.10	-29.40	-26.08	-7.01	-13.53	8435.24	-5	2	2	2	2	2	-5	2	2	2	2	2	-5	2	2	2	2	2	-5	2	2	2	2	2
		-16.73	-19.74	-43.44	11.45	-19.07	164.53	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
		-227.41	31.42	25.65	49.51	-54.60	386.88	-8	2	2	2	2	2	-8	2	2	2	2	2	-8	2	2	2	2	2	-8	2	2	2	2	2
		-330.14	-128.41	-154.29	-14.45	22.72	515.31	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
		60.90	17.77	33	-1.00	-8.14	-406.59	-2	2	2	2	2	2	-2	2	2	2	2	2	-2	2	2	2	2	2	-2	2	2	2	2	2
171	3	-130.51	88.75	-21.19	109.25	-8.64	5110.51	-2	2	2	2	2	2	-2	2	2	2	2	2	-2	2	2	2	2	2	-2	2	2	2	2	2
		-213.48	27.77	7.05	-59.51	34.86	-438.25	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
		-247.30	42.45	-73.25	41.77	24.63	515.31	-8	2	2	2	2	2	-8	2	2	2	2	2	-8	2	2	2	2	2	-8	2	2	2	2	2
		90.25	43.11	2.62	-31.02	-35.42	-406.59	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
172	4	-73.89	19.67	-16.13	5.00	-28.04	239.13	-2	2	2	2	2	2	-2	2	2	2	2	2	-2	2	2	2	2	2	-2	2	2	2	2	2
		-294.86	-0.04	-44.71	1.73	-12.63	5397.89	-9	2	2	2	2	2	-9	2	2	2	2	2	-9	2	2	2	2	2	-9	2	2	2	2	2
		57.46	143.88	50.74	13.14	5.74	562.43	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		-8.87	-84.82	-52.42	-15.22	-28.61	-92.91	-9	2	2	2	2	2	-9	2	2	2	2	2	-9	2	2	2	2	2	-9	2	2	2	2	2
173	5	-130.34	19.62	-50.53	-15.22	-28.61	-92.91	-9	2	2	2	2	2	-9	2	2	2	2	2	-9	2	2	2	2	2	-9	2	2	2	2	2
		-253.44	26.12	-161.36	-39.27	-111.23	7397.89	-10	2	2	2	2	2	-10	2	2	2	2	2	-10	2	2	2	2	2	-10	2	2	2	2	2
		-376.22	-110.34	-161.36	-9.43	-51.65	8465.99	-10	2	2	2	2	2	-10	2	2	2	2	2	-10	2	2	2	2	2	-10	2	2	2	2	2
		52.52	73.17	15.27	-1.84	31.04	562.43	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
174	6	-53.07	25.13	15.07	-161.62	-18.50	280.51	-10	2	2	2	2	2	-10	2	2	2	2	2	-10	2	2	2	2	2	-10	2	2	2	2	2
		-221.77	221.31	50.44	-14.51	-11.50	607.61	-10	2	2	2	2	2	-10	2	2	2	2	2	-10	2	2	2	2	2	-10	2	2	2	2	2
		14.74	2.50	-9.02	-486.70	-234.28	836.11	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		41.12	41.57	4.50	16.36	-19.30	620.01	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		-90.96	6.34	-20.60	-17.16	-19.97	-61.50	-3	2	2	2	2	2	-3	2	2	2	2	2	-3	2	2	2	2	2	-3	2	2	2	2	2
		-132.21	-10.34	-60.80	-60.80	89.27	607.61	-10	2	2	2	2	2	-10	2	2	2	2	2	-10	2	2	2	2	2	-10	2	2	2	2	2
		65.87	121.47	38.11	-21.74	-10.82	836.11	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
175	7	-214.90	95.83	-76.39	-35.13	-25.12	334.08	-3	2	2	2	2	2	-3	2	2	2	2	2	-3	2	2	2	2	2	-3	2	2	2	2	2
		-78.42	92.83	-5.70	-46.72	-234.28	696.24	10	2	2	2	2	2	10	2	2	2	2	2	10	2	2	2	2	2	10	2	2	2	2	2
		-428.70	-19.16	-244.99	-43.00	-12.05	686.82	-10	2	2	2	2	2	-10	2	2	2	2	2	-10	2	2	2	2	2	-10	2	2	2	2	2
		67.42	79.63	21.51	-15.67	-30.76	836.11	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
176	8	-177.05	-2.62	14.10	11.23	-5.51	-56.11	-3	2	2	2	2	2	-3	2	2	2	2	2	-3	2	2	2	2	2	-3	2	2	2	2	2
		-297.76	-16.99	53.32	-107.35	-12.77	8465.99	-10	2	2	2	2	2	-10	2	2	2	2	2	-10	2	2	2	2	2	-10	2	2	2	2	2
		-262.75	131.41	-99.04	474.19	12.77	686.82	10	2	2	2	2	2	10	2	2	2	2	2	10	2	2	2	2	2	10	2	2	2	2	2
		40.35	37.44	3.43	33.14	-9.52	836.11	-3	2	2	2	2	2	-3	2	2	2	2	2	-3	2	2	2	2	2	-3	2	2	2	2	2
177	9	-134.61	-32.85	-36.28	-2.35	-37.57	411.50	-4	2	2	2	2	2	-4	2	2	2	2	2	-4	2	2	2	2	2	-4	2	2	2	2	2
		-385.11	-70.74	9.19	-18.95	-48.15	335.92	-12	2	2	2	2	2	-12	2	2	2	2	2	-12	2	2	2	2	2	-12	2	2	2	2	2
		-1.79	21.81	-65.63	4.47	-30.76	794.78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		-14.83	-46.62	52.38	7.73	-23.79	803.72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
178	10	-302.05	144.97	-53.04	-26.11	-1.08	7.33	-8	2	2	2	2	2	-8	2	2	2	2	2	-8	2	2	2	2	2	-8	2	2	2	2	2
		-483.10	-299.83	88.99	-55.83	-48.11	357.92	-12	2	2	2	2	2	-12	2	2	2	2	2	-12	2	2	2	2	2	-12	2	2	2	2	2
		-440.16	-134.33	-39.98	-36.74	-15.54	8465.99	-13	2	2	2	2	2	-13	2	2	2	2	2	-13	2	2	2	2	2	-13	2	2	2	2	2
		6.10	2.25	-30.15	7.05	166.39	803.72	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
179	11	-159.05	-121.70	64.69	-205.77	-46.88	529.11	-4	2	2	2	2	2	-4	2	2	2	2	2	-4	2	2	2	2	2	-4	2	2	2	2	2
		-155.79	-171.14	261.63	-14.74	-38.93	941.38	-13	2	2	2	2	2	-13	2	2	2	2	2	-13	2	2	2	2	2	-13	2	2	2	2	2
		-143.61	-445.39	-50.33	-610.16	-67.97	294.78	-13	2	2	2	2	2	-13	2	2	2	2	2	-13	2	2	2	2	2	-13	2	2	2	2	2
		27.26	48.42	-11.21	7.59	-351.73	940.74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
180	12	-206.91	282.41	-12.41	-32.33	267.73	941.38	-4	2	2	2	2	2	-4	2																

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183 15	-585.07	-590.82	-486.17	204.05	22.54	207.93	-9	-9	-4	18	2	28
	-701.61	-879.65	-82.15	-9.47	-151.26	-145.34	-21	-21	13	-1	14	13
	-108.03	-927.35	-1312.32	669.52	-41.21	1212.64	-14	-14	24	58	-4	105
184 16	2.64	74.70	-64.04	-47.60	274.10	720.349	2	2	-3	-4	24	106
	-562.07	-674.45	-464.11	51.04	785.70	520.69	-12	-12	-5	4	66	45
	-784.58	-867.77	-104.73	61.66	789.46	-384.02	-21	-21	13	5	68	103
185 17	-801.67	-1278.20	-1332.00	103.04	1125.22	921.03	-1	-1	-24	9	98	108
	52.07	182.71	-26.51	-12.18	332.41	1025.65	-22	-22	-3	33	33	109
	-250.05	-271.61	-72.44	28.85	-11.41	132.73	-6	-6	-4	-1	-4	105
	-566.22	-476.09	74.13	101.94	67.43	132.73	-10	-10	15	0	8	103
186 18	-523.63	-276.69	-444.86	-73.54	-73.65	2243.40	-11	-11	15	0	8	103
	-64.71	11.21	-148.10	-11.09	-10.61	1025.65	-15	-15	3	-0	-0	101
	-239.54	-240.10	-65.03	-189.24	505.90	421.40	-1	-1	3	-0	-0	109
	-665.59	-62.26	-143.42	59.65	403.32	859.23	-14	-14	3	16	49	107
	52.01	47.50	119.33	-63.13	685.12	7436.41	-1	-1	3	5	35	104
187 19	-161.42	-153.76	-173.75	5.77	599.40	641.39	-0	-0	-3	-55	41	103
	-274.64	-124.21	14.83	49.57	-37.04	25.41	-5	-5	-4	0	52	102
	-480.88	-222.20	39.29	1.88	-230.27	659.23	-14	-14	4	4	-3	102
	-14.80	-05.67	49.68	51.90	80.96	3430.91	-0	-0	3	4	4	104
188 20	-27.24	-35.34	-31.48	5.90	41.50	3346.59	-0	-0	3	1	0	100
	-234.32	-27.38	63.45	-5.99	374.21	327.61	-0	-0	5	1	33	108
	-316.52	167.30	167.30	-2.61	324.15	734.13	-13	-13	0	-1	23	102
	-319.81	-112.00	36.12	4.70	333.28	219.31	-13	-13	0	0	29	104
189 21	7.37	-4.60	-13.07	-19.95	535.21	-470.02	-0	-0	-0	-2	46	101
	-327.10	-203.38	-63.16	145.34	4.34	-49.37	-0	-0	3	16	0	104
	-418.91	-36.94	-42.59	21.21	153.74	397.40	-13	-13	3	12	0	104
	-559.01	-483.46	-123.08	579.56	-123.75	719.31	-0	-0	3	0	29	102
190 22	-2.36	-29.68	-23.62	-44.74	35.03	-470.02	-13	-13	0	50	11	101
	-110.78	5.75	75.34	1.08	260.67	276.53	-15	-15	4	0	2	102
	-407.20	-71.34	-31.40	10.47	303.21	446.08	-13	-13	4	0	2	104
	126.00	182.74	282.28	-12.33	335.82	654.42	-0	-0	4	0	23	103
191 23	-51.01	-94.14	-24.87	3.10	267.06	640.08	-1	-1	0	10	13	106
	-255.88	-7.17	-17.56	12.05	-23.29	-74.72	-0	-0	1	3	1	104
	-354.84	50.97	21.02	307.00	-11.90	466.08	-13	-13	2	1	2	100
	-424.17	-123.87	-11.21	14.34	81.52	938.73	-12	-12	2	1	1	104
192 24	11.36	21.40	37.50	-14.80	143.59	640.08	-1	-1	2	1	8	106
	-183.24	8.20	44.48	-252.48	190.84	238.13	-5	-5	3	-13	17	103
	-163.02	1.07	-24.57	21.13	227.72	573.20	-12	-12	3	2	20	100
	124.03	330.83	180.67	-49.55	202.27	449.92	-1	-1	2	2	25	103
193 25	-76.72	-27.04	-31.65	20.97	52.52	591.12	-11	-11	1	43	2	101
	-132.64	-27.04	-8.23	25.90	-24.51	96.18	-5	-5	3	2	3	100
	-419.00	-23.20	-73.55	37.74	-18.27	573.20	-12	-12	3	2	2	100
194 26	23.50	26.25	69.13	29.14	-32.52	449.92	-1	-1	3	3	3	100
	-67.62	-78.07	-40.27	16.13	64.25	-411.01	-1	-1	3	3	3	100
	-221.12	49.34	5.06	-10.17	104.44	215.24	-0	-0	3	1	9	100
	-285.44	157.44	34.61	-11.32	14.51	544.28	-11	-11	3	1	1	100
	-327.12	-71.70	39.73	-16.44	132.44	437.48	-1	-1	3	3	13	100
195 27	7.61	59.41	21.02	-16.44	132.44	437.48	-1	-1	3	3	13	100
	-275.89	-94.78	-33.46	152.14	-5.80	-69.57	-0	-0	3	3	1	100
	-457.41	-57.47	10.51	33.10	42.49	310.10	-11	-11	3	3	1	100
	-428.50	-191.64	-91.15	437.69	-26.48	538.07	-11	-11	3	3	1	100
	-41.37	-15.22	-10.54	-34.45	-12.61	437.48	-1	-1	3	3	1	100
196 28	-159.47	-27.86	30.28	39.41	26.90	296.49	-0	-0	3	3	3	100
	-177.41	-51.74	6.02	43.35	41.29	330.81	-13	-13	3	3	2	100
	-29.44	44.33	111.36	55.42	-22.19	537.29	-2	-2	3	3	2	100
197 29	-73.16	-56.11	-26.54	-1.58	60.41	641.87	-3	-3	3	3	2	100
	268.37	17.64	9.09	-17.15	51.09	368.91	-1	-1	3	3	2	100
	59.29	-16.27	4.69	-7.01	51.09	368.91	-1	-1	3	3	2	100
	187.80	14.30	11.24	60.16	-54.40	537.14	-12	-12	3	3	2	100
198 30	354.02	-15.04	11.34	-50.25	-27.63	167.10	-5	-5	3	3	2	100
	150.00	3.7	-14.85	-36.51	-27.63	167.10	-5	-5	3	3	2	100
	54.14	90.95	31.09	-1.00	-47.58	393.50	-2	-2	3	3	2	100

199	31	-14.75	-19.44	-12.17	-6.65	33.34	512.70	2	-2	-3	-5	3
		704.12	59.47	-47.90	-47.90	-66.64	8404.79	12	-2	-3	-4	-3
		159.25	20.25	-9.50	13.53	-25.23	109.35	5	-1	-2	-4	-3
		80.22	34.08	28.22	-3.02	19.77	436.04	2	1	-0	-2	2
		34.33	8.18	-22.59	43.30	3.86	512.70	2	1	-3	3	0
200	32	356.21	-1.92	15.61	-2.77	-99.19	504.79	12	-4	-3	-0	0
		216.90	-42.42	-12.40	18.36	-64.76	235.37	6	-4	-2	-1	-7
		-1.81	-77.78	-35.04	13.18	-126.77	339.44	1	-2	-0	1	-7
		370.61	57.46	42.36	12.98	-128.31	545.80	11	-2	-3	1	-11
		281.90	-146.97	-35.62	-2.75	2.48	559.75	12	-6	-3	2	-11
201	33	125.67	-1.81	25.45	2.85	-17.80	524.75	4	-1	-2	2	0
		65.88	40.18	31.75	-1.84	-161.39	339.44	1	2	-0	-0	-9
		-59.72	-154.00	48.93	3.73	6.67	844.53	1	-3	-2	-3	-3
		174.45	49.30	48.93	35.67	40.22	534.75	12	-4	-2	-11	3
202	34	221.05	-43.32	-8.1	-13.43	-163.11	284.04	8	-3	-2	-3	3
		45.15	15.01	15.01	16.36	-35.32	630.95	1	-2	-2	-1	3
		322.67	-122.99	-14.71	-45.51	-242.40	331.73	11	-2	-2	-0	-14
		321.13	-72.88	-3.63	4.85	-212.72	511.73	11	-1	-2	-4	-2
203	35	237.52	-3.23	7.33	4.82	-17.65	622.99	11	-6	-3	-4	-21
		-1.55	-8.02	-22.79	16.20	-61.24	78.07	6	-3	-2	-4	-10
		402.11	15.67	64.53	43.84	-11.64	610.05	1	-1	-2	4	7
		114.00	-70.53	-29.75	8.64	-18.17	331.73	11	-1	-2	4	-28
204	36	125.41	-21.18	-62.69	-11.16	-231.13	463.38	11	-5	-3	-1	-38
		70.47	82.04	28.63	-15.67	-231.17	633.99	1	-2	-1	-0	30
		-300.06	-104.40	-22.75	-11.69	-114.41	886.00	1	-3	-1	-1	90
		408.43	47.30	34.04	1.67	-326.92	1386.14	13	-3	-3	1	30
205	37	205.73	156.40	19.83	12.74	-31.59	-57.53	3	3	-3	16	-28
		68.41	56.71	48.38	-33.14	-64.17	-472.44	1	1	0	-3	-31
		92.59	271.14	-83.14	54.88	84.11	909.09	1	9	-0	47	7
		440.03	141.14	74.26	30.29	-114.72	336.14	13	-1	-3	3	-28
206	38	244.69	15.14	-63.06	24.94	-354.15	405.11	9	-2	-4	-4	-10
		7.99	-24.60	8.77	1.73	-504.57	362.32	3	-1	-4	1	-31
		407.07	85.67	-26.31	30.69	-326.16	787.22	13	-1	-6	3	-44
		314.78	-76.52	-105.63	36.40	-236.70	790.42	13	-4	-4	3	-28
207	39	171.87	142.08	-14.98	3.83	21.46	-1.08	4	-3	-4	-21	9
		30.22	27.18	28.00	1.05	-44.38	362.32	4	3	-4	2	9
		14.57	126.13	54.01	26.62	-122.49	2431.20	-0	5	-3	12	-11
		484.41	272.81	-84.92	70.87	231.21	790.41	13	5	-0	6	-27
208	40	179.01	219.30	70.87	-195.17	-554.62	542.42	9	3	-4	-17	99
		52.35	78.51	58.98	7.59	-562.71	905.64	4	4	-4	-49	84
		438.00	22.00	41.82	-60.71	-713.46	203.51	14	2	-3	-52	-25
		610.62	57.33	111.80	10.61	-387.69	935.13	14	-4	-0	-32	82
209	41	385.61	36.10	36.06	48.49	45.27	107.74	9	6	-0	1	9
		54.03	44.53	61.56	2.22	212.02	905.64	2	2	-0	2	4
		536.96	252.09	140.74	41.28	83.57	223.51	0	1	-3	4	84
		564.91	594.14	78.99	-96.14	-150.78	158.90	14	15	-15	7	-25
210	42	374.35	642.87	-24.05	-46.49	-654.31	690.00	14	16	-11	-31	-31
		60.61	55.25	46.09	-10.34	-379.40	1113.59	6	6	-4	-4	37
		187.82	790.31	159.07	-43.41	-406.95	1179.63	1	1	-1	-1	12
211	43	874.62	1150.06	159.93	-67.71	-694.59	222.98	1	27	-19	-4	-77
		294.40	432.30	-99.88	156.36	-55.9	267.08	16	27	-15	-6	-60
		97.08	103.14	95.05	-47.89	-204.68	155.52	6	13	-11	14	-10
		-23.14	256.02	619.69	619.69	-15.88	1179.63	1	15	-1	-4	-23
212	44	800.44	943.95	94.75	-10.73	203.80	-22.98	1	15	-15	54	-1
		485.18	616.00	-7.25	-28.52	696.60	512.00	16	23	-15	0	18
		124.59	259.31	152.26	-12.11	723.57	336.70	10	16	-11	-2	60
		364.43	140.45	-411.94	26.31	1829.03	936.41	0	6	-1	1	83
213	45	963.33	1814.35	237.93	-89.44	336.39	1005.50	15	6	-2	2	69
		232.89	247.51	-56.02	-61.19	137.99	110.77	16	35	-10	-6	29
		7.01	-24.50	30.57	-11.91	200.25	337.68	0	6	-7	1	1
		154.16	357.08	10.38	-109.30	-28.42	267.58	0	-1	-9	-9	-34
		532.37	409.48	-191.03	-122.36	-135.15	1015.50	2	10	-5	-11	-23

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214 46	139.83	254.47	-10.98	-249.54	491.29	427.69	9	5	-6	21	43	37
	-22.98	-75.24	0.20	5.77	744.51	862.79	-0	-2	0	0	32	35
	474.89	95.70	29.75	-655.99	638.78	546.33	14	11	-5	-59	55	-38
215 47	486.60	-201.72	-201.72	-41.47	470.17	854.52	14	17	10	0	41	74
	133.75	120.14	51.18	-35.12	-91.0	28.68	9	0	-3	-3	-1	2
	7.13	-5.85	39.56	5.97	-191.27	862.78	-0	-1	1	1	-17	75
	472.79	134.45	37.45	-32.1	116.15	546.33	14	-1	-5	-3	10	-30
216 48	523.32	267.23	74.20	-78.63	461.2	532.48	14	-1	-5	-3	14	-30
	166.20	38.53	44.04	-24.76	386.61	354.92	5	-1	-0	-2	34	39
	37.74	25.77	57.79	-19.95	302.25	739.36	0	-1	-2	-2	26	64
	32.10	-11.12	89.08	-15.59	329.14	728.64	0	-2	-1	-1	29	63
217 49	424.76	70.83	-4.83	-39.57	529.13	465.24	13	-2	-5	-3	46	-40
	95.10	-138.08	-28.39	134.78	-22.8	-1.88	5	-5	10	-10	-2	-40
	15.88	-18.58	28.64	-44.74	83.11	598.57	0	-1	1	1	7	-34
	-134.54	-69.94	-81.56	513.06	-152.14	728.64	0	-1	1	4	-13	63
218 50	484.83	20.84	-27.54	-112.89	15.1	465.24	13	-5	-10	-10	-13	-40
	250.54	-0.18	89.47	-11.27	209.24	471.47	13	-3	1	1	25	24
	-50.62	-73.75	-27.04	3.10	415.11	272.21	-1	-4	-1	0	36	-41
	474.04	151.01	29.25	-27.94	160.10	648.73	12	-2	0	-2	14	36
219 51	328.20	-85.10	23.11	-14.97	203.35	639.38	12	-6	-1	-1	25	55
	114.41	-1.64	19.48	-39.93	-157.9	-28.41	4	-1	-1	-1	1	-7
	11.75	51.79	36.42	-14.80	156	471.47	-1	-1	-1	0	0	-41
	-12.84	-112.12	-84.62	-37.04	99.18	466.13	0	-3	-1	-3	9	-35
220 52	395.50	42.59	84.40	-67.94	-148.0	639.38	12	-3	-2	-6	-13	55
	184.33	-48.88	27.73	-153.21	175.45	228.97	6	-4	-0	-13	15	21
	-67.45	-63.74	-24.01	20.97	215.84	523.58	-1	-2	2	2	19	30
	413.65	264.06	167.90	-502.04	281.59	441.88	10	-1	-1	-4	24	-39
221 53	209.78	-68.71	-68.71	21.47	28.72	595.28	10	-10	-2	2	2	52
	195.73	-13.25	31.02	-24.29	-11.67	-93.01	6	-3	-0	-0	-1	2
	-55.55	-66.0	-12.11	10.13	-72.94	523.58	-10	-2	1	1	-8	-30
	369.72	12.21	133.02	-162	-16.1	445.88	10	-3	-1	-1	-2	-39
222 54	273.63	-77.13	-14.00	-17.23	750.5	435.78	10	-3	0	0	7	9
	89.63	-42.95	1.75	-9.38	105.69	237.34	3	-2	-1	-1	9	39
	11.25	71.48	49.18	-16.44	9.15	527.98	-1	-2	-1	-1	12	47
	-84.58	-159.10	-20.32	-7.47	142.74	542.04	-1	-4	1	-1	14	-38
223 55	289.23	-39.83	-4.61	-10.23	164.88	-428.01	10	-4	-3	-1	14	-38
	65.83	-56.82	0	86.12	-23.15	-73.37	3	-3	-1	-1	-2	-9
	-24.88	-14.74	28.27	-39.45	30.23	55.14	-1	-1	-3	-3	3	-27
	-83.72	-17.17	-16.45	39.14	-50.64	542.04	-1	-4	-3	-3	-4	-47
224 56	290.76	1.74	17.47	-10.14	-49.93	433.01	10	-3	-3	-9	-4	-38
	179.63	20.27	63.68	-27.92	42.1	231.38	5	-2	-2	-2	-4	-25
	-55.40	-40.14	10.22	-1.55	70.11	525.13	-2	-1	0	-0	6	-38
	516.70	117.45	16.15	-10.54	-9.78	531.83	-8	-1	-1	-1	6	-40
	277.59	-16.27	14.66	-72.68	68.41	666.47	9	-1	-0	-0	-1	38

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*** STRESS-PSI ***

*** STRESSES OF SEGMENT 5 ***

*** STRAINS-MICRO INCHES ***

FLT ELS	X	Y	Z	XV	YZ	YV	Y	Z	XV	YV	YV	XZ	XZ
226 1	-49.07	49.07	-28.52	44.82	11.84	-18.27	-2	-1	4	1	1	1	1
	-100.30	56.47	-7.48	-31.61	11.68	160.51	-4	0	-3	1	1	1	1
	-94.09	100.22	-74.00	193.17	64.64	289.08	-4	0	-3	1	1	1	1
	55.07	18.53	11.82	-26.91	-40.92	3103.30	2	0	17	6	6	6	6
226 2	-68.01	-6.41	52.75	36.63	-54.16	206.50	2	0	2	3	3	3	3
	-169.12	22	-36.59	47.58	-123.22	126.83	2	0	4	5	5	5	5
	-21.06	32.97	-72.57	56.38	-52.79	318.48	0	0	4	5	5	5	5
	-7.61	-52.42	-49.09	11.93	13.53	426.11	0	0	4	5	5	5	5
227 3	-11.96	21.9	-39.68	-15.87	17.11	49.03	-3	0	-1	1	1	1	1
	-152.23	19.04	-19.69	-32.87	-50.27	126.83	-3	0	-1	1	1	1	1
	-211.50	-43.21	-65.02	-11.31	5.29	126.83	-3	0	-1	1	1	1	1
228 4	27.78	10.14	-13.71	-1.43	98.31	126.83	-3	0	-1	1	1	1	1
	-28.59	10.14	-13.71	-1.43	98.31	126.83	-3	0	-1	1	1	1	1
	-94.40	150.35	59.05	-40.24	34.66	426.11	-3	0	-1	1	1	1	1
	-25.07	-123.44	-47.09	-28.40	-175.08	426.11	-3	0	-1	1	1	1	1
	30.11	28.54	-14.15	-6.56	-85.42	474.04	1	0	-1	1	1	1	1
229 5	-28.42	12.24	4.88	-16.05	33.02	52.55	-1	0	1	1	1	1	1
	-157.45	-9.63	-0.02	-43.80	151.28	426.11	-1	0	1	1	1	1	1
	57.25	48.22	34.43	-10.64	-50.61	426.11	-1	0	1	1	1	1	1
	10.74	-21.01	-10.77	14.30	-50.61	426.11	-1	0	1	1	1	1	1
230 6	-76.51	70.04	3.75	-20.65	-123.03	287.50	1	0	1	1	1	1	1
	-92.67	145.11	67.50	-45.13	-111.23	508.44	-3	0	1	1	1	1	1
	-194.59	-35.40	-84.52	-23.61	-56.65	465.80	-3	0	1	1	1	1	1
231 7	50.74	78.44	32.14	7.01	-252.22	112.35	-3	0	1	1	1	1	1
	-64.79	54.75	13.15	30.64	51.27	55.61	-3	0	1	1	1	1	1
	-169.73	-7.75	-20.53	-9.77	6.77	109.63	-3	0	1	1	1	1	1
	-48.01	313.27	64.10	23.45	196.42	465.80	-3	0	1	1	1	1	1
232 8	21.30	-6.37	-4.21	-23.66	-48.98	112.35	1	0	1	1	1	1	1
	-57.06	20.91	-12.61	-11.41	-156.43	331.04	1	0	1	1	1	1	1
	-193.05	17.37	-19.09	-47.13	-320.12	105.02	-6	0	1	1	1	1	1
233 9	64.44	113.94	37.58	-22.22	-28.35	545.12	1	0	1	1	1	1	1
	-45.78	-66.58	-55.42	29.11	-28.35	545.12	1	0	1	1	1	1	1
	-215.68	-24.31	-37.18	-25.18	66.94	63.52	-3	0	1	1	1	1	1
	-211.44	-23.68	-37.58	-59.66	-36.40	105.02	-3	0	1	1	1	1	1
234 10	-249.44	-58.23	-54.35	23.44	-17.94	109.30	-7	0	1	1	1	1	1
	-64.97	10.97	-19.61	6.97	252.51	464.88	-7	0	1	1	1	1	1
	-83.69	-108.07	-2.05	-147.86	-161.40	306.80	-7	0	1	1	1	1	1
	-104.20	71.11	134.42	-97.85	-32.77	453.32	-7	0	1	1	1	1	1
235 11	-155.72	-416.13	-131.21	-331.86	-354.90	85.07	-6	0	1	1	1	1	1
	10.44	20.94	-13.07	-13.24	-96.52	552.14	-6	0	1	1	1	1	1
	-55.02	-45.22	29.82	-21.49	70.43	66.28	-2	0	1	1	1	1	1
	-17.91	-48.99	67.70	-62.70	281.99	453.32	-2	0	1	1	1	1	1
236 12	2.94	-45.91	27.45	-22.97	-19.83	85.33	-6	0	1	1	1	1	1
	5.91	-2.85	-6.69	13.21	-50.58	109.42	-6	0	1	1	1	1	1
	-121.84	-43.04	34.50	-3.67	-193.88	307.04	-6	0	1	1	1	1	1
	-22.35	-19.97	20.87	-41.26	-48.11	535.86	-6	0	1	1	1	1	1
237 13	-158.25	-12.42	82.12	27.61	-151.84	470.54	-6	0	1	1	1	1	1
	10.67	13.07	74.51	20.87	-387.80	470.54	-6	0	1	1	1	1	1
	-91.18	5.10	74.51	20.87	-387.80	470.54	-6	0	1	1	1	1	1
	-245.89	-256.11	23.91	-45.75	81.23	111.59	-6	0	1	1	1	1	1
238 14	-4.53	329.84	28.74	-45.75	81.23	111.59	-6	0	1	1	1	1	1
	-10.40	-57.50	-20.77	-11.47	26.91	470.54	-6	0	1	1	1	1	1
	-195.55	-302.15	-74.70	-11.47	26.91	470.54	-6	0	1	1	1	1	1
	-186.27	-469.07	-91.26	26.20	-172.10	508.04	-6	0	1	1	1	1	1
	-142.79	-409.23	-33.23	4.71	-315.12	534.53	-6	0	1	1	1	1	1
	-57.60	2.42	-99.60	33.57	-237.23	467.50	-6	0	1	1	1	1	1

[illegible]

254	31	130.34	-26.03	-99.10	21.40	-54.44	312.36	-1	4	2	5	25	25
		156.16	-104.12	-77.74	-26.64	7.57	427.50	-4	3	1	2	25	25
		74.45	-1.94	-18.43	15.72	22.11	44.32	-1	1	1	1	2	25
		41.74	44.11	18.07	-1.43	-45.45	3127.97	-1	1	1	1	2	25
		-17.45	-59.01	-45.31	18.44	9.02	555.59	-1	1	1	1	2	25
256	32	199.06	9.94	-28.85	30.16	102.75	427.50	-1	3	3	3	25	25
		110.65	-6.01	-34.52	-77.54	-86.35	272.00	-4	1	1	1	25	25
		41.06	17.31	11.45	-6.54	19.70	446.59	-1	1	1	1	25	25
		130.32	-209.66	-45.00	-259.64	-179.56	408.18	-1	1	1	1	25	25
		160.55	-85.69	-69.10	3.06	-99.19	478.00	-4	1	1	1	25	25
257	33	160.00	13.44	-23.51	41.97	35.91	541.19	-1	1	1	1	25	25
		15.15	-93.19	-14.48	14.30	151.31	446.59	-1	1	1	1	25	25
		252.79	75.17	76.17	30.97	-46.03	408.18	-1	1	1	1	25	25
		212.45	-11.65	29.85	22.62	28.45	475.72	-1	1	1	1	25	25
258	34	75.79	-16.97	-18.53	31.52	-111.22	287.44	-1	1	1	1	25	25
		54.15	76.07	24.44	7.01	-181.39	509.78	-1	1	1	1	25	25
		-129.34	-122.25	-122.25	22.14	8.67	467.13	-1	1	1	1	25	25
		227.15	1.68	38.24	25.36	-240.94	414.03	-1	1	1	1	25	25
259	35	132.76	105.14	39.24	107.51	44.23	55.03	-1	1	1	1	25	25
		35.74	1.50	12.04	-23.66	142	4185.12	-1	1	1	1	25	25
		159.53	310.37	64.21	302.61	187.25	467.13	-1	1	1	1	25	25
		228.40	4.51	39.49	48.59	-54.08	414.03	-1	1	1	1	25	25
260	36	32.40	-52.79	-47.08	93.21	-150.26	299.13	-1	1	1	1	25	25
		-28.15	-51.95	-21.28	29.11	-316.00	105.00	-1	1	1	1	25	25
		214.07	39.14	4.00	54.18	-116.01	543.24	-1	1	1	1	25	25
		92.27	-145.54	-124.78	44.34	-181.17	400.00	-1	1	1	1	25	25
261	37	46.96	13.59	-14.28	70.83	60.20	405.00	-1	1	1	1	25	25
		7.56	11.06	14.53	8.97	-35.74	105.00	-1	1	1	1	25	25
		-45.88	-28.44	-31.43	45.20	-10.20	1173.27	-1	1	1	1	25	25
		170.11	17.04	-37.04	78.87	258.43	460.00	-1	1	1	1	25	25
262	38	67.71	-117.27	-41.06	-64.05	-181.30	310.00	-1	1	1	1	25	25
		30.10	46.21	31.87	-13.25	-64.07	462.59	-1	1	1	1	25	25
		35.29	-39.05	-15.25	-25.09	-365.34	84.48	-1	1	1	1	25	25
		182.73	72.02	-30.47	-60.80	-114.72	553.20	-1	1	1	1	25	25
263	39	160.85	25.24	-36.87	58.31	85.40	49.14	-1	1	1	1	25	25
		15.74	7.14	17.72	19.21	292.14	462.59	-1	1	1	1	25	25
		244.22	96.45	93.08	56.39	-52.31	84.48	-1	1	1	1	25	25
		222.37	120.04	-7.79	99.33	-30.63	175.30	-1	1	1	1	25	25
264	40	118.62	131.27	9.58	93.23	-177.19	314.20	-1	1	1	1	25	25
		20.71	23.10	23.02	20.87	-44.78	546.12	-1	1	1	1	25	25
		32.97	124.02	-44.13	22.77	-122.46	462.59	-1	1	1	1	25	25
265	41	278.19	216.70	50.94	83.05	-364.73	86.40	-1	1	1	1	25	25
		154.29	244.71	60.36	108.16	52.03	339.75	-1	1	1	1	25	25
		57	-87.41	17.30	11.47	-94.86	402.59	-1	1	1	1	25	25
		203.29	531.44	124.20	295.36	247.31	402.59	-1	1	1	1	25	25
266	42	264.81	210.14	39.57	40.59	3.04	86.40	-1	1	1	1	25	25
		134.06	210.14	-67.23	64.14	-116.59	290.00	-1	1	1	1	25	25
		4.67	6.66	50.36	33.57	-282.56	83.02	-1	1	1	1	25	25
		203.28	179.84	-2.27	79.34	83.57	523.00	-1	1	1	1	25	25
267	43	194.23	176.02	-251.29	79.54	-150.78	432.00	-1	1	1	1	25	25
		37.89	176.02	-114.31	-6.64	45.50	92.00	-1	1	1	1	25	25
		-29.46	17.47	14.29	1.35	73.06	83.02	-1	1	1	1	25	25
		56.69	262.74	-0.09	-29.27	101.15	70.30	-1	1	1	1	25	25
268	44	84.38	142.74	-303.13	3.87	163.94	432.00	-1	1	1	1	25	25
		288.29	448.11	60.85	-170.47	1.19	267.00	-1	1	1	1	25	25
		52.01	43.00	74.33	-50.10	4.46	476.00	-1	1	1	1	25	25
		405.66	526.93	181.25	-369.35	4.46	476.00	-1	1	1	1	25	25
269	45	407.20	793.57	-77.64	-109.94	203.80	422.12	-1	1	1	1	25	25
		184.02	145.06	-77.64	-109.94	203.80	422.12	-1	1	1	1	25	25
		44.09	47.44	69.31	-15.43	-29.49	106.12	-1	1	1	1	25	25
		222.42	110.31	1.02	7.00	-138.74	476.00	-1	1	1	1	25	25
		294.25	354.22	14.85	-39.97	-45.40	-61.00	-1	1	1	1	25	25

IV-20

278	46	168.49	233.16	33.29	-53223	162535	235.78	3	-3	-3	0	14	32
		17.60	-22354	32.59	4.99	200535	391.98	0	1	1	-1	17	34
		335.54	-11.76	-11.76	-53141	-26152	50.74	0	-5	-5	-5	22	44
		386.13	446.59	79.03	-181227	314.11	-11.38	0	-6	-6	-6	27	33
271	47	41.13	-15.85	-182.21	48163	-94121	97.87	3	-3	-3	4	-8	-13
		48.83	46.34	44.40	-26.47	-15317	-78.18	0	0	0	-7	-1	-1
		-231.02	-452.95	-59.51	273597	-382176	50.74	0	-5	-5	24	-26	45
272	48	305.57	250.63	-1.53	-106.58	35118	112.35	0	-9	-9	-9	3	33
		111.17	29.61	-57.07	-1305	180546	268.68	4	-3	-3	-1	14	32
		-33.06	-35.01	-17.49	26.96	37752	5178.28	-1	2	2	2	33	35
		148.42	-81.26	-184.72	-143	116115	45.51	4	-5	-5	-5	10	30
273	49	220.14	132.10	-48.04	-63.64	46102	506.74	7	-5	-5	0	14	44
		48.06	49.47	-37.52	-4.35	-81527	88.92	2	-2	-2	-4	-7	7
		-12.13	20.83	6.45	.84	2759	-176.20	-1	6	6	0	2	-15
		3.02	34.31	-33.42	-47.67	2054	-87.69	7	-2	-2	-4	2	-8
274	50	215.49	115.27	-65.58	-86.82	-29218	566.74	7	-5	-5	-4	-25	44
		195.30	140.27	13.22	-10259	13818	251.08	5	-2	-2	-15	12	33
		-8.41	-28.84	10.57	-17.99	8351	515.44	7	1	1	-2	2	35
275	51	443.27	522.29	-24.21	-39360	33217	105.54	7	-2	-2	-34	29	38
		153.05	-79.11	-33.13	-94.14	111	433.34	7	-5	-5	-6	0	30
		160.15	33.37	28.48	-1.14	-8514	80.37	5	1	1	-1	-7	7
		-74	-2.69	14.27	14.36	-27157	515.44	-0	-0	-0	1	-24	45
		233.42	78.97	33.36	-10.74	-642	215.54	7	-2	-2	-2	-12	30
276	52	236.74	25.93	14.81	-4.11	2317	-186.79	7	-2	-2	-4	12	33
		65.69	-23.74	-4.26	-2.11	13514	200.73	-0	1	1	-2	8	4
		31.51	49.24	44.88	2.83	1156	447.14	-8	-1	-1	-5	26	35
		-57.64	-119.56	-74.74	-30.72	99108	514.25	0	-2	-2	-3	9	45
277	53	223.21	-12.29	5.08	-50.44	38419	519.28	0	-3	-3	5	26	36
		20.27	-93.24	-35.21	54.03	-8015	2135	2	-1	-1	-5	-7	6
		-169.30	-379.82	24.08	-52.25	11158	-118.01	-0	0	0	-3	1	30
		265.64	47.18	-102.48	282.84	-22543	514.25	-0	-0	-0	-3	-20	38
278	54	81.65	-63.97	47.72	-88.54	-2741	519.28	8	-2	-2	-5	-2	36
		-64.69	-74.51	-32.80	2.93	893	253.40	-1	-0	-0	0	10	33
		185.37	-74.51	-31.13	2.74	21254	5188.28	4	0	0	2	10	35
		-185.37	27.48	49.25	-3313	-1811	422.62	6	-3	-3	-0	-2	30
279	55	114.47	-145.89	-84.75	-1.03	75105	455.45	6	-3	-3	-1	-7	38
		57.96	58.69	-2.21	-4.24	-5219	88.41	2	-1	-1	-4	-5	3
		-21.96	25.63	11.74	.73	-7116	-188.29	-1	0	0	0	-1	35
		-2.55	29.65	-65.68	-95.27	-619	-42.34	4	-2	-2	-6	-12	35
280	56	224.41	120.74	27.10	-72.39	-1214	455.45	4	-3	-3	-1	3	30
		143.16	42.45	24.98	-148.44	2313	327.40	-1	-1	-1	-13	2	35
		-22.34	-15.24	27.64	-5.93	5053	556.40	7	-1	-1	-1	3	30
		281.88	197.44	98.67	-359.52	9056	-66.71	-1	-3	-3	-31	8	4
		167.94	-54.74	-83.69	-79.86	-4913	422.62	7	-5	-5	-3	-1	31

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CONCLUSIONS

*** STRESS-PSI ***

ELY	ELS	X	Y	Z	XV	VZ	KZ	X	Y	Z	XV	VZ	KZ	XZ
281	1	-21.17	41.33	-5.78	-1.98	57.05	84.52	-1	1	0	-0	5	84.52	7
		-21.55	41.30	-6.08	-1.10	22.29	46.38	-1	2	0	-0	5	46.38	4
		-45.53	-9.77	-16.57	-0.84	51.14	43.09	-1	0	0	-0	4	43.09	4
		3.55	7.95	-1.83	3.00	97.72	166.08	0	0	0	0	0	166.08	8
282	2	-1.12	-1.14	1.57	32.25	-38.28	165.29	0	0	0	-3	-3	165.29	14
		-6.6	71.12	35.22	-17.62	11.68	219.83	-1	2	0	-3	-3	219.83	14
		-16.00	-75.89	-27.33	-78.44	-65.52	75.38	0	-2	0	-7	-7	75.38	3
		13.04	.57	-6.19	-15.69	-40.92	200.78	0	0	0	-1	-1	200.78	7
283	3	-3.54	-2.21	7.87	-8.15	89.48	388.67	0	0	0	-1	-1	388.67	9
		-32.41	-2.84	7.47	-23.43	145.56	219.83	-1	0	0	-2	-2	219.83	9
		23.12	18.19	11.80	-13.61	51.14	75.38	0	0	0	0	13	75.38	19
		7.67	-19.06	-3.66	17.59	71.74	38.18	0	0	0	0	13	38.18	19
284	4	5.33	35.09	21.99	-14.77	-55.61	196.79	0	-1	0	1	1	196.79	6
		12.45	116.31	50.87	-26.81	-58.27	268.68	-1	3	0	-1	-1	268.68	3
		-35.00	12.42	-9.98	-13.53	3.29	242.32	-1	1	0	-1	-1	242.32	4
		34.34	44.95	24.94	2.01	-120.75	79.12	-1	1	0	0	-10	79.12	21
285	5	-12.94	5.14	4.92	-2.84	129.73	115.27	-1	0	0	-1	-1	115.27	7
		-60.32	-49.13	-32.63	-57.59	95.47	24.38	-1	1	0	-1	-1	24.38	10
		13.08	124.57	38.08	51.43	105.17	242.32	-1	4	0	-5	-5	242.32	10
		-4.64	-40.01	-10.99	-1.51	71.74	79.12	-1	1	0	0	17	79.12	21
286	6	-6.38	16.28	-1.80	-15.74	-66.91	299.00	0	1	0	-1	-1	299.00	7
		-47.71	74.29	-7.03	-37.12	-150.32	85.94	-2	1	0	-3	-3	85.94	10
		45.89	13.29	29.60	-27.55	-50.51	303.74	-1	1	0	-2	-2	303.74	17
		-27.41	-38.01	-27.98	1.57	4.68	237.58	0	1	0	0	-4	237.58	26
		-40.88	15.37	-10.74	-13.99	154.59	119.38	-1	1	0	1	13	119.38	21
287	7	-30.50	43.45	1.28	-38.51	95.47	85.94	-2	2	0	-3	-3	85.94	7
		-84.13	-15.29	-20.92	-7.86	123.28	31.59	-2	1	0	0	11	31.59	10
		.99	18.12	-3.58	7.41	245.18	237.58	-1	1	0	-1	-1	237.58	3
288	8	-24.21	-56.16	-14.46	-67.16	-78.57	217.59	-1	1	0	-	-	217.59	3
		5.74	57.44	54.67	-73.74	63.7	235.26	-1	2	0	-6	-6	235.26	19
		-82.21	-22.70	-11.47	-15.47	-169.09	184.42	0	0	1	0	-15	184.42	20
		7.44	-14.74	-12.59	-13.24	-48.88	311.23	0	0	0	-1	-1	311.23	27
289	9	-4.64	-13.39	5.50	-15.34	180.59	120.38	-1	0	0	-2	-2	120.38	30
		-20.84	-15.54	19.09	-47.44	292.37	235.08	-1	0	0	-4	-4	235.08	20
		9.89	-9.64	-17	-26.27	123.28	184.42	0	0	0	-2	-2	184.42	2
		6.83	-14.84	-2.43	32.59	120.21	21.09	0	0	0	1	11	21.09	2
290	10	4.31	40.75	39.67	-13.32	86.13	224.68	-1	1	1	-1	-1	224.68	19
		-2.98	45.32	51.41	-43.64	-36.48	317.48	0	2	1	-4	-4	317.48	19
		13.49	34.93	44.77	-16.31	17.08	252.79	-1	1	1	-1	-1	252.79	28
		29.40	40.01	20.82	12.99	-204.92	103.82	0	0	0	1	1	103.82	22
291	11	-23.46	-9.67	3.51	-1.65	197.67	127.83	-1	0	0	-1	-1	127.83	9
		-186.00	-135.92	70.78	-69.59	125.77	26.83	-1	-3	0	-6	-6	26.83	11
		63.13	213.76	135.39	42.39	320.51	252.79	-1	5	0	-3	-3	252.79	28
		-31.52	-16.81	-9.09	-8.74	126.51	252.79	0	0	0	-1	-1	252.79	20
292	12	-36.36	-53.24	-15.64	-17.47	-92.34	243.08	-1	-1	-1	-2	-2	243.08	10
		-186.58	-176.11	-63.82	-45.43	-206.11	110.32	-1	-1	0	-4	-4	110.32	20
		15.75	-40.41	32.04	-22.07	-19.83	337.92	1	-2	0	-2	-2	337.92	10
		-16.25	-13.21	-10.05	15.08	-50.59	251.32	-1	0	0	-1	-1	251.32	23
293	13	-50.3	-18.62	-28.50	-11.26	169.94	140.88	-2	-2	0	-1	-1	140.88	23
		-79.24	-42.35	-34.48	-33.87	125.77	110.02	-2	0	0	-3	-3	110.02	10
		-89.32	-22.97	-33.49	-10.20	109.19	58.08	-2	0	0	-1	-1	58.08	5
		-8.53	9.47	-6.33	10.22	272.17	251.32	-2	0	0	-1	-1	251.32	23
294	14	-73.50	-101.43	-23.51	-51.43	-53.92	229.18	-2	-2	0	-4	-4	229.18	20
		-62.71	-177.63	102.42	-35.99	-55.16	254.75	-1	0	0	-3	-3	254.75	22
		-134.11	-339.04	-117.14	-105.40	-134.51	119.78	0	-4	0	-9	-9	119.78	10
		-19.68	-57.62	-29.80	-8.91	26.91	312.78	0	-1	0	-1	-1	312.78	27

295	15	-19.84	-67.91	31.05	1.06	97.39	154.96	-0	-2	2	0	14
		-15.99	-66.61	349.14	-9.03	159.27	254.75	-1	-4	6	-1	19
		-53.82	-142.36	-54.65	11.76	109.10	119.70	0	-4	0	0	2
		10.29	7.23	9.26	12.96	25.70	90.34	1	0	0	1	2
296	16	-59.24	-102.24	31.56	26.06	-31.51	229.18	-1	-3	3	2	3
		-126.26	-277.14	53.49	35.30	-62.63	279.10	-2	-9	0	2	5
		-49.44	-13.84	46.30	24.66	-193.62	302.40	-2	-0	0	2	9
		-2.01	-15.04	-4.33	16.28	-52.74	109.48	-3	-0	1	2	9
297	17	-56.86	-49.87	-11.01	24.86	-128.57	175.93	-1	-1	1	2	5
		-119.96	-198.20	-74.45	-1.51	-47.70	117.84	-2	-2	0	2	5
		-64.90	-54.67	28.04	80.80	-13.62	300.46	-2	-1	0	0	1
		18.69	13.22	16.57	-33.63	23.70	109.49	0	1	2	0	1
298	18	-127.01	-177.63	-80.07	50.64	40.66	221.40	-1	1	0	1	2
		-33.51	-319.87	-	62.74	78.35	86.34	-3	-4	0	4	7
		-117.78	-277.84	-41.40	65.31	98.57	272.18	-6	-6	0	4	7
		-27.75	14.27	-38.20	24.54	-54.64	305.56	-1	-6	2	5	9
299	19	-92.97	-48.95	-52.16	23.54	-120.43	181.38	-2	-7	-1	0	10
		-162.29	-139.01	-90.39	54.34	-47.70	86.34	-3	-7	0	2	4
		-83.51	-9.57	-27.93	13.43	-114.66	151.47	-3	-7	0	0	10
		-33.10	1.74	-40.57	2.67	-198.94	305.90	-2	1	1	0	4
300	20	-87.34	-48.00	54.54	-25.70	82.51	207.91	-1	1	1	0	1
		-84.21	220.64	91.47	-0.93	4.58	304.50	-3	-2	1	2	5
		7.04	55.22	-13.59	-16.94	16.11	81.63	0	0	3	0	1
301	21	-30.66	-10.34	21.40	41.50	-173.62	176.49	-0	2	1	0	14
		-61.63	-8.00	61.26	66.32	-280.94	304.50	-3	-0	3	2	0
		-20.69	-24.13	-13.45	44.53	-114.66	61.63	-5	-6	0	4	15
		-0.67	1.56	-2.12	13.64	-129.36	143.26	-10	-0	0	4	10
302	22	-52.58	-54	16.34	26.45	64.96	206.63	-2	-0	1	3	0
		-62.62	-4.04	62.13	64.68	6.20	320.58	-3	-0	3	0	1
		-105.60	-23.04	-48.46	22.30	2.12	325.15	-3	-0	0	2	0
		11.48	29.60	12.35	-7.71	186.57	64.12	-3	-1	0	0	16
303	23	-65.35	-2.77	-22.62	39.44	-188.99	172.77	-0	1	1	0	16
		-55.67	77.71	11.51	25.26	-122.54	129.04	-2	1	0	0	10
		-192.91	-240.79	-34.76	13.32	-315.17	325.15	-3	-3	2	2	11
		56.52	134.77	57.39	-16.15	-129.36	64.12	-3	-3	1	1	27
304	24	-73.57	-10.87	-30.42	43.54	61.93	203.39	-4	-1	0	4	15
		-127.13	-16.94	-43.22	67.83	174.47	53.04	-4	-1	0	4	15
		-44.90	16.09	-18.20	43.87	-128.57	249.44	-4	-1	0	4	15
		-45.71	13.77	-30.43	43.87	-128.57	249.44	-4	-1	0	4	15
305	25	-84.51	-7.43	-10.91	13.04	19.85	307.10	-1	-1	0	1	11
		-134.17	-13.94	-50.49	56.97	-122.54	53.04	-4	-1	0	1	11
		-95.50	7.87	-31.01	13.52	-129.18	307.10	-1	-1	0	1	11
		-23.61	19.85	-10.73	3.53	-241.29	201.00	-1	-1	0	1	11
306	26	-42.67	95.14	65.12	-17.40	48.68	201.00	-1	-1	0	1	11
		112.86	235.16	121.25	-11.19	28.43	296.44	-1	-1	0	1	11
		-8.76	91.57	-5.25	-11.19	137.49	64.40	-0	-0	2	0	2
307	27	-37.67	-5.34	-5.25	-11.19	137.49	64.40	-0	-0	2	0	2
		-74.05	-1.44	48.59	36.67	-249.54	296.44	-1	-1	0	1	11
		-13.53	17.51	-11.00	15.50	-129.18	64.40	-0	-0	2	0	2
308	28	-22.35	-17.51	-11.00	15.50	-129.18	64.40	-0	-0	2	0	2
		-83.14	-10.90	-5.90	1.33	27.93	206.33	-3	-3	1	1	11
		-132.47	-30.20	-30.20	19.27	-28.23	353.35	-4	-4	1	1	11
		1.45	32.37	10.25	-7.46	127.22	27.98	-0	-0	2	0	2
309	29	7.43	13.85	-13.70	5.63	50.69	85.48	-0	-0	2	0	2
		7.43	13.85	-13.70	5.63	50.69	85.48	-0	-0	2	0	2
		-11.61	-13.85	-13.70	5.63	50.69	85.48	-0	-0	2	0	2
		30.76	-21.54	-14.48	5.52	55.72	44.10	-1	-1	0	0	0
310	30	19.57	-44.25	-22.26	11.36	94.37	165.18	-1	-1	0	0	0
		14.03	2.53	-1.03	-35.25	-34.05	160.97	-2	-2	0	0	0
					-33.64	6.40	221.54	-0	-0	2	0	0

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311	31	12.90	-120.69	-34.14	-75.56	-81.60	70.60	-7	-7	1
		30.61	-70.00	-31.03	-14.51	-46.06	200.60	-4	-4	1
		44.26	-12.00	7.36	26.18	91.16	100.37	-1	-1	1
		3.70	-73.87	-12.92	10.59	147.15	221.54	-1	-1	1
		73.16	81.7	23.12	22.03	551.2	70.60	-1	-1	1
312	32	58.91	-19.33	11.37	45.92	70.72	30.90	-1	-1	1
		30.67	-10.34	-1.57	16.30	-51.6	17.02	-4	-4	1
		34.17	41.95	15.71	28.1	-45.45	209.70	-4	-4	1
		-13.07	-50.04	-13.43	15.44	9.12	202.90	-1	-1	1
313	33	71.73	-14.54	17.03	31.44	-110.15	74.30	-1	-1	1
		31.16	-11.54	-1.52	38.19	121.23	125.50	-1	-1	1
		-6.44	-40.01	-19.09	-14.51	98.34	251.09	-1	-1	1
		55.50	102.64	25.44	94.39	194.14	242.90	-1	-1	1
314	34	44.70	-77.64	-10.00	26.69	70.72	78.30	-3	-3	1
		-13.08	-67.81	-27.44	36.11	-63.69	200.30	-1	-1	1
		-18.03	-34.46	-15.44	14.57	-146.70	66.37	-1	-1	1
		64.71	-54.24	-4.27	22.13	-46.13	303.12	-1	-1	1
315	35	-4.74	-104.74	-63.23	66.05	2.35	23.42	-1	-1	1
		-1.45	-12.00	-14.01	33.22	157.60	117.60	-3	-3	1
		6.17	73.50	9.66	7.41	98.14	60.37	-0	-0	1
		-40.78	-40.43	-24.36	30.67	126.74	31.10	-1	-1	1
		31.47	-19.37	-26.62	53.43	245.17	25.42	-1	-1	1
316	36	-19.23	-23.12	-8.38	-9.69	-73.11	200.03	-1	-1	1
		18.58	-7.74	3.66	-13.24	-165.67	20.48	-0	-0	1
		-56.38	-23.60	-9.11	-50.32	-105.00	105.00	-0	-0	1
		13.49	-47.50	-52.62	43.82	-54.00	30.60	-5	-5	1
317	37	47.36	4.54	16.50	43.57	-54.00	30.60	-4	-4	1
		4.22	-13.34	1.20	15.59	182.15	121.10	-4	-4	1
		65.49	10.16	22.67	36.33	294.10	28.47	-1	-1	1
		68.74	16.87	25.54	43.51	120.14	115.00	-1	-1	1
318	38	38.71	21.15	16.84	78.77	125.11	20.12	-1	-1	1
		37.09	41.50	24.53	12.99	-82.13	225.94	-0	-0	1
		4.70	-5.95	-8.90	46.41	-35.74	321.20	-1	-1	1
		74.44	27.81	31.48	70.54	-105.00	24.30	-0	-0	1
319	39	30.45	16.80	-12.67	48.32	-202.64	102.20	-0	-0	1
		-37.42	-110.00	-32.09	-8.76	187.10	129.10	-0	-0	1
		107.61	229.04	92.21	103.00	122.10	30.85	-3	-3	1
		35.07	-73.49	-11.49	51.31	125.31	244.30	-6	-6	1
320	40	27.54	18.92	-24.21	43.91	-78.10	102.30	-2	-2	1
		-14.44	-9.30	-7.15	15.04	-200.15	11.70	-1	-1	1
		78.27	27.44	22.56	39.57	-53.1	35.60	-0	-0	1
321	41	4.23	32.43	-88.04	77.07	-301.3	244.40	-0	-0	1
		-4.72	13.20	-22.33	31.97	102.23	19.23	-3	-3	1
		-2.42	60.14	9.57	10.22	122.10	11.70	-1	-1	

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