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STRUCTURAL EVALUATION OF W-211 FLEXIBLE RECEIVER PLATFORMS AND TANK PIT WALLS

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Abstract: This document is a structural analysis of the Flexible Receiver Platforms and the tank-pit wall during removal of equipment and during a accidental drop of that equipment. The platform and the pit walls must withstand a accidental drop of a mixer and transfer pumps in specific pits in tanks 102-AP and 104-AP. A mixer pump will be removed from riser 11 in pit 2A on tank 241-AP-102. A transfer pump will be removed from riser 13 in pit 2D on tank 241-AP-102 and another transfer pump will be removed from riser 3A in pit 4A on tank 241-AP-104.

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**STRUCTURAL EVALUATION OF W-211 FLEXIBLE
RECEIVER PLATFORMS AND TANK PIT WALLS**

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September 1997

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Yes No N/A

☒ [] []	Problem adequately defined.
☒ [] []	Necessary assumptions stated and supported.
☒ [] []	Computer codes and data files documented
☒ [] []	Data used in calculations stated in document.
☒ [] []	Data checked for consistency with original source information as applicable.
☒ [] []	Mathematical derivations checked including dimensional consistency of results.
☒ [] []	Models appropriate and used within range of validity or use outside range of established validity justified.
☒ [] []	Hand Calculations checked for errors.
☒ [] []	Computer code run streams correct and consistent with analysis documentation
☒ [] []	Computer code output consistent with input and with results reported in analysis documentation.
☒ [] []	Acceptability limits on analytical results applicable and supported. Limits checked against sources.
☒ [] []	Safety margins consistent with good engineering practices.
☒ [] []	Conclusions consistent with analytical results and applicable limits.
☒ [] []	Results and conclusions address all points required in the problem statement.

Reviewer

10/8/97

Date

SUMMARY

Transient dynamic analyses have been performed to evaluate the ability of the flexible receiver platforms and the tank-pit walls to sustain the loading resulting from mixer pump and transfer pump being dropped from a 60 ft height during their retrieval from the 241-AP-102 and 241-AP-104 underground tanks. The platforms are permitted to deform permanently to the extent that does not result in complete collapse which may damage the tank risers. It is assumed that a 5% limit on the platform equivalent plastic strain is safe for protecting the tank risers.

The time-varying loads on the tank-pit walls are obtained from the above analyses and the highest loads are used to evaluate the structural adequacy of the pit walls in accordance with the American Concrete Institute code ACI 318R-89. The survival of the concrete walls is the primary concern for these analyses.

The results indicate that the maximum plastic strain for the platform is 4.17% which results from the mixer pump drop. The impact due to falling transfer pump causes only 0.02% plastic strain. The loading on the tank pits are also within the safe limits.

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- A Mixer Pump Drop Analysis
- B Transfer Pump Drop Analysis
- C Structural Evaluation of Pit Walls and Bolted Joints

1.0 INTRODUCTION

Removal of equipment from underground waste storage tanks utilizes a flexible receiver located on top of the riser from which the equipment is to be removed. Recent safety analysis work for Project W-211, Initial Tank Retrieval Systems, has indicated a need for an impact limiting device to be located on top of the flexible receiver platform to mitigate the consequences of the accidental drop of the equipment during removal process. A bellow is also required between the platform and the riser to protect the riser from overloading. Design of the impact limiter and the bellow is beyond the scope of the analyses presented in this document, however, the impact limiter properties need to be considered to predict the loads transmitted to the platform and the tank-pit walls.

The purpose of this document is to evaluate the ability of the platform and the tank-pit walls to withstand the loads resulting from the accidental drop of the mixer and transfer pumps. As directed by the customer, only vertical drop is considered in this analysis. The specific platforms and tank pits addressed herein are those required for removal of the transfer pump and the mixer pump from the 241-AP-102 tank and the transfer pump from the 241-AP-104 tank. In tank 241-AP-102, the mixer pump is to be removed from riser 11 located in pit 2A and the transfer pump from riser 13, pit 2D. The transfer pump in tank 241-AP-104 is in riser 3A in pit 4A. The platform used for the removal of the mixer pump from 241-AP-102 will also be used for removing the transfer pump from 241-AP-104. A different platform will be utilized to remove the transfer pump from 241-AP-102 tank.

The weight of the mixer pump assembly is nearly 13,000 lbf. The transfer pump approximately weighs 2,000 lbf. Both pumps are postulated to drop from a height of 60 ft. Although mixer pump drop is associated with significantly higher impact energy compared to the transfer pump drop, two separate analyses are performed to evaluate each of the platforms. The platform that will be used for the transfer pump removal from the 241-AP-104 is judged acceptable based on the results of the mixer pump drop on this platform and the transfer pump drop on the other platform.

The primary safety concern associated with the accidental drop of these pumps is the structural integrity of the pit walls. The platform is permitted to suffer permanent deformation to the extent that it does not collapse. In view of nearly 20% ductility of structural steel and that the pump drop is a highly unlikely beyond design basis accident, a 5% limit on equivalent plastic strain is considered safe.

The tank-pit walls are evaluated for the maximum loads and in accordance with the requirements of the American Concrete Institute code, ACI 318R-89 (ACI 1989).

The bellows between the riser and the platform will be designed to accommodate vertical displacements of the platform.

2.0 STRUCTURAL EVALUATION OF PLATFORMS AND PIT WALLS

An elastic/plastic transient dynamic analysis of each platform is performed to determine the platform responses under the impact loading and the loads on the pit walls. These analyses use version 5.2 of the general purpose finite-element code ANSYS (ANSYS 1994).

The transient dynamic analysis provides time-varying reaction forces at the concrete walls. The maximum reactions are used to evaluate pit-wall structural integrity.

2.1 MIXER PUMP DROP ANALYSIS

The mixer pump is located in riser 11 of the 241-AP-102 tank. The flexible receiver platform assembly that will be used to remove the pump is shown on drawing H-2-824709, Rev. 0 (HNF 1997a). This platform consists of a frame fabricated from W12 x 40 beams. A 1-in thick cover plate with two nearly square openings is welded to the beams. A flexible receiver adapter plate (HNF 1997c), 2-in thick with a 50-in diameter hole, is bolted to the cover plate. The platform will be aligned such that this adaptor plate is placed directly above riser 11. The impact limiter will be installed over this plate prior to the pump removal. A 1-in thick solid plate will be bolted to the platform to cover the opening that is not in use while the mixer pump is removed.

The beams and the plates are modeled using SHELL43 element which is a plastic shell element appropriate for an elastic/plastic analysis. The CONTAC52 elements that permit the beam to lift up vertically are generated, at appropriate beam nodes, between the beams and pit walls. The CONTAC52 elements are also used between the adapter plate and the cover plate at those nodes of these plates where they are not bolted together. The adapter plate node and the cover plate node at a bolt location are coupled together in all three translational directions.

The pump mass is modeled using a spring and gap element (COMBIN40)

connected to the center of a rigid plate which, in turn, is connected to the adapter plate by a set of COMBIN40 elements that are allowed to deform at a constant load. These COMBIN40 elements represent the impact limiter that deforms at a constant load after an initially small linear deformation.

The impact limiter has an inside diameter of 50-in, outside diameter of 70-in and a crush strength of 170 lbf/in². This provides a crush load of 320,000 lbf. There are a total of 32 springs representing the impact limiter. Therefore, the analysis model assumes that each spring deforms at a constant load of 10,000 lbf. The initial stiffness has been arbitrarily assumed as 50,000 lbf/in².

As the structure is symmetric with respect to the east-west axis, only half model of the platform is used in this analysis. The finite-element model is shown in Figures 1 to 3.

The transient analysis is performed in three load sets. The first load set is a static load case in which the pump mass is held at a height of 720 in. In the second load set, the mass is released and dynamic analysis is performed starting from zero time to 1.93 sec during which the pump falls freely and makes initial contact with the impact limiter. In this load set, automatic time stepping option is used with 1000 maximum load steps permitted. As the platform is expected to deform inelastically, the automatic time stepping is turned off in the third load set. However, during the next 0.06 sec, a very small fixed time step of 0.0001 sec is used to accurately predict the inelastic response.

The analysis input and output files are included in Appendix A. The results are post-processed using /POST26 module of the ANSYS program to obtain the time-history plots of the reaction forces, bolt forces, and displacements.

2.1.1 Results

The time-history plots of reaction forces, bolt loading, and displacements at critical nodes are shown in Figures 4 through 16. Their extreme values are listed on pages 77 and 78 of Appendix A. Some of the significant results are given below:

- Reaction forces at the pit West wall: The sum of the maximum reactions at nodes 10560 to 10569 is 143,540 lbf. This force acts over a 5 ft length of the wall. Therefore, the average loading on this wall is 28,700 lbf/ft.

¹ANSYS is a trademarked proprietary code, but a user's license is commercially available from Swanson Analysis Systems, Inc.

- Reaction force at the North and South walls: The maximum reaction force occurs at node 10440 and is equal to 71,900 lbf.
- The maximum vertical displacement of the impacted beam is 3.4 in. The bellow assembly must be capable to accommodate this displacement.
- The maximum horizontal displacement of the beam ends is less than ½ in. The alignment bolts must be turned back ½ in to avoid undesirable punching load on the walls.
- Bolt Loading: The axial and shear loads on bolts used for connecting the flexible receiver to the cover plate are given below:

Table 1: Bolt Loads, 241-AP-102, Pit 2A Platform

Node No.	Axial Load (lbf)	Shear, FX (lbf)	Shear, FY (lbf)	Total Shear (lbf)
457	5,268	3,014	10,360	10,790
474	6,937	10,620	9,699	14,382
494	7,764	10,260	5,422	11,605
514	11,330	19,380	5,315	20,096
534	7,215	31,220	19,580	36,852
577	6,879	518	4,104	4,137

- The impact limiter vertical displacement is 27.12 in. which is less than the design stopping distance of 29.8 in.
- The maximum equivalent plastic strain, as shown in Figures 17 to 19, is 4.17%.

The bolted connections and the pit walls are evaluated in Appendix C. 1-in nominal diameter A490 bolts are adequate to sustain the impact load. The only exceptions are the bolt at node 534 and the bolt located directly opposite to this node. These bolts have high shear loads. One additional bolt is added in close proximity of this node and one on the opposite side to reduce the shear loading on these two bolts.

The pit walls are shown to have adequate safety margin when subjected to the impact load resulting from the mixer pump accidental drop. The peak reaction forces are compared with the allowable concentrated load on tank dome and the tank dome is found safe to carry the impact loads.

The W12 x 40 beams, directly under the applied loading deform inelastically. However, the maximum plastic strain, localized in a small area, is less than 5% and, therefore, the beams are not expected to collapse. Two stiffeners are provided at each location of the center beam where it rests on the pit wall to prevent flange bending and web crippling.

2.2 TRANSFER PUMP DROP ANALYSIS

The transfer pumps are located in riser 13 of the 241-AP-102 tank and riser 3A of the 241-AP-104 tank. The flexible receiver platform assembly, analyzed above, will also be used to remove the transfer pump from the 241-AP-104 tank. The mixer pump drop is more critical for this platform and the tank pit. Therefore, the second platform, shown on drawing H-2-824707, Rev. 0 (HNF 1997b) is analyzed for loading resulting from the accidental drop of the transfer pump.

This platform also consists of a frame fabricated from W12 x 40 beams and a 1-in thick cover plate. The flexible receiver adapter plate is also identical to that used for the previous platform except that its thickness is only 1½ in.

The finite-element model of this platform uses the same types of elements as those described in Section 2.1. The analysis methodology is also identical. However, as there is no symmetry plane with respect to the platform geometry and the applied loading, a full model is used to analyze this platform. The model is shown in Figures 20 through 22.

The pump mass is also modeled using a spring and gap element (COMBIN40) connected to the center of a rigid plate which, in turn, is connected to the adapter plate by a set of COMBIN40 elements that are allowed to deform at a constant load. The weight of this pump, considered in this analysis is 2,000 lbf although the actual weight is slightly less.

The impact limiter crushes at 75,000 lbf loading. There are a total of 32 springs representing the impact limiter and, therefore, each spring element is modeled to

deform at a constant load of 2,350 lbf. The initial stiffness has been arbitrarily assumed as 50,000 lbf/in².

The transient analysis is again performed in three load sets. The first load set is a static load case in which the pump mass is held at a height of 720 in. In the second load set, the mass is released and dynamic analysis is performed starting from zero time to 1.93 sec during which the pump falls freely and makes initial contact with the impact limiter. In this load set, automatic time stepping option is used with 1000 maximum load steps permitted. As the platform is expected to deform inelastically, the automatic time stepping is turned off in the third load set. However, during the next 0.05 sec, a very small fixed time step of 0.0001 sec is used to accurately predict the inelastic response.

The analysis input and output files are included in Appendix B. The results are post-processed using /POST26 module of the ANSYS program to obtain the time-history plots of the reaction forces, bolt forces, and displacements.

2.2.1 Results

The time-history plots of reaction forces, bolt loading, and displacements at critical nodes are shown in Figures 23 through 41. Their extreme values are listed on pages 68 and 69 of Appendix B. Some of the significant results are given below:

- Reaction forces at the pit South wall: The sum of the maximum reactions at nodes 11315 to 11329 is 139,560 lbf (see page B-68). This force acts over nearly 8 ft length of the wall. Therefore, the average loading on this wall is 17,500 lbf/ft.
- Reaction forces at the pit North wall: The maximum reaction occurs at node 11628 and is equal to 47,650 lbf.
- Reaction force at the East and West walls: The maximum reaction force occurs at node 11465 and is equal to 34,130 lbf.
- The maximum vertical displacement of the impacted beam, as shown in Figure 41, is less than 0.25 in. The bellow assembly should have no problem accommodating this displacement.
- Bolt Loading: The axial and shear loads on bolts used for connecting the flexible

receiver to the cover plate are given in Table 2 below:

- The impact limiter vertical displacement is 17.83 in. which is less than the design stopping distance of 24 in.
- The maximum equivalent plastic strain, as shown in Figure 38, is 0.02%. Thus, the platform structure remains nearly elastic.

Table 2: Bolt Loads, 241-AP-102, Pit 2D Platform

Node No.	Axial Load (lbf)	Shear, FX (lbf)	Shear, FY (lbf)	Total Shear (lbf)
372	5,058	9,666	6,796	11,816
432	6,744	28,280	3,524	28,499
456	6,172	10,710	14,510	18,035
460	5,718	21,720	14,340	26,027
364	5,230	9,281	10,730	14,187
424	5,106	12,750	6,732	14,418
336	6,471	2,851	6,309	6,923
340	5,556	4,175	5,276	6,728

The bolted connections and the pit walls are evaluated in Appendix C. 1-in nominal diameter A490 bolts are adequate to sustain the impact load. The only exceptions are the bolts at nodes 432 and 460 that have high shear loads. One additional bolt is added in close proximity of these nodes to reduce the shear loading on these two bolts. The pit walls are shown to have adequate safety margin when subjected to the impact load resulting from the transfer pump accidental drop.

The W12 x 40 beams, remain nearly elastic. The maximum plastic strain, localized in a very small area, is less than 0.0025%. The beams will not, therefore, collapse.

3.0 CONCLUSION

The two platforms designed for removal of the mixer and transfer pumps are structurally adequate to sustain the impacts loads caused by the postulated pump drops. The mixer pump drop is associated with a high impact energy. The platform deforms inelastically, however, the maximum plastic strain suffered by the W12x40 beams is less than 5%. In case of the transfer pump, the structure remains virtually elastic.

The pit walls have been evaluated using the maximum reaction force and have been found to be safe under the impact loads. Minor changes in the adaptor plate design and associated bolted connections, as a result of these analyses, have already been incorporated in the final design.

4.0 REFERENCES

- ANSYS, 1994, *User's Manual, Version 5.2*, ANSYS Inc., Houston, Pennsylvania.
- ACI, 1989, *Building Code Requirements for Reinforced Concrete*, ACI 318R-89, American Concrete Institute, Detroit, Michigan.
- HNF, 1997a, *LLCE Platform Assembly 16' x 10' Piece*, Dwg. No. H-2-824709, Rev. 0, U.S. Department of Energy, Richland, Washington.
- HNF, 1997b, *LLCE Platform Assembly 13' x 8'1 Piece*, Dwg. No. H-2-824707, Rev. 0, U.S. Department of Energy, Richland, Washington.
- HNF, 1997c, *LLCE Flexible Receiver Adapter 50" Plate*, Dwg. No. H-2-824718, Rev. 1, U.S. Department of Energy, Richland, Washington.

ANSYS 5.2
AUG 26 1997
08:26:13
PLOT NO. 1
ELEMENTS
TYPE NUM

XV =1
YV =1
ZV =1
*DIST=111.622
*XF =160.402
*YF =94.229
*ZF =118.797
VUP =Z
Z-BUFFER

FIGURE 1

1

mixer pump drop, element plot

ANSYS 5.2
 AUG 26 1997
 08:27:06
 PLOT NO. 2
 ELEMENTS
 TYPE NUM
 U
 ROT
 CP
 ACEL

 XV =1
 YV =1
 ZV =1
 *DIST=111.622
 *XF =160.402
 *YF =94.229
 *ZF =118.797
 VUP =Z
 Z-BUFFER

FIGURE 2

8-2-10

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 Rev. 0

1

mixer pump drop, element plot

ANSYS 5.2
AUG 26 1997
08:28:08
PLOT NO. 3
ELEMENTS
TYPE NUM

XV =1
YV =1
ZV =1
*DIST=111.622
*XF =160.402
*YF =94.229
*ZF =118.797
VUP =Z
Z-BUFFER

FIGURE 3

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ANSYS 5.2
AUG 26 1997
08:42:30
PLOT NO. 4
POST26
ZV = 1
DIST = .75
XF = .5
YF = .5
ZF = .5
VUP = Z
Z-BUFFER

mixer pump drop, reaction forces

FIGURE 4

1

mixer pump drop, reaction forces

FIGURE 5

ANSYS 5.2
 AUG 26 1997
 08:43:34
 PLOT NO. 5
 POST26

ZV =1
 DIST=.75
 XF =.5
 YF =.5
 ZF =.5
 VUP =Z
 Z-BUFFER

1

mixer pump drop, forces on one impact limiter element

ANSYS 5.2
AUG 26 1997
08:46:34
PLOT NO. 6
POST26

ZV =1
DIST=.75
XF =.5
YF =.5
ZF =.5
VUP =Z
Z-BUFFER

FIGURE 6

Page-15

ANSYS 5.2
AUG 26 1997
08:47:49
PLOT NO. 7
POST26

ZV = 1
DIST = .75
XF = .5
ZF = .5
VUP = Z
Z-BUFFER

mixer pump drop, UX of beam nodes

FIGURE 7

ANSYS 5.2
AUG 26 1997
08:48:48
PLOT NO. 8
POST26

ZV =1
DIST=.75
XF =.5
YF =.5
ZF =.5
VUP =Z
Z-BUFFER

FIGURE 8

Page - 17

ANSYS 5.2
AUG 26 1997
08:50:17
PLOT NO. 9
POST26
ZV = 1
DIST = .75
XF = .5
YF = .5
ZF = .5
VUP = Z
Z-BUFFER

mixer pump drop, UZ of center beam and plate nodes

FIGURE 9

ANSYS 5.2
AUG 26 1997
08:54:44
PLOT NO. 10
POST26

ZV =1
DIST=.75
XF =.5
YF =.5
ZF =.5
VUP =Z
Z-BUFFER

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FIGURE 10

ANSYS 5.2
AUG 26 1997
09:21:01
PLOT NO. 11
POST26

ZV =1
DIST=.75
XF =.5
YF =.5
ZF =.5
VUP =Z
Z-BUFFER

FIGURE 11

1

mixer pump drop, bolt forces at node 474

ANSYS 5.2
AUG 26 1997
09:22:13
PLOT NO. 12
POST26

ZV =1
DIST=.75
XF =.5
YF =.5
ZF =.5
VUP =Z
Z-BUFFER

FIGURE 12

ANSYS 5.2
AUG 26 1997
09:23:17
PLOT NO. 13
POST26

ZV =1
DIST=.75
XF =.5
YF =.5
ZF =.5
VUP =Z
Z-BUFFER

FIGURE 13

1

mixer pump drop, bolt forces at node 514

FIGURE 14

ANSYS 5.2
AUG 26 1997
09:24:32
PLOT NO. 14
POST26

ZV =1
DIST=.75
XF =.5
YF =.5
ZF =.5
VUP =Z
Z-BUFFER

1

mixer pump drop, bolt forces at node 534

ANSYS 5.2
AUG 26 1997
09:25:54
PLOT NO. 15
POST26

ZV =1
DIST=.75
XF =.5
YF =.5
ZF =.5
VUP =Z
Z-BUFFER

FIGURE 15

1

mixer pump drop, bolt forces at node 577

ANSYS 5.2
AUG 26 1997
09:27:12
PLOT NO. 16
POST26

ZV =1
DIST=.75
XF =.5
YF =.5
ZF =.5
VUP =Z
Z-BUFFER

FIGURE 16

1

mixer pump drop, equivalent plastic strain at $t=1.967$

ANSYS 5.2
AUG 26 1997
09:34:09
PLOT NO. 18
NODAL SOLUTION
STEP=3
SUB =369
TIME=1.967
NLEPEQ (AVG)
TOP
DMX =3.833
SMX =.041731
0
.004637
.009274
.01391
.018547
.023184
.027821
.032457
.037094
.041731

FIGURE 17

1

mixer pump drop, equivalent plastic strain at t=1.967

ANSYS 5.2
 AUG 26 1997
 09:35:14
 PLOT NO. 19
 NODAL SOLUTION
 STEP=3
 SUB =369
 TIME=1.967
 NLEPEQ (AVG)
 TOP
 DMX =3.65
 SMX =.041731
 0
 .004637
 .009274
 .01391
 .018547
 .023184
 .027821
 .032457
 .037094
 .041731

FIGURE 18

FIGURE 19

1

ANSYS 5.2
SEP 2 1997
13:19:06
PLOT NO. 5
ELEMENTS
TYPE NUM

XV =1
YV =1
ZV =1
DIST=96.975
XF =77.675
YF =47
ZF =-5.45
VUP =Z
Z-BUFFER

transfer pump drop, element plot

FIGURE 20

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ANSYS 5.2
SEP 2 1997
13:20:24
PLOT NO. 6
ELEMENTS
TYPE NUM
XV =1
XV =1
XV =1
DLST=96.975
XF =77.675
YF =47
ZF =-5.45
VUP =Z
Z-BUFFER

transfer pump drop, element plot

FIGURE 21

ANSYS 5.2
SEP 2 1997
13:17:19
PLOT NO. 4
ELEMENTS
TYPE NUM

XV =1
YV =1
ZV =1
DIST=95.419
XF =79.675
YF =47
ZF =-10.92
VUP =Z
Z-BUFFER

FIGURE 22

ANSYS 5.2
SEP 4 1997
07:50:24
PLOT NO. 2
POST26

ZV =1
DIST=.75
XF =.5
YF =.5
ZF =.5
Z-BUFFER

FIGURE 23

1

transfer pump drop, vertical disp. of impact limiter

ANSYS 5.2
SEP 4 1997
07:51:29
PLOT NO. 3
POST26

ZV =1
DIST=.75
XF =.5
YF =.5
ZF =.5
Z-BUFFER

FIGURE 24

1

transfer pump drop, reactions at continuously supported beam

FIGURE 25

ANSYS 5.2
SEP 4 1997
08:01:24
PLOT NO. 5
POST26

ZV =1
DIST=.75
XF =.5
YF =.5
ZF =.5
Z-BUFFER

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ANSYS 5.2
SEP 4 1997
08:02:56
PLOT NO. 6
POST25
ZV = 1
DIST = .75
XF = .5
YF = .5
ZF = .5
Z-BUFFER

1

transfer pump drop, reactions at other beams

FIGURE 27

ANSYS 5.2
 SEP 4 1997
 08:05:07
 PLOT NO. 7
 POST26

ZV =1
 DIST=.75
 XF =.5
 YF =.5
 ZF =.5
 Z-BUFFER

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ANSYS 5.2
 SEP 4 1997
 08:40:36
 PLOT NO. 8
 POST26
 ZV =1
 DIST=.75
 XF =.5
 YF =.5
 ZF =.5
 Z-BUFFER

HNF-SD-TWR-CN-002
 Rev. 0

Ref-36

transfer pump drop, reactions at other beams

FIGURE 28

1

transfer pump drop, forces on bolt at node 372

FIGURE 29

ANSYS 5.2
SEP 4 1997
09:22:54
PLOT NO. 10
POST26

ZV =1
DIST=.75
XF =.5
YF =.5
ZF =.5
Z-BUFFER

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ANSYS 5.2
SEP 4 1997
09:24:33
PLOT NO. 11
POST26

ZV = 1
DIST = .75
XF = .5
YF = .5
ZF = .5
Z-BUFFER

1

transfer pump drop, forces on bolt at node 456

ANSYS 5.2
SEP 4 1997
09:25:42
PLOT NO. 12
POST26

ZV =1
DIST=.75
XF =.5
YF =.5
ZF =.5
Z-BUFFER

FIGURE 31

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ANSYS 5.2
SEP 4 1997
09:27:09
PLOT NO. 13
POST26
ZV =1
DIST=.75
XF =.5
YF =.5
ZF =.5
Z-BUFFER

FIGURE 32

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ANSYS 5.2
SEP 4 1997
09:28:17
PLOT NO. 14
POST26

ZV =1
DIST=.75
XF =.5
YF =.5
ZF =.5
Z-BUFFER

Figure 33

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ANSYS 5.2
SEP 4 1997
09:29:18
PLOT NO. 15
POST26
ZV =1
DIST=.75
XF =.5
YF =.5
ZF =.5
Z-BUFFER

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ANSYS 5.2
SEP 4 1997
09:30:10
PLOT NO. 16
POST26
ZV =1
DIST=.75
XF =.5
ZF =.5
Z-BUFFER

1

transfer pump drop, forces on bolt at node 340

ANSYS 5.2
SEP 4 1997
09:31:02
PLOT NO. 17
POST26

ZV =1
DIST=.75
XF =.5
YF =.5
ZF =.5
Z-BUFFER

FIGURE 36

1

transfer pump drop, vertical displacement of adaptor plate nodes

ANSYS 5.2
 SEP 4 1997
 09:37:56
 PLOT NO. 18
 POST26

ZV =1
 DIST=.75
 XF =.5
 YF =.5
 ZF =.5
 Z-BUFFER

FIGURE 37

ANSYS 5.2
 SEP 4 1997
 09:47:17
 PLOT NO. 19
 NODAL SOLUTION
 STEP=3
 SUB =180
 TIME=1.948
 NLEPEQ (AVG)
 TOP
 DMX =.55733
 SMX =.195E-03
 0
 .216E-04
 .433E-04
 .649E-04
 .866E-04
 .108E-03
 .130E-03
 .152E-03
 .173E-03
 .195E-03

FIGURE 38

ANSYS 5.2
 SEP 4 1997
 09:48:17
 PLOT NO. 20
 NODAL SOLUTION
 STEP=3
 SUB =180
 TIME=1.948
 NLEPEQ (AVG)
 TOP
 DMX =.55733
 SMX =.252E-04
 0
 .280E-05
 .561E-05
 .841E-05
 .112E-04
 .140E-04
 .168E-04
 .196E-04
 .224E-04
 .252E-04

FIGURE 39

ANSYS 5.2
 SEP 4 1997
 09:52:23
 PLOT NO. 21
 NODAL SOLUTION
 STEP=3
 SUB =189
 TIME=1.949
 NLEPEQ (AVG)
 TOP
 DMX =.553617
 SMX =.195E-03
 0
 .216E-04
 .433E-04
 .649E-04
 .866E-04
 .108E-03
 .130E-03
 .152E-03
 .173E-03
 .195E-03

FIGURE 40

1

transfer pump drop, vertical disp. of center beam

ANSYS 5.2
SEP 8 1997
11:25:24
PLOT NO. 1
POST26

ZV =1
DIST=.75
XF =.5
YF =.5
ZF =.5
VUP =Z
Z-BUFFER

FIGURE 41

APPENDIX A
MIXER PUMP DROP ANALYSIS

```

/prep7
/title,flex receiver platform - elastic/plastic analysis
et,1,shell43
r,1,2.      ***** cover plate with hole
r,2,1.      ***** cover plate without hole
r,3,1.      ***** bottom plate
r,4,1,515   ***** beam upper flange
r,5,0,515   ***** beam lower flange
r,6,0,295   ***** beam web
ex,1,29e6
nuxy,1,0.3
dens,1,0.000734
tb,kin,1,1
tbdata,1,36000,145000.
tbtemp,70
ex,2,290e6
local,13,0,-71.75,-59.75
csys,13
n,300      *****cover plate
n,301,,10
n,302,,20.
n,303,,24.
n,304,,26.
n,305,,28.
n,306,,36.375
n,307,,44.75
n,308,,52.25
n,309,,59.75
ngen,4,10,300,309,1,10.6667
ngen,3,10,330,339,1,4.
ngen,3,10,350,359,1,8.375
ngen,5,10,370,379,1,7.5
ngen,3,10,410,419,1,8.375
ngen,2,10,430,439,1,4.
ngen,3,10,440,449,1,2.
ngen,3,10,460,469,1,8.375
ngen,5,10,480,489,1,7.5
ngen,3,10,520,529,1,8.375
ngen,2,10,540,549,1,8.
ngen,2,10,550,559,1,4.
ngen,3,10,560,569,1,2.
real,3
e,300,310,311,301
egen,3,10,-1
egen,2,1,-3
e,305,315,316,306
egen,3,10,-1
egen,4,1,-3
e,350,360,361,351
egen,8,10,-1
egen,2,1,-8
e,460,470,471,461

```

```

egen,9,10,-1
egen,2,1,-9
e,545,555,556,546
egen,4,1,-1
real,4          *****cover plate + beam upper flange
e,302,312,313,303
egen,3,10,-1
egen,3,1,-3
e,330,340,341,331
egen,2,10,-1
egen,9,1,-2
e,352,362,363,353
egen,8,10,-1
egen,3,1,-8
e,430,440,441,431
egen,3,10,-1
egen,9,1,-3
e,462,472,473,463
egen,9,10,-1
egen,3,1,-9
e,550,560,561,551
egen,3,10,-1
egen,9,1,-3
real,6          ****beam web
ngen,3,2000,303,583,10,,,5.455
ngen,3,2000,340,349,1,,,5.455
ngen,3,2000,440,449,1,,,5.455
ngen,3,2000,560,569,1,,,5.455
e,303,313,2313,2303
egen,26,10,-1
egen,2,2000,-26
e,340,341,2341,2340
egen,9,1,-1
egen,2,2000,-9
e,440,441,2441,2440
egen,9,1,-1
egen,2,2000,-9
e,560,561,2561,2560
egen,9,1,-1
egen,2,2000,-9
real,5          **** beam lower flange
ngen,2,4000,4303,4583,10,,-4.
ngen,2,5000,4303,4583,10,,-4.
ngen,2,4000,4340,4341,1,-4.
ngen,2,5000,4340,4341,1,4.
ngen,2,4000,4346,4349,1,-4.
ngen,2,5000,4346,4349,1,4.
ngen,2,4000,4440,4441,1,-4.
ngen,2,5000,4440,4441,1,2.
ngen,2,5010,4440,4441,1,4.
ngen,2,5000,4560,4561,1,2.
ngen,2,5010,4560,4561,1,4.

```

ngen,2,5000,4446,4449,1,2.
ngen,2,5010,4446,4449,1,4.
ngen,2,5000,4566,4569,1,2.
ngen,2,5010,4566,4569,1,4.
ngen,2,4000,4446,4449,1,-4.
ngen,2,4000,4560,4561,1,-4.
ngen,2,4000,4566,4569,1,-4.
e,4303,4313,8313,8303
egen,28,10,-1
e,4303,4313,9313,9303
egen,28,10,-1
e,4340,4341,8341,8340
e,4340,4341,9341,9340
e,4341,8343,8333,8341
e,4341,8343,8353,9341
e,9333,9343,4346,8346
e,9343,9353,9346,4346
e,4346,4347,8347,8346
egen,3,1,-1
e,4346,4347,9347,9346
egen,3,1,-1
e,4440,4441,8441,8440
e,4440,4441,9441,9440
e,9440,9441,9451,9450
e,4441,8443,8433,8441
e,4441,8443,8453,9441
e,9441,8453,8463,9451
e,9443,4446,8446,9433
e,9443,4446,9446,9453
e,9453,9446,9456,9463
e,4446,4447,8447,8446
egen,3,1,-1
e,4446,4447,9447,9446
egen,3,1,-1
e,9446,9447,9457,9456
egen,3,1,-1
e,4560,4561,8561,8560
e,4560,4561,9561,9560
e,9560,9561,9571,9570
e,4561,8563,8553,8561
e,4561,8563,8573,9561
e,9561,8573,8583,9571
e,9563,4566,8566,9553
e,9563,4566,9566,9573
e,9573,9566,9576,9583
e,4566,4567,8567,8566
egen,3,1,-1
e,4566,4567,9567,9566
egen,3,1,-1
e,9566,9567,9577,9576
egen,3,1,-1
csys,0

n,1,-16,-16
n,9,16,-16
fill
ngen,5,9,1,9,1,,4
type,1
real,2
e,1,2,11,10
egen,8,1,-1
egen,4,9,-8
csys,1
n,100,25
n,108,25,90
fill
n,116,25,180
fill
n,117,25,-168.75
n,124,25,-90
fill
n,131,25,-11.25
fill
e,37,116,117,28
e,28,117,118,19
e,19,118,119,10
e,10,119,120,1
e,1,120,121,2
e,2,121,122,3
e,3,122,123,4
e,4,123,124,5
e,5,124,125,6
e,6,125,126,7
e,7,126,127,8
e,8,127,128,9
e,9,128,129,18
e,18,129,130,27
e,27,130,131,36
e,36,131,100,45
ngen,3,32,100,131,1,2.5
e,116,148,149,117
egen,15,1,-1
e,131,163,132,100
egen,2,32,-16
e,180,359,358,181
e,181,358,357,182
e,182,357,356,183
e,183,356,355,184
e,184,355,365,185
e,185,365,375,186
e,186,375,385,187
e,187,385,395,188
e,188,395,405,189
e,189,405,415,190
e,190,415,425,191

e,191,425,435,192
e,192,435,436,193
egen,3,1,-1
e,195,438,439,164
local,11,0,71.5
csys,11
real,1
local,12,1,71.5 *****second plate
csys,12
n,1100,25,,0.01
n,1108,25,90,0.01
fill
n,1116,25,180,0.01
fill
n,1117,25,-168.75,0.01
n,1124,25,-90,0.01
fill
n,1131,25,-11.25,0.01
fill
ngen,3,32,1100,1131,1,2.5
type,1
real,1
e,1116,1148,1149,1117
egen,15,1,-1
e,1131,1163,1132,1100
egen,2,32,-16
csys,0
ngen,2,30000,454,459,1,,,0.01
ngen,2,30000,474,574,10,,,0.01
ngen,2,30000,546,549,1,,,0.01
ngen,2,30000,556,559,1,,,0.01
ngen,2,30000,575,579,1,,,0.01
e,1180,30459,30458,1181
e,1181,30458,30457,1182
e,1182,30457,30456,1183
e,1183,30456,30454,1184
e,1184,30454,30474,1185
e,1185,30474,30484,1186
e,1186,30484,30494,1187
e,1187,30494,30504,1188
e,1188,30504,30514,1189
e,1189,30514,30524,1190
e,1190,30524,30534,1191
e,1191,30534,30544,1192
e,1192,30544,30546,1193
e,1193,30546,30547,1194
e,1194,30547,30548,1195
e,1195,30548,30549,1164
e,544,554,556,546
e,546,556,557,547
egen,3,1,-1
e,554,574,576,556

e,556,576,577,557
 egen,3,1,-1
 cp,1,uz,457,30457
 cp,2,uz,474,30474
 cp,3,uz,494,30494
 cp,4,uz,514,30514
 cp,5,uz,534,30534
 cp,6,uz,577,30577
 cp,7,ux,457,30457
 cp,8,ux,474,30474
 cp,9,ux,494,30494
 cp,10,ux,514,30514
 cp,11,ux,534,30534
 cp,12,ux,577,30577
 cp,13,uy,457,30457
 cp,14,uy,474,30474
 cp,15,uy,494,30494
 cp,16,uy,514,30514
 cp,17,uy,534,30534
 cp,18,uy,577,30577
 et,5,combin14,,1
 r,12,10.
 type,5
 real,12
 ngen,2,6000,4303,,,-0.1
 e,4303,10303
 ngen,2,6000,4583,,,-0.01
 e,4583,10583
 et,6,combin14,,2
 r,13,10.
 type,6
 real,13
 ngen,2,6000,4340,,,,-0.01
 e,4340,10340
 ngen,2,6000,4440,,,,-0.01
 e,4440,10440
 nsel,s,,,10303
 nsel,a,,,10583
 nsel,a,,,10340
 nsel,a,,,10440
 d,all,all
 alls
 csys,0
 ngen,2,6000,4560,4569,1,,,0.01
 ngen,2,6000,4303,4340,37,,,0.01
 ngen,2,6000,4440,,,,-0.01
 et,2,contac52,,,,,1
 r,11,1.0e8,,1
 r,20,1.0e7,,1
 type,2
 real,11
 e,10560,4560

```

egen,4,1,-1
e,10565,4565
egen,5,1,-1
e,10303,4303
e,10340,4340
e,10440,4440
nsel,s,,,10560,10563
nsel,a,,,10565,10569
nsel,a,,,10440
nsel,a,,,10340
nsel,a,,,10303
d,all,all
alls
ndel,366,369
ndel,376,379
ndel,386,389
ndel,396,399
ndel,406,409
ndel,416,419
ndel,426,429
ndel,476,479
ndel,486,489
ndel,496,499
ndel,506,509
ndel,516,519
ndel,526,529
ndel,536,539
type,2
real,20
e,458,30458
egen,2,1,-1
e,456,30456
e,454,30454
e,484,30484
e,504,30504
e,524,30524
e,554,30554
e,574,30574
e,575,30575
e,576,30576
e,578,30578
e,579,30579
e,546,30546
egen,4,1,-1
csys,11
type,1
mat,2
r,8,12.0
real,8
n,21001,-16,-16,20.
n,21009,16,-16,20.
fill

```

***** top plate

```
ngen,5,9,21001,21009,1,,4
e,21001,21002,21011,21010
egen,8,1,-1
egen,4,9,-8
csys,12
n,21100,25,,20.
n,21108,25,90,20.
fill
n,21116,25,180,20.
fill
n,21117,25,-168.75,20.
n,21124,25,-90,20.
fill
n,21131,25,-11.25,20.
fill
e,21037,21116,21117,21028
e,21028,21117,21118,21019
e,21019,21118,21119,21010
e,21010,21119,21120,21001
e,21001,21120,21121,21002
e,21002,21121,21122,21003
e,21003,21122,21123,21004
e,21004,21123,21124,21005
e,21005,21124,21125,21006
e,21006,21125,21126,21007
e,21007,21126,21127,21008
e,21008,21127,21128,21009
e,21009,21128,21129,21018
e,21018,21129,21130,21027
e,21027,21130,21131,21036
e,21036,21131,21100,21045
ngen,3,32,21100,21131,1,2,5
e,21116,21148,21149,21117
egen,15,1,-1
e,21131,21163,21132,21100
egen,2,32,-16
et,3,combin40,,,3
r,9,50000,,,,10000
r,10,25000,,,,5000
type,3
real,9
e,1181,21181
egen,15,1,-1
real,10
e,1180,21180
e,1164,21164
d,21188,ux,,,,uy,rotx,roty,rotz
alls
et,4,combin40,1,,,3,,,2
g=386.4
r,11,100000,,(6500/g),720.
ngen,2,3000,21041,,,,720.
```

```
type,4
real,11
e,21041,24041
tunif,70.
csys,13
nset,s,loc,y,59.74,59.76
dsym,symm,y,13
alls
save
fini
/solu
antype,trans
kbc,1
acel,,,g
d,24041,uz
timint,off
time,0.00001
nsubst,2
neqit,40
lswrite
timint,on
time,1.93
nsubst,1000
outres,,5
autots,on
ddelete,24041,uz
lswrite
time,1.99
nsubst,600
outres,,3
neqit,40
autots,off
lswrite
lssolve,1,3
fini
/exit
```

Running ANSYS 5.2 on workstation: cea3 on: Mon Aug 25 11:37:25 PDT 1997
ANSYS 5.2 has been verified by ICF KH
Class 3 Error Reports are in the directory: /apps/ansys/class3_errors.
Executing /apps/ansys/sgi/ansys52/bin/ansys.e52

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NONE

*** NOTE ***

CP= 3.560 TIME= 11:37:56

There are no parameters and no abbreviations defined.

32207 VERSION=SGI IRIS4D REVISION= 5.2
FOR SUPPORT CALL K McMillian 373- PHONE JLR 206-353-8089 FAX FAX 509-373-6975
CURRENT JOBNAME=file 11:37:56 AUG 25, 1997 CP= 3.570

RUN SETUP PROCEDURE FROM FILE = /apps/ansys/sgi/ansys52/docu/start.ans

/INPUT FILE = /apps/ansys/sgi/ansys52/docu/start.ans LINE = 0

BEGIN:

***** ANSYS - ENGINEERING ANALYSIS SYSTEM REVISION 5.2 *****
32207 VERSION = SGI IRIS4D 11:38:09 AUG 25, 1997 CP = 3.810
FOR SUPPORT CALL K McMillian 373- PHONE JLR 206-353-8089 FAX FAX 509-373-6975

***** ANSYS ANALYSIS DEFINITION (PREP7) *****

ENTER /SHOW,DEVICE-NAME TO ENABLE GRAPHIC DISPLAY
ENTER FINISH TO LEAVE PREP7
PRINTOUT KEY SET TO /GOPR (USE /NOPR TO SUPPRESS)

PREP7:

TITLE =
flex receiver platform - elastic/plastic analysis

PREP7:

ELEMENT TYPE 1 IS SHELL43 4-NODE STRUCTURAL SHELL
KEYOPT(1-12) = 0 0 0 0 0 0 0 0 0 0 0 0

CURRENT NODAL DOF SET IS UX UY UZ ROTX ROTY ROTZ
THREE-DIMENSIONAL MODEL

PREP7:

REAL CONSTANT SET 1 ITEMS 1 TO 6
2.0000 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00

PREP7:

REAL CONSTANT SET 2 ITEMS 1 TO 6
1.0000 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00

PREP7:

REAL CONSTANT SET 3 ITEMS 1 TO 6
1.0000 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00

PREP7:

REAL CONSTANT SET 4 ITEMS 1 TO 6

1.5150 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00

PREP7:

REAL CONSTANT SET 5 ITEMS 1 TO 6
0.51500 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00

PREP7:

REAL CONSTANT SET 6 ITEMS 1 TO 6
0.29500 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00

PREP7:

MATERIAL 1 EX = 0.2900000E+08

PREP7:

MATERIAL 1 NUXY = 0.3000000

PREP7:

MATERIAL 1 DENS = 0.7340000E-03

PREP7:

DEFINE DATA TABLE BKin FOR MATERIAL 1
WITH A MAXIMUM OF 1 TEMPERATURE SPECIFICATIONS

PREP7:

DATA FOR BKin TABLE FOR MATERIAL 1 AT TEMPERATURE= 0.00000E+00
LOC = 1 36000. 0.14500E+06

PREP7:

TEMPERATURE TO BE USED FOR THE NEXT TBDAT COMMAND = 70.000
TEMPERATURE SPECIFICATION = 1

PREP7:

MATERIAL 2 EX = 0.2900000E+09

PREP7:

COORDINATE SYSTEM 13 DEFINITION. TYPE = 0 (CARTESIAN)
XC,YC,ZC = -71.750 -59.750 0.00000E+00
ANGLES = 0.00 0.00 0.00 PARAMETERS = 1.000 1.000
ORIENTATION = 1.00 0.00 0.00 0.00 1.00 0.00 0.00 0.00 1.00

ACTIVE COORDINATE SYSTEM SET TO 13 (CARTESIAN)

PREP7:

ACTIVE COORDINATE SYSTEM SET TO 13 (CARTESIAN)

PREP7:

NODE 300 KCS = 13 X,Y,Z= 0.00000E+00 0.00000E+00 0.00000E+00

PREP7:

NODE 301 KCS = 13 X,Y,Z= 0.00000E+00 10.000 0.00000E+00

PREP7:

NODE 302 KCS = 13 X,Y,Z= 0.00000E+00 20.000 0.00000E+00

PREP7:

NODE 303 KCS = 13 X,Y,Z= 0.00000E+00 24.000 0.00000E+00

PREP7:

NODE 304 KCS = 13 X,Y,Z= 0.00000E+00 26.000 0.00000E+00

PREP7:

NODE 305 KCS = 13 X,Y,Z= 0.00000E+00 28.000 0.00000E+00

PREP7:

NODE 306 KCS = 13 X,Y,Z= 0.00000E+00 36.375 0.00000E+00

PREP7:

NODE 307 KCS = 13 X,Y,Z= 0.00000E+00 44.750 0.00000E+00

PREP7:

NODE 308 KCS = 13 X,Y,Z= 0.00000E+00 52.250 0.00000E+00

PREP7:

NODE 309 KCS = 13 X,Y,Z= 0.00000E+00 59.750 0.00000E+00

PREP7:

GENERATE 4 TOTAL SETS OF NODES WITH INCREMENT 10
SET IS SELECTED NODES IN RANGE 300 TO 309 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 10.667 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

GENERATE 3 TOTAL SETS OF NODES WITH INCREMENT 10
SET IS SELECTED NODES IN RANGE 330 TO 339 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 4.0000 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

GENERATE 3 TOTAL SETS OF NODES WITH INCREMENT 10
SET IS SELECTED NODES IN RANGE 350 TO 359 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 8.3750 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

GENERATE 5 TOTAL SETS OF NODES WITH INCREMENT 10
SET IS SELECTED NODES IN RANGE 370 TO 379 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 7.5000 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

GENERATE 3 TOTAL SETS OF NODES WITH INCREMENT 10
SET IS SELECTED NODES IN RANGE 410 TO 419 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 8.3750 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 10
SET IS SELECTED NODES IN RANGE 430 TO 439 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 4.0000 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

GENERATE 3 TOTAL SETS OF NODES WITH INCREMENT 10
SET IS SELECTED NODES IN RANGE 440 TO 449 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 2.0000 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

GENERATE 3 TOTAL SETS OF NODES WITH INCREMENT 10
SET IS SELECTED NODES IN RANGE 460 TO 469 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 8.3750 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

GENERATE 5 TOTAL SETS OF NODES WITH INCREMENT 10
SET IS SELECTED NODES IN RANGE 480 TO 489 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 7.5000 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

GENERATE 3 TOTAL SETS OF NODES WITH INCREMENT 10
SET IS SELECTED NODES IN RANGE 520 TO 529 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 8.3750 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 10
SET IS SELECTED NODES IN RANGE 540 TO 549 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 8.0000 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 10
SET IS SELECTED NODES IN RANGE 550 TO 559 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 4.0000 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

GENERATE 3 TOTAL SETS OF NODES WITH INCREMENT 10
SET IS SELECTED NODES IN RANGE 560 TO 569 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 2.0000 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

REAL CONSTANT NUMBER= 3

PREP7:

ELEMENT 1 300 310 311 301

PREP7:

GENERATE 3 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 10
SET IS SELECTED ELEMENTS IN RANGE 1 TO 1 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 3

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 1 TO 3 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 6

PREP7:

ELEMENT 7 305 315 316 306

PREP7:

GENERATE 3 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 10
SET IS SELECTED ELEMENTS IN RANGE 7 TO 7 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 9

PREP7:

GENERATE 4 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 7 TO 9 IN STEPS OF 1

MAXIMUM ELEMENT NUMBER = 18

PREP7:

ELEMENT 19 350 360 361 351

PREP7:

GENERATE 8 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 10
SET IS SELECTED ELEMENTS IN RANGE 19 TO 19 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 26

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 19 TO 26 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 34

PREP7:

ELEMENT 35 460 470 471 461

PREP7:

GENERATE 9 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 10
SET IS SELECTED ELEMENTS IN RANGE 35 TO 35 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 43

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 35 TO 43 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 52

PREP7:

ELEMENT 53 545 555 556 546

PREP7:

GENERATE 4 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 53 TO 53 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 56

PREP7:

REAL CONSTANT NUMBER = 4

PREP7:

ELEMENT 57 302 312 313 303

PREP7:

GENERATE 3 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 10
SET IS SELECTED ELEMENTS IN RANGE 57 TO 57 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 59

PREP7:

GENERATE 3 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 57 TO 59 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 65

PREP7:

ELEMENT 66 330 340 341 331

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 10
SET IS SELECTED ELEMENTS IN RANGE 66 TO 66 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 67

PREP7:

GENERATE 9 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 66 TO 67 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 83

PREP7:

ELEMENT 84 352 362 363 353

PREP7:

GENERATE 8 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 10
SET IS SELECTED ELEMENTS IN RANGE 84 TO 84 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 91

PREP7:

GENERATE 3 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 84 TO 91 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 107

PREP7:

ELEMENT 108 430 440 441 431

PREP7:

GENERATE 3 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 10
SET IS SELECTED ELEMENTS IN RANGE 108 TO 108 IN STEPS OF 1

MAXIMUM ELEMENT NUMBER = 110

PREP7:

GENERATE 9 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 108 TO 110 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 134

PREP7:

ELEMENT 135 462 472 473 463

PREP7:

GENERATE 9 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 10
SET IS SELECTED ELEMENTS IN RANGE 135 TO 135 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 143

PREP7:

GENERATE 3 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 135 TO 143 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 161

PREP7:

ELEMENT 162 550 560 561 551

PREP7:

GENERATE 3 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 10
SET IS SELECTED ELEMENTS IN RANGE 162 TO 162 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 164

PREP7:

GENERATE 9 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 162 TO 164 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 188

PREP7:

REAL CONSTANT NUMBER = 6

PREP7:

GENERATE 3 TOTAL SETS OF NODES WITH INCREMENT 2000
SET IS SELECTED NODES IN RANGE 303 TO 583 IN STEPS OF 10
GEOMETRY INCREMENTS ARE 0.00000E+00 0.00000E+00 -5.4550 SPACING = 1.0000

PREP7:

GENERATE 3 TOTAL SETS OF NODES WITH INCREMENT 2000
SET IS SELECTED NODES IN RANGE 340 TO 349 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 0.00000E+00 0.00000E+00 -5.4550 SPACING= 1.0000

PREP7:

GENERATE 3 TOTAL SETS OF NODES WITH INCREMENT 2000
SET IS SELECTED NODES IN RANGE 440 TO 449 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 0.00000E+00 0.00000E+00 -5.4550 SPACING= 1.0000

PREP7:

GENERATE 3 TOTAL SETS OF NODES WITH INCREMENT 2000
SET IS SELECTED NODES IN RANGE 560 TO 569 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 0.00000E+00 0.00000E+00 -5.4550 SPACING= 1.0000

PREP7:

ELEMENT 189 303 313 2313 2303

PREP7:

GENERATE 26 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 10
SET IS SELECTED ELEMENTS IN RANGE 189 TO 189 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 214

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 2000
SET IS SELECTED ELEMENTS IN RANGE 189 TO 214 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 240

PREP7:

ELEMENT 241 340 341 2341 2340

PREP7:

GENERATE 9 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 241 TO 241 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 249

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 2000
SET IS SELECTED ELEMENTS IN RANGE 241 TO 249 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 258

PREP7:

ELEMENT 259 440 441 2441 2440

PREP7:

GENERATE 9 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 259 TO 259 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 267

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 2000
SET IS SELECTED ELEMENTS IN RANGE 259 TO 267 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 276

PREP7:

ELEMENT 277 560 561 2561 2560

PREP7:

GENERATE 9 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 277 TO 277 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 285

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 2000
SET IS SELECTED ELEMENTS IN RANGE 277 TO 285 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 294

PREP7:

REAL CONSTANT NUMBER = 5

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 4000
SET IS SELECTED NODES IN RANGE 4303 TO 4583 IN STEPS OF 10
GEOMETRY INCREMENTS ARE 0.00000E+00 -4.0000 0.00000E+00 SPACING = 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 5000
SET IS SELECTED NODES IN RANGE 4303 TO 4583 IN STEPS OF 10
GEOMETRY INCREMENTS ARE 0.00000E+00 4.0000 0.00000E+00 SPACING = 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 4000
SET IS SELECTED NODES IN RANGE 4340 TO 4341 IN STEPS OF 1
GEOMETRY INCREMENTS ARE -4.0000 0.00000E+00 0.00000E+00 SPACING = 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 5000
SET IS SELECTED NODES IN RANGE 4340 TO 4341 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 4.0000 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 4000
SET IS SELECTED NODES IN RANGE 4346 TO 4349 IN STEPS OF 1
GEOMETRY INCREMENTS ARE -4.0000 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 5000
SET IS SELECTED NODES IN RANGE 4346 TO 4349 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 4.0000 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 4000
SET IS SELECTED NODES IN RANGE 4440 TO 4441 IN STEPS OF 1
GEOMETRY INCREMENTS ARE -4.0000 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 5000
SET IS SELECTED NODES IN RANGE 4440 TO 4441 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 2.0000 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 5010
SET IS SELECTED NODES IN RANGE 4440 TO 4441 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 4.0000 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 5000
SET IS SELECTED NODES IN RANGE 4560 TO 4561 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 2.0000 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 5010
SET IS SELECTED NODES IN RANGE 4560 TO 4561 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 4.0000 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 5000
SET IS SELECTED NODES IN RANGE 4446 TO 4449 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 2.0000 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 5010
SET IS SELECTED NODES IN RANGE 4446 TO 4449 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 4.0000 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 5000
SET IS SELECTED NODES IN RANGE 4566 TO 4569 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 2.0000 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 5010
SET IS SELECTED NODES IN RANGE 4566 TO 4569 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 4.0000 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 4000
SET IS SELECTED NODES IN RANGE 4446 TO 4449 IN STEPS OF 1
GEOMETRY INCREMENTS ARE -4.0000 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 4000
SET IS SELECTED NODES IN RANGE 4560 TO 4561 IN STEPS OF 1
GEOMETRY INCREMENTS ARE -4.0000 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 4000
SET IS SELECTED NODES IN RANGE 4566 TO 4569 IN STEPS OF 1
GEOMETRY INCREMENTS ARE -4.0000 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

ELEMENT 295 4303 4313 8313 8303

PREP7:

GENERATE 28 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 10
SET IS SELECTED ELEMENTS IN RANGE 295 TO 295 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 322

PREP7:

ELEMENT 323 4303 4313 9313 9303

PREP7:

GENERATE 28 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 10
SET IS SELECTED ELEMENTS IN RANGE 323 TO 323 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 350

PREP7:

ELEMENT 351 4340 4341 8341 8340

PREP7:

ELEMENT 352 4340 4341 9341 9340

PREP7:

ELEMENT 353 4341 8343 8333 8341

PREP7:

ELEMENT 354 4341 8343 8353 9341

PREP7:

ELEMENT 355 9333 9343 4346 8346

PREP7:

ELEMENT 356 9343 9353 9346 4346

PREP7:

ELEMENT 357 4346 4347 8347 8346

PREP7:

GENERATE 3 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 357 TO 357 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 359

PREP7:

ELEMENT 360 4346 4347 9347 9346

PREP7:

GENERATE 3 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 360 TO 360 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 362

PREP7:

ELEMENT 363 4440 4441 8441 8440

PREP7:

ELEMENT 364 4440 4441 9441 9440

PREP7:

ELEMENT 365 9440 9441 9451 9450

PREP7:

ELEMENT 366 4441 8443 8433 8441

PREP7:

ELEMENT 367 4441 8443 8453 9441

PREP7:

ELEMENT 368 9441 8453 8463 9451

PREP7:

ELEMENT 369 9443 4446 8446 9433

PREP7:

ELEMENT 370 9443 4446 9446 9453

PREP7:

ELEMENT 371 9453 9446 9456 9463

PREP7:

ELEMENT 372 4446 4447 8447 8446

PREP7:

GENERATE 3 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 372 TO 372 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 374

PREP7:

ELEMENT 375 4446 4447 9447 9446

PREP7:

GENERATE 3 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 375 TO 375 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 377

PREP7:

ELEMENT 378 9446 9447 9457 9456

PREP7:

GENERATE 3 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 378 TO 378 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 380

PREP7:

ELEMENT 381 4560 4561 8561 8560

PREP7:

ELEMENT 382 4560 4561 9561 9560

PREP7:

ELEMENT 383 9560 9561 9571 9570

PREP7:

ELEMENT 384 4561 8563 8553 8561

PREP7:

ELEMENT 385 4561 8563 8573 9561

PREP7:

ELEMENT 386 9561 8573 8583 9571

PREP7:

ELEMENT 387 9563 4566 8566 9553

PREP7:

ELEMENT 388 9563 4566 9566 9573

PREP7:

ELEMENT 389 9573 9566 9576 9583

PREP7:

ELEMENT 390 4566 4567 8567 8566

PREP7:

GENERATE 3 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 390 TO 390 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 392

PREP7:

ELEMENT 393 4566 4567 9567 9566

PREP7:

GENERATE 3 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 393 TO 393 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 395

PREP7:

ELEMENT 396 9566 9567 9577 9576

PREP7:

GENERATE 3 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 396 TO 396 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 398

PREP7:

ACTIVE COORDINATE SYSTEM SET TO 0 (CARTESIAN)

PREP7:

NODE 1 KCS= 0 X,Y,Z= -16.000 -16.000 0.00000E+00

PREP7:

NODE 9 KCS= 0 X,Y,Z= 16.000 -16.000 0.00000E+00

PREP7:

FILL 7 POINTS BETWEEN NODE 1 AND NODE 9
START WITH NODE 2 AND INCREMENT BY 1

PREP7:

GENERATE 5 TOTAL SETS OF NODES WITH INCREMENT 9
SET IS SELECTED NODES IN RANGE 1 TO 9 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 0.00000E+00 4.0000 0.00000E+00 SPACING= 1.0000

PREP7:

ELEMENT TYPE SET TO 1

PREP7:

REAL CONSTANT NUMBER= 2

PREP7:

ELEMENT 399 1 2 11 10

PREP7:

GENERATE 8 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 399 TO 399 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 406

PREP7:

GENERATE 4 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 9
SET IS SELECTED ELEMENTS IN RANGE 399 TO 406 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 430

PREP7:

ACTIVE COORDINATE SYSTEM SET TO 1 (CYLINDRICAL)

PREP7:

NODE 100 KCS= 1 X,Y,Z= 25.000 0.00000E+00 0.00000E+00

PREP7:

NODE 108 KCS= 1 X,Y,Z= 25.000 90.000 0.00000E+00

PREP7:

FILL 7 POINTS BETWEEN NODE 100 AND NODE 108
START WITH NODE 101 AND INCREMENT BY 1

PREP7:

NODE 116 KCS= 1 X,Y,Z= 25.000 180.00 0.00000E+00

PREP7:

FILL 7 POINTS BETWEEN NODE 108 AND NODE 116
START WITH NODE 109 AND INCREMENT BY 1

PREP7:

NODE 117 KCS= 1 X,Y,Z= 25.000 -168.75 0.00000E+00

PREP7:

NODE 124 KCS= 1 X,Y,Z= 25.000 -90.000 0.00000E+00

PREP7:

FILL 6 POINTS BETWEEN NODE 117 AND NODE 124
START WITH NODE 118 AND INCREMENT BY 1

PREP7:

NODE 131 KCS= 1 X,Y,Z= 25.000 -11.250 0.00000E+00

PREP7:

FILL 6 POINTS BETWEEN NODE 124 AND NODE 131
START WITH NODE 125 AND INCREMENT BY 1

PREP7:

ELEMENT 431 37 116 117 28

PREP7:

ELEMENT 432 28 117 118 19

PREP7:

ELEMENT 433 19 118 119 10

PREP7:

ELEMENT 434 10 119 120 1

PREP7:

ELEMENT 435 1 120 121 2

PREP7:

ELEMENT 436 2 121 122 3

PREP7:

ELEMENT 437 3 122 123 4

PREP7:

ELEMENT 438 4 123 124 5

PREP7:

ELEMENT 439 5 124 125 6

PREP7:

ELEMENT 440 6 125 126 7

PREP7:

ELEMENT 441 7 126 127 8

PREP7:

ELEMENT 442 8 127 128 9

PREP7:

ELEMENT 443 9 128 129 18

PREP7:

ELEMENT 444 18 129 130 27

PREP7:

ELEMENT 445 27 130 131 36

PREP7:

ELEMENT 446 36 131 100 45

PREP7:

GENERATE 3 TOTAL SETS OF NODES WITH INCREMENT 32
SET IS SELECTED NODES IN RANGE 100 TO 131 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 2.5000 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

ELEMENT 447 116 148 149 117

PREP7:

GENERATE 15 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 447 TO 447 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 461

PREP7:

ELEMENT 462 131 163 132 100

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 32
SET IS SELECTED ELEMENTS IN RANGE 447 TO 462 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 478

PREP7:

ELEMENT 479 180 359 358 181

PREP7:

ELEMENT 480 181 358 357 182

PREP7:

ELEMENT 481 182 357 356 183

PREP7:

ELEMENT 482 183 356 355 184

PREP7:

ELEMENT 483 184 355 365 185

PREP7:

ELEMENT 484 185 365 375 186

PREP7:

ELEMENT 485 186 375 385 187

PREP7:

ELEMENT 486 187 385 395 188

PREP7:

ELEMENT 487 188 395 405 189

PREP7:

ELEMENT 488 189 405 415 190

PREP7:

ELEMENT 489 190 415 425 191

PREP7:

ELEMENT 490 191 425 435 192

PREP7:

ELEMENT 491 192 435 436 193

PREP7:

GENERATE 3 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 491 TO 491 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 493

PREP7:

ELEMENT 494 195 438 439 164

PREP7:

COORDINATE SYSTEM 11 DEFINITION. TYPE= 0 (CARTESIAN)
XC,YC,ZC= 71.500 0.00000E+00 0.00000E+00
ANGLES= 0.00 0.00 0.00 PARAMETERS= 1.000 1.000
ORIENTATION= 1.00 0.00 0.00 0.00 1.00 0.00 0.00 0.00 1.00

ACTIVE COORDINATE SYSTEM SET TO 11 (CARTESIAN)

PREP7:

ACTIVE COORDINATE SYSTEM SET TO 11 (CARTESIAN)

PREP7:

REAL CONSTANT NUMBER= 1

PREP7:

COORDINATE SYSTEM 12 DEFINITION. TYPE= 1 (CYLINDRICAL)
XC,YC,ZC= 71.500 0.00000E+00 0.00000E+00
ANGLES= 0.00 0.00 0.00 PARAMETERS= 1.000 1.000
ORIENTATION= 1.00 0.00 0.00 0.00 1.00 0.00 0.00 0.00 1.00

ACTIVE COORDINATE SYSTEM SET TO 12 (CYLINDRICAL)

PREP7:

ACTIVE COORDINATE SYSTEM SET TO 12 (CYLINDRICAL)

PREP7:

NODE 1100 KCS= 12 X,Y,Z= 25.000 0.00000E+00 0.10000E-01

PREP7:

NODE 1108 KCS= 12 X,Y,Z= 25.000 90.000 0.10000E-01

PREP7:

FILL 7 POINTS BETWEEN NODE 1100 AND NODE 1108
START WITH NODE 1101 AND INCREMENT BY 1

PREP7:

NODE 1116 KCS = 12 X,Y,Z = 25.000 180.00 0.10000E-01

PREP7:

FILL 7 POINTS BETWEEN NODE 1108 AND NODE 1116
START WITH NODE 1109 AND INCREMENT BY 1

PREP7:

NODE 1117 KCS = 12 X,Y,Z = 25.000 -168.75 0.10000E-01

PREP7:

NODE 1124 KCS = 12 X,Y,Z = 25.000 -90.000 0.10000E-01

PREP7:

FILL 6 POINTS BETWEEN NODE 1117 AND NODE 1124
START WITH NODE 1118 AND INCREMENT BY 1

PREP7:

NODE 1131 KCS = 12 X,Y,Z = 25.000 -11.250 0.10000E-01

PREP7:

FILL 6 POINTS BETWEEN NODE 1124 AND NODE 1131
START WITH NODE 1125 AND INCREMENT BY 1

PREP7:

GENERATE 3 TOTAL SETS OF NODES WITH INCREMENT 32
SET IS SELECTED NODES IN RANGE 1100 TO 1131 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 2.5000 0.00000E+00 0.00000E+00 SPACING = 1.0000

PREP7:

ELEMENT TYPE SET TO 1

PREP7:

REAL CONSTANT NUMBER = 1

PREP7:

ELEMENT 495 1116 1148 1149 1117

PREP7:

GENERATE 15 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1

SET IS SELECTED ELEMENTS IN RANGE 495 TO 495 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 509

PREP7:

ELEMENT 510 1131 1163 1132 1100

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 32
SET IS SELECTED ELEMENTS IN RANGE 495 TO 510 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 526

PREP7:

ACTIVE COORDINATE SYSTEM SET TO 0 (CARTESIAN)

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 30000
SET IS SELECTED NODES IN RANGE 454 TO 459 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 0.00000E+00 0.00000E+00 0.10000E-01 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 30000
SET IS SELECTED NODES IN RANGE 474 TO 574 IN STEPS OF 10
GEOMETRY INCREMENTS ARE 0.00000E+00 0.00000E+00 0.10000E-01 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 30000
SET IS SELECTED NODES IN RANGE 546 TO 549 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 0.00000E+00 0.00000E+00 0.10000E-01 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 30000
SET IS SELECTED NODES IN RANGE 556 TO 559 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 0.00000E+00 0.00000E+00 0.10000E-01 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 30000
SET IS SELECTED NODES IN RANGE 575 TO 579 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 0.00000E+00 0.00000E+00 0.10000E-01 SPACING= 1.0000

PREP7:

ELEMENT 527 1180 30459 30458 1181

PREP7:

ELEMENT 528 1181 30458 30457 1182

PREP7:

ELEMENT 529 1182 30457 30456 1183

PREP7:

ELEMENT 530 1183 30456 30454 1184

PREP7:

ELEMENT 531 1184 30454 30474 1185

PREP7:

ELEMENT 532 1185 30474 30484 1186

PREP7:

ELEMENT 533 1186 30484 30494 1187

PREP7:

ELEMENT 534 1187 30494 30504 1188

PREP7:

ELEMENT 535 1188 30504 30514 1189

PREP7:

ELEMENT 536 1189 30514 30524 1190

PREP7:

ELEMENT 537 1190 30524 30534 1191

PREP7:

ELEMENT 538 1191 30534 30544 1192

PREP7:

ELEMENT 539 1192 30544 30546 1193

PREP7:

ELEMENT 540 1193 30546 30547 1194

PREP7:

ELEMENT 541 1194 30547 30548 1195

PREP7:

ELEMENT 542 1195 30548 30549 1164

PREP7:

ELEMENT 543 544 554 556 546

PREP7:

ELEMENT 544 546 556 557 547

PREP7:

GENERATE 3 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 544 TO 544 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 546

PREP7:

ELEMENT 547 554 574 576 556

PREP7:

ELEMENT 548 556 576 577 557

PREP7:

GENERATE 3 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 548 TO 548 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 550

PREP7:

COUPLED SET = 1 DIRECTION = UZ TOTAL NODES = 2
NODES ADDED = 457 30457
MAXIMUM COUPLED SET NUMBER = 1

PREP7:

COUPLED SET = 2 DIRECTION = UZ TOTAL NODES = 2
NODES ADDED = 474 30474
MAXIMUM COUPLED SET NUMBER = 2

PREP7:

COUPLED SET = 3 DIRECTION = UZ TOTAL NODES = 2
NODES ADDED = 494 30494
MAXIMUM COUPLED SET NUMBER = 3

PREP7:

COUPLED SET= 4 DIRECTION= UZ TOTAL NODES= 2
NODES ADDED = 514 30514
MAXIMUM COUPLED SET NUMBER= 4

PREP7:

COUPLED SET= 5 DIRECTION= UZ TOTAL NODES= 2
NODES ADDED = 534 30534
MAXIMUM COUPLED SET NUMBER= 5

PREP7:

COUPLED SET= 6 DIRECTION= UZ TOTAL NODES= 2
NODES ADDED = 577 30577
MAXIMUM COUPLED SET NUMBER= 6

PREP7:

COUPLED SET= 7 DIRECTION= UX TOTAL NODES= 2
NODES ADDED = 457 30457
MAXIMUM COUPLED SET NUMBER= 7

PREP7:

COUPLED SET= 8 DIRECTION= UX TOTAL NODES= 2
NODES ADDED = 474 30474
MAXIMUM COUPLED SET NUMBER= 8

PREP7:

COUPLED SET= 9 DIRECTION= UX TOTAL NODES= 2
NODES ADDED = 494 30494
MAXIMUM COUPLED SET NUMBER= 9

PREP7:

COUPLED SET= 10 DIRECTION= UX TOTAL NODES= 2
NODES ADDED = 514 30514
MAXIMUM COUPLED SET NUMBER= 10

PREP7:

COUPLED SET= 11 DIRECTION= UX TOTAL NODES= 2
NODES ADDED = 534 30534
MAXIMUM COUPLED SET NUMBER= 11

PREP7:

COUPLED SET= 12 DIRECTION= UX TOTAL NODES= 2
NODES ADDED = 577 30577

MAXIMUM COUPLED SET NUMBER= 12

PREP7:

COUPLED SET= 13 DIRECTION= UY TOTAL NODES= 2
NODES ADDED = 457 30457
MAXIMUM COUPLED SET NUMBER= 13

PREP7:

COUPLED SET= 14 DIRECTION= UY TOTAL NODES= 2
NODES ADDED = 474 30474
MAXIMUM COUPLED SET NUMBER= 14

PREP7:

COUPLED SET= 15 DIRECTION= UY TOTAL NODES= 2
NODES ADDED = 494 30494
MAXIMUM COUPLED SET NUMBER= 15

PREP7:

COUPLED SET= 16 DIRECTION= UY TOTAL NODES= 2
NODES ADDED = 514 30514
MAXIMUM COUPLED SET NUMBER= 16

PREP7:

COUPLED SET= 17 DIRECTION= UY TOTAL NODES= 2
NODES ADDED = 534 30534
MAXIMUM COUPLED SET NUMBER= 17

PREP7:

COUPLED SET= 18 DIRECTION= UY TOTAL NODES= 2
NODES ADDED = 577 30577
MAXIMUM COUPLED SET NUMBER= 18

PREP7:

ELEMENT TYPE 5 IS COMBIN14 SPRING-DAMPER
KEYOPT(1-12)= 0 1 0 0 0 0 0 0 0 0 0 0

CURRENT NODAL DOF SET IS UX UY UZ ROTX ROTY ROTZ
THREE-DIMENSIONAL MODEL

PREP7:

REAL CONSTANT SET 12 ITEMS 1 TO 6
10.000 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00

PREP7:

ELEMENT TYPE SET TO 5

PREP7:

REAL CONSTANT NUMBER = 12

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 6000
SET IS SELECTED NODES IN RANGE 4303 TO 4303 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 0.10000E-01 0.00000E+00 0.00000E+00 SPACING = 1.0000

PREP7:

ELEMENT 551 4303 10303

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 6000
SET IS SELECTED NODES IN RANGE 4583 TO 4583 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 0.10000E-01 0.00000E+00 0.00000E+00 SPACING = 1.0000

PREP7:

ELEMENT 552 4583 10583

PREP7:

ELEMENT TYPE 6 IS COMBIN14 SPRING-DAMPER
KEYOPT(1-12) = 0 2 0 0 0 0 0 0 0 0 0 0

CURRENT NODAL DOF SET IS UX UY UZ ROTX ROTY ROTZ
THREE-DIMENSIONAL MODEL

PREP7:

REAL CONSTANT SET 13 ITEMS 1 TO 6
10.000 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00

PREP7:

ELEMENT TYPE SET TO 6

PREP7:

REAL CONSTANT NUMBER = 13

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 6000
SET IS SELECTED NODES IN RANGE 4340 TO 4340 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 0.00000E+00-0.10000E-01 0.00000E+00 SPACING = 1.0000

PREP7:

ELEMENT 553 4340 10340

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 6000
SET IS SELECTED NODES IN RANGE 4440 TO 4440 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 0.00000E+00-0.10000E-01 0.00000E+00 SPACING = 1.0000

PREP7:

ELEMENT 554 4440 10440

PREP7:

SELECT FOR ITEM=NODE COMPONENT =
IN RANGE 10303 TO 10303 STEP 1
1 NODES (OF 779 DEFINED) SELECTED BY NSEL COMMAND.

PREP7:

ALSO SELECT FOR ITEM=NODE COMPONENT =
IN RANGE 10583 TO 10583 STEP 1
2 NODES (OF 779 DEFINED) SELECTED BY NSEL COMMAND.

PREP7:

ALSO SELECT FOR ITEM=NODE COMPONENT =
IN RANGE 10340 TO 10340 STEP 1
3 NODES (OF 779 DEFINED) SELECTED BY NSEL COMMAND.

PREP7:

ALSO SELECT FOR ITEM=NODE COMPONENT =
IN RANGE 10440 TO 10440 STEP 1
4 NODES (OF 779 DEFINED) SELECTED BY NSEL COMMAND.

PREP7:

SPECIFIED CONSTRAINT UX FOR SELECTED NODES 1 TO 30579 BY 1
REAL= 0.000000000E+00 IMAG= 0.000000000E+00
ADDITIONAL DOFS= UY UZ ROTX ROTY ROTZ

PREP7:

SELECT ALL ENTITIES OF TYPE= ALL AND BELOW

ALL SELECT FOR ITEM=VOLUME COMPONENT =
IN RANGE 0 TO 0 STEP 1

0 VOLUMES (OF 0 DEFINED) SELECTED BY VSEL COMMAND.

ALL SELECT FOR ITEM=AREA COMPONENT =
IN RANGE 0 TO 0 STEP 1

0 AREAS (OF 0 DEFINED) SELECTED BY ASEL COMMAND.

ALL SELECT FOR ITEM=LINE COMPONENT =
IN RANGE 0 TO 0 STEP 1

0 LINES (OF 0 DEFINED) SELECTED BY LSEL COMMAND.

ALL SELECT FOR ITEM=KP COMPONENT =
IN RANGE 0 TO 0 STEP 1

0 KEYPOINTS (OF 0 DEFINED) SELECTED BY KSEL COMMAND.

ALL SELECT FOR ITEM=ELEM COMPONENT =
IN RANGE 1 TO 554 STEP 1

554 ELEMENTS (OF 554 DEFINED) SELECTED BY ESEL COMMAND.

ALL SELECT FOR ITEM=NODE COMPONENT =
IN RANGE 1 TO 30579 STEP 1

779 NODES (OF 779 DEFINED) SELECTED BY NSEL COMMAND.

PREP7:

ACTIVE COORDINATE SYSTEM SET TO 0 (CARTESIAN)

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 6000
SET IS SELECTED NODES IN RANGE 4560 TO 4569 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 0.00000E+00 0.00000E+00-0.10000E-01 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 6000
SET IS SELECTED NODES IN RANGE 4303 TO 4340 IN STEPS OF 37
GEOMETRY INCREMENTS ARE 0.00000E+00 0.00000E+00-0.10000E-01 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 6000
SET IS SELECTED NODES IN RANGE 4440 TO 4440 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 0.00000E+00 0.00000E+00-0.10000E-01 SPACING= 1.0000

PREP7:

ELEMENT TYPE 2 IS CONTACT 3-D INTERFACE
KEYOPT(1-12)= 0 0 0 0 0 0 0 0 0 0 0 0
INOPR = 1

CURRENT NODAL DOF SET IS UX UY UZ ROTX ROTY ROTZ
THREE-DIMENSIONAL MODEL

PREP7:

REAL CONSTANT SET 11 ITEMS 1 TO 6
0.10000E+09 0.00000E+00 1.0000 0.00000E+00 0.00000E+00 0.00000E+00

PREP7:

REAL CONSTANT SET 20 ITEMS 1 TO 6
0.10000E+08 0.00000E+00 1.0000 0.00000E+00 0.00000E+00 0.00000E+00

PREP7:

ELEMENT TYPE SET TO 2

PREP7:

REAL CONSTANT NUMBER = 11

PREP7:

ELEMENT 555 10560 4560

PREP7:

GENERATE 4 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 555 TO 555 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 558

PREP7:

ELEMENT 559 10565 4565

PREP7:

GENERATE 5 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 559 TO 559 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 563

PREP7:

ELEMENT 564 10303 4303

PREP7:

ELEMENT 565 10340 4340

PREP7:

ELEMENT 566 10440 4440

PREP7:

SELECT FOR ITEM=NODE COMPONENT =
IN RANGE 10560 TO 10563 STEP 1

4 NODES (OF 789 DEFINED) SELECTED BY NSEL COMMAND.

PREP7:

ALSO SELECT FOR ITEM=NODE COMPONENT =
IN RANGE 10565 TO 10569 STEP 1

9 NODES (OF 789 DEFINED) SELECTED BY NSEL COMMAND.

PREP7:

ALSO SELECT FOR ITEM=NODE COMPONENT =
IN RANGE 10440 TO 10440 STEP 1

10 NODES (OF 789 DEFINED) SELECTED BY NSEL COMMAND.

PREP7:

ALSO SELECT FOR ITEM=NODE COMPONENT =
IN RANGE 10340 TO 10340 STEP 1

11 NODES (OF 789 DEFINED) SELECTED BY NSEL COMMAND.

PREP7:

ALSO SELECT FOR ITEM=NODE COMPONENT =
IN RANGE 10303 TO 10303 STEP 1

12 NODES (OF 789 DEFINED) SELECTED BY NSEL COMMAND.

PREP7:

SPECIFIED CONSTRAINT UX FOR SELECTED NODES 1 TO 30579 BY 1
REAL= 0.000000000E+00 IMAG= 0.000000000E+00
ADDITIONAL DOFS= UY UZ ROTX ROTY ROTZ

PREP7:

SELECT ALL ENTITIES OF TYPE= ALL AND BELOW

ALL SELECT FOR ITEM=VOLU COMPONENT=

IN RANGE 0 TO 0 STEP 1

0 VOLUMES (OF 0 DEFINED) SELECTED BY VSEL COMMAND.

ALL SELECT FOR ITEM=AREA COMPONENT =
IN RANGE 0 TO 0 STEP 1

0 AREAS (OF 0 DEFINED) SELECTED BY ASEL COMMAND.

ALL SELECT FOR ITEM=LINE COMPONENT =
IN RANGE 0 TO 0 STEP 1

0 LINES (OF 0 DEFINED) SELECTED BY LSEL COMMAND.

ALL SELECT FOR ITEM=KP COMPONENT =
IN RANGE 0 TO 0 STEP 1

0 KEYPOINTS (OF 0 DEFINED) SELECTED BY KSEL COMMAND.

ALL SELECT FOR ITEM=ELEM COMPONENT =
IN RANGE 1 TO 566 STEP 1

566 ELEMENTS (OF 566 DEFINED) SELECTED BY ESEL COMMAND.

ALL SELECT FOR ITEM=NODE COMPONENT =
IN RANGE 1 TO 30579 STEP 1

789 NODES (OF 789 DEFINED) SELECTED BY NSEL COMMAND.

PREP7:

DELETE SELECTED NODES FROM 366 TO 369 BY 1

PREP7:

DELETE SELECTED NODES FROM 376 TO 379 BY 1

PREP7:

DELETE SELECTED NODES FROM 386 TO 389 BY 1

PREP7:

DELETE SELECTED NODES FROM 396 TO 399 BY 1

PREP7:

DELETE SELECTED NODES FROM 406 TO 409 BY 1

PREP7:

DELETE SELECTED NODES FROM 416 TO 419 BY 1

PREP7:

DELETE SELECTED NODES FROM 426 TO 429 BY 1

PREP7:

DELETE SELECTED NODES FROM 476 TO 479 BY 1

PREP7:

DELETE SELECTED NODES FROM 486 TO 489 BY 1

PREP7:

DELETE SELECTED NODES FROM 496 TO 499 BY 1

PREP7:

DELETE SELECTED NODES FROM 506 TO 509 BY 1

PREP7:

DELETE SELECTED NODES FROM 516 TO 519 BY 1

PREP7:

DELETE SELECTED NODES FROM 526 TO 529 BY 1

PREP7:

DELETE SELECTED NODES FROM 536 TO 539 BY 1

PREP7:

ELEMENT TYPE SET TO 2

PREP7:

REAL CONSTANT NUMBER = 20

PREP7:

ELEMENT 567 458 30458

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 567 TO 567 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 568

PREP7:

ELEMENT 569 456 30456

PREP7:

ELEMENT 570 454 30454

PREP7:

ELEMENT 571 484 30484

PREP7:

ELEMENT 572 504 30504

PREP7:

ELEMENT 573 524 30524

PREP7:

ELEMENT 574 554 30554

PREP7:

ELEMENT 575 574 30574

PREP7:

ELEMENT 576 575 30575

PREP7:

ELEMENT 577 576 30576

PREP7:

ELEMENT 578 578 30578

PREP7:

ELEMENT 579 579 30579

PREP7:

ELEMENT 580 546 30546

PREP7:

GENERATE 4 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 580 TO 580 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 583

PREP7:

ACTIVE COORDINATE SYSTEM SET TO 11 (CARTESIAN)

PREP7:

ELEMENT TYPE SET TO 1

PREP7:

MATERIAL NUMBER SET TO 2

PREP7:

REAL CONSTANT SET 8 ITEMS 1 TO 6
12.000 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00

PREP7:

REAL CONSTANT NUMBER= 8

PREP7:

NODE 21001 KCS= 11 X,Y,Z= -16.000 -16.000 20.000

PREP7:

NODE 21009 KCS= 11 X,Y,Z= 16.000 -16.000 20.000

PREP7:

FILL 7 POINTS BETWEEN NODE 21001 AND NODE 21009
START WITH NODE 21002 AND INCREMENT BY 1

PREP7:

GENERATE 5 TOTAL SETS OF NODES WITH INCREMENT 9
SET IS SELECTED NODES IN RANGE 21001 TO 21009 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 0.00000E+00 4.0000 0.00000E+00 SPACING= 1.0000

PREP7:

ELEMENT 584 21001 21002 21011 21010

PREP7:

GENERATE 8 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 584 TO 584 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 591

PREP7:

GENERATE 4 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 9
SET IS SELECTED ELEMENTS IN RANGE 584 TO 591 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 615

PREP7:

ACTIVE COORDINATE SYSTEM SET TO 12 (CYLINDRICAL)

PREP7:

NODE 21100 KCS = 12 X,Y,Z = 25.000 0.00000E+00 20.000

PREP7:

NODE 21108 KCS = 12 X,Y,Z = 25.000 90.000 20.000

PREP7:

FILL 7 POINTS BETWEEN NODE 21100 AND NODE 21108
START WITH NODE 21101 AND INCREMENT BY 1

PREP7:

NODE 21116 KCS = 12 X,Y,Z = 25.000 180.00 20.000

PREP7:

FILL 7 POINTS BETWEEN NODE 21108 AND NODE 21116
START WITH NODE 21109 AND INCREMENT BY 1

PREP7:

NODE 21117 KCS = 12 X,Y,Z = 25.000 -168.75 20.000

PREP7:

NODE 21124 KCS = 12 X,Y,Z = 25.000 -90.000 20.000

PREP7:

FILL 6 POINTS BETWEEN NODE 21117 AND NODE 21124
START WITH NODE 21118 AND INCREMENT BY 1

PREP7:

NODE 21131 KCS = 12 X,Y,Z = 25.000 -11.250 20.000

PREP7:

FILL 6 POINTS BETWEEN NODE 21124 AND NODE 21131
START WITH NODE 21125 AND INCREMENT BY 1

PREP7:

ELEMENT 616 21037 21116 21117 21028

PREP7:

ELEMENT 617 21028 21117 21118 21019

PREP7:

ELEMENT 618 21019 21118 21119 21010

PREP7:

ELEMENT 619 21010 21119 21120 21001

PREP7:

ELEMENT 620 21001 21120 21121 21002

PREP7:

ELEMENT 621 21002 21121 21122 21003

PREP7:

ELEMENT 622 21003 21122 21123 21004

PREP7:

ELEMENT 623 21004 21123 21124 21005

PREP7:

ELEMENT 624 21005 21124 21125 21006

PREP7:

ELEMENT 625 21006 21125 21126 21007

PREP7:

ELEMENT 626 21007 21126 21127 21008

PREP7:

ELEMENT 627 21008 21127 21128 21009

PREP7:

ELEMENT 628 21009 21128 21129 21018

PREP7:

ELEMENT 629 21018 21129 21130 21027

PREP7:

ELEMENT 630 21027 21130 21131 21036

PREP7:

ELEMENT 631 21036 21131 21100 21045

PREP7:

GENERATE 3 TOTAL SETS OF NODES WITH INCREMENT 32
SET IS SELECTED NODES IN RANGE 21100 TO 21131 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 2.5000 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

ELEMENT 632 21116 21148 21149 21117

PREP7:

GENERATE 15 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 632 TO 632 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 646

PREP7:

ELEMENT 647 21131 21163 21132 21100

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 32
SET IS SELECTED ELEMENTS IN RANGE 632 TO 647 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 663

PREP7:

ELEMENT TYPE 3 IS COMBIN40 COMBINATION
KEYOPT(1-12)= 0 0 3 0 0 0 0 0 0 0 0 0

CURRENT NODAL DOF SET IS UX UY UZ ROTX ROTY ROTZ
THREE-DIMENSIONAL MODEL

PREP7:

REAL CONSTANT SET 9 ITEMS 1 TO 6
50000. 0.00000E+00 0.00000E+00 0.00000E+00 10000. 0.00000E+00

PREP7:

REAL CONSTANT SET 10 ITEMS 1 TO 6
25000. 0.00000E+00 0.00000E+00 0.00000E+00 5000.0 0.00000E+00

PREP7:

ELEMENT TYPE SET TO 3

PREP7:

REAL CONSTANT NUMBER = 9

PREP7:

ELEMENT 664 1181 21181

PREP7:

GENERATE 15 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 664 TO 664 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 678

PREP7:

REAL CONSTANT NUMBER = 10

PREP7:

ELEMENT 679 1180 21180

PREP7:

ELEMENT 680 1164 21164

PREP7:

SPECIFIED CONSTRAINT UX FOR SELECTED NODES 21188 TO 21188 BY 1
REAL = 0.000000000E+00 IMAG = 0.000000000E+00
ADDITIONAL DOFS = UY ROTX ROTY ROTZ

PREP7:

SELECT ALL ENTITIES OF TYPE = ALL AND BELOW

ALL SELECT FOR ITEM = VOLU COMPONENT =
IN RANGE 0 TO 0 STEP 1

0 VOLUMES (OF 0 DEFINED) SELECTED BY VSEL COMMAND.

ALL SELECT FOR ITEM = AREA COMPONENT =
IN RANGE 0 TO 0 STEP 1

0 AREAS (OF 0 DEFINED) SELECTED BY ASEL COMMAND.

ALL SELECT FOR ITEM=LINE COMPONENT =
IN RANGE 0 TO 0 STEP 1

0 LINES (OF 0 DEFINED) SELECTED BY LSEL COMMAND.

ALL SELECT FOR ITEM=KP COMPONENT =
IN RANGE 0 TO 0 STEP 1

0 KEYPOINTS (OF 0 DEFINED) SELECTED BY KSEL COMMAND.

ALL SELECT FOR ITEM=ELEM COMPONENT =
IN RANGE 1 TO 680 STEP 1

680 ELEMENTS (OF 680 DEFINED) SELECTED BY ESEL COMMAND.

ALL SELECT FOR ITEM=NODE COMPONENT =
IN RANGE 1 TO 30579 STEP 1

874 NODES (OF 874 DEFINED) SELECTED BY NSEL COMMAND.

PREP7:

ELEMENT TYPE 4 IS COMBIN40 COMBINATION
KEYOPT(1-12)= 1 0 3 0 0 2 0 0 0 0 0 0

CURRENT NODAL DOF SET IS UX UY UZ ROTX ROTY ROTZ
THREE-DIMENSIONAL MODEL

PREP7:

PARAMETER G = 386.4000

PREP7:

REAL CONSTANT SET 11 ITEMS 1 TO 6
0.10000E+06 0.00000E+00 16.822 720.00 0.00000E+00 0.00000E+00

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 3000
SET IS SELECTED NODES IN RANGE 21041 TO 21041 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 0.00000E+00 0.00000E+00 720.00 SPACING= 1.0000

PREP7:

ELEMENT TYPE SET TO 4

PREP7:

REAL CONSTANT NUMBER= 11

PREP7:

ELEMENT 681 21041 24041

PREP7:

UNIFORM TEMPERATURE= 70.000 (TREF= 0.000)

PREP7:

ACTIVE COORDINATE SYSTEM SET TO 13 (CARTESIAN)

PREP7:

SELECT FOR ITEM=LOC COMPONENT=Y BETWEEN 59.740 AND 59.760
KABS= 0. TOLERANCE= 0.000000E+00

71 NODES (OF 875 DEFINED) SELECTED BY NSEL COMMAND.

PREP7:

SYMMETRY CONSTRAINTS FOR COORDINATE SYSTEM 13 IN DIRECTION Y
ON SURFACE DEFINED BY ALL SELECTED NODES

*** NOTE *** CP= 8.850 TIME= 11:38:19
Nodes on symmetry surfaces are rotated into coordinate system 13.

TOTAL SPECIFIED CONSTRAINTS= 293

PREP7:

SELECT ALL ENTITIES OF TYPE= ALL AND BELOW

ALL SELECT FOR ITEM=VOLU COMPONENT=
IN RANGE 0 TO 0 STEP 1

0 VOLUMES (OF 0 DEFINED) SELECTED BY VSEL COMMAND.

ALL SELECT FOR ITEM=AREA COMPONENT=
IN RANGE 0 TO 0 STEP 1

0 AREAS (OF 0 DEFINED) SELECTED BY ASEL COMMAND.

ALL SELECT FOR ITEM=LINE COMPONENT=
IN RANGE 0 TO 0 STEP 1

0 LINES (OF 0 DEFINED) SELECTED BY LSEL COMMAND.

ALL SELECT FOR ITEM=KP COMPONENT=
IN RANGE 0 TO 0 STEP 1

0 KEYPOINTS (OF 0 DEFINED) SELECTED BY KSEL COMMAND.

ALL SELECT FOR ITEM=ELEM COMPONENT=

IN RANGE 1 TO 681 STEP 1

681 ELEMENTS (OF 681 DEFINED) SELECTED BY ESEL COMMAND.

ALL SELECT FOR ITEM=NODE COMPONENT=
IN RANGE 1 TO 30579 STEP 1

875 NODES (OF 875 DEFINED) SELECTED BY NSEL COMMAND.

PREP7:

ALL CURRENT ANSYS DATA WRITTEN TO FILE NAME = file.db
FOR POSSIBLE RESUME FROM THIS POINT

PREP7:

***** ROUTINE COMPLETED ***** CP = 9.470

BEGIN:

***** ANSYS SOLUTION ROUTINE *****

SOLU_LS1:

PERFORM A TRANSIENT ANALYSIS
THIS WILL BE A NEW ANALYSIS

SOLU_LS1:

STEP BOUNDARY CONDITION KEY = 1

SOLU_LS1:

ACEL = 0.00000E+00 0.00000E+00 386.40

SOLU_LS1:

SPECIFIED CONSTRAINT UZ FOR SELECTED NODES 24041 TO 24041 BY 1
REAL = 0.000000000E+00 IMAG = 0.000000000E+00

SOLU_LS1:

DO NOT INCLUDE TRANSIENT EFFECTS FOR ALL DOFS THIS LOAD STEP

SOLU_LS1:

TIME = 0.10000E-04

SOLU_LS1:

USE 2 SUBSTEP(S) THIS LOAD STEP FOR ALL DOFS

SOLU_LS1:

USE A MAXIMUM OF 40 EQUILIBRIUM ITERATIONS EACH SUBSTEP

SOLU_LS1:

WRITE ANSYS LOADS DATA AS FILE=file.s01

SOLU_LS1:

INCLUDE TRANSIENT EFFECTS FOR ALL DOFS THIS LOAD STEP

SOLU_LS1:

TIME= 1.9300

SOLU_LS1:

USE 1000 SUBSTEP(S) THIS LOAD STEP FOR ALL DOFS

SOLU_LS1:

WRITE ALL ITEMS TO THE DATABASE WITH A FREQUENCY OF 5
FOR ALL APPLICABLE ENTITIES

SOLU_LS1:

USE AUTOMATIC TIME STEPPING THIS LOAD STEP

SOLU_LS1:

DELETE SPECIFIED CONSTRAINT UZ FOR SELECTED NODES
RANGE 24041 TO 24041 BY 1

NUMBER OF SPECIFIED CONSTRAINTS DELETED = 1

SOLU_LS1:

WRITE ANSYS LOADS DATA AS FILE=file.s02

SOLU_LS1:

TIME= 1.9900

SOLU_LS1:

USE 600 SUBSTEP(S) THIS LOAD STEP FOR ALL DOFS

SOLU_LS1:

WRITE ALL ITEMS TO THE DATABASE WITH A FREQUENCY OF 3
FOR ALL APPLICABLE ENTITIES

SOLU_LS1:

USE A MAXIMUM OF 40 EQUILIBRIUM ITERATIONS EACH SUBSTEP

SOLU_LS1:

DO NOT USE AUTOMATIC TIME STEPPING THIS LOAD STEP

SOLU_LS1:

WRITE ANSYS LOADS DATA AS FILE=file.s03

SOLU_LS1:

ANSYS REVISION 5.2 11:38:21 08/25/1997

PRINTOUT RESUMED BY /GOP

Load step file number 1. Begin solution ...

***** ANSYS SOLVE COMMAND *****

*** WARNING *** CP= 11.180 TIME= 11:38:26
Real constant 11 referenced by at least element types 2 and 4.

*** WARNING *** CP= 11.550 TIME= 11:38:27
Nodes I and J of element 551 (COMBIN14) are not coincident.

*** WARNING *** CP= 11.550 TIME= 11:38:27
Nodes I and J of element 552 (COMBIN14) are not coincident.

*** WARNING *** CP= 11.560 TIME= 11:38:27
Nodes I and J of element 553 (COMBIN14) are not coincident.

*** WARNING *** CP= 11.560 TIME= 11:38:27
Nodes I and J of element 554 (COMBIN14) are not coincident.

*** WARNING *** CP= 11.600 TIME= 11:38:27
Nodes I and J of element 664 (COMBIN40) are not coincident.

*** WARNING *** CP= 11.600 TIME= 11:38:27
Nodes I and J of element 665 (COMBIN40) are not coincident.

*** WARNING *** CP= 11.600 TIME= 11:38:27
Nodes I and J of element 666 (COMBIN40) are not coincident.

*** WARNING *** CP= 11.600 TIME= 11:38:27
Nodes I and J of element 667 (COMBIN40) are not coincident.

*** WARNING *** CP= 11.600 TIME= 11:38:27
Nodes I and J of element 668 (COMBIN40) are not coincident.

*** WARNING *** CP= 11.600 TIME= 11:38:27
Nodes I and J of element 669 (COMBIN40) are not coincident.

*** WARNING *** CP= 11.610 TIME= 11:38:27
Nodes I and J of element 670 (COMBIN40) are not coincident.

*** WARNING *** CP= 11.610 TIME= 11:38:27
Nodes I and J of element 671 (COMBIN40) are not coincident.

*** WARNING *** CP= 11.610 TIME= 11:38:27
Nodes I and J of element 672 (COMBIN40) are not coincident.

*** WARNING *** CP= 11.610 TIME= 11:38:27
Nodes I and J of element 673 (COMBIN40) are not coincident.

*** WARNING *** CP= 11.610 TIME= 11:38:27
Nodes I and J of element 674 (COMBIN40) are not coincident.

*** WARNING *** CP= 11.610 TIME= 11:38:27
Nodes I and J of element 675 (COMBIN40) are not coincident.

*** WARNING *** CP= 11.610 TIME= 11:38:27
Nodes I and J of element 676 (COMBIN40) are not coincident.

*** WARNING *** CP= 11.620 TIME= 11:38:27
Nodes I and J of element 677 (COMBIN40) are not coincident.

*** WARNING *** CP= 11.620 TIME= 11:38:27
Nodes I and J of element 678 (COMBIN40) are not coincident.

Error messages discontinued after 20 messages were displayed.
More may exist. See (file.err) for suppressed messages.

*** NOTE *** CP= 11.620 TIME= 11:38:27
The model data was checked and warning messages were found.
Please review output or errors file (file.err) for these warning
messages.

SOLUTION OPTIONS

PROBLEM DIMENSIONALITY.3-D
DEGREES OF FREEDOM. UX UY UZ ROTX ROTY ROTZ
ANALYSIS TYPETRANSIENT
SOLUTION METHOD.FULL

PLASTIC MATERIAL PROPERTIES INCLUDED.YES
NEWTON-RAPHSON OPTIONPROGRAM CHOSEN

*** NOTE *** CP= 11.760 TIME= 11:38:28
This load step will be a static (steady-state) step.

*** NOTE *** CP= 11.920 TIME= 11:38:28
The step data was checked and warning messages were found.
Please review output or errors file (file.err) for these warning
messages.

*** NOTE *** CP= 11.920 TIME= 11:38:28
Results printout suppressed for interactive execute.

*** NOTE *** CP= 11.920 TIME= 11:38:28
Nonlinear analysis, NROPT set to 1 (full Newton-Raphson solution
procedure) for ALL DOFs.
•• Reordering still in progress ••
•• Reordering still in progress ••
•• Reordering still in progress ••

LOAD STEP OPTIONS

LOAD STEP NUMBER. 1
TIME AT END OF THE LOAD STEP. 0.10000E-04
NUMBER OF SUBSTEPS. 2
MAXIMUM NUMBER OF EQUILIBRIUM ITERATIONS. 40
STEP CHANGE BOUNDARY CONDITIONS YES
TRANSIENT (INERTIA) EFFECTS OFF
TERMINATE ANALYSIS IF NOT CONVERGEDYES (EXIT)
CONVERGENCE CONTROLS.USE DEFAULTS
INERTIA LOADS X Y Z
ACEL 0.00000E+00 0.00000E+00 386.40
COPY INTEGRATION POINT VALUES TO NODEYES, FOR ELEMENTS WITH
ACTIVE MAT. NONLINEARITIES
PRINT OUTPUT CONTROLSNO PRINTOUT
DATABASE OUTPUT CONTROLS
ITEM FREQUENCY COMPONENT
ALL 5
ALL 3

Element Formation Element= 270 Cum. Iter.= 1 CP= 19.980
Time= 0.50000E-05 Load Step= 1 Substep= 1 Equilibrium Iteration= 1.
Element Formation Element= 640 Cum. Iter.= 1 CP= 28.530
Time= 0.50000E-05 Load Step= 1 Substep= 1 Equilibrium Iteration= 1.

***** CENTROID, MASS, AND MASS MOMENTS OF INERTIA *****

CALCULATIONS ASSUME ELEMENT MASS AT ELEMENT CENTROID

TOTAL MASS = 29.185

CENTROID	MOM. OF INERTIA ABOUT ORIGIN	MOM. OF INERTIA ABOUT CENTROID
XC = 54.419	IXX = 0.9226E+07	IXX = 0.3926E+07
YC = -12.839	IYY = 0.9351E+07	IYY = 0.3969E+07
ZC = 425.98	IZZ = 0.1534E+06	IZZ = 0.6220E+05
	IXY = 0.1117E+05	IXY = -9218.
	IYZ = -528.4	IYZ = -0.1601E+06
	IZX = -0.8896E+06	IZX = -0.2130E+06

*** MASS SUMMARY BY ELEMENT TYPE ***

TYPE	MASS
1	12.3630
4	16.8219

Range of element maximum matrix coefficients in global coordinates
Maximum = 4.166712683E+10 at element 649.
Minimum = 10 at element 552.

*** ELEMENT MATRIX FORMULATION TIMES

TYPE	NUMBER	ENAME	TOTAL CP	AVE CP
1	630	SHELL43	16.610	0.026
2	29	CONTAC52	0.040	0.001
3	17	COMBIN40	0.010	0.001
4	1	COMBIN40	0.000	0.000
5	2	COMBIN14	0.060	0.030
6	2	COMBIN14	0.000	0.000

Time at end of element matrix formulation CP= 29.5.

FORCE CONVERGENCE VALUE = 263.1 CRITERION = 0.2631

MOMENT CONVERGENCE VALUE = 0.0000E+00 CRITERION = 0.1000E-02

Estimated number of active DOF= 4056.

Maximum wavefront = 171.

Equation Solution Element= 380 Cum. Iter. = 1 CP= 32.970

Time = 0.50000E-05 Load Step= 1 Substep= 1 Equilibrium Iteration= 1.

F Convergence Norm = 263.05 Previous Norm = 263.05

Time at end of matrix triangularization CP= 34.9099998.

Equation solver maximum pivot = 1.097381962E+11 at node 21157 ROTX.

Equation solver minimum pivot = 19.9999072 at node 4583 UX.

EQUIL ITER 1 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC= -0.1862E-01

Element Formation Element= 110 Cum. Iter. = 2 CP= 38.530

Time = 0.50000E-05 Load Step= 1 Substep= 1 Equilibrium Iteration= 2.

F Convergence Norm = 263.05 Previous Norm = 263.05

Element Formation Element= 320 Cum. Iter. = 2 CP= 44.800

Time = 0.50000E-05 Load Step= 1 Substep= 1 Equilibrium Iteration= 2.

F Convergence Norm = 263.05 Previous Norm = 263.05

Element Formation Element= 560 Cum. Iter. = 2 CP= 50.810
Time = 0.50000E-05 Load Step= 1 Substep= 1 Equilibrium Iteration= 2.
F Convergence Norm= 263.05 Previous Norm= 263.05
FORCE CONVERGENCE VALUE = 622.8 CRITERION = 2.897
MOMENT CONVERGENCE VALUE = 0.1465E-06 CRITERION = 24.83 <<< CONVERGED
* RESIDUAL INCREASED. PREV SOLN REMOVED. DESCENT PARAM SET TO 1.000

Element Formation Element= 100 Cum. Iter. = 2 CP= 57.810
Time = 0.50000E-05 Load Step= 1 Substep= 1 Equilibrium Iteration= 2.
F Convergence Norm= 263.05 Previous Norm= 263.05
M Convergence Norm= 0.14652E-06 Previous Norm= 0.00000E+00

Element Formation Element= 400 Cum. Iter. = 2 CP= 65.810
Time = 0.50000E-05 Load Step= 1 Substep= 1 Equilibrium Iteration= 2.
F Convergence Norm= 263.05 Previous Norm= 263.05
M Convergence Norm= 0.14652E-06 Previous Norm= 0.00000E+00
FORCE CONVERGENCE VALUE = 263.1 CRITERION = 0.2631
MOMENT CONVERGENCE VALUE = 0.0000E+00 CRITERION = 0.1000E-02

Equation Solution Element= 90 Cum. Iter. = 2 CP= 73.980
Time = 0.50000E-05 Load Step= 1 Substep= 1 Equilibrium Iteration= 2.
F Convergence Norm= 263.05 Previous Norm= 263.05
M Convergence Norm= 0.00000E+00 Previous Norm= 0.14652E-06
EQUIL ITER 2 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC= -0.1863E-01

Element Formation Element= 150 Cum. Iter. = 3 CP= 82.260
Time = 0.50000E-05 Load Step= 1 Substep= 1 Equilibrium Iteration= 3.
F Convergence Norm= 263.05 Previous Norm= 263.05
M Convergence Norm= 0.00000E+00 Previous Norm= 0.14652E-06

Element Formation Element= 290 Cum. Iter. = 3 CP= 86.320
Time = 0.50000E-05 Load Step= 1 Substep= 1 Equilibrium Iteration= 3.
F Convergence Norm= 263.05 Previous Norm= 263.05
M Convergence Norm= 0.00000E+00 Previous Norm= 0.14652E-06

Element Formation Element= 300 Cum. Iter. = 3 CP= 86.690
Time = 0.50000E-05 Load Step= 1 Substep= 1 Equilibrium Iteration= 3.
F Convergence Norm= 263.05 Previous Norm= 263.05
M Convergence Norm= 0.00000E+00 Previous Norm= 0.14652E-06

Element Formation Element= 590 Cum. Iter. = 3 CP= 93.970
Time = 0.50000E-05 Load Step= 1 Substep= 1 Equilibrium Iteration= 3.
F Convergence Norm= 263.05 Previous Norm= 263.05
M Convergence Norm= 0.00000E+00 Previous Norm= 0.14652E-06
FORCE CONVERGENCE VALUE = 126.1 CRITERION = 2.910
MOMENT CONVERGENCE VALUE = 0.1364E-06 CRITERION = 24.84 <<< CONVERGED

Equation Solution Element= 550 Cum. Iter. = 3 CP= 100.970
Time = 0.50000E-05 Load Step= 1 Substep= 1 Equilibrium Iteration= 3.
F Convergence Norm= 126.12 Previous Norm= 263.05
M Convergence Norm= 0.13644E-06 Previous Norm= 0.00000E+00
EQUIL ITER 3 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC= 0.3859E-05

Element Formation Element= 230 Cum. Iter. = 4 CP= 108.660
Time = 0.50000E-05 Load Step= 1 Substep= 1 Equilibrium Iteration= 4.
F Convergence Norm= 126.12 Previous Norm= 263.05
M Convergence Norm= 0.13644E-06 Previous Norm= 0.00000E+00

Element Formation Element= 550 Cum. Iter. = 4 CP= 116.950
Time = 0.50000E-05 Load Step= 1 Substep= 1 Equilibrium Iteration= 4.
F Convergence Norm= 126.12 Previous Norm= 263.05
M Convergence Norm= 0.13644E-06 Previous Norm= 0.00000E+00

FORCE CONVERGENCE VALUE = 112.5 CRITERION= 2.910
MOMENT CONVERGENCE VALUE = 0.1424E-10 CRITERION= 24.83 <<< CONVERGED
Equation Solution Element = 560 Cum. Iter. = 4 CP= 124.940
Time = 0.50000E-05 Load Step= 1 Substep= 1 Equilibrium Iteration= 4.
F Convergence Norm = 112.49 Previous Norm = 126.12
M Convergence Norm = 0.14238E-10 Previous Norm = 0.13644E-06
EQUIL ITER 4 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC= 0.3948E-05
Element Formation Element = 130 Cum. Iter. = 5 CP= 129.750
Time = 0.50000E-05 Load Step= 1 Substep= 1 Equilibrium Iteration= 5.
F Convergence Norm = 112.49 Previous Norm = 126.12
M Convergence Norm = 0.14238E-10 Previous Norm = 0.13644E-06
Element Formation Element = 140 Cum. Iter. = 5 CP= 130.080
Time = 0.50000E-05 Load Step= 1 Substep= 1 Equilibrium Iteration= 5.
F Convergence Norm = 112.49 Previous Norm = 126.12
M Convergence Norm = 0.14238E-10 Previous Norm = 0.13644E-06
Element Formation Element = 390 Cum. Iter. = 5 CP= 137.190
Time = 0.50000E-05 Load Step= 1 Substep= 1 Equilibrium Iteration= 5.
F Convergence Norm = 112.49 Previous Norm = 126.12
M Convergence Norm = 0.14238E-10 Previous Norm = 0.13644E-06
Solution Preparation Element = 10 Cum. Iter. = 5 CP= 144.410
Time = 0.50000E-05 Load Step= 1 Substep= 1 Equilibrium Iteration= 5.
F Convergence Norm = 112.49 Previous Norm = 126.12
M Convergence Norm = 0.14238E-10 Previous Norm = 0.13644E-06
FORCE CONVERGENCE VALUE = 104.2 CRITERION= 2.911
MOMENT CONVERGENCE VALUE = 0.1581E-10 CRITERION= 24.82 <<< CONVERGED
RESIDUAL DECREASED. DESCENT PARAMETER SET TO 0.2500
EQUIL ITER 5 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC= 0.3997E-05
Element Formation Element = 60 Cum. Iter. = 6 CP= 151.830
Time = 0.50000E-05 Load Step= 1 Substep= 1 Equilibrium Iteration= 6.
F Convergence Norm = 104.16 Previous Norm = 112.49
M Convergence Norm = 0.15811E-10 Previous Norm = 0.14238E-10
Element Formation Element = 340 Cum. Iter. = 6 CP= 159.880
Time = 0.50000E-05 Load Step= 1 Substep= 1 Equilibrium Iteration= 6.
F Convergence Norm = 104.16 Previous Norm = 112.49
M Convergence Norm = 0.15811E-10 Previous Norm = 0.14238E-10
Element Formation Element = 670 Cum. Iter. = 6 CP= 167.940
Time = 0.50000E-05 Load Step= 1 Substep= 1 Equilibrium Iteration= 6.
F Convergence Norm = 104.16 Previous Norm = 112.49
M Convergence Norm = 0.15811E-10 Previous Norm = 0.14238E-10
FORCE CONVERGENCE VALUE = 98.73 CRITERION= 2.911
MOMENT CONVERGENCE VALUE = 0.1258E-10 CRITERION= 24.81 <<< CONVERGED
RESIDUAL DECREASED. DESCENT PARAMETER SET TO 0.6250E-01
EQUIL ITER 6 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC= 0.1545E-04
Element Formation Element = 110 Cum. Iter. = 7 CP= 177.020
Time = 0.50000E-05 Load Step= 1 Substep= 1 Equilibrium Iteration= 7.
F Convergence Norm = 98.731 Previous Norm = 104.16
M Convergence Norm = 0.12575E-10 Previous Norm = 0.15811E-10
Element Formation Element = 490 Cum. Iter. = 7 CP= 187.270
Time = 0.50000E-05 Load Step= 1 Substep= 1 Equilibrium Iteration= 7.
F Convergence Norm = 98.731 Previous Norm = 104.16
M Convergence Norm = 0.12575E-10 Previous Norm = 0.15811E-10
Solution Preparation Element = 10 Cum. Iter. = 7 CP= 192.110

Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 7.
F Convergence Norm = 98.731 Previous Norm = 104.16
M Convergence Norm = 0.12575E-10 Previous Norm = 0.15811E-10
FORCE CONVERGENCE VALUE = 88.08 CRITERION = 2.912
MOMENT CONVERGENCE VALUE = 0.3335E-10 CRITERION = 24.79 <<< CONVERGED
RESIDUAL DECREASED. DESCENT PARAMETER SET TO 0.1562E-01
Equation Solution Element = 660 Cum. Iter. = 7 CP = 197.410
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 7.
F Convergence Norm = 88.084 Previous Norm = 98.731
M Convergence Norm = 0.33354E-10 Previous Norm = 0.12575E-10
EQUIL ITER 7 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = 0.4885E-04
Element Formation Element = 230 Cum. Iter. = 8 CP = 204.660
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 8.
F Convergence Norm = 88.084 Previous Norm = 98.731
M Convergence Norm = 0.33354E-10 Previous Norm = 0.12575E-10
Element Formation Element = 510 Cum. Iter. = 8 CP = 212.020
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 8.
F Convergence Norm = 88.084 Previous Norm = 98.731
M Convergence Norm = 0.33354E-10 Previous Norm = 0.12575E-10
FORCE CONVERGENCE VALUE = 67.87 CRITERION = 2.917
MOMENT CONVERGENCE VALUE = 0.8210E-10 CRITERION = 24.72 <<< CONVERGED
RESIDUAL DECREASED. DESCENT PARAMETER SET TO 0.0000E+00
Equation Solution Element = 450 Cum. Iter. = 8 CP = 220.090
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 8.
F Convergence Norm = 67.867 Previous Norm = 88.084
M Convergence Norm = 0.82095E-10 Previous Norm = 0.33354E-10
EQUIL ITER 8 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = 0.9432E-04
Element Formation Element = 200 Cum. Iter. = 9 CP = 227.630
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 9.
F Convergence Norm = 67.867 Previous Norm = 88.084
M Convergence Norm = 0.82095E-10 Previous Norm = 0.33354E-10
Element Formation Element = 560 Cum. Iter. = 9 CP = 236.990
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 9.
F Convergence Norm = 67.867 Previous Norm = 88.084
M Convergence Norm = 0.82095E-10 Previous Norm = 0.33354E-10
FORCE CONVERGENCE VALUE = 114.5 CRITERION = 2.925
MOMENT CONVERGENCE VALUE = 0.1445E-09 CRITERION = 24.59 <<< CONVERGED
* RESIDUAL INCREASED. PREV SOLN REMOVED. DESCENT PARAM SET TO 1.000
Element Formation Element = 10 Cum. Iter. = 9 CP = 241.520
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 9.
F Convergence Norm = 67.867 Previous Norm = 88.084
M Convergence Norm = 0.14448E-09 Previous Norm = 0.82095E-10
Element Formation Element = 290 Cum. Iter. = 9 CP = 249.680
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 9.
F Convergence Norm = 67.867 Previous Norm = 88.084
M Convergence Norm = 0.14448E-09 Previous Norm = 0.82095E-10
Element Formation Element = 610 Cum. Iter. = 9 CP = 257.820
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 9.
F Convergence Norm = 67.867 Previous Norm = 88.084
M Convergence Norm = 0.14448E-09 Previous Norm = 0.82095E-10
FORCE CONVERGENCE VALUE = 67.87 CRITERION = 2.917
MOMENT CONVERGENCE VALUE = 0.8207E-10 CRITERION = 24.72

Equation Solution Element = 400 Cum. Iter. = 9 CP = 263.160
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 9.
F Convergence Norm = 67.867 Previous Norm = 67.867
M Convergence Norm = 0.82066E-10 Previous Norm = 0.14448E-09
EQUIL ITER 9 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = 0.3002E-05
Element Formation Element = 180 Cum. Iter. = 10 CP = 270.480
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 10.
F Convergence Norm = 67.867 Previous Norm = 67.867
M Convergence Norm = 0.82066E-10 Previous Norm = 0.14448E-09
Element Formation Element = 500 Cum. Iter. = 10 CP = 278.920
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 10.
F Convergence Norm = 67.867 Previous Norm = 67.867
M Convergence Norm = 0.82066E-10 Previous Norm = 0.14448E-09
FORCE CONVERGENCE VALUE = 66.71 CRITERION = 2.917
MOMENT CONVERGENCE VALUE = 0.9361E-11 CRITERION = 24.71 <<< CONVERGED
Equation Solution Element = 400 Cum. Iter. = 10 CP = 286.830
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 10.
F Convergence Norm = 66.706 Previous Norm = 67.867
M Convergence Norm = 0.93612E-11 Previous Norm = 0.82066E-10
EQUIL ITER 10 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = 0.2952E-05
Element Formation Element = 220 Cum. Iter. = 11 CP = 295.260
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 11.
F Convergence Norm = 66.706 Previous Norm = 67.867
M Convergence Norm = 0.93612E-11 Previous Norm = 0.82066E-10
Element Formation Element = 230 Cum. Iter. = 11 CP = 295.570
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 11.
F Convergence Norm = 66.706 Previous Norm = 67.867
M Convergence Norm = 0.93612E-11 Previous Norm = 0.82066E-10
Element Formation Element = 430 Cum. Iter. = 11 CP = 301.100
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 11.
F Convergence Norm = 66.706 Previous Norm = 67.867
M Convergence Norm = 0.93612E-11 Previous Norm = 0.82066E-10
Solution Preparation Element = 280 Cum. Iter. = 11 CP = 307.890
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 11.
F Convergence Norm = 66.706 Previous Norm = 67.867
M Convergence Norm = 0.93612E-11 Previous Norm = 0.82066E-10
FORCE CONVERGENCE VALUE = 65.58 CRITERION = 2.917
MOMENT CONVERGENCE VALUE = 0.8672E-11 CRITERION = 24.71 <<< CONVERGED
EQUIL ITER 11 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = 0.2901E-05
Element Formation Element = 90 Cum. Iter. = 12 CP = 315.650
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 12.
F Convergence Norm = 65.579 Previous Norm = 66.706
M Convergence Norm = 0.86717E-11 Previous Norm = 0.93612E-11
Element Formation Element = 370 Cum. Iter. = 12 CP = 323.640
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 12.
F Convergence Norm = 65.579 Previous Norm = 66.706
M Convergence Norm = 0.86717E-11 Previous Norm = 0.93612E-11
Solution Preparation Element = 330 Cum. Iter. = 12 CP = 331.750
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 12.
F Convergence Norm = 65.579 Previous Norm = 66.706
M Convergence Norm = 0.86717E-11 Previous Norm = 0.93612E-11
FORCE CONVERGENCE VALUE = 64.48 CRITERION = 2.917

MOMENT CONVERGENCE VALUE = 0.9060E-11 CRITERION = 24.71 <<< CONVERGED
RESIDUAL DECREASED. DESCENT PARAMETER SET TO 0.2500
EQUIL ITER 12 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = 0.2852E-05
Element Formation Element = 30 Cum. Iter. = 13 CP = 337.540
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 13.
F Convergence Norm = 64.481 Previous Norm = 65.579
M Convergence Norm = 0.90602E-11 Previous Norm = 0.86717E-11
Element Formation Element = 40 Cum. Iter. = 13 CP = 337.880
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 13.
F Convergence Norm = 64.481 Previous Norm = 65.579
M Convergence Norm = 0.90602E-11 Previous Norm = 0.86717E-11
Element Formation Element = 290 Cum. Iter. = 13 CP = 345.220
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 13.
F Convergence Norm = 64.481 Previous Norm = 65.579
M Convergence Norm = 0.90602E-11 Previous Norm = 0.86717E-11
Element Formation Element = 600 Cum. Iter. = 13 CP = 353.070
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 13.
F Convergence Norm = 64.481 Previous Norm = 65.579
M Convergence Norm = 0.90602E-11 Previous Norm = 0.86717E-11
FORCE CONVERGENCE VALUE = 63.41 CRITERION = 2.918
MOMENT CONVERGENCE VALUE = 0.8824E-11 CRITERION = 24.70 <<< CONVERGED
RESIDUAL DECREASED. DESCENT PARAMETER SET TO 0.6250E-01
EQUIL ITER 13 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = 0.1068E-04
Element Formation Element = 10 Cum. Iter. = 14 CP = 361.050
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 14.
F Convergence Norm = 63.408 Previous Norm = 64.481
M Convergence Norm = 0.88237E-11 Previous Norm = 0.90602E-11
Element Formation Element = 290 Cum. Iter. = 14 CP = 369.130
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 14.
F Convergence Norm = 63.408 Previous Norm = 64.481
M Convergence Norm = 0.88237E-11 Previous Norm = 0.90602E-11
Element Formation Element = 590 Cum. Iter. = 14 CP = 376.590
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 14.
F Convergence Norm = 63.408 Previous Norm = 64.481
M Convergence Norm = 0.88237E-11 Previous Norm = 0.90602E-11
FORCE CONVERGENCE VALUE = 59.44 CRITERION = 2.919
MOMENT CONVERGENCE VALUE = 0.1758E-10 CRITERION = 24.69 <<< CONVERGED
RESIDUAL DECREASED. DESCENT PARAMETER SET TO 0.1562E-01
Equation Solution Element = 450 Cum. Iter. = 14 CP = 382.670
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 14.
F Convergence Norm = 59.438 Previous Norm = 63.408
M Convergence Norm = 0.17581E-10 Previous Norm = 0.88237E-11
EQUIL ITER 14 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = 0.3367E-04
Element Formation Element = 140 Cum. Iter. = 15 CP = 388.490
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 15.
F Convergence Norm = 59.438 Previous Norm = 63.408
M Convergence Norm = 0.17581E-10 Previous Norm = 0.88237E-11
Element Formation Element = 250 Cum. Iter. = 15 CP = 391.800
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 15.
F Convergence Norm = 59.438 Previous Norm = 63.408
M Convergence Norm = 0.17581E-10 Previous Norm = 0.88237E-11
Element Formation Element = 320 Cum. Iter. = 15 CP = 393.920

Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 15.
F Convergence Norm = 59.438 Previous Norm = 63.408
M Convergence Norm = 0.17581E-10 Previous Norm = 0.88237E-11
Element Formation Element = 640 Cum. Iter. = 15 CP = 401.810
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 15.
F Convergence Norm = 59.438 Previous Norm = 63.408
M Convergence Norm = 0.17581E-10 Previous Norm = 0.88237E-11
FORCE CONVERGENCE VALUE = 46.98 CRITERION = 2.922
MOMENT CONVERGENCE VALUE = 0.4575E-10 CRITERION = 24.64 <<< CONVERGED
RESIDUAL DECREASED. DESCENT PARAMETER SET TO 0.0000E+00
EQUIL ITER 15 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = 0.6191E-04
Element Formation Element = 10 Cum. Iter. = 16 CP = 408.830
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 16.
F Convergence Norm = 46.979 Previous Norm = 59.438
M Convergence Norm = 0.45751E-10 Previous Norm = 0.17581E-10
Element Formation Element = 290 Cum. Iter. = 16 CP = 416.990
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 16.
F Convergence Norm = 46.979 Previous Norm = 59.438
M Convergence Norm = 0.45751E-10 Previous Norm = 0.17581E-10
Element Formation Element = 630 Cum. Iter. = 16 CP = 425.480
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 16.
F Convergence Norm = 46.979 Previous Norm = 59.438
M Convergence Norm = 0.45751E-10 Previous Norm = 0.17581E-10
FORCE CONVERGENCE VALUE = 21.46 CRITERION = 2.927
MOMENT CONVERGENCE VALUE = 0.1104E-09 CRITERION = 24.55 <<< CONVERGED
EQUIL ITER 16 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = 0.5255E-04
Element Formation Element = 20 Cum. Iter. = 17 CP = 432.810
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 17.
F Convergence Norm = 21.463 Previous Norm = 46.979
M Convergence Norm = 0.11037E-09 Previous Norm = 0.45751E-10
Element Formation Element = 160 Cum. Iter. = 17 CP = 436.950
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 17.
F Convergence Norm = 21.463 Previous Norm = 46.979
M Convergence Norm = 0.11037E-09 Previous Norm = 0.45751E-10
Element Formation Element = 190 Cum. Iter. = 17 CP = 437.860
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 17.
F Convergence Norm = 21.463 Previous Norm = 46.979
M Convergence Norm = 0.11037E-09 Previous Norm = 0.45751E-10
Element Formation Element = 270 Cum. Iter. = 17 CP = 440.250
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 17.
F Convergence Norm = 21.463 Previous Norm = 46.979
M Convergence Norm = 0.11037E-09 Previous Norm = 0.45751E-10
Element Formation Element = 550 Cum. Iter. = 17 CP = 447.410
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 17.
F Convergence Norm = 21.463 Previous Norm = 46.979
M Convergence Norm = 0.11037E-09 Previous Norm = 0.45751E-10
FORCE CONVERGENCE VALUE = 0.7084E-10 CRITERION = 2.932 <<< CONVERGED
MOMENT CONVERGENCE VALUE = 0.8789E-10 CRITERION = 24.48 <<< CONVERGED
>>> SOLUTION CONVERGED AFTER EQUILIBRIUM ITERATION 16
Element Output Element = 70 Cum. Iter. = 16 CP = 453.280
Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 16.
F Convergence Norm = 0.70835E-10 Previous Norm = 21.463

M Convergence Norm = 0.87886E-10 Previous Norm = 0.11037E-09

*** ELEMENT RESULT CALCULATION TIMES

TYPE	NUMBER	ENAME	TOTAL CP	AVE CP
1	630	SHELL43	9.460	0.015
2	29	CONTACT52	0.040	0.001
3	17	COMBIN40	0.010	0.001
4	1	COMBIN40	0.000	0.000
5	2	COMBIN14	0.010	0.005
6	2	COMBIN14	0.010	0.005

*** NODAL LOAD CALCULATION TIMES

TYPE	NUMBER	ENAME	TOTAL CP	AVE CP
1	630	SHELL43	0.120	0.000
2	29	CONTACT52	0.000	0.000
3	17	COMBIN40	0.000	0.000
4	1	COMBIN40	0.000	0.000
5	2	COMBIN14	0.010	0.005
6	2	COMBIN14	0.000	0.000

*** LOAD STEP 1 SUBSTEP 1 COMPLETED. CUM ITER = 16

*** TIME = 0.500000E-05 TIME INC = 0.500000E-05

Element Formation Element = 10 Cum. Iter. = 17 CP = 463.950
Time = 0.10000E-04 Load Step = 1 Substep = 2 Equilibrium Iteration = 1.
F Convergence Norm = 0.70835E-10 Previous Norm = 21.463
M Convergence Norm = 0.87886E-10 Previous Norm = 0.11037E-09
Element Formation Element = 270 Cum. Iter. = 17 CP = 471.440
Time = 0.10000E-04 Load Step = 1 Substep = 2 Equilibrium Iteration = 1.
F Convergence Norm = 0.70835E-10 Previous Norm = 21.463
M Convergence Norm = 0.87886E-10 Previous Norm = 0.11037E-09
Element Formation Element = 590 Cum. Iter. = 17 CP = 479.320
Time = 0.10000E-04 Load Step = 1 Substep = 2 Equilibrium Iteration = 1.
F Convergence Norm = 0.70835E-10 Previous Norm = 21.463
M Convergence Norm = 0.87886E-10 Previous Norm = 0.11037E-09
FORCE CONVERGENCE VALUE = 0.7084E-10 CRITERION = 2.932
MOMENT CONVERGENCE VALUE = 0.8789E-10 CRITERION = 24.48
Equation Solution Element = 470 Cum. Iter. = 17 CP = 485.620
Time = 0.10000E-04 Load Step = 1 Substep = 2 Equilibrium Iteration = 1.
F Convergence Norm = 0.70835E-10 Previous Norm = 0.70835E-10
M Convergence Norm = 0.87886E-10 Previous Norm = 0.87886E-10
EQUIL ITER 1 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = 0.5434E-15
Element Formation Element = 210 Cum. Iter. = 18 CP = 493.410
Time = 0.10000E-04 Load Step = 1 Substep = 2 Equilibrium Iteration = 2.
F Convergence Norm = 0.70835E-10 Previous Norm = 0.70835E-10
M Convergence Norm = 0.87886E-10 Previous Norm = 0.87886E-10
Element Formation Element = 370 Cum. Iter. = 18 CP = 498.060
Time = 0.10000E-04 Load Step = 1 Substep = 2 Equilibrium Iteration = 2.
F Convergence Norm = 0.70835E-10 Previous Norm = 0.70835E-10
M Convergence Norm = 0.87886E-10 Previous Norm = 0.87886E-10
Element Formation Element = 430 Cum. Iter. = 18 CP = 499.590

Time = 0.10000E-04 Load Step= 1 Substep= 2 Equilibrium Iteration= 2.
F Convergence Norm = 0.70835E-10 Previous Norm = 0.70835E-10
M Convergence Norm = 0.87886E-10 Previous Norm = 0.87886E-10
Solution Preparation Element = 10 Cum. Iter. = 18 CP= 505.950
Time = 0.10000E-04 Load Step= 1 Substep= 2 Equilibrium Iteration= 2.
F Convergence Norm = 0.70835E-10 Previous Norm = 0.70835E-10
M Convergence Norm = 0.87886E-10 Previous Norm = 0.87886E-10
FORCE CONVERGENCE VALUE = 0.3586E-10 CRITERION= 2.932 <<< CONVERGED
MOMENT CONVERGENCE VALUE = 0.5052E-11 CRITERION= 24.48 <<< CONVERGED
>>> SOLUTION CONVERGED AFTER EQUILIBRIUM ITERATION 1
Element Output Element = 220 Cum. Iter. = 17 CP= 511.050
Time = 0.10000E-04 Load Step= 1 Substep= 2 Equilibrium Iteration= 1.
F Convergence Norm = 0.35858E-10 Previous Norm = 0.70835E-10
M Convergence Norm = 0.50519E-11 Previous Norm = 0.87886E-10
*** LOAD STEP 1 SUBSTEP 2 COMPLETED. CUM ITER = 17
*** TIME = 0.100000E-04 TIME INC = 0.500000E-05

*** PROBLEM STATISTICS

ACTUAL NO. OF ACTIVE DEGREES OF FREEDOM = 4045
R.M.S. WAVEFRONT SIZE = 125.8

*** ANSYS BINARY FILE STATISTICS

BUFFER SIZE USED = 4096

3.297 MB WRITTEN ON ELEMENT MATRIX FILE: file.emat
9.859 MB WRITTEN ON ELEMENT SAVED DATA FILE: file.esav
4.047 MB WRITTEN ON TRIANGULARIZED MATRIX FILE: file.tri
1.672 MB WRITTEN ON RESULTS FILE: file.rst

ANSYS REVISION 5.2 11:38:22 08/25/1997

PRINTOUT RESUMED BY /GOP

Load step file number 2. Begin solution ...

***** ANSYS SOLVE COMMAND *****

*** WARNING *** CP= 519.700 TIME= 11:55:53
Coupled node set 6 has unused node 30577.

*** WARNING *** CP= 519.700 TIME= 11:55:53
Coupled node set 12 has unused node 30577.

*** WARNING *** CP= 519.700 TIME= 11:55:53
Coupled node set 18 has unused node 30577.

*** WARNING *** CP= 519.820 TIME= 11:55:53
Specified DOF constraint UY at unused node 30559.

*** WARNING *** CP= 519.820 TIME= 11:55:53
Specified DOF constraint ROTX at unused node 30559.

*** WARNING *** CP= 519.820 TIME= 11:55:53
Specified DOF constraint ROTZ at unused node 30559.

*** NOTE *** CP= 519.830 TIME= 11:55:53
The step data was checked and warning messages were found.
Please review output or errors file (file.err) for these warning
messages.

*** NOTE *** CP= 519.830 TIME= 11:55:53
Results printout suppressed for interactive execute.

*** NOTE *** CP= 519.830 TIME= 11:55:53
Nonlinear analysis, NROPT set to 2 (modified Newton-Raphson solution
procedure) for ALL DOFs.

LOAD STEP OPTIONS

LOAD STEP NUMBER. 2
TIME AT END OF THE LOAD STEP. 1.9300
AUTOMATIC TIME STEPPING ON
INITIAL NUMBER OF SUBSTEPS 1000
MAXIMUM NUMBER OF SUBSTEPS 1000
MINIMUM NUMBER OF SUBSTEPS 1
MAXIMUM NUMBER OF EQUILIBRIUM ITERATIONS. 40
STEP CHANGE BOUNDARY CONDITIONS YES
TRANSIENT (INERTIA) EFFECTS
STRUCTURAL DOFS. ON
TRANSIENT INTEGRATION PARAMETERS
ALPHA. 0.25251
DELTA. 0.50500
TERMINATE ANALYSIS IF NOT CONVERGED YES (EXIT)
CONVERGENCE CONTROLS. USE DEFAULTS
INERTIA LOADS X Y Z
ACEL 0.00000E+00 0.00000E+00 386.40
COPY INTEGRATION POINT VALUES TO NODE YES, FOR ELEMENTS WITH
ACTIVE MAT. NONLINEARITIES
PRINT OUTPUT CONTROLS NO PRINTOUT
DATABASE OUTPUT CONTROLS
ITEM FREQUENCY COMPONENT
ALL 3
ALL 5

Element Formation Element= 10 Cum. Iter.= 18 CP= 521.840
Time= 0.19400E-02 Load Step= 2 Substep= 1 Equilibrium Iteration= 1.
F Convergence Norm= 0.35858E-10 Previous Norm= 0.70835E-10
M Convergence Norm= 0.50519E-11 Previous Norm= 0.87886E-10
Element Formation Element= 290 Cum. Iter.= 18 CP= 529.860
Time= 0.19400E-02 Load Step= 2 Substep= 1 Equilibrium Iteration= 1.
F Convergence Norm= 0.35858E-10 Previous Norm= 0.70835E-10
M Convergence Norm= 0.50519E-11 Previous Norm= 0.87886E-10
Element Formation Element= 620 Cum. Iter.= 18 CP= 538.000

Time = 0.19400E-02 Load Step = 2 Substep = 1 Equilibrium Iteration = 1.
F Convergence Norm = 0.35858E-10 Previous Norm = 0.70835E-10
M Convergence Norm = 0.50519E-11 Previous Norm = 0.87886E-10
FORCE CONVERGENCE VALUE = 6500. CRITERION = 7.131
MOMENT CONVERGENCE VALUE = 0.5052E-11 CRITERION = 24.48
Equation Solution Element = 290 Cum. Iter. = 18 CP = 542.710
Time = 0.19400E-02 Load Step = 2 Substep = 1 Equilibrium Iteration = 1.
F Convergence Norm = 6500.0 Previous Norm = 6500.0
M Convergence Norm = 0.50519E-11 Previous Norm = 0.50519E-11
EQUIL ITER 1 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = -0.3634E-03
Element Formation Element = 170 Cum. Iter. = 19 CP = 550.510
Time = 0.19400E-02 Load Step = 2 Substep = 1 Equilibrium Iteration = 2.
F Convergence Norm = 6500.0 Previous Norm = 6500.0
M Convergence Norm = 0.50519E-11 Previous Norm = 0.50519E-11
Element Formation Element = 470 Cum. Iter. = 19 CP = 558.670
Time = 0.19400E-02 Load Step = 2 Substep = 1 Equilibrium Iteration = 2.
F Convergence Norm = 6500.0 Previous Norm = 6500.0
M Convergence Norm = 0.50519E-11 Previous Norm = 0.50519E-11
Element Formation Element = 630 Cum. Iter. = 19 CP = 562.840
Time = 0.19400E-02 Load Step = 2 Substep = 1 Equilibrium Iteration = 2.
F Convergence Norm = 6500.0 Previous Norm = 6500.0
M Convergence Norm = 0.50519E-11 Previous Norm = 0.50519E-11
FORCE CONVERGENCE VALUE = 0.1621E-10 CRITERION = 2.932 <<< CONVERGED
MOMENT CONVERGENCE VALUE = 0.3234E-11 CRITERION = 24.48 <<< CONVERGED
>>> SOLUTION CONVERGED AFTER EQUILIBRIUM ITERATION 1
Element Output Element = 10 Cum. Iter. = 18 CP = 565.900
Time = 0.19400E-02 Load Step = 2 Substep = 1 Equilibrium Iteration = 1.
F Convergence Norm = 0.16215E-10 Previous Norm = 6500.0
M Convergence Norm = 0.32338E-11 Previous Norm = 0.50519E-11
Element Output Element = 170 Cum. Iter. = 18 CP = 568.610
Time = 0.19400E-02 Load Step = 2 Substep = 1 Equilibrium Iteration = 1.
F Convergence Norm = 0.16215E-10 Previous Norm = 6500.0
M Convergence Norm = 0.32338E-11 Previous Norm = 0.50519E-11
Element Output Element = 530 Cum. Iter. = 18 CP = 574.110
Time = 0.19400E-02 Load Step = 2 Substep = 1 Equilibrium Iteration = 1.
F Convergence Norm = 0.16215E-10 Previous Norm = 6500.0
M Convergence Norm = 0.32338E-11 Previous Norm = 0.50519E-11
*** LOAD STEP 2 SUBSTEP 1 COMPLETED. CUM ITER = 18
*** TIME = 0.193999E-02 TIME INC = 0.192999E-02
*** RESPONSE FREQ = 0.1159E-11 PERIOD = 0.8631E+12 PTS/CYC = 0.45E+15
*** ESTIMATED TIME FOR ELEMENT 681 TO CHANGE STATUS IS 2.720
*** AUTO STEP TIME: NEXT TIME INC = 0.19300E-02 UNCHANGED

Element Formation Element = 80 Cum. Iter. = 19 CP = 580.090
Time = 0.38700E-02 Load Step = 2 Substep = 2 Equilibrium Iteration = 1.
F Convergence Norm = 0.16215E-10 Previous Norm = 6500.0
M Convergence Norm = 0.32338E-11 Previous Norm = 0.50519E-11
Element Formation Element = 350 Cum. Iter. = 19 CP = 587.780
Time = 0.38700E-02 Load Step = 2 Substep = 2 Equilibrium Iteration = 1.
F Convergence Norm = 0.16215E-10 Previous Norm = 6500.0
M Convergence Norm = 0.32338E-11 Previous Norm = 0.50519E-11
Solution Preparation Element = 10 Cum. Iter. = 19 CP = 595.840

Time = 0.38700E-02 Load Step = 2 Substep = 2 Equilibrium Iteration = 1.
F Convergence Norm = 0.16215E-10 Previous Norm = 6500.0
M Convergence Norm = 0.32338E-11 Previous Norm = 0.50519E-11
FORCE CONVERGENCE VALUE = 0.2587E+05 CRITERION = 26.04
MOMENT CONVERGENCE VALUE = 0.3234E-11 CRITERION = 24.48
Equation Solution Element = 420 Cum. Iter. = 19 CP = 599.750
Time = 0.38700E-02 Load Step = 2 Substep = 2 Equilibrium Iteration = 1.
F Convergence Norm = 25871. Previous Norm = 25871.
M Convergence Norm = 0.32338E-11 Previous Norm = 0.32338E-11
EQUIL ITER 1 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = -0.1446E-02
Element Formation Element = 10 Cum. Iter. = 20 CP = 602.210
Time = 0.38700E-02 Load Step = 2 Substep = 2 Equilibrium Iteration = 2.
F Convergence Norm = 25871. Previous Norm = 25871.
M Convergence Norm = 0.32338E-11 Previous Norm = 0.32338E-11
Element Formation Element = 250 Cum. Iter. = 20 CP = 609.390
Time = 0.38700E-02 Load Step = 2 Substep = 2 Equilibrium Iteration = 2.
F Convergence Norm = 25871. Previous Norm = 25871.
M Convergence Norm = 0.32338E-11 Previous Norm = 0.32338E-11
Element Formation Element = 560 Cum. Iter. = 20 CP = 617.460
Time = 0.38700E-02 Load Step = 2 Substep = 2 Equilibrium Iteration = 2.
F Convergence Norm = 25871. Previous Norm = 25871.
M Convergence Norm = 0.32338E-11 Previous Norm = 0.32338E-11
FORCE CONVERGENCE VALUE = 0.1496E-10 CRITERION = 2.932 <<< CONVERGED
MOMENT CONVERGENCE VALUE = 0.3691E-11 CRITERION = 24.48 <<< CONVERGED
>>> SOLUTION CONVERGED AFTER EQUILIBRIUM ITERATION 1

ITERATION SUMMARY FOR INTERMEDIATE STEPS HAVE BEEN DELETED.

Element Output Element = 370 Cum. Iter. = 34 CP = 1466.580
Time = 1.9300 Load Step = 2 Substep = 17 Equilibrium Iteration = 1.
F Convergence Norm = 0.43574E-08 Previous Norm = 0.29673E+08
M Convergence Norm = 0.33255E-11 Previous Norm = 0.37324E-11
Element Output Element = 390 Cum. Iter. = 34 CP = 1466.960
Time = 1.9300 Load Step = 2 Substep = 17 Equilibrium Iteration = 1.
F Convergence Norm = 0.43574E-08 Previous Norm = 0.29673E+08
M Convergence Norm = 0.33255E-11 Previous Norm = 0.37324E-11
Element Output Element = 450 Cum. Iter. = 34 CP = 1468.080
Time = 1.9300 Load Step = 2 Substep = 17 Equilibrium Iteration = 1.
F Convergence Norm = 0.43574E-08 Previous Norm = 0.29673E+08
M Convergence Norm = 0.33255E-11 Previous Norm = 0.37324E-11
Element Output Element = 680 Cum. Iter. = 34 CP = 1471.810
Time = 1.9300 Load Step = 2 Substep = 17 Equilibrium Iteration = 1.
F Convergence Norm = 0.43574E-08 Previous Norm = 0.29673E+08
M Convergence Norm = 0.33255E-11 Previous Norm = 0.37324E-11
*** LOAD STEP 2 SUBSTEP 17 COMPLETED. CUM ITER = 34
*** TIME = 1.93000 TIME INC = 0.167276E-02
*** RESPONSE FREQ = 0.3486E-15 PERIOD = 0.2868E+16 PTS/CYC = 0.17E+19
ANSYS REVISION 5.2 11:38:22 08/25/1997

PRINTOUT RESUMED BY /GOP

Load step file number 3. Begin solution ...

***** ANSYS SOLVE COMMAND *****

*** WARNING *** CP= 1473.370 TIME= 12:33:08
Coupled node set 6 has unused node 30577.

*** WARNING *** CP= 1473.370 TIME= 12:33:09
Coupled node set 12 has unused node 30577.

*** WARNING *** CP= 1473.370 TIME= 12:33:09
Coupled node set 18 has unused node 30577.

*** WARNING *** CP= 1473.490 TIME= 12:33:09
Specified DOF constraint UY at unused node 30559.

*** WARNING *** CP= 1473.490 TIME= 12:33:09
Specified DOF constraint ROTX at unused node 30559.

*** WARNING *** CP= 1473.490 TIME= 12:33:09
Specified DOF constraint ROTZ at unused node 30559.

*** NOTE *** CP= 1473.500 TIME= 12:33:09
The step data was checked and warning messages were found.
Please review output or errors file (file.err) for these warning
messages.

*** NOTE *** CP= 1473.500 TIME= 12:33:09
Results printout suppressed for interactive execute.

*** NOTE *** CP= 1473.500 TIME= 12:33:09
Nonlinear analysis, NROPT set to 2 (modified Newton-Raphson solution
procedure) for ALL DOFs.

LOAD STEP OPTIONS

LOAD STEP NUMBER. 3
TIME AT END OF THE LOAD STEP. 1.9900
NUMBER OF SUBSTEPS. 600
MAXIMUM NUMBER OF EQUILIBRIUM ITERATIONS. 40
STEP CHANGE BOUNDARY CONDITIONS YES
TRANSIENT (INERTIA) EFFECTS
STRUCTURAL DOFS. ON
TRANSIENT INTEGRATION PARAMETERS
ALPHA. 0.25251
DELTA. 0.50500
TERMINATE ANALYSIS IF NOT CONVERGED YES (EXIT)
CONVERGENCE CONTROLS. USE DEFAULTS
INERTIA LOADS X Y Z
ACEL 0.00000E+00 0.00000E+00 386.40

COPY INTEGRATION POINT VALUES TO NODE YES, FOR ELEMENTS WITH
ACTIVE MAT. NONLINEARITIES

PRINT OUTPUT CONTROLS NO PRINTOUT

DATABASE OUTPUT CONTROLS

ITEM	FREQUENCY	COMPONENT
ALL	5	
ALL	3	

```

Element Formation Element = 10 Cum. Iter. = 35 CP= 1475.530
Time = 1.9301 Load Step = 3 Substep = 1 Equilibrium Iteration = 1.
F Convergence Norm = 0.43574E-08 Previous Norm = 0.29673E+08
M Convergence Norm = 0.33255E-11 Previous Norm = 0.37324E-11
Element Formation Element = 290 Cum. Iter. = 35 CP= 1483.520
Time = 1.9301 Load Step = 3 Substep = 1 Equilibrium Iteration = 1.
F Convergence Norm = 0.43574E-08 Previous Norm = 0.29673E+08
M Convergence Norm = 0.33255E-11 Previous Norm = 0.37324E-11
Element Formation Element = 320 Cum. Iter. = 35 CP= 1484.500
Time = 1.9301 Load Step = 3 Substep = 1 Equilibrium Iteration = 1.
F Convergence Norm = 0.43574E-08 Previous Norm = 0.29673E+08
M Convergence Norm = 0.33255E-11 Previous Norm = 0.37324E-11
Element Formation Element = 600 Cum. Iter. = 35 CP= 1491.250
Time = 1.9301 Load Step = 3 Substep = 1 Equilibrium Iteration = 1.
F Convergence Norm = 0.43574E-08 Previous Norm = 0.29673E+08
M Convergence Norm = 0.33255E-11 Previous Norm = 0.37324E-11
FORCE CONVERGENCE VALUE = 0.4966E+09 CRITERION = 0.4966E+06
MOMENT CONVERGENCE VALUE = 0.3325E-11 CRITERION = 24.48
Equation Solution Element = 10 Cum. Iter. = 35 CP= 1494.940
Time = 1.9301 Load Step = 3 Substep = 1 Equilibrium Iteration = 1.
F Convergence Norm = 0.49658E+09 Previous Norm = 0.49658E+09
M Convergence Norm = 0.33255E-11 Previous Norm = 0.33255E-11
EQUIL ITER 1 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = -0.7454E-01
Element Formation Element = 90 Cum. Iter. = 36 CP= 1501.800
Time = 1.9301 Load Step = 3 Substep = 1 Equilibrium Iteration = 2.
F Convergence Norm = 0.49658E+09 Previous Norm = 0.49658E+09
M Convergence Norm = 0.33255E-11 Previous Norm = 0.33255E-11
Element Formation Element = 370 Cum. Iter. = 36 CP= 1509.900
Time = 1.9301 Load Step = 3 Substep = 1 Equilibrium Iteration = 2.
F Convergence Norm = 0.49658E+09 Previous Norm = 0.49658E+09
M Convergence Norm = 0.33255E-11 Previous Norm = 0.33255E-11
Element Formation Element = 660 Cum. Iter. = 36 CP= 1517.090
Time = 1.9301 Load Step = 3 Substep = 1 Equilibrium Iteration = 2.
F Convergence Norm = 0.49658E+09 Previous Norm = 0.49658E+09
M Convergence Norm = 0.33255E-11 Previous Norm = 0.33255E-11
FORCE CONVERGENCE VALUE = 0.5479E-07 CRITERION = 2.932 <<< CONVERGED
MOMENT CONVERGENCE VALUE = 0.3868E-11 CRITERION = 24.48 <<< CONVERGED
>>> SOLUTION CONVERGED AFTER EQUILIBRIUM ITERATION 1

```

INTERMEDIATE LOAD STEPS' ITERATION SUMMARY HAVE BEEN DELETED.

*** TIME = 1.98980 TIME INC = 0.100000E-03
*** MAX PLASTIC STRAIN STEP = 0.7620E-05
*** RESPONSE FREQ = 6.386 PERIOD = 0.1566 PTS/CYC = 0.16E+04

Element Formation Element = 20 Cum. Iter. = 948 CP = 41233.719
Time = 1.9899 Load Step = 3 Substep = 599 Equilibrium Iteration = 1.
F Convergence Norm = 0.77731 Previous Norm = 0.15036E+09
M Convergence Norm = 0.34751 Previous Norm = 0.85964
Element Formation Element = 420 Cum. Iter. = 948 CP = 41244.391
Time = 1.9899 Load Step = 3 Substep = 599 Equilibrium Iteration = 1.
F Convergence Norm = 0.77731 Previous Norm = 0.15036E+09
M Convergence Norm = 0.34751 Previous Norm = 0.85964
FORCE CONVERGENCE VALUE = 0.1498E+09 CRITERION = 0.1499E+06
MOMENT CONVERGENCE VALUE = 0.3477 CRITERION = 931.9
Equation Solution Element = 510 Cum. Iter. = 948 CP = 41254.691
Time = 1.9899 Load Step = 3 Substep = 599 Equilibrium Iteration = 1.
F Convergence Norm = 0.14975E+09 Previous Norm = 0.14975E+09
M Convergence Norm = 0.34769 Previous Norm = 0.34769
EQUIL ITER 1 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = -0.2248E-01
Element Formation Element = 340 Cum. Iter. = 949 CP = 41265.500
Time = 1.9899 Load Step = 3 Substep = 599 Equilibrium Iteration = 2.
F Convergence Norm = 0.14975E+09 Previous Norm = 0.14975E+09
M Convergence Norm = 0.34769 Previous Norm = 0.34769
FORCE CONVERGENCE VALUE = 0.3935 CRITERION = 185.9 <<< CONVERGED
MOMENT CONVERGENCE VALUE = 0.3073 CRITERION = 931.8 <<< CONVERGED
>>> SOLUTION CONVERGED AFTER EQUILIBRIUM ITERATION 1
Element Output Element = 90 Cum. Iter. = 948 CP = 41276.449
Time = 1.9899 Load Step = 3 Substep = 599 Equilibrium Iteration = 1.
F Convergence Norm = 0.39353 Previous Norm = 0.14975E+09
M Convergence Norm = 0.30729 Previous Norm = 0.34769
*** LOAD STEP 3 SUBSTEP 599 COMPLETED. CUM ITER = 948
*** TIME = 1.98990 TIME INC = 0.100000E-03
*** MAX PLASTIC STRAIN STEP = 0.6599E-05
*** RESPONSE FREQ = 6.321 PERIOD = 0.1582 PTS/CYC = 0.16E+04

Element Formation Element = 30 Cum. Iter. = 949 CP = 41286.910
Time = 1.9900 Load Step = 3 Substep = 600 Equilibrium Iteration = 1.
F Convergence Norm = 0.39353 Previous Norm = 0.14975E+09
M Convergence Norm = 0.30729 Previous Norm = 0.34769
Element Formation Element = 430 Cum. Iter. = 949 CP = 41297.500
Time = 1.9900 Load Step = 3 Substep = 600 Equilibrium Iteration = 1.
F Convergence Norm = 0.39353 Previous Norm = 0.14975E+09
M Convergence Norm = 0.30729 Previous Norm = 0.34769
FORCE CONVERGENCE VALUE = 0.1491E+09 CRITERION = 0.1493E+06
MOMENT CONVERGENCE VALUE = 0.3074 CRITERION = 931.8
Equation Solution Element = 650 Cum. Iter. = 949 CP = 41308.320
Time = 1.9900 Load Step = 3 Substep = 600 Equilibrium Iteration = 1.
F Convergence Norm = 0.14915E+09 Previous Norm = 0.14915E+09

```

M Convergence Norm = 0.30735      Previous Norm = 0.30735
EQUIL ITER 1 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = -0.2239E-01
Element Formation Element = 370 Cum. Iter. = 950 CP = 41319.191
Time = 1.9900 Load Step = 3 Substep = 600 Equilibrium Iteration = 2.
F Convergence Norm = 0.14915E+09 Previous Norm = 0.14915E+09
M Convergence Norm = 0.30735      Previous Norm = 0.30735
FORCE CONVERGENCE VALUE = 5.453 CRITERION = 185.9 <<< CONVERGED
MOMENT CONVERGENCE VALUE = 0.6020 CRITERION = 931.7 <<< CONVERGED
>>> SOLUTION CONVERGED AFTER EQUILIBRIUM ITERATION 1
Element Output Element = 110 Cum. Iter. = 949 CP = 41329.891
Time = 1.9900 Load Step = 3 Substep = 600 Equilibrium Iteration = 1.
F Convergence Norm = 5.4527 Previous Norm = 0.14915E+09
M Convergence Norm = 0.60200 Previous Norm = 0.30735
*** LOAD STEP 3 SUBSTEP 600 COMPLETED. CUM ITER = 949
*** TIME = 1.99000 TIME INC = 0.100000E-03
*** MAX PLASTIC STRAIN STEP = 0.5536E-05
*** RESPONSE FREQ = 6.254 PERIOD = 0.1599 PTS/CYC = 0.16E+04

```

SOLU_LS4:

FINISH SOLUTION PROCESSING

```
***** ROUTINE COMPLETED **** CP = 41338.820
```

*** NOTE *** CP= 41338.820 TIME= 03:39:35
A total of 42 warnings and errors written to file.err.

BEGIN:

PURGE ALL SOLUTION AND POST DATA
SAVE ALL MODEL DATA

*** NOTE *** CP= 41338.941 TIME= 03:39:36
NEW BACKUP FILE NAME= file.dbb.

ALL CURRENT ANSYS DATA WRITTEN TO FILE NAME= file.db
FOR POSSIBLE RESUME FROM THIS POINT

NUMBER OF WARNING MESSAGES ENCOUNTERED= 42
NUMBER OF ERROR MESSAGES ENCOUNTERED= 0

DATA INPUT WRITTEN ON file.log

```
*-----*
```

```
|
```

```
| ANSYS RUN COMPLETED |
```

```
|
```

REV. 5.2		SGI IRIS4D	
CP TIME	(sec) =	41339.379	TIME = 03:39:37
ELAPSED TIME	(sec) =	57724.000	DATE = 08/26/97

37589.0u 3750.4s 16:02:13 71% 0+0k 176898+30252io 33817pf+0w
Ran ANSYS 5.2 on workstation: cea3 on: Tue Aug 26 03:39:40 PDT 1997
ANSYS 5.2 has been verified by ICF KH
Class 3 Error Reports are in the directory: /apps/ansys/class3_errors.

POST26 SUMMARY OF VARIABLE EXTREME VALUES
VARI TYPE IDENTIFIERS NAME MINIMUM AT TIME MAXIMUM AT TIME

2	RFOR	10303 FZ	fz10303	0.0000E+00	1.936	808.4	1.927
3	RFOR	10340 FZ	fz10340	0.0000E+00	1.986	0.4646E+05	1.960
4	RFOR	10440 FZ	fz10440	866.3	1.934	0.7190E+05	1.965
5	RFOR	10560 FZ	fz10560	0.0000E+00	1.934	0.1092E+05	1.948
6	RFOR	10561 FZ	fz10561	40.62	1.934	0.1209E+05	1.948
7	RFOR	10562 FZ	fz10562	147.2	1.934	0.1437E+05	1.940
8	RFOR	10563 FZ	fz10563	174.5	1.934	0.1557E+05	1.940
9	RFOR	10565 FZ	fz10565	156.3	1.934	0.1612E+05	1.940
10	RFOR	10566 FZ	fz10566	159.8	1.934	0.1758E+05	1.940
11	RFOR	10567 FZ	fz10567	188.1	1.933	0.1862E+05	1.940
12	RFOR	10568 FZ	fz10568	208.5	1.933	0.1919E+05	1.940
13	RFOR	10569 FZ	fz10569	211.3	1.933	0.1908E+05	1.940
14	ESOL	667 F Z	fz1184	-0.1000E+05	1.934	78.09	1.931
15	ESOL	667 F Z	fz21184	-78.09	1.931	0.1000E+05	1.934
16	NSOL	4303 UX	ux4303	-0.3063	1.990	-0.1292E-02	1.930
17	NSOL	4583 UX	ux4583	0.1292E-02	1.927	0.4693	1.966
18	NSOL	4340 UY	uy4340	-0.3667E-01	1.968	-0.3060E-03	1.941
19	NSOL	4440 UZ	uy4440	-0.7190	1.965	-0.8663E-02	1.934
20	NSOL	4449 UZ	uz4449	-3.402	1.966	-0.1349E-01	1.927
21	NSOL	21184 UZ	uz21184	-27.12	1.990	-0.1042E-01	1.927
22	NSOL	164 UZ	uz164	-3.242	1.967	-0.1478E-01	1.932

STORAGE COMPLETE FOR 202 DATA POINTS

SUMMARY OF VARIABLES STORED THIS STEP AND EXTREME VALUES

VARI TYPE IDENTIFIERS NAME MINIMUM AT TIME MAXIMUM AT TIME

2	ESOL	128 F	Z	fz457	-43.88	1.927	5268.	1.982
3	ESOL	145 F	Z	fz474	-6937.	1.936	6697.	1.955
4	ESOL	147 F	Z	fz494	18.91	1.927	7764.	1.937
5	ESOL	149 F	Z	fz514	62.92	1.931	0.1133E+05	1.943
6	ESOL	151 F	Z	fz534	-7215.	1.945	1005.	1.940
7	ESOL	182 F	Z	fz577	-6879.	1.982	-50.54	1.930
8	ESOL	128 F	X	fx457	-1124.	1.936	3014.	1.990
9	ESOL	145 F	X	fx474	43.37	1.930	0.1062E+05	1.937
10	ESOL	147 F	X	fx494	-0.1026E+05	1.963	1168.	1.936
11	ESOL	151 F	X	fx534	-0.3122E+05	1.943	-450.6	1.927
12	ESOL	182 F	X	fx577	2.698	1.932	517.8	1.986
13	ESOL	128 F	Y	fy457	-2771.	1.990	0.1036E+05	1.954
14	ESOL	145 F	Y	fy474	-4740.	1.990	9699.	1.945
15	ESOL	147 F	Y	fy494	-5422.	1.937	2321.	1.980
16	ESOL	149 F	Y	fy514	-5315.	1.937	-42.90	1.932
17	ESOL	151 F	Y	fy534	97.46	1.930	0.1958E+05	1.961
18	ESOL	182 F	Y	fy577	0.5659	1.933	4104.	1.960
19	ESOL	149 F	X	fx514	-0.1938E+05	1.949	-165.3	1.927

POST26 SUMMARY OF VARIABLE EXTREME VALUES

VARI TYPE IDENTIFIERS NAME MINIMUM AT TIME MAXIMUM AT TIME

2	ESOL	128 F	Z	fz457	-43.88	1.927	5268.	1.982
3	ESOL	145 F	Z	fz474	-6937.	1.936	6697.	1.955
4	ESOL	147 F	Z	fz494	18.91	1.927	7764.	1.937
5	ESOL	149 F	Z	fz514	62.92	1.931	0.1133E+05	1.943
6	ESOL	151 F	Z	fz534	-7215.	1.945	1005.	1.940
7	ESOL	182 F	Z	fz577	-6879.	1.982	-50.54	1.930
8	ESOL	128 F	X	fx457	-1124.	1.936	3014.	1.990
9	ESOL	145 F	X	fx474	43.37	1.930	0.1062E+05	1.937
10	ESOL	147 F	X	fx494	-0.1026E+05	1.963	1168.	1.936
11	ESOL	151 F	X	fx534	-0.3122E+05	1.943	-450.6	1.927
12	ESOL	182 F	X	fx577	2.698	1.932	517.8	1.986
13	ESOL	128 F	Y	fy457	-2771.	1.990	0.1036E+05	1.954
14	ESOL	145 F	Y	fy474	-4740.	1.990	9699.	1.945
15	ESOL	147 F	Y	fy494	-5422.	1.937	2321.	1.980
16	ESOL	149 F	Y	fy514	-5315.	1.937	-42.90	1.932
17	ESOL	151 F	Y	fy534	97.46	1.930	0.1958E+05	1.961
18	ESOL	182 F	Y	fy577	0.5659	1.933	4104.	1.960
19	ESOL	149 F	X	fx514	-0.1938E+05	1.949	-165.3	1.927

HNF-SD-TWR-CN-002

Rev. 0

Appendix B

APPENDIX B
TRANSFER PUMP DROP ANALYSIS

```

/prep7
/title,flex receiver platform - impact analysis
et,1,shell43
r,1,1.5 ***** cover plate with hole
r,2,1. ***** cover plate without hole
r,3,1. ***** bottom plate
r,4,1.515 ***** beam upper flange
r,5,0.515 ***** beam lower flange
r,6,0.295 ***** beam web
ex,1,29e6
nuxy,1,0.3
dens,1,0.000734
tb,bkin,1,1
tbdata,1,36000,145000.
tbtemp,70
ex,2,290e6
csys,0
n,300 *****cover plate
n,302,,16.75
fill
n,304,,24.75
fill
n,306,,40.375
fill
n,308,,55.375
fill
n,310,,70.375
fill
n,312,,86.
fill
n,314,,94.
fill
ngen,3,15,300,314,1,4.
ngen,9,15,330,344,1,8.
ngen,3,15,450,464,1,4.
ngen,5,15,480,494,1,8.0625
ngen,3,15,540,554,1,4.
ngen,4,15,570,584,1,11.7
mat,1
type,1
real,3
e,330,345,346,331
egen,8,15,-1
egen,2,1,-8
e,480,495,496,481
egen,4,15,-1
egen,2,1,-4
e,570,585,586,571
egen,3,15,-1
egen,2,1,-3
e,484,499,500,485
egen,4,15,-1

```

```

egen,8,1,-4
e,574,589,590,575
egen,3,15,-1
egen,8,1,-3
real,4          *****cover plate + beam upper flange
e,302,317,318,303
egen,21,15,-1
egen,2,1,-21
e,312,327,328,313
egen,21,15,-1
egen,2,1,-21
e,300,315,316,301
egen,2,15,-1
egen,2,1,-2
e,304,319,320,305
egen,2,15,-1
egen,8,1,-2
e,450,465,466,451
egen,2,15,-1
egen,2,1,-2
e,454,469,470,455
egen,2,15,-1
egen,8,1,-2
e,540,555,556,541
egen,2,15,-1
egen,2,1,-2
e,544,559,560,545
egen,2,15,-1
egen,8,1,-2
real,6          *****beam web
ngen,3,2000,303,618,15,,,-5.455
ngen,3,2000,313,628,15,,,-5.455
ngen,3,2000,315,329,1,,,-5.455
ngen,3,2000,465,479,1,,,-5.455
ngen,3,2000,555,569,1,,,-5.455
e,303,318,2318,2303
egen,21,15,-1
egen,2,2000,-21
e,313,328,2328,2313
egen,21,15,-1
egen,2,2000,-21
e,315,316,2316,2315
egen,13,1,-1
egen,2,2000,-13
e,465,466,2466,2465
egen,13,1,-1
egen,2,2000,-13
e,555,556,2556,2555
egen,13,1,-1
egen,2,2000,-13
real,5          ***** beam lower flange
ngen,2,4000,4303,4618,15,,,-4.

```

ngen,2,5000,4303,4618,15,,4.
ngen,2,4000,4313,4628,15,,4.
ngen,2,5000,4313,4628,15,,4.
ngen,2,4000,4315,4316,1,-4.
ngen,2,5000,4315,4316,1,-4.
ngen,2,4000,4320,4326,1,-4.
ngen,2,5000,4320,4326,1,-4.
ngen,2,4000,4465,4466,1,-4.
ngen,2,5000,4465,4466,1,-4.
ngen,2,4000,4470,4476,1,-4.
ngen,2,5000,4470,4476,1,-4.
ngen,2,4000,4555,4556,1,-4.
ngen,2,5000,4555,4556,1,-4.
ngen,2,4000,4560,4566,1,-4.
ngen,2,5000,4560,4566,1,-4.
e,4303,4318,8318,8303
egen,21,15,-1
e,4313,4328,8328,8313
egen,21,15,-1
e,4303,4318,9318,9303
egen,21,15,-1
e,4313,4328,9328,9313
egen,21,15,-1
e,4315,4316,8316,8315
e,4315,4316,9316,9315
e,4316,8318,8303,8316
e,4316,8318,8333,9316
e,9318,4320,8320,9303
e,9318,4320,9320,9333
e,4320,4321,8321,8320
egen,6,1,-1
e,4320,4321,9321,9320
egen,6,1,-1
e,4326,8328,8313,8326
e,4326,8328,8343,9326
e,4465,4466,8466,8465
e,4465,4466,9466,9465
e,4466,8468,8453,8466
e,4466,8468,8483,9466
e,9468,4470,8470,9453
e,9468,4470,9470,9483
e,4470,4471,8471,8470
egen,6,1,-1
e,4470,4471,9471,9470
egen,6,1,-1
e,4476,8478,8463,8476
e,4476,8478,8493,9476
e,4555,4556,8556,8555
e,4555,4556,9556,9555
e,4556,8558,8543,8556
e,4556,8558,8573,9556
e,9558,4560,8560,9543

e,9558,4560,9560,9573
e,4560,4561,8561,8560
egen,6,1,-1
e,4560,4561,9561,9560
egen,6,1,-1
e,4566,8568,8553,8566
e,4566,8568,8583,9566
local,13,1,40,55.375
csys,13
n,100,25,,0.01
n,108,25,90,0.01
fill
n,116,25,180,0.01
fill
n,117,25,-168.75,0.01
n,124,25,-90,0.01
fill
n,131,25,-11.25,0.01
fill
ngen,3,32,100,131,1,2,,0.01
type,1
real,1
e,100,132,133,101
egen,31,1,-1
e,131,163,132,100
egen,2,32,-32
ngen,2,30000,454,462,1,,,0.01
ngen,2,30000,334,342,1,,,0.01
ngen,2,30000,357,447,15,,,0.01
ngen,2,30000,349,439,15,,,0.01
e,164,30458,30459,165
egen,4,1,-1
e,168,30462,30447,169
e,169,30447,30432,170
e,170,30432,30417,171
e,171,30417,30402,172
e,172,30402,30387,173
e,173,30387,30372,174
e,174,30372,30357,175
e,175,30357,30342,176
e,176,30342,30341,177
e,177,30341,30340,178
e,178,30340,30339,179
e,179,30339,30338,180
e,180,30338,30337,181
e,181,30337,30336,182
e,182,30336,30335,183
e,183,30335,30334,184
e,184,30334,30349,185
e,185,30349,30364,186
e,186,30364,30379,187
e,187,30379,30394,188

e,188,30394,30409,189
e,189,30409,30424,190
e,190,30424,30439,191
e,191,30439,30454,192
e,192,30454,30455,193
egen,3,1,-1
e,195,30457,30458,164
csys,0
cp,1,uz,372,30372
cp,2,uz,432,30432
cp,3,uz,456,30456
cp,4,uz,460,30460
cp,5,uz,364,30364
cp,6,uz,424,30424
cp,7,uz,336,30336
cp,8,uz,340,30340
cp,9,ux,372,30372
cp,10,ux,432,30432
cp,11,ux,456,30456
cp,12,ux,460,30460
cp,13,ux,364,30364
cp,14,ux,424,30424
cp,15,ux,336,30336
cp,16,ux,340,30340
cp,17,uy,372,30372
cp,18,uy,432,30432
cp,19,uy,456,30456
cp,20,uy,460,30460
cp,21,uy,364,30364
cp,22,uy,424,30424
cp,23,uy,336,30336
cp,24,uy,340,30340
et,5,combin14,,1
r,12,10.
type,5
real,12
ngen,2,6000,4303,4313,10,-,0.1
e,4303,10303
e,4313,10313
ngen,2,6000,4618,4628,10,0.01
e,4618,10618
e,4628,10628
et,6,combin14,,2
r,13,10.
type,6
real,13
ngen,2,6000,4465,4555,90,-,0.01
e,4465,10465
e,4555,10555
ngen,2,6000,4479,4569,90,,0.1
e,4479,10479
e,4569,10569

```

nset,,,,10303,10313,10
nset,a,,,10618,10628,10
nset,a,,,10465,10555,90
nset,a,,,10479,10569,90
d,all,all
alls
csys,0
ngen,2,7000,4315,4329,1,,,0.01
ngen,2,7000,4465,4479,14,,,0.01
ngen,2,7000,4555,4569,14,,,0.01
ngen,2,7000,4618,4628,10,,,0.01
et,2,contact52,,,,,1
r,11,1.0e7,,1
r,20,1.0e6,,1
type,2
real,11
e,11315,4315
egen,15,1,-1
e,11465,4465
e,11479,4479
e,11555,4555
e,11569,4569
e,11618,4618
e,11628,4628
real,20
e,334,30334
egen,2,1,-1
e,337,30337
egen,3,1,-1
e,341,30341
egen,2,1,-1
e,357,30357
e,387,30387
egen,3,15,-1
e,447,30447
e,349,30349
e,379,30379
egen,3,15,-1
e,439,30439
e,454,30454
egen,2,1,-1
e,457,30457
egen,3,1,-1
e,461,30461
egen,2,1,-1
nset,s,node,,11315,11329
nset,a,node,,11465,11479,14
nset,a,node,,11555,11569,14
nset,a,node,,11618,11628,10
d,all,all
alls
local,15,0,40,55.375

```


csys,15
type,1
mat,2
r,8,12.0
real,8
n,20001,-16,-16,20. ***** top plate
n,20009,16,-16,20.
fill
ngen,9,9,20001,20009,1,,4
e,20001,20002,20011,20010
egen,8,1,-1
egen,8,9,-8
csys,13
n,20100,25,,20.
n,20108,25,90,20.
fill
n,20116,25,180,20.
fill
n,20117,25,-168.75,20.
n,20124,25,-90,20.
fill
n,20131,25,-11.25,20.
fill
e,20045,20100,20101,20054
e,20054,20101,20102,20063
e,20063,20102,20103,20072
e,20072,20103,20104,20081
e,20081,20104,20105,20080
e,20080,20105,20106,20079
e,20079,20106,20107,20078
e,20078,20107,20108,20077
e,20077,20108,20109,20076
e,20076,20109,20110,20075
e,20075,20110,20111,20074
e,20074,20111,20112,20073
e,20073,20112,20113,20064
e,20064,20113,20114,20055
e,20055,20114,20115,20046
e,20046,20115,20116,20037
e,20037,20116,20117,20028
e,20028,20117,20118,20019
e,20019,20118,20119,20010
e,20010,20119,20120,20001
e,20001,20120,20121,20002
e,20002,20121,20122,20003
e,20003,20122,20123,20004
e,20004,20123,20124,20005
e,20005,20124,20125,20006
e,20006,20125,20126,20007
e,20007,20126,20127,20008
e,20008,20127,20128,20009
e,20009,20128,20129,20018

e,20018,20129,20130,20027
 e,20027,20130,20131,20036
 e,20036,20131,20100,20045
 ngen,2,32,20100,20131,1,4.
 e,20100,20132,20133,20101
 egen,31,1,-1
 e,20131,20163,20132,20100
 et,3,combin40,,,3
 r,9,23500,,,2350
 type,3
 real,9
 e,132,20132
 egen,32,1,-1
 nsel,s,node,,20132,20156,8
 d,all,ux,,,,uy,rotx,roty,rotz
 alls
 et,4,combin40,1,,3,,,2
 g=386.4
 r,25,100000,,(2000/g),720.
 ngen,2,3000,20041,,,,,720.
 type,4
 real,25
 e,20041,23041
 tunif,70.
 alls
 save
 fini
 /solu
 antype,trans
 kbc,1
 acel,,,g
 d,23041,uz
 timint,off
 time,0.00001
 nsubst,2
 neqit,40
 lswrite
 timint,on
 time,1.93
 nsubst,1200
 outres,,5
 autots,on
 ddele,23041,uz
 lswrite
 time,1.98
 nsubst,500
 outres,,3
 neqit,40
 autots,off
 lswrite
 lssolve,1,3
 fini

/exit

Running ANSYS 5.2 on workstation: cea7 on: Wed Sep 3 13:36:39 PDT 1997

ANSYS 5.2 has been verified by ICF KH

Class 3 Error Reports are in the directory: /apps/ansys/class3_errors.

Executing /apps/ansys/sgi/ansys52/bin/ansys.e52

| WELCOME TO THE ANSYS PROGRAM |

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PRESS <CR> OR <ENTER> TO CONTINUE

***** ANSYS COMMAND LINE ARGUMENTS *****

NONE

*** NOTE ***

CP= 2.460 TIME= 13:36:46

There are no parameters and no abbreviations defined.

32207 VERSION=SGI IRIS4D REVISION= 5.2
FOR SUPPORT CALL K McMillian 373- PHONE JLR 206-353-8089 FAX FAX 509-373-6975
CURRENT JOBNAME=file 13:36:46 SEP 03, 1997 CP= 2.470

RUN SETUP PROCEDURE FROM FILE = /apps/ansys/sgi/ansys52/docu/start.ans

/INPUT FILE = /apps/ansys/sgi/ansys52/docu/start.ans LINE = 0

BEGIN:

***** ANSYS - ENGINEERING ANALYSIS SYSTEM REVISION 5.2 *****
32207 VERSION=SGI IRIS4D 13:36:47 SEP 03, 1997 CP= 2.620
FOR SUPPORT CALL K McMillian 373- PHONE JLR 206-353-8089 FAX FAX 509-373-6975

***** ANSYS ANALYSIS DEFINITION (PREP7) *****

ENTER /SHOW,DEVICE-NAME TO ENABLE GRAPHIC DISPLAY
ENTER FINISH TO LEAVE PREP7
PRINTOUT KEY SET TO /GOPR (USE /NOPR TO SUPPRESS)

PREP7:

TITLE=
flex receiver platform - impact analysis

PREP7:

ELEMENT TYPE 1 IS SHELL43 4-NODE STRUCTURAL SHELL
KEYOPT(1-12)= 0 0 0 0 0 0 0 0 0 0 0 0

CURRENT NODAL DOF SET IS UX UY UZ ROTX ROTY ROTZ
THREE-DIMENSIONAL MODEL

PREP7:

REAL CONSTANT SET 1 ITEMS 1 TO 6
1.5000 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00

PREP7:

REAL CONSTANT SET 2 ITEMS 1 TO 6
1.0000 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00

PREP7:

REAL CONSTANT SET 3 ITEMS 1 TO 6
1.0000 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00

PREP7:

REAL CONSTANT SET 4 ITEMS 1 TO 6
1.5150 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00

PREP7:

REAL CONSTANT SET 5 ITEMS 1 TO 6
0.51500 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00

PREP7:

REAL CONSTANT SET 6 ITEMS 1 TO 6
0.29500 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00

PREP7:

MATERIAL 1 EX = 0.2900000E+08

PREP7:

MATERIAL 1 NUXY = 0.3000000

PREP7:

MATERIAL 1 DENS = 0.7340000E-03

PREP7:

DEFINE DATA TABLE BKIN FOR MATERIAL 1
WITH A MAXIMUM OF 1 TEMPERATURE SPECIFICATIONS

PREP7:

DATA FOR BKIN TABLE FOR MATERIAL 1 AT TEMPERATURE= 0.00000E+00
LOC= 1 36000. 0.14500E+06

PREP7:

TEMPERATURE TO BE USED FOR THE NEXT TBCAT COMMAND = 70.000
TEMPERATURE SPECIFICATION = 1

PREP7:

MATERIAL 2 EX = 0.2900000E+09

PREP7:

ACTIVE COORDINATE SYSTEM SET TO 0 (CARTESIAN)

PREP7:

NODE 300 KCS = 0 X,Y,Z= 0.00000E+00 0.00000E+00 0.00000E+00

PREP7:

NODE 302 KCS = 0 X,Y,Z= 0.00000E+00 16.750 0.00000E+00

PREP7:

FILL 1 POINTS BETWEEN NODE 300 AND NODE 302
START WITH NODE 301 AND INCREMENT BY 1

PREP7:

NODE 304 KCS = 0 X,Y,Z= 0.00000E+00 24.750 0.00000E+00

PREP7:

FILL 1 POINTS BETWEEN NODE 302 AND NODE 304
START WITH NODE 303 AND INCREMENT BY 1

PREP7:

NODE 306 KCS = 0 X,Y,Z= 0.00000E+00 40.375 0.00000E+00

PREP7:

FILL 1 POINTS BETWEEN NODE 304 AND NODE 306
START WITH NODE 305 AND INCREMENT BY 1

PREP7:

NODE 308 KCS = 0 X,Y,Z= 0.00000E+00 55.375 0.00000E+00

PREP7:

FILL 1 POINTS BETWEEN NODE 306 AND NODE 308
START WITH NODE 307 AND INCREMENT BY 1

PREP7:

NODE 310 KCS = 0 X,Y,Z= 0.00000E+00 70.375 0.00000E+00

PREP7:

FILL 1 POINTS BETWEEN NODE 308 AND NODE 310
START WITH NODE 309 AND INCREMENT BY 1

PREP7:

NODE 312 KCS = 0 X,Y,Z= 0.00000E+00 86.000 0.00000E+00

PREP7:

FILL 1 POINTS BETWEEN NODE 310 AND NODE 312

START WITH NODE 311 AND INCREMENT BY 1

PREP7:

NODE 314 KCS = 0 X,Y,Z = 0.00000E+00 94.000 0.00000E+00

PREP7:

FILL 1 POINTS BETWEEN NODE 312 AND NODE 314
START WITH NODE 313 AND INCREMENT BY 1

PREP7:

GENERATE 3 TOTAL SETS OF NODES WITH INCREMENT 15
SET IS SELECTED NODES IN RANGE 300 TO 314 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 4.0000 0.00000E+00 0.00000E+00 SPACING = 1.0000

PREP7:

GENERATE 9 TOTAL SETS OF NODES WITH INCREMENT 15
SET IS SELECTED NODES IN RANGE 330 TO 344 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 8.0000 0.00000E+00 0.00000E+00 SPACING = 1.0000

PREP7:

GENERATE 3 TOTAL SETS OF NODES WITH INCREMENT 15
SET IS SELECTED NODES IN RANGE 450 TO 464 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 4.0000 0.00000E+00 0.00000E+00 SPACING = 1.0000

PREP7:

GENERATE 5 TOTAL SETS OF NODES WITH INCREMENT 15
SET IS SELECTED NODES IN RANGE 480 TO 494 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 8.0625 0.00000E+00 0.00000E+00 SPACING = 1.0000

PREP7:

GENERATE 3 TOTAL SETS OF NODES WITH INCREMENT 15
SET IS SELECTED NODES IN RANGE 540 TO 554 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 4.0000 0.00000E+00 0.00000E+00 SPACING = 1.0000

PREP7:

GENERATE 4 TOTAL SETS OF NODES WITH INCREMENT 15
SET IS SELECTED NODES IN RANGE 570 TO 584 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 11.700 0.00000E+00 0.00000E+00 SPACING = 1.0000

PREP7:

MATERIAL NUMBER SET TO 1

PREP7:

ELEMENT TYPE SET TO 1

PREP7:

REAL CONSTANT NUMBER= 3

PREP7:

ELEMENT 1 330 345 346 331

PREP7:

GENERATE 8 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 15
SET IS SELECTED ELEMENTS IN RANGE 1 TO 1 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 8

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 1 TO 8 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 16

PREP7:

ELEMENT 17 480 495 496 481

PREP7:

GENERATE 4 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 15
SET IS SELECTED ELEMENTS IN RANGE 17 TO 17 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 20

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 17 TO 20 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 24

PREP7:

ELEMENT 25 570 585 586 571

PREP7:

GENERATE 3 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 15
SET IS SELECTED ELEMENTS IN RANGE 25 TO 25 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 27

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 25 TO 27 IN STEPS OF 1

MAXIMUM ELEMENT NUMBER = 30

PREP7:

ELEMENT 31 484 499 500 485

PREP7:

GENERATE 4 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 15
SET IS SELECTED ELEMENTS IN RANGE 31 TO 31 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 34

PREP7:

GENERATE 8 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 31 TO 34 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 62

PREP7:

ELEMENT 63 574 589 590 575

PREP7:

GENERATE 3 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 15
SET IS SELECTED ELEMENTS IN RANGE 63 TO 63 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 65

PREP7:

GENERATE 8 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 63 TO 65 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 86

PREP7:

REAL CONSTANT NUMBER = 4

PREP7:

ELEMENT 87 302 317 318 303

PREP7:

GENERATE 21 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 15
SET IS SELECTED ELEMENTS IN RANGE 87 TO 87 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 107

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 87 TO 107 IN STEPS OF 1

MAXIMUM ELEMENT NUMBER = 128

PREP7:

ELEMENT 129 312 327 328 313

PREP7:

GENERATE 21 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 15
SET IS SELECTED ELEMENTS IN RANGE 129 TO 129 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 149

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 129 TO 149 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 170

PREP7:

ELEMENT 171 300 315 316 301

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 15
SET IS SELECTED ELEMENTS IN RANGE 171 TO 171 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 172

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 171 TO 172 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 174

PREP7:

ELEMENT 175 304 319 320 305

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 15
SET IS SELECTED ELEMENTS IN RANGE 175 TO 175 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 176

PREP7:

GENERATE 8 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 175 TO 176 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 190

PREP7:

ELEMENT 191 450 465 466 451

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 15
SET IS SELECTED ELEMENTS IN RANGE 191 TO 191 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 192

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 191 TO 192 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 194

PREP7:

ELEMENT 195 454 469 470 455

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 15
SET IS SELECTED ELEMENTS IN RANGE 195 TO 195 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 196

PREP7:

GENERATE 8 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 195 TO 196 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 210

PREP7:

ELEMENT 211 540 555 556 541

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 15
SET IS SELECTED ELEMENTS IN RANGE 211 TO 211 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 212

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 211 TO 212 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 214

PREP7:

ELEMENT 215 544 559 560 545

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 15
SET IS SELECTED ELEMENTS IN RANGE 215 TO 215 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 216

PREP7:

GENERATE 8 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 215 TO 216 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 230

PREP7:

REAL CONSTANT NUMBER = 6

PREP7:

GENERATE 3 TOTAL SETS OF NODES WITH INCREMENT 2000
SET IS SELECTED NODES IN RANGE 303 TO 618 IN STEPS OF 15
GEOMETRY INCREMENTS ARE 0.00000E+00 0.00000E+00 -5.4550 SPACING = 1.0000

PREP7:

GENERATE 3 TOTAL SETS OF NODES WITH INCREMENT 2000
SET IS SELECTED NODES IN RANGE 313 TO 628 IN STEPS OF 15
GEOMETRY INCREMENTS ARE 0.00000E+00 0.00000E+00 -5.4550 SPACING = 1.0000

PREP7:

GENERATE 3 TOTAL SETS OF NODES WITH INCREMENT 2000
SET IS SELECTED NODES IN RANGE 315 TO 329 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 0.00000E+00 0.00000E+00 -5.4550 SPACING = 1.0000

PREP7:

GENERATE 3 TOTAL SETS OF NODES WITH INCREMENT 2000
SET IS SELECTED NODES IN RANGE 465 TO 479 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 0.00000E+00 0.00000E+00 -5.4550 SPACING = 1.0000

PREP7:

GENERATE 3 TOTAL SETS OF NODES WITH INCREMENT 2000
SET IS SELECTED NODES IN RANGE 555 TO 569 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 0.00000E+00 0.00000E+00 -5.4550 SPACING = 1.0000

PREP7:

ELEMENT 231 303 318 2318 2303

PREP7:

GENERATE 21 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 15
SET IS SELECTED ELEMENTS IN RANGE 231 TO 231 IN STEPS OF 1

MAXIMUM ELEMENT NUMBER = 251

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 2000
SET IS SELECTED ELEMENTS IN RANGE 231 TO 251 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 272

PREP7:

ELEMENT 273 313 328 2328 2313

PREP7:

GENERATE 21 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 15
SET IS SELECTED ELEMENTS IN RANGE 273 TO 273 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 293

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 2000
SET IS SELECTED ELEMENTS IN RANGE 273 TO 293 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 314

PREP7:

ELEMENT 315 315 316 2316 2315

PREP7:

GENERATE 13 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 315 TO 315 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 327

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 2000
SET IS SELECTED ELEMENTS IN RANGE 315 TO 327 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 340

PREP7:

ELEMENT 341 465 466 2466 2465

PREP7:

GENERATE 13 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 341 TO 341 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 353

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 2000
SET IS SELECTED ELEMENTS IN RANGE 341 TO 353 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 366

PREP7:

ELEMENT 367 555 556 2556 2555

PREP7:

GENERATE 13 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 367 TO 367 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 379

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 2000
SET IS SELECTED ELEMENTS IN RANGE 367 TO 379 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 392

PREP7:

REAL CONSTANT NUMBER = 5

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 4000
SET IS SELECTED NODES IN RANGE 4303 TO 4618 IN STEPS OF 15
GEOMETRY INCREMENTS ARE 0.00000E+00 -4.0000 0.00000E+00 SPACING = 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 5000
SET IS SELECTED NODES IN RANGE 4303 TO 4618 IN STEPS OF 15
GEOMETRY INCREMENTS ARE 0.00000E+00 4.0000 0.00000E+00 SPACING = 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 4000
SET IS SELECTED NODES IN RANGE 4313 TO 4628 IN STEPS OF 15
GEOMETRY INCREMENTS ARE 0.00000E+00 -4.0000 0.00000E+00 SPACING = 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 5000
SET IS SELECTED NODES IN RANGE 4313 TO 4628 IN STEPS OF 15
GEOMETRY INCREMENTS ARE 0.00000E+00 4.0000 0.00000E+00 SPACING = 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 4000
SET IS SELECTED NODES IN RANGE 4315 TO 4316 IN STEPS OF 1

GEOMETRY INCREMENTS ARE -4.0000 0.00000E+00 0.00000E+00 SPACING = 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 5000
SET IS SELECTED NODES IN RANGE 4315 TO 4316 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 4.0000 0.00000E+00 0.00000E+00 SPACING = 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 4000
SET IS SELECTED NODES IN RANGE 4320 TO 4326 IN STEPS OF 1
GEOMETRY INCREMENTS ARE -4.0000 0.00000E+00 0.00000E+00 SPACING = 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 5000
SET IS SELECTED NODES IN RANGE 4320 TO 4326 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 4.0000 0.00000E+00 0.00000E+00 SPACING = 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 4000
SET IS SELECTED NODES IN RANGE 4465 TO 4466 IN STEPS OF 1
GEOMETRY INCREMENTS ARE -4.0000 0.00000E+00 0.00000E+00 SPACING = 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 5000
SET IS SELECTED NODES IN RANGE 4465 TO 4466 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 4.0000 0.00000E+00 0.00000E+00 SPACING = 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 4000
SET IS SELECTED NODES IN RANGE 4470 TO 4476 IN STEPS OF 1
GEOMETRY INCREMENTS ARE -4.0000 0.00000E+00 0.00000E+00 SPACING = 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 5000
SET IS SELECTED NODES IN RANGE 4470 TO 4476 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 4.0000 0.00000E+00 0.00000E+00 SPACING = 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 4000
SET IS SELECTED NODES IN RANGE 4555 TO 4556 IN STEPS OF 1
GEOMETRY INCREMENTS ARE -4.0000 0.00000E+00 0.00000E+00 SPACING = 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 5000
SET IS SELECTED NODES IN RANGE 4555 TO 4556 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 4.0000 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 4000
SET IS SELECTED NODES IN RANGE 4560 TO 4566 IN STEPS OF 1
GEOMETRY INCREMENTS ARE -4.0000 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 5000
SET IS SELECTED NODES IN RANGE 4560 TO 4566 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 4.0000 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

ELEMENT 393 4303 4318 8318 8303

PREP7:

GENERATE 21 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 15
SET IS SELECTED ELEMENTS IN RANGE 393 TO 393 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 413

PREP7:

ELEMENT 414 4313 4328 8328 8313

PREP7:

GENERATE 21 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 15
SET IS SELECTED ELEMENTS IN RANGE 414 TO 414 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 434

PREP7:

ELEMENT 435 4303 4318 9318 9303

PREP7:

GENERATE 21 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 15
SET IS SELECTED ELEMENTS IN RANGE 435 TO 435 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 455

PREP7:

ELEMENT 456 4313 4328 9328 9313

PREP7:

GENERATE 21 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 15
SET IS SELECTED ELEMENTS IN RANGE 456 TO 456 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 476

PREP7:

ELEMENT 477 4315 4316 8316 8315

PREP7:

ELEMENT 478 4315 4316 9316 9315

PREP7:

ELEMENT 479 4316 8318 8303 8316

PREP7:

ELEMENT 480 4316 8318 8333 9316

PREP7:

ELEMENT 481 9318 4320 8320 9303

PREP7:

ELEMENT 482 9318 4320 9320 9333

PREP7:

ELEMENT 483 4320 4321 8321 8320

PREP7:

GENERATE 6 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 483 TO 483 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 488

PREP7:

ELEMENT 489 4320 4321 9321 9320

PREP7:

GENERATE 6 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 489 TO 489 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 494

PREP7:

ELEMENT 495 4326 8328 8313 8326

PREP7:

ELEMENT 496 4326 8328 8343 9326

PREP7:

ELEMENT 497 4465 4466 8466 8465

PREP7:

ELEMENT 498 4465 4466 9466 9465

PREP7:

ELEMENT 499 4466 8468 8453 8466

PREP7:

ELEMENT 500 4466 8468 8483 9466

PREP7:

ELEMENT 501 9468 4470 8470 9453

PREP7:

ELEMENT 502 9468 4470 9470 9483

PREP7:

ELEMENT 503 4470 4471 8471 8470

PREP7:

GENERATE 6 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 503 TO 503 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 508

PREP7:

ELEMENT 509 4470 4471 9471 9470

PREP7:

GENERATE 6 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 509 TO 509 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 514

PREP7:

ELEMENT 515 4476 8478 8463 8476

PREP7:

ELEMENT 516 4476 8478 8493 9476

PREP7:

ELEMENT 517 4555 4556 8556 8555

PREP7:

ELEMENT 518 4555 4556 9556 9555

PREP7:

ELEMENT 519 4556 8558 8543 8556

PREP7:

ELEMENT 520 4556 8558 8573 9556

PREP7:

ELEMENT 521 9558 4560 8560 9543

PREP7:

ELEMENT 522 9558 4560 9560 9573

PREP7:

ELEMENT 523 4560 4561 8561 8560

PREP7:

GENERATE 6 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 523 TO 523 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 528

PREP7:

ELEMENT 529 4560 4561 9561 9560

PREP7:

GENERATE 6 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 529 TO 529 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 534

PREP7:

ELEMENT 535 4566 8568 8553 8566

PREP7:

ELEMENT 536 4566 8568 8583 9566

PREP7:

COORDINATE SYSTEM 13 DEFINITION. TYPE= 1 (CYLINDRICAL)
XC,YC,ZC= 40.000 55.375 0.00000E+00
ANGLES= 0.00 0.00 0.00 PARAMETERS= 1.000 1.000
ORIENTATION= 1.00 0.00 0.00 0.00 1.00 0.00 0.00 0.00 1.00

ACTIVE COORDINATE SYSTEM SET TO 13 (CYLINDRICAL)

PREP7:

ACTIVE COORDINATE SYSTEM SET TO 13 (CYLINDRICAL)

PREP7:

NODE 100 KCS= 13 X,Y,Z= 25.000 0.00000E+00 0.10000E-01

PREP7:

NODE 108 KCS= 13 X,Y,Z= 25.000 90.000 0.10000E-01

PREP7:

FILL 7 POINTS BETWEEN NODE 100 AND NODE 108
START WITH NODE 101 AND INCREMENT BY 1

PREP7:

NODE 116 KCS= 13 X,Y,Z= 25.000 180.00 0.10000E-01

PREP7:

FILL 7 POINTS BETWEEN NODE 108 AND NODE 116
START WITH NODE 109 AND INCREMENT BY 1

PREP7:

NODE 117 KCS= 13 X,Y,Z= 25.000 -168.75 0.10000E-01

PREP7:

NODE 124 KCS= 13 X,Y,Z= 25.000 -90.000 0.10000E-01

PREP7:

FILL 6 POINTS BETWEEN NODE 117 AND NODE 124
START WITH NODE 118 AND INCREMENT BY 1

PREP7:

NODE 131 KCS= 13 X,Y,Z= 25.000 -11.250 0.10000E-01

PREP7:

FILL 6 POINTS BETWEEN NODE 124 AND NODE 131
START WITH NODE 125 AND INCREMENT BY 1

PREP7:

GENERATE 3 TOTAL SETS OF NODES WITH INCREMENT 32
SET IS SELECTED NODES IN RANGE 100 TO 131 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 2.0000 0.10000E-01 0.00000E+00 SPACING= 1.0000

PREP7:

ELEMENT TYPE SET TO 1

PREP7:

REAL CONSTANT NUMBER= 1

PREP7:

ELEMENT 537 100 132 133 101

PREP7:

GENERATE 31 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 537 TO 537 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 567

PREP7:

ELEMENT 568 131 163 132 100

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 32
SET IS SELECTED ELEMENTS IN RANGE 537 TO 568 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 600

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 30000
SET IS SELECTED NODES IN RANGE 454 TO 462 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 0.00000E+00 0.00000E+00 0.10000E-01 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 30000

SET IS SELECTED NODES IN RANGE 334 TO 342 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 0.00000E+00 0.00000E+00 0.10000E-01 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 30000
SET IS SELECTED NODES IN RANGE 357 TO 447 IN STEPS OF 15
GEOMETRY INCREMENTS ARE 0.00000E+00 0.00000E+00 0.10000E-01 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 30000
SET IS SELECTED NODES IN RANGE 349 TO 439 IN STEPS OF 15
GEOMETRY INCREMENTS ARE 0.00000E+00 0.00000E+00 0.10000E-01 SPACING= 1.0000

PREP7:

ELEMENT 601 164 30458 30459 165

PREP7:

GENERATE 4 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 601 TO 601 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 604

PREP7:

ELEMENT 605 168 30462 30447 169

PREP7:

ELEMENT 606 169 30447 30432 170

PREP7:

ELEMENT 607 170 30432 30417 171

PREP7:

ELEMENT 608 171 30417 30402 172

PREP7:

ELEMENT 609 172 30402 30387 173

PREP7:

ELEMENT 610 173 30387 30372 174

PREP7:

ELEMENT 611 174 30372 30357 175

PREP7:

ELEMENT 612 175 30357 30342 176

PREP7:

ELEMENT 613 176 30342 30341 177

PREP7:

ELEMENT 614 177 30341 30340 178

PREP7:

ELEMENT 615 178 30340 30339 179

PREP7:

ELEMENT 616 179 30339 30338 180

PREP7:

ELEMENT 617 180 30338 30337 181

PREP7:

ELEMENT 618 181 30337 30336 182

PREP7:

ELEMENT 619 182 30336 30335 183

PREP7:

ELEMENT 620 183 30335 30334 184

PREP7:

ELEMENT 621 184 30334 30349 185

PREP7:

ELEMENT 622 185 30349 30364 186

PREP7:

ELEMENT 623 186 30364 30379 187

PREP7:

ELEMENT 624 187 30379 30394 188

PREP7:

ELEMENT 625 188 30394 30409 189

PREP7:

ELEMENT 626 189 30409 30424 190

PREP7:

ELEMENT 627 190 30424 30439 191

PREP7:

ELEMENT 628 191 30439 30454 192

PREP7:

ELEMENT 629 192 30454 30455 193

PREP7:

GENERATE 3 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 629 TO 629 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 631

PREP7:

ELEMENT 632 195 30457 30458 164

PREP7:

ACTIVE COORDINATE SYSTEM SET TO 0 (CARTESIAN)

PREP7:

COUPLED SET= 1 DIRECTION= UZ TOTAL NODES= 2
NODES ADDED = 372 30372
MAXIMUM COUPLED SET NUMBER= 1

PREP7:

COUPLED SET= 2 DIRECTION= UZ TOTAL NODES= 2
NODES ADDED = 432 30432
MAXIMUM COUPLED SET NUMBER= 2

PREP7:

COUPLED SET= 3 DIRECTION= UZ TOTAL NODES= 2
NODES ADDED = 456 30456
MAXIMUM COUPLED SET NUMBER= 3

PREP7:

COUPLED SET = 4 DIRECTION = UZ TOTAL NODES = 2
NODES ADDED = 460 30460
MAXIMUM COUPLED SET NUMBER = 4

PREP7:

COUPLED SET = 5 DIRECTION = UZ TOTAL NODES = 2
NODES ADDED = 364 30364
MAXIMUM COUPLED SET NUMBER = 5

PREP7:

COUPLED SET = 6 DIRECTION = UZ TOTAL NODES = 2
NODES ADDED = 424 30424
MAXIMUM COUPLED SET NUMBER = 6

PREP7:

COUPLED SET = 7 DIRECTION = UZ TOTAL NODES = 2
NODES ADDED = 336 30336
MAXIMUM COUPLED SET NUMBER = 7

PREP7:

COUPLED SET = 8 DIRECTION = UZ TOTAL NODES = 2
NODES ADDED = 340 30340
MAXIMUM COUPLED SET NUMBER = 8

PREP7:

COUPLED SET = 9 DIRECTION = UX TOTAL NODES = 2
NODES ADDED = 372 30372
MAXIMUM COUPLED SET NUMBER = 9

PREP7:

COUPLED SET = 10 DIRECTION = UX TOTAL NODES = 2
NODES ADDED = 432 30432
MAXIMUM COUPLED SET NUMBER = 10

PREP7:

COUPLED SET = 11 DIRECTION = UX TOTAL NODES = 2
NODES ADDED = 456 30456
MAXIMUM COUPLED SET NUMBER = 11

PREP7:

COUPLED SET = 12 DIRECTION = UX TOTAL NODES = 2
NODES ADDED = 460 30460

MAXIMUM COUPLED SET NUMBER = 12

PREP7:

COUPLED SET = 13 DIRECTION = UX TOTAL NODES = 2
NODES ADDED = 364 30364
MAXIMUM COUPLED SET NUMBER = 13

PREP7:

COUPLED SET = 14 DIRECTION = UX TOTAL NODES = 2
NODES ADDED = 424 30424
MAXIMUM COUPLED SET NUMBER = 14

PREP7:

COUPLED SET = 15 DIRECTION = UX TOTAL NODES = 2
NODES ADDED = 336 30336
MAXIMUM COUPLED SET NUMBER = 15

PREP7:

COUPLED SET = 16 DIRECTION = UX TOTAL NODES = 2
NODES ADDED = 340 30340
MAXIMUM COUPLED SET NUMBER = 16

PREP7:

COUPLED SET = 17 DIRECTION = UY TOTAL NODES = 2
NODES ADDED = 372 30372
MAXIMUM COUPLED SET NUMBER = 17

PREP7:

COUPLED SET = 18 DIRECTION = UY TOTAL NODES = 2
NODES ADDED = 432 30432
MAXIMUM COUPLED SET NUMBER = 18

PREP7:

COUPLED SET = 19 DIRECTION = UY TOTAL NODES = 2
NODES ADDED = 456 30456
MAXIMUM COUPLED SET NUMBER = 19

PREP7:

COUPLED SET = 20 DIRECTION = UY TOTAL NODES = 2
NODES ADDED = 460 30460
MAXIMUM COUPLED SET NUMBER = 20

PREP7:

COUPLED SET= 21 DIRECTION= UY TOTAL NODES= 2
NODES ADDED = 364 30364
MAXIMUM COUPLED SET NUMBER= 21

PREP7:

COUPLED SET= 22 DIRECTION= UY TOTAL NODES= 2
NODES ADDED = 424 30424
MAXIMUM COUPLED SET NUMBER= 22

PREP7:

COUPLED SET= 23 DIRECTION= UY TOTAL NODES= 2
NODES ADDED = 336 30336
MAXIMUM COUPLED SET NUMBER= 23

PREP7:

COUPLED SET= 24 DIRECTION= UY TOTAL NODES= 2
NODES ADDED = 340 30340
MAXIMUM COUPLED SET NUMBER= 24

PREP7:

ELEMENT TYPE 5 IS COMBIN14 SPRING-DAMPER
KEYOPT(1-12)= 0 1 0 0 0 0 0 0 0 0 0 0

CURRENT NODAL DOF SET IS UX UY UZ ROTX ROTY ROTZ
THREE-DIMENSIONAL MODEL

PREP7:

REAL CONSTANT SET 12 ITEMS 1 TO 6
10.000 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00

PREP7:

ELEMENT TYPE SET TO 5

PREP7:

REAL CONSTANT NUMBER= 12

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 6000
SET IS SELECTED NODES IN RANGE 4303 TO 4313 IN STEPS OF 10
GEOMETRY INCREMENTS ARE-0.10000E-01 0.00000E+00 0.00000E+00 SPACING= 1.0000

PREP7:

ELEMENT 633 4303 10303

PREP7:

ELEMENT 634 4313 10313

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 6000
SET IS SELECTED NODES IN RANGE 4618 TO 4628 IN STEPS OF 10
GEOMETRY INCREMENTS ARE 0.10000E-01 0.00000E+00 0.00000E+00 SPACING = 1.0000

PREP7:

ELEMENT 635 4618 10618

PREP7:

ELEMENT 636 4628 10628

PREP7:

ELEMENT TYPE 6 IS COMBIN14 SPRING-DAMPER
KEYOPT(1-12)= 0 2 0 0 0 0 0 0 0 0 0 0

CURRENT NODAL DOF SET IS UX UY UZ ROTX ROTY ROTZ
THREE-DIMENSIONAL MODEL

PREP7:

REAL CONSTANT SET 13 ITEMS 1 TO 6
10.000 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00

PREP7:

ELEMENT TYPE SET TO 6

PREP7:

REAL CONSTANT NUMBER = 13

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 6000
SET IS SELECTED NODES IN RANGE 4465 TO 4555 IN STEPS OF 90
GEOMETRY INCREMENTS ARE 0.00000E+00-0.10000E-01 0.00000E+00 SPACING = 1.0000

PREP7:

ELEMENT 637 4465 10465

PREP7:

ELEMENT 638 4555 10555

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 6000
SET IS SELECTED NODES IN RANGE 4479 TO 4569 IN STEPS OF 90
GEOMETRY INCREMENTS ARE 0.00000E+00 0.10000E-01 0.00000E+00 SPACING= 1.0000

PREP7:

ELEMENT 639 4479 10479

PREP7:

ELEMENT 640 4569 10569

PREP7:

SELECT FOR ITEM=NODE COMPONENT =
IN RANGE 10303 TO 10313 STEP 10

2 NODES (OF 774 DEFINED) SELECTED BY NSEL COMMAND.

PREP7:

ALSO SELECT FOR ITEM=NODE COMPONENT =
IN RANGE 10618 TO 10628 STEP 10

4 NODES (OF 774 DEFINED) SELECTED BY NSEL COMMAND.

PREP7:

ALSO SELECT FOR ITEM=NODE COMPONENT =
IN RANGE 10465 TO 10555 STEP 90

6 NODES (OF 774 DEFINED) SELECTED BY NSEL COMMAND.

PREP7:

ALSO SELECT FOR ITEM=NODE COMPONENT =
IN RANGE 10479 TO 10569 STEP 90

8 NODES (OF 774 DEFINED) SELECTED BY NSEL COMMAND.

PREP7:

SPECIFIED CONSTRAINT UX FOR SELECTED NODES 1 TO 30462 BY 1
REAL= 0.000000000E+00 IMAG= 0.000000000E+00
ADDITIONAL DOFS= UY UZ ROTX ROTY ROTZ

PREP7:

SELECT ALL ENTITIES OF TYPE= ALL AND BELOW

ALL SELECT FOR ITEM=VOLUME COMPONENT=
IN RANGE 0 TO 0 STEP 1

0 VOLUMES (OF 0 DEFINED) SELECTED BY VSEL COMMAND.

ALL SELECT FOR ITEM=AREA COMPONENT=
IN RANGE 0 TO 0 STEP 1

0 AREAS (OF 0 DEFINED) SELECTED BY ASEL COMMAND.

ALL SELECT FOR ITEM=LINE COMPONENT=
IN RANGE 0 TO 0 STEP 1

0 LINES (OF 0 DEFINED) SELECTED BY LSEL COMMAND.

ALL SELECT FOR ITEM=KP COMPONENT=
IN RANGE 0 TO 0 STEP 1

0 KEYPOINTS (OF 0 DEFINED) SELECTED BY KSEL COMMAND.

ALL SELECT FOR ITEM=ELEM COMPONENT=
IN RANGE 1 TO 640 STEP 1

640 ELEMENTS (OF 640 DEFINED) SELECTED BY ESEL COMMAND.

ALL SELECT FOR ITEM=NODE COMPONENT=
IN RANGE 1 TO 30462 STEP 1

774 NODES (OF 774 DEFINED) SELECTED BY NSEL COMMAND.

PREP7:

ACTIVE COORDINATE SYSTEM SET TO 0 (CARTESIAN)

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 7000
SET IS SELECTED NODES IN RANGE 4315 TO 4329 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 0.00000E+00 0.00000E+00-0.10000E-01 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 7000
SET IS SELECTED NODES IN RANGE 4465 TO 4479 IN STEPS OF 14
GEOMETRY INCREMENTS ARE 0.00000E+00 0.00000E+00-0.10000E-01 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 7000
SET IS SELECTED NODES IN RANGE 4555 TO 4569 IN STEPS OF 14
GEOMETRY INCREMENTS ARE 0.00000E+00 0.00000E+00-0.10000E-01 SPACING= 1.0000

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 7000
SET IS SELECTED NODES IN RANGE 4618 TO 4628 IN STEPS OF 10
GEOMETRY INCREMENTS ARE 0.00000E+00 0.00000E+00-0.10000E-01 SPACING= 1.0000

PREP7:

ELEMENT TYPE 2 IS CONTAC52 3-D INTERFACE
KEYOPT(1-12)= 0 0 0 0 0 0 0 0 0 0 0 0
INOPR = 1

CURRENT NODAL DOF SET IS UX UY UZ ROTX ROTY ROTZ
THREE-DIMENSIONAL MODEL

PREP7:

REAL CONSTANT SET 11 ITEMS 1 TO 6
0.10000E+08 0.00000E+00 1.0000 0.00000E+00 0.00000E+00 0.00000E+00

PREP7:

REAL CONSTANT SET 20 ITEMS 1 TO 6
0.10000E+07 0.00000E+00 1.0000 0.00000E+00 0.00000E+00 0.00000E+00

PREP7:

ELEMENT TYPE SET TO 2

PREP7:

REAL CONSTANT NUMBER= 11

PREP7:

ELEMENT 641 11315 4315

PREP7:

GENERATE 15 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 641 TO 641 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 655

PREP7:

ELEMENT 656 11465 4465

PREP7:

ELEMENT 657 11479 4479

PREP7:

ELEMENT 658 11555 4555

PREP7:

ELEMENT 659 11569 4569

PREP7:

ELEMENT 660 11618 4618

PREP7:

ELEMENT 661 11628 4628

PREP7:

REAL CONSTANT NUMBER = 20

PREP7:

ELEMENT 662 334 30334

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 662 TO 662 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 663

PREP7:

ELEMENT 664 337 30337

PREP7:

GENERATE 3 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 664 TO 664 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 666

PREP7:

ELEMENT 667 341 30341

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 667 TO 667 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 668

PREP7:

ELEMENT 669 357 30357

PREP7:

ELEMENT 670 387 30387

PREP7:

GENERATE 3 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 15
SET IS SELECTED ELEMENTS IN RANGE 670 TO 670 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 672

PREP7:

ELEMENT 673 447 30447

PREP7:

ELEMENT 674 349 30349

PREP7:

ELEMENT 675 379 30379

PREP7:

GENERATE 3 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 15
SET IS SELECTED ELEMENTS IN RANGE 675 TO 675 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 677

PREP7:

ELEMENT 678 439 30439

PREP7:

ELEMENT 679 454 30454

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 679 TO 679 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 680

PREP7:

ELEMENT 681 457 30457

PREP7:

GENERATE 3 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 681 TO 681 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 683

PREP7:

ELEMENT 684 461 30461

PREP7:

GENERATE 2 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 684 TO 684 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 685

PREP7:

SELECT FOR ITEM=NODE COMPONENT=
IN RANGE 11315 TO 11329 STEP 1

15 NODES (OF 795 DEFINED) SELECTED BY NSEL COMMAND.

PREP7:

ALSO SELECT FOR ITEM=NODE COMPONENT=
IN RANGE 11465 TO 11479 STEP 14

17 NODES (OF 795 DEFINED) SELECTED BY NSEL COMMAND.

PREP7:

ALSO SELECT FOR ITEM=NODE COMPONENT=
IN RANGE 11555 TO 11569 STEP 14

19 NODES (OF 795 DEFINED) SELECTED BY NSEL COMMAND.

PREP7:

ALSO SELECT FOR ITEM=NODE COMPONENT=
IN RANGE 11618 TO 11628 STEP 10

21 NODES (OF 795 DEFINED) SELECTED BY NSEL COMMAND.

PREP7:

SPECIFIED CONSTRAINT UX FOR SELECTED NODES 1 TO 30462 BY 1
REAL= 0.000000000E+00 IMAG= 0.000000000E+00
ADDITIONAL DOFS= UY UZ ROTX ROTY ROTZ

PREP7:

SELECT ALL ENTITIES OF TYPE= ALL AND BELOW

ALL SELECT FOR ITEM=VOLU COMPONENT=
IN RANGE 0 TO 0 STEP 1

0 VOLUMES (OF 0 DEFINED) SELECTED BY VSEL COMMAND.

ALL SELECT FOR ITEM=AREA COMPONENT =
IN RANGE 0 TO 0 STEP 1

0 AREAS (OF 0 DEFINED) SELECTED BY ASEL COMMAND.

ALL SELECT FOR ITEM=LINE COMPONENT =
IN RANGE 0 TO 0 STEP 1

0 LINES (OF 0 DEFINED) SELECTED BY LSEL COMMAND.

ALL SELECT FOR ITEM=KP COMPONENT =
IN RANGE 0 TO 0 STEP 1

0 KEYPOINTS (OF 0 DEFINED) SELECTED BY KSEL COMMAND.

ALL SELECT FOR ITEM=ELEM COMPONENT =
IN RANGE 1 TO 685 STEP 1

685 ELEMENTS (OF 685 DEFINED) SELECTED BY ESEL COMMAND.

ALL SELECT FOR ITEM=NODE COMPONENT =
IN RANGE 1 TO 30462 STEP 1

795 NODES (OF 795 DEFINED) SELECTED BY NSEL COMMAND.

PREP7:

COORDINATE SYSTEM 15 DEFINITION, TYPE= 0 (CARTESIAN)
XC,YC,ZC= 40.000 55.375 0.00000E+00
ANGLES= 0.00 0.00 0.00 PARAMETERS= 1.000 1.000
ORIENTATION= 1.00 0.00 0.00 0.00 1.00 0.00 0.00 0.00 1.00

ACTIVE COORDINATE SYSTEM SET TO 15 (CARTESIAN)

PREP7:

ACTIVE COORDINATE SYSTEM SET TO 15 (CARTESIAN)

PREP7:

ELEMENT TYPE SET TO 1

PREP7:

MATERIAL NUMBER SET TO 2

PREP7:

REAL CONSTANT SET 8 ITEMS 1 TO 6
12.000 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00

PREP7:

REAL CONSTANT NUMBER= 8

PREP7:

NODE 20001 KCS= 15 X,Y,Z= -16.000 -16.000 20.000

PREP7:

NODE 20009 KCS= 15 X,Y,Z= 16.000 -16.000 20.000

PREP7:

FILL 7 POINTS BETWEEN NODE 20001 AND NODE 20009
START WITH NODE 20002 AND INCREMENT BY 1

PREP7:

GENERATE 9 TOTAL SETS OF NODES WITH INCREMENT 9
SET IS SELECTED NODES IN RANGE 20001 TO 20009 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 0.00000E+00 4.0000 0.00000E+00 SPACING= 1.0000

PREP7:

ELEMENT 686 20001 20002 20011 20010

PREP7:

GENERATE 8 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 686 TO 686 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 693

PREP7:

GENERATE 8 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 9
SET IS SELECTED ELEMENTS IN RANGE 686 TO 693 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER= 749

PREP7:

ACTIVE COORDINATE SYSTEM SET TO 13 (CYLINDRICAL)

PREP7:

NODE 20100 KCS= 13 X,Y,Z= 25.000 0.00000E+00 20.000

PREP7:

NODE 20108 KCS= 13 X,Y,Z= 25.000 90.000 20.000

PREP7:

FILL 7 POINTS BETWEEN NODE 20100 AND NODE 20108

START WITH NODE 20101 AND INCREMENT BY 1

PREP7:

NODE 20116 KCS= 13 X,Y,Z= 25.000 180.00 20.000

PREP7:

FILL 7 POINTS BETWEEN NODE 20108 AND NODE 20116
START WITH NODE 20109 AND INCREMENT BY 1

PREP7:

NODE 20117 KCS= 13 X,Y,Z= 25.000 -168.75 20.000

PREP7:

NODE 20124 KCS= 13 X,Y,Z= 25.000 -90.000 20.000

PREP7:

FILL 6 POINTS BETWEEN NODE 20117 AND NODE 20124
START WITH NODE 20118 AND INCREMENT BY 1

PREP7:

NODE 20131 KCS= 13 X,Y,Z= 25.000 -11.250 20.000

PREP7:

FILL 6 POINTS BETWEEN NODE 20124 AND NODE 20131
START WITH NODE 20125 AND INCREMENT BY 1

PREP7:

ELEMENT 750 20045 20100 20101 20054

PREP7:

ELEMENT 751 20054 20101 20102 20063

PREP7:

ELEMENT 752 20063 20102 20103 20072

PREP7:

ELEMENT 753 20072 20103 20104 20081

PREP7:

ELEMENT 754 20081 20104 20105 20080

PREP7:

ELEMENT 755 20080 20105 20106 20079

PREP7:

ELEMENT 756 20079 20106 20107 20078

PREP7:

ELEMENT 757 20078 20107 20108 20077

PREP7:

ELEMENT 758 20077 20108 20109 20076

PREP7:

ELEMENT 759 20076 20109 20110 20075

PREP7:

ELEMENT 760 20075 20110 20111 20074

PREP7:

ELEMENT 761 20074 20111 20112 20073

PREP7:

ELEMENT 762 20073 20112 20113 20064

PREP7:

ELEMENT 763 20064 20113 20114 20055

PREP7:

ELEMENT 764 20055 20114 20115 20046

PREP7:

ELEMENT 765 20046 20115 20116 20037

PREP7:

ELEMENT 766 20037 20116 20117 20028

PREP7:

ELEMENT 767 20028 20117 20118 20019

PREP7:

ELEMENT 768 20019 20118 20119 20010

PREP7:

ELEMENT 769 20010 20119 20120 20001

PREP7:

ELEMENT 770 20001 20120 20121 20002

PREP7:

ELEMENT 771 20002 20121 20122 20003

PREP7:

ELEMENT 772 20003 20122 20123 20004

PREP7:

ELEMENT 773 20004 20123 20124 20005

PREP7:

ELEMENT 774 20005 20124 20125 20006

PREP7:

ELEMENT 775 20006 20125 20126 20007

PREP7:

ELEMENT 776 20007 20126 20127 20008

PREP7:

ELEMENT 777 20008 20127 20128 20009

PREP7:

ELEMENT 778 20009 20128 20129 20018

PREP7:

ELEMENT 779 20018 20129 20130 20027

PREP7:

ELEMENT 780 20027 20130 20131 20036

PREP7:

ELEMENT 781 20036 20131 20100 20045

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 32
SET IS SELECTED NODES IN RANGE 20100 TO 20131 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 4.0000 0.00000E+00 0.00000E+00 SPACING = 1.0000

PREP7:

ELEMENT 782 20100 20132 20133 20101

PREP7:

GENERATE 31 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1
SET IS SELECTED ELEMENTS IN RANGE 782 TO 782 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 812

PREP7:

ELEMENT 813 20131 20163 20132 20100

PREP7:

ELEMENT TYPE 3 IS COMBIN40 COMBINATION
KEYOPT(1-12)= 0 0 3 0 0 0 0 0 0 0 0 0

CURRENT NODAL DOF SET IS UX UY UZ ROTX ROTY ROTZ
THREE-DIMENSIONAL MODEL

PREP7:

REAL CONSTANT SET 9 ITEMS 1 TO 6
23500. 0.00000E+00 0.00000E+00 0.00000E+00 2350.0 0.00000E+00

PREP7:

ELEMENT TYPE SET TO 3

PREP7:

REAL CONSTANT NUMBER = 9

PREP7:

ELEMENT 814 132 20132

PREP7:

GENERATE 32 TOTAL SETS OF ELEMENTS WITH NODE INCREMENT OF 1

SET IS SELECTED ELEMENTS IN RANGE 814 TO 814 IN STEPS OF 1
MAXIMUM ELEMENT NUMBER = 845

PREP7:

SELECT FOR ITEM=NODE COMPONENT =
IN RANGE 20132 TO 20156 STEP 8

4 NODES (OF 940 DEFINED) SELECTED BY NSEL COMMAND.

PREP7:

SPECIFIED CONSTRAINT UX FOR SELECTED NODES 1 TO 30462 BY 1
REAL = 0.000000000E+00 IMAG = 0.000000000E+00
ADDITIONAL DOFS = UY ROTX ROTY ROTZ

PREP7:

SELECT ALL ENTITIES OF TYPE= ALL AND BELOW

ALL SELECT FOR ITEM=VOLUME COMPONENT =
IN RANGE 0 TO 0 STEP 1

0 VOLUMES (OF 0 DEFINED) SELECTED BY VSEL COMMAND.

ALL SELECT FOR ITEM=AREA COMPONENT =
IN RANGE 0 TO 0 STEP 1

0 AREAS (OF 0 DEFINED) SELECTED BY ASEL COMMAND.

ALL SELECT FOR ITEM=LINE COMPONENT =
IN RANGE 0 TO 0 STEP 1

0 LINES (OF 0 DEFINED) SELECTED BY LSEL COMMAND.

ALL SELECT FOR ITEM=KP COMPONENT =
IN RANGE 0 TO 0 STEP 1

0 KEYPOINTS (OF 0 DEFINED) SELECTED BY KSEL COMMAND.

ALL SELECT FOR ITEM=ELEM COMPONENT =
IN RANGE 1 TO 845 STEP 1

845 ELEMENTS (OF 845 DEFINED) SELECTED BY ESEL COMMAND.

ALL SELECT FOR ITEM=NODE COMPONENT =
IN RANGE 1 TO 30462 STEP 1

940 NODES (OF 940 DEFINED) SELECTED BY NSEL COMMAND.

PREP7:

ELEMENT TYPE 4 IS COMBIN40 COMBINATION
KEYOPT(1-12)= 1 0 3 0 0 2 0 0 0 0 0 0

CURRENT NODAL DOF SET IS UX UY UZ ROTX ROTY ROTZ
THREE-DIMENSIONAL MODEL

PREP7:

PARAMETER G = 386.4000

PREP7:

REAL CONSTANT SET 25 ITEMS 1 TO 6
0.10000E+06 0.00000E+00 5.1760 720.00 0.00000E+00 0.00000E+00

PREP7:

GENERATE 2 TOTAL SETS OF NODES WITH INCREMENT 3000
SET IS SELECTED NODES IN RANGE 20041 TO 20041 IN STEPS OF 1
GEOMETRY INCREMENTS ARE 0.00000E+00 0.00000E+00 720.00 SPACING= 1.0000

PREP7:

ELEMENT TYPE SET TO 4

PREP7:

REAL CONSTANT NUMBER= 25

PREP7:

ELEMENT 846 20041 23041

PREP7:

UNIFORM TEMPERATURE= 70.000 (TREF= 0.000)

PREP7:

SELECT ALL ENTITIES OF TYPE= ALL AND BELOW

ALL SELECT FOR ITEM=VOLU COMPONENT=
IN RANGE 0 TO 0 STEP 1

0 VOLUMES (OF 0 DEFINED) SELECTED BY VSEL COMMAND.

ALL SELECT FOR ITEM=AREA COMPONENT=
IN RANGE 0 TO 0 STEP 1

0 AREAS (OF 0 DEFINED) SELECTED BY ASEL COMMAND.

ALL SELECT FOR ITEM=LINE COMPONENT=

IN RANGE 0 TO 0 STEP 1

0 LINES (OF 0 DEFINED) SELECTED BY LSEL COMMAND.

ALL SELECT FOR ITEM=KP COMPONENT=
IN RANGE 0 TO 0 STEP 1

0 KEYPOINTS (OF 0 DEFINED) SELECTED BY KSEL COMMAND.

ALL SELECT FOR ITEM=ELEM COMPONENT=
IN RANGE 1 TO 846 STEP 1

846 ELEMENTS (OF 846 DEFINED) SELECTED BY ESEL COMMAND.

ALL SELECT FOR ITEM=NODE COMPONENT=
IN RANGE 1 TO 30462 STEP 1

941 NODES (OF 941 DEFINED) SELECTED BY NSEL COMMAND.

PREP7:

ALL CURRENT ANSYS DATA WRITTEN TO FILE NAME= file.db
FOR POSSIBLE RESUME FROM THIS POINT

PREP7:

***** ROUTINE COMPLETED ***** CP = 10.480

BEGIN:

***** ANSYS SOLUTION ROUTINE *****

SOLU_LS1:

PERFORM A TRANSIENT ANALYSIS
THIS WILL BE A NEW ANALYSIS

SOLU_LS1:

STEP BOUNDARY CONDITION KEY= 1

SOLU_LS1:

ACEL= 0.00000E+00 0.00000E+00 386.40

SOLU_LS1:

SPECIFIED CONSTRAINT UZ FOR SELECTED NODES 23041 TO 23041 BY 1

REAL = 0.000000000E+00 IMAG = 0.000000000E+00

SOLU_LS1:

DO NOT INCLUDE TRANSIENT EFFECTS FOR ALL DOFS THIS LOAD STEP

SOLU_LS1:

TIME = 0.10000E-04

SOLU_LS1:

USE 2 SUBSTEP(S) THIS LOAD STEP FOR ALL DOFS

SOLU_LS1:

USE A MAXIMUM OF 40 EQUILIBRIUM ITERATIONS EACH SUBSTEP

SOLU_LS1:

WRITE ANSYS LOADS DATA AS FILE=file.s01

SOLU_LS1:

INCLUDE TRANSIENT EFFECTS FOR ALL DOFS THIS LOAD STEP

SOLU_LS1:

TIME = 1.9300

SOLU_LS1:

USE 1200 SUBSTEP(S) THIS LOAD STEP FOR ALL DOFS

SOLU_LS1:

WRITE ALL ITEMS TO THE DATABASE WITH A FREQUENCY OF 5
FOR ALL APPLICABLE ENTITIES

SOLU_LS1:

USE AUTOMATIC TIME STEPPING THIS LOAD STEP

SOLU_LS1:

DELETE SPECIFIED CONSTRAINT UZ FOR SELECTED NODES
RANGE 23041 TO 23041 BY 1

NUMBER OF SPECIFIED CONSTRAINTS DELETED = 1

SOLU_LS1:

WRITE ANSYS LOADS DATA AS FILE=file.s02

SOLU_LS1:

TIME= 1.9800

SOLU_LS1:

USE 500 SUBSTEP(S) THIS LOAD STEP FOR ALL DOFS

SOLU_LS1:

WRITE ALL ITEMS TO THE DATABASE WITH A FREQUENCY OF 3
FOR ALL APPLICABLE ENTITIES

SOLU_LS1:

USE A MAXIMUM OF 40 EQUILIBRIUM ITERATIONS EACH SUBSTEP

SOLU_LS1:

DO NOT USE AUTOMATIC TIME STEPPING THIS LOAD STEP

SOLU_LS1:

WRITE ANSYS LOADS DATA AS FILE=file.s03

SOLU_LS1:

ANSYS REVISION 5.2 13:36:56 09/03/1997

PRINTOUT RESUMED BY /GOP

Load step file number 1. Begin solution

***** ANSYS SOLVE COMMAND *****

*** WARNING *** CP= 12.080 TIME= 13:36:59
Nodes I and J of element 633 (COMBIN14) are not coincident.

*** WARNING *** CP= 12.080 TIME= 13:36:59
Nodes I and J of element 634 (COMBIN14) are not coincident.

*** WARNING *** CP= 12.090 TIME= 13:36:59
Nodes I and J of element 635 (COMBIN14) are not coincident.

*** WARNING *** CP= 12.090 TIME= 13:36:59
Nodes I and J of element 636 (COMBIN14) are not coincident.

*** WARNING *** CP= 12.090 TIME= 13:36:59
Nodes I and J of element 637 (COMBIN14) are not coincident.

*** WARNING *** CP= 12.090 TIME= 13:36:59
Nodes I and J of element 638 (COMBIN14) are not coincident.

*** WARNING *** CP= 12.090 TIME= 13:36:59
Nodes I and J of element 639 (COMBIN14) are not coincident.

*** WARNING *** CP= 12.090 TIME= 13:36:59
Nodes I and J of element 640 (COMBIN14) are not coincident.

*** WARNING *** CP= 12.160 TIME= 13:36:59
Nodes I and J of element 814 (COMBIN40) are not coincident.

*** WARNING *** CP= 12.160 TIME= 13:36:59
Nodes I and J of element 815 (COMBIN40) are not coincident.

*** WARNING *** CP= 12.170 TIME= 13:36:59
Nodes I and J of element 816 (COMBIN40) are not coincident.

*** WARNING *** CP= 12.170 TIME= 13:36:59
Nodes I and J of element 817 (COMBIN40) are not coincident.

*** WARNING *** CP= 12.170 TIME= 13:36:59
Nodes I and J of element 818 (COMBIN40) are not coincident.

*** WARNING *** CP= 12.180 TIME= 13:36:59
Nodes I and J of element 819 (COMBIN40) are not coincident.

*** WARNING *** CP= 12.180 TIME= 13:36:59
Nodes I and J of element 820 (COMBIN40) are not coincident.

*** WARNING *** CP= 12.180 TIME= 13:36:59
Nodes I and J of element 821 (COMBIN40) are not coincident.

*** WARNING *** CP= 12.180 TIME= 13:36:59
Nodes I and J of element 822 (COMBIN40) are not coincident.

*** WARNING *** CP= 12.180 TIME= 13:36:59
Nodes I and J of element 823 (COMBIN40) are not coincident.

*** WARNING *** CP= 12.180 TIME= 13:36:59
Nodes I and J of element 824 (COMBIN40) are not coincident.

*** WARNING *** CP= 12.180 TIME= 13:36:59
Nodes I and J of element 825 (COMBIN40) are not coincident.

Error messages discontinued after 20 messages were displayed.
More may exist. See (file.err) for suppressed messages.

*** NOTE *** CP= 12.210 TIME= 13:36:59
The model data was checked and warning messages were found.

Please review output or errors file (file.err) for these warning messages.

SOLUTION OPTIONS

PROBLEM DIMENSIONALITY.3-D
DEGREES OF FREEDOM. UX UY UZ ROTX ROTY ROTZ
ANALYSIS TYPETRANSIENT
SOLUTION METHOD.FULL
PLASTIC MATERIAL PROPERTIES INCLUDED.YES
NEWTON-RAPHSON OPTIONPROGRAM CHOSEN

*** NOTE *** CP= 12.350 TIME= 13:36:59
This load step will be a static (steady-state) step.

*** NOTE *** CP= 12.520 TIME= 13:36:59
Results printout suppressed for interactive execute.

*** NOTE *** CP= 12.520 TIME= 13:36:59
Nonlinear analysis, NROPT set to 1 (full Newton-Raphson solution procedure) for ALL DOFs.
** Reordering still in progress **
** Reordering still in progress **
** Reordering still in progress **

*** NOTE *** CP= 13.060 TIME= 13:37:00
Model is discontinuous - WSORT reordering may be better.
MODEL DISCONTINUOUS ELEMENT 579 USED FOR NEW START AS ELEMENT 1
MODEL DISCONTINUOUS ELEMENT 647 USED FOR NEW START AS ELEMENT 3
MODEL DISCONTINUOUS ELEMENT 114 USED FOR NEW START AS ELEMENT 5

LOAD STEP OPTIONS

LOAD STEP NUMBER. 1
TIME AT END OF THE LOAD STEP. 0.10000E-04
NUMBER OF SUBSTEPS. 2
MAXIMUM NUMBER OF EQUILIBRIUM ITERATIONS. 40
STEP CHANGE BOUNDARY CONDITIONS YES
TRANSIENT (INERTIA) EFFECTS OFF
TERMINATE ANALYSIS IF NOT CONVERGEDYES (EXIT)
CONVERGENCE CONTROLS.USE DEFAULTS
INERTIA LOADS X Y Z
ACEL 0.00000E+00 0.00000E+00 386.40
COPY INTEGRATION POINT VALUES TO NODE YES, FOR ELEMENTS WITH
ACTIVE MAT. NONLINEARITIES
PRINT OUTPUT CONTROLSNO PRINTOUT
DATABASE OUTPUT CONTROLS
ITEM FREQUENCY COMPONENT
ALL 5
ALL 3

Element Formation Element = 480 Cum. Iter. = 1 CP = 24.160
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 1.

***** CENTROID, MASS, AND MASS MOMENTS OF INERTIA *****

CALCULATIONS ASSUME ELEMENT MASS AT ELEMENT CENTROID

TOTAL MASS = 19.851

CENTROID	MOM. OF INERTIA ABOUT ORIGIN	MOM. OF INERTIA ABOUT CENTROID
XC = 67.930	IXX = 0.2897E+07	IXX = 0.2118E+07
YC = 49.800	IYY = 0.2962E+07	IYY = 0.2141E+07
ZC = 191.66	IZZ = 0.1897E+06	IZZ = 0.4884E+05
	IXY = -0.6633E+05	IXY = 822.2
	IYZ = -0.2108E+06	IYZ = -0.2133E+05
	IZX = -0.1514E+06	IZX = 0.1071E+06

*** MASS SUMMARY BY ELEMENT TYPE ***

TYPE	MASS
1	14.6755
4	5.17598

Range of element maximum matrix coefficients in global coordinates

Maximum = 4.038371725E+10 at element 762.

Minimum = 10 at element 636.

*** ELEMENT MATRIX FORMULATION TIMES

TYPE	NUMBER	ENAME	TOTAL CP	AVE CP
1	760	SHELL43	19.890	0.026
2	45	CONTAC52	0.070	0.002
3	32	COMBIN40	0.050	0.002
4	1	COMBIN40	0.000	0.000
5	4	COMBIN14	0.000	0.000
6	4	COMBIN14	0.010	0.003

Time at end of element matrix formulation CP = 33.4900017.

Solution Preparation Element = 560 Cum. Iter. = 1 CP = 34.410

Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 1.

FORCE CONVERGENCE VALUE = 271.3 CRITERION = 0.2713

MOMENT CONVERGENCE VALUE = 0.0000E+00 CRITERION = 0.1000E-02

Estimated number of active DOF = 5101.

Maximum wavefront = 372.

Equation Solution Element = 670 Cum. Iter. = 1 CP = 45.010

Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 1.

F Convergence Norm = 271.28 Previous Norm = 271.28
 Time at end of matrix triangularization CP = 47.5999985.
 Equation solver maximum pivot = 1.00419965E+11 at node 20077 ROTY.
 Equation solver minimum pivot = 23.0170983 at node 156 ROTZ.
 EQUIL ITER 1 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = -0.8133E-02
 Element Formation Element = 290 Cum. Iter. = 2 CP = 55.580
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 2.
 F Convergence Norm = 271.28 Previous Norm = 271.28
 Element Formation Element = 700 Cum. Iter. = 2 CP = 66.420
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 2.
 F Convergence Norm = 271.28 Previous Norm = 271.28
 FORCE CONVERGENCE VALUE = 3476. CRITERION = 1.962
 MOMENT CONVERGENCE VALUE = 0.7885E-07 CRITERION = 5.083 <<< CONVERGED
 * RESIDUAL INCREASED. PREV SOLN REMOVED. DESCENT PARAM SET TO 1.000
 Element Formation Element = 200 Cum. Iter. = 2 CP = 77.080
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 2.
 F Convergence Norm = 271.28 Previous Norm = 271.28
 M Convergence Norm = 0.78851E-07 Previous Norm = 0.00000E+00
 Element Formation Element = 640 Cum. Iter. = 2 CP = 87.700
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 2.
 F Convergence Norm = 271.28 Previous Norm = 271.28
 M Convergence Norm = 0.78851E-07 Previous Norm = 0.00000E+00
 FORCE CONVERGENCE VALUE = 271.3 CRITERION = 0.2713
 MOMENT CONVERGENCE VALUE = 0.0000E+00 CRITERION = 0.1000E-02
 Equation Solution Element = 340 Cum. Iter. = 2 CP = 98.450
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 2.
 F Convergence Norm = 271.28 Previous Norm = 271.28
 M Convergence Norm = 0.00000E+00 Previous Norm = 0.78851E-07
 EQUIL ITER 2 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = -0.8975E-02
 Element Formation Element = 10 Cum. Iter. = 3 CP = 108.870
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 3.
 F Convergence Norm = 271.28 Previous Norm = 271.28
 M Convergence Norm = 0.00000E+00 Previous Norm = 0.78851E-07
 Element Formation Element = 440 Cum. Iter. = 3 CP = 119.790
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 3.
 F Convergence Norm = 271.28 Previous Norm = 271.28
 M Convergence Norm = 0.00000E+00 Previous Norm = 0.78851E-07
 Element Formation Element = 820 Cum. Iter. = 3 CP = 130.340
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 3.
 F Convergence Norm = 271.28 Previous Norm = 271.28
 M Convergence Norm = 0.00000E+00 Previous Norm = 0.78851E-07
 FORCE CONVERGENCE VALUE = 124.3 CRITERION = 1.908
 MOMENT CONVERGENCE VALUE = 0.1239E-06 CRITERION = 9.243 <<< CONVERGED
 Equation Solution Element = 570 Cum. Iter. = 3 CP = 140.940
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 3.
 F Convergence Norm = 124.34 Previous Norm = 271.28
 M Convergence Norm = 0.12391E-06 Previous Norm = 0.00000E+00
 EQUIL ITER 3 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = 0.6531E-04
 Element Formation Element = 190 Cum. Iter. = 4 CP = 151.090
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 4.
 F Convergence Norm = 124.34 Previous Norm = 271.28
 M Convergence Norm = 0.12391E-06 Previous Norm = 0.00000E+00

Element Formation Element = 620 Cum. Iter. = 4 CP = 161.880
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 4.
 F Convergence Norm = 124.34 Previous Norm = 271.28
 M Convergence Norm = 0.12391E-06 Previous Norm = 0.00000E+00
 FORCE CONVERGENCE VALUE = 97.84 CRITERION = 1.908
 MOMENT CONVERGENCE VALUE = 0.1762E-09 CRITERION = 9.216 <<< CONVERGED
 Equation Solution Element = 290 Cum. Iter. = 4 CP = 172.580
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 4.
 F Convergence Norm = 97.841 Previous Norm = 124.34
 M Convergence Norm = 0.17625E-09 Previous Norm = 0.12391E-06
 Equation Solution Element = 840 Cum. Iter. = 4 CP = 182.940
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 4.
 F Convergence Norm = 97.841 Previous Norm = 124.34
 M Convergence Norm = 0.17625E-09 Previous Norm = 0.12391E-06
 EQUIL ITER 4 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = 0.5336E-04
 Element Formation Element = 380 Cum. Iter. = 5 CP = 193.260
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 5.
 F Convergence Norm = 97.841 Previous Norm = 124.34
 M Convergence Norm = 0.17625E-09 Previous Norm = 0.12391E-06
 Element Formation Element = 770 Cum. Iter. = 5 CP = 203.750
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 5.
 F Convergence Norm = 97.841 Previous Norm = 124.34
 M Convergence Norm = 0.17625E-09 Previous Norm = 0.12391E-06
 FORCE CONVERGENCE VALUE = 81.77 CRITERION = 1.908
 MOMENT CONVERGENCE VALUE = 0.1464E-09 CRITERION = 9.194 <<< CONVERGED
 RESIDUAL DECREASED. DESCENT PARAMETER SET TO 0.2500
 Equation Solution Element = 490 Cum. Iter. = 5 CP = 214.300
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 5.
 F Convergence Norm = 81.771 Previous Norm = 97.841
 M Convergence Norm = 0.14641E-09 Previous Norm = 0.17625E-09
 EQUIL ITER 5 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = 0.4508E-04
 Element Formation Element = 130 Cum. Iter. = 6 CP = 224.430
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 6.
 F Convergence Norm = 81.771 Previous Norm = 97.841
 M Convergence Norm = 0.14641E-09 Previous Norm = 0.17625E-09
 Element Formation Element = 570 Cum. Iter. = 6 CP = 235.380
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 6.
 F Convergence Norm = 81.771 Previous Norm = 97.841
 M Convergence Norm = 0.14641E-09 Previous Norm = 0.17625E-09
 FORCE CONVERGENCE VALUE = 72.68 CRITERION = 1.909
 MOMENT CONVERGENCE VALUE = 0.1180E-09 CRITERION = 9.176 <<< CONVERGED
 RESIDUAL DECREASED. DESCENT PARAMETER SET TO 0.6250E-01
 Equation Solution Element = 180 Cum. Iter. = 6 CP = 245.960
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 6.
 F Convergence Norm = 72.681 Previous Norm = 81.771
 M Convergence Norm = 0.11799E-09 Previous Norm = 0.14641E-09
 Equation Solution Element = 740 Cum. Iter. = 6 CP = 256.500
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 6.
 F Convergence Norm = 72.681 Previous Norm = 81.771
 M Convergence Norm = 0.11799E-09 Previous Norm = 0.14641E-09
 EQUIL ITER 6 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = 0.1360E-03
 Element Formation Element = 340 Cum. Iter. = 7 CP = 267.020

Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 7.
 F Convergence Norm = 72.681 Previous Norm = 81.771
 M Convergence Norm = 0.11799E-09 Previous Norm = 0.14641E-09
 Element Formation Element = 750 Cum. Iter. = 7 CP = 277.970
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 7.
 F Convergence Norm = 72.681 Previous Norm = 81.771
 M Convergence Norm = 0.11799E-09 Previous Norm = 0.14641E-09
 FORCE CONVERGENCE VALUE = 57.94 CRITERION = 1.909
 MOMENT CONVERGENCE VALUE = 0.2925E-09 CRITERION = 9.131 <<< CONVERGED
 RESIDUAL DECREASED. DESCENT PARAMETER SET TO 0.1562E-01
 Equation Solution Element = 440 Cum. Iter. = 7 CP = 288.050
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 7.
 F Convergence Norm = 57.938 Previous Norm = 72.681
 M Convergence Norm = 0.29248E-09 Previous Norm = 0.11799E-09
 EQUIL ITER 7 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = 0.2990E-03
 Element Formation Element = 90 Cum. Iter. = 8 CP = 298.350
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 8.
 F Convergence Norm = 57.938 Previous Norm = 72.681
 M Convergence Norm = 0.29248E-09 Previous Norm = 0.11799E-09
 Element Formation Element = 510 Cum. Iter. = 8 CP = 308.780
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 8.
 F Convergence Norm = 57.938 Previous Norm = 72.681
 M Convergence Norm = 0.29248E-09 Previous Norm = 0.11799E-09
 Solution Preparation Element = 710 Cum. Iter. = 8 CP = 319.520
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 8.
 F Convergence Norm = 57.938 Previous Norm = 72.681
 M Convergence Norm = 0.29248E-09 Previous Norm = 0.11799E-09
 FORCE CONVERGENCE VALUE = 32.00 CRITERION = 1.910
 MOMENT CONVERGENCE VALUE = 0.6824E-09 CRITERION = 9.053 <<< CONVERGED
 RESIDUAL DECREASED. DESCENT PARAMETER SET TO 0.0000E+00
 Equation Solution Element = 690 Cum. Iter. = 8 CP = 330.440
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 8.
 F Convergence Norm = 31.998 Previous Norm = 57.938
 M Convergence Norm = 0.68245E-09 Previous Norm = 0.29248E-09
 EQUIL ITER 8 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = 0.2934E-03
 Element Formation Element = 300 Cum. Iter. = 9 CP = 340.940
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 9.
 F Convergence Norm = 31.998 Previous Norm = 57.938
 M Convergence Norm = 0.68245E-09 Previous Norm = 0.29248E-09
 Element Formation Element = 710 Cum. Iter. = 9 CP = 351.700
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 9.
 F Convergence Norm = 31.998 Previous Norm = 57.938
 M Convergence Norm = 0.68245E-09 Previous Norm = 0.29248E-09
 FORCE CONVERGENCE VALUE = 7.863 CRITERION = 1.911
 MOMENT CONVERGENCE VALUE = 0.6815E-09 CRITERION = 8.989 <<< CONVERGED
 Equation Solution Element = 420 Cum. Iter. = 9 CP = 362.430
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 9.
 F Convergence Norm = 7.8630 Previous Norm = 31.998
 M Convergence Norm = 0.68147E-09 Previous Norm = 0.68245E-09
 EQUIL ITER 9 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = 0.9643E-04
 Element Formation Element = 60 Cum. Iter. = 10 CP = 372.440
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 10.

F Convergence Norm = 7.8630 Previous Norm = 31.998
 M Convergence Norm = 0.68147E-09 Previous Norm = 0.68245E-09
 Element Formation Element = 490 Cum. Iter. = 10 CP = 383.160
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 10.
 F Convergence Norm = 7.8630 Previous Norm = 31.998
 M Convergence Norm = 0.68147E-09 Previous Norm = 0.68245E-09
 Solution Preparation Element = 400 Cum. Iter. = 10 CP = 393.810
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 10.
 F Convergence Norm = 7.8630 Previous Norm = 31.998
 M Convergence Norm = 0.68147E-09 Previous Norm = 0.68245E-09
 FORCE CONVERGENCE VALUE = 0.2128E-09 CRITERION = 1.911 <<< CONVERGED
 MOMENT CONVERGENCE VALUE = 0.2888E-09 CRITERION = 8.969 <<< CONVERGED
 >>> SOLUTION CONVERGED AFTER EQUILIBRIUM ITERATION 9
 Element Output Element = 700 Cum. Iter. = 9 CP = 404.450
 Time = 0.50000E-05 Load Step = 1 Substep = 1 Equilibrium Iteration = 9.
 F Convergence Norm = 0.21279E-09 Previous Norm = 7.8630
 M Convergence Norm = 0.28883E-09 Previous Norm = 0.68147E-09

*** ELEMENT RESULT CALCULATION TIMES

TYPE	NUMBER	ENAME	TOTAL CP	AVE CP
1	760	SHELL43	11.370	0.015
2	45	CONTAC52	0.070	0.002
3	32	COMBIN40	0.010	0.000
4	1	COMBIN40	0.010	0.010
5	4	COMBIN14	0.000	0.000
6	4	COMBIN14	0.000	0.000

*** NODAL LOAD CALCULATION TIMES

TYPE	NUMBER	ENAME	TOTAL CP	AVE CP
1	760	SHELL43	0.140	0.000
2	45	CONTAC52	0.010	0.000
3	32	COMBIN40	0.010	0.000
4	1	COMBIN40	0.000	0.000
5	4	COMBIN14	0.000	0.000
6	4	COMBIN14	0.000	0.000

*** LOAD STEP 1 SUBSTEP 1 COMPLETED. CUM ITER = 9

*** TIME = 0.500000E-05 TIME INC = 0.500000E-05

Element Formation Element = 170 Cum. Iter. = 10 CP = 412.530
 Time = 0.10000E-04 Load Step = 1 Substep = 2 Equilibrium Iteration = 1.
 F Convergence Norm = 0.21279E-09 Previous Norm = 7.8630
 M Convergence Norm = 0.28883E-09 Previous Norm = 0.68147E-09
 Element Formation Element = 600 Cum. Iter. = 10 CP = 422.920
 Time = 0.10000E-04 Load Step = 1 Substep = 2 Equilibrium Iteration = 1.
 F Convergence Norm = 0.21279E-09 Previous Norm = 7.8630
 M Convergence Norm = 0.28883E-09 Previous Norm = 0.68147E-09
 FORCE CONVERGENCE VALUE = 0.2128E-09 CRITERION = 1.911
 MOMENT CONVERGENCE VALUE = 0.2888E-09 CRITERION = 8.969
 Equation Solution Element = 250 Cum. Iter. = 10 CP = 433.300
 Time = 0.10000E-04 Load Step = 1 Substep = 2 Equilibrium Iteration = 1.

F Convergence Norm = 0.21279E-09 Previous Norm = 0.21279E-09
 M Convergence Norm = 0.28883E-09 Previous Norm = 0.28883E-09
 Equation Solution Element = 810 Cum. Iter. = 10 CP = 444.020
 Time = 0.10000E-04 Load Step = 1 Substep = 2 Equilibrium Iteration = 1.
 F Convergence Norm = 0.21279E-09 Previous Norm = 0.21279E-09
 M Convergence Norm = 0.28883E-09 Previous Norm = 0.28883E-09
 EQUIL ITER 1 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = -0.1685E-12
 Element Formation Element = 380 Cum. Iter. = 11 CP = 454.690
 Time = 0.10000E-04 Load Step = 1 Substep = 2 Equilibrium Iteration = 2.
 F Convergence Norm = 0.21279E-09 Previous Norm = 0.21279E-09
 M Convergence Norm = 0.28883E-09 Previous Norm = 0.28883E-09
 Element Formation Element = 770 Cum. Iter. = 11 CP = 465.190
 Time = 0.10000E-04 Load Step = 1 Substep = 2 Equilibrium Iteration = 2.
 F Convergence Norm = 0.21279E-09 Previous Norm = 0.21279E-09
 M Convergence Norm = 0.28883E-09 Previous Norm = 0.28883E-09
 FORCE CONVERGENCE VALUE = 0.6190E-11 CRITERION = 1.911 <<< CONVERGED
 MOMENT CONVERGENCE VALUE = 0.2395E-11 CRITERION = 8.969 <<< CONVERGED
 >>> SOLUTION CONVERGED AFTER EQUILIBRIUM ITERATION 1
 Element Output Element = 410 Cum. Iter. = 10 CP = 475.060
 Time = 0.10000E-04 Load Step = 1 Substep = 2 Equilibrium Iteration = 1.
 F Convergence Norm = 0.61900E-11 Previous Norm = 0.21279E-09
 M Convergence Norm = 0.23948E-11 Previous Norm = 0.28883E-09
 *** LOAD STEP 1 SUBSTEP 2 COMPLETED. CUM ITER = 10
 *** TIME = 0.100000E-04 TIME INC = 0.500000E-05

*** PROBLEM STATISTICS

ACTUAL NO. OF ACTIVE DEGREES OF FREEDOM = 5097
 R.M.S. WAVEFRONT SIZE = 270.8

*** ANSYS BINARY FILE STATISTICS

BUFFER SIZE USED = 4096
 3.984 MB WRITTEN ON ELEMENT MATRIX FILE: file.emat
 11.688 MB WRITTEN ON ELEMENT SAVED DATA FILE: file.esav
 10.281 MB WRITTEN ON TRIANGULARIZED MATRIX FILE: file.tri
 2.000 MB WRITTEN ON RESULTS FILE: file.rst
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PRINTOUT RESUMED BY /GOP

Load step file number 2. Begin solution ...

***** ANSYS SOLVE COMMAND *****

*** NOTE *** CP = 483.210 TIME = 13:45:14
 Results printout suppressed for interactive execute.

*** NOTE *** CP = 483.210 TIME = 13:45:14
 Nonlinear analysis, NROPT set to 2 (modified Newton-Raphson solution procedure) for ALL DOFs.

LOAD STEP OPTIONS

```

LOAD STEP NUMBER. .... 2
TIME AT END OF THE LOAD STEP. .... 1.9300
AUTOMATIC TIME STEPPING ..... ON
INITIAL NUMBER OF SUBSTEPS ..... 1200
MAXIMUM NUMBER OF SUBSTEPS ..... 1200
MINIMUM NUMBER OF SUBSTEPS ..... 1
MAXIMUM NUMBER OF EQUILIBRIUM ITERATIONS. .... 40
STEP CHANGE BOUNDARY CONDITIONS ..... YES
TRANSIENT (INERTIA) EFFECTS
  STRUCTURAL DOFS. .... ON
TRANSIENT INTEGRATION PARAMETERS
  ALPHA. .... 0.25251
  DELTA. .... 0.50500
TERMINATE ANALYSIS IF NOT CONVERGED ..... YES (EXIT)
CONVERGENCE CONTROLS. .... USE DEFAULTS
INERTIA LOADS
  X Y Z
  ACEL ..... 0.00000E+00 0.00000E+00 386.40
COPY INTEGRATION POINT VALUES TO NODE ..... YES, FOR ELEMENTS WITH
  ACTIVE MAT. NONLINEARITIES
PRINT OUTPUT CONTROLS ..... NO PRINTOUT
DATABASE OUTPUT CONTROLS
  ITEM FREQUENCY COMPONENT
  ALL 3
  ALL 5

```

Element Formation Element = 10 Cum. Iter. = 11 CP = 484.900
 Time = 0.16183E-02 Load Step = 2 Substep = 1 Equilibrium Iteration = 1.
 F Convergence Norm = 0.61900E-11 Previous Norm = 0.21279E-09
 M Convergence Norm = 0.23948E-11 Previous Norm = 0.28883E-09
 Element Formation Element = 440 Cum. Iter. = 11 CP = 495.530
 Time = 0.16183E-02 Load Step = 2 Substep = 1 Equilibrium Iteration = 1.
 F Convergence Norm = 0.61900E-11 Previous Norm = 0.21279E-09
 M Convergence Norm = 0.23948E-11 Previous Norm = 0.28883E-09
 Element Formation Element = 840 Cum. Iter. = 11 CP = 506.280
 Time = 0.16183E-02 Load Step = 2 Substep = 1 Equilibrium Iteration = 1.
 F Convergence Norm = 0.61900E-11 Previous Norm = 0.21279E-09
 M Convergence Norm = 0.23948E-11 Previous Norm = 0.28883E-09
 FORCE CONVERGENCE VALUE = 2000. CRITERION = 2.766
 MOMENT CONVERGENCE VALUE = 0.2395E-11 CRITERION = 8.969
 Equation Solution Element = 590 Cum. Iter. = 11 CP = 516.930
 Time = 0.16183E-02 Load Step = 2 Substep = 1 Equilibrium Iteration = 1.
 F Convergence Norm = 2000.0 Previous Norm = 2000.0
 M Convergence Norm = 0.23948E-11 Previous Norm = 0.23948E-11
 EQUIL ITER 1 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = -0.2524E-03
 Element Formation Element = 200 Cum. Iter. = 12 CP = 527.010
 Time = 0.16183E-02 Load Step = 2 Substep = 1 Equilibrium Iteration = 2.
 F Convergence Norm = 2000.0 Previous Norm = 2000.0
 M Convergence Norm = 0.23948E-11 Previous Norm = 0.23948E-11
 Element Formation Element = 630 Cum. Iter. = 12 CP = 537.890

Time = 0.16183E-02 Load Step = 2 Substep = 1 Equilibrium Iteration = 2.
F Convergence Norm = 2000.0 Previous Norm = 2000.0
M Convergence Norm = 0.23948E-11 Previous Norm = 0.23948E-11
FORCE CONVERGENCE VALUE = 0.3734E-11 CRITERION = 1.911 <<< CONVERGED
MOMENT CONVERGENCE VALUE = 0.1871E-11 CRITERION = 8.969 <<< CONVERGED
>>> SOLUTION CONVERGED AFTER EQUILIBRIUM ITERATION 1

ITERATION SUMMARY FOR INTERMEDIATE LOAD STEPS ARE DELETED.

Element Formation Element = 10 Cum. Iter. = 28 CP = 1768.670
Time = 1.9300 Load Step = 2 Substep = 18 Equilibrium Iteration = 1.
F Convergence Norm = 0.13065E-08 Previous Norm = 0.15383E+08
M Convergence Norm = 0.16021E-11 Previous Norm = 0.17672E-11
Element Formation Element = 450 Cum. Iter. = 28 CP = 1779.490
Time = 1.9300 Load Step = 2 Substep = 18 Equilibrium Iteration = 1.
F Convergence Norm = 0.13065E-08 Previous Norm = 0.15383E+08
M Convergence Norm = 0.16021E-11 Previous Norm = 0.17672E-11
Solution Preparation Element = 10 Cum. Iter. = 28 CP = 1790.260
Time = 1.9300 Load Step = 2 Substep = 18 Equilibrium Iteration = 1.
F Convergence Norm = 0.13065E-08 Previous Norm = 0.15383E+08
M Convergence Norm = 0.16021E-11 Previous Norm = 0.17672E-11
FORCE CONVERGENCE VALUE = 0.1539E+08 CRITERION = 0.1539E+05
MOMENT CONVERGENCE VALUE = 0.1602E-11 CRITERION = 8.969
Equation Solution Element = 590 Cum. Iter. = 28 CP = 1800.710
Time = 1.9300 Load Step = 2 Substep = 18 Equilibrium Iteration = 1.
F Convergence Norm = 0.15391E+08 Previous Norm = 0.15391E+08
M Convergence Norm = 0.16021E-11 Previous Norm = 0.16021E-11
EQUIL ITER 1 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = -0.7397
Element Formation Element = 210 Cum. Iter. = 29 CP = 1811.090
Time = 1.9300 Load Step = 2 Substep = 18 Equilibrium Iteration = 2.
F Convergence Norm = 0.15391E+08 Previous Norm = 0.15391E+08
M Convergence Norm = 0.16021E-11 Previous Norm = 0.16021E-11
Element Formation Element = 640 Cum. Iter. = 29 CP = 1822.010
Time = 1.9300 Load Step = 2 Substep = 18 Equilibrium Iteration = 2.
F Convergence Norm = 0.15391E+08 Previous Norm = 0.15391E+08
M Convergence Norm = 0.16021E-11 Previous Norm = 0.16021E-11
FORCE CONVERGENCE VALUE = 0.4659E-10 CRITERION = 1.911 <<< CONVERGED
MOMENT CONVERGENCE VALUE = 0.1690E-11 CRITERION = 8.969 <<< CONVERGED
>>> SOLUTION CONVERGED AFTER EQUILIBRIUM ITERATION 1
Element Output Element = 170 Cum. Iter. = 28 CP = 1832.490
Time = 1.9300 Load Step = 2 Substep = 18 Equilibrium Iteration = 1.
F Convergence Norm = 0.46592E-10 Previous Norm = 0.15391E+08
M Convergence Norm = 0.16901E-11 Previous Norm = 0.16021E-11
Element Output Element = 840 Cum. Iter. = 28 CP = 1843.200
Time = 1.9300 Load Step = 2 Substep = 18 Equilibrium Iteration = 1.
F Convergence Norm = 0.46592E-10 Previous Norm = 0.15391E+08
M Convergence Norm = 0.16901E-11 Previous Norm = 0.16021E-11
*** LOAD STEP 2 SUBSTEP 18 COMPLETED. CUM ITER = 28
*** TIME = 1.93000 TIME INC = 0.992585E-03

*** RESPONSE FREQ = 0.2509E-14 PERIOD= 0.3986E+15 PTS/CYC = 0.40E+18
ANSYS REVISION 5.2 13:36:57 09/03/1997

PRINTOUT RESUMED BY /GOP

Load step file number 3. Begin solution ...

***** ANSYS SOLVE COMMAND *****

*** NOTE *** CP= 1844.330 TIME= 14:09:46
Results printout suppressed for interactive execute.

*** NOTE *** CP= 1844.330 TIME= 14:09:46
Nonlinear analysis, NROPT set to 2 (modified Newton-Raphson solution procedure) for ALL DOFs.

LOAD STEP OPTIONS

LOAD STEP NUMBER. 3
TIME AT END OF THE LOAD STEP. 1.9800
NUMBER OF SUBSTEPS. 500
MAXIMUM NUMBER OF EQUILIBRIUM ITERATIONS. 40
STEP CHANGE BOUNDARY CONDITIONS. YES
TRANSIENT (INERTIA) EFFECTS
STRUCTURAL DOFS. ON
TRANSIENT INTEGRATION PARAMETERS
ALPHA. 0.25251
DELTA. 0.50500
TERMINATE ANALYSIS IF NOT CONVERGED YES (EXIT)
CONVERGENCE CONTROLS. USE DEFAULTS
INERTIA LOADS X Y Z
ACEL. 0.00000E+00 0.00000E+00 386.40
COPY INTEGRATION POINT VALUES TO NODE YES, FOR ELEMENTS WITH
ACTIVE MAT. NONLINEARITIES
PRINT OUTPUT CONTROLS. NO PRINTOUT
DATABASE OUTPUT CONTROLS
ITEM FREQUENCY COMPONENT
ALL 5
ALL 3

Element Formation Element= 220 Cum. Iter.= 29 CP= 1851.340
Time= 1.9301 Load Step= 3 Substep= 1 Equilibrium Iteration= 1.
F Convergence Norm= 0.46592E-10 Previous Norm= 0.15391E+08
M Convergence Norm= 0.16901E-11 Previous Norm= 0.16021E-11
Element Formation Element= 650 Cum. Iter.= 29 CP= 1861.960
Time= 1.9301 Load Step= 3 Substep= 1 Equilibrium Iteration= 1.
F Convergence Norm= 0.46592E-10 Previous Norm= 0.15391E+08
M Convergence Norm= 0.16901E-11 Previous Norm= 0.16021E-11
FORCE CONVERGENCE VALUE = 0.1528E+09 CRITERION= 0.1528E+06
MOMENT CONVERGENCE VALUE = 0.1690E-11 CRITERION= 8.969
Equation Solution Element= 330 Cum. Iter.= 29 CP= 1872.710

Time = 1.9301 Load Step = 3 Substep = 1 Equilibrium Iteration = 1.
F Convergence Norm = 0.15281E+09 Previous Norm = 0.15281E+09
M Convergence Norm = 0.16901E-11 Previous Norm = 0.16901E-11
EQUIL ITER 1 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = -0.7455E-01
Element Formation Element = 10 Cum. Iter. = 30 CP = 1883.240
Time = 1.9301 Load Step = 3 Substep = 1 Equilibrium Iteration = 2.
F Convergence Norm = 0.15281E+09 Previous Norm = 0.15281E+09
M Convergence Norm = 0.16901E-11 Previous Norm = 0.16901E-11
Element Formation Element = 430 Cum. Iter. = 30 CP = 1893.840
Time = 1.9301 Load Step = 3 Substep = 1 Equilibrium Iteration = 2.
F Convergence Norm = 0.15281E+09 Previous Norm = 0.15281E+09
M Convergence Norm = 0.16901E-11 Previous Norm = 0.16901E-11
Element Formation Element = 810 Cum. Iter. = 30 CP = 1904.450
Time = 1.9301 Load Step = 3 Substep = 1 Equilibrium Iteration = 2.
F Convergence Norm = 0.15281E+09 Previous Norm = 0.15281E+09
M Convergence Norm = 0.16901E-11 Previous Norm = 0.16901E-11
FORCE CONVERGENCE VALUE = 0.1559E-07 CRITERION = 1.911 <<< CONVERGED
MOMENT CONVERGENCE VALUE = 0.1785E-11 CRITERION = 8.969 <<< CONVERGED
>>> SOLUTION CONVERGED AFTER EQUILIBRIUM ITERATION 1

ITERATION SUMMARY FOR INTERMEDIATE LOAD STEPS ARE DELETED.

*** LOAD STEP 3 SUBSTEP 499 COMPLETED. CUM ITER = 661
*** TIME = 1.97990 TIME INC = 0.100000E-03
*** RESPONSE FREQ = 107.0 PERIOD = 0.9348E-02 PTS/CYC = 93.

Element Formation Element = 30 Cum. Iter. = 662 CP = 44708.328
Time = 1.9800 Load Step = 3 Substep = 500 Equilibrium Iteration = 1.
F Convergence Norm = 0.49422E-07 Previous Norm = 0.13839E+08
M Convergence Norm = 0.83391E-07 Previous Norm = 0.89727E-07
Element Formation Element = 430 Cum. Iter. = 662 CP = 44718.230
Time = 1.9800 Load Step = 3 Substep = 500 Equilibrium Iteration = 1.
F Convergence Norm = 0.49422E-07 Previous Norm = 0.13839E+08
M Convergence Norm = 0.83391E-07 Previous Norm = 0.89727E-07
Element Formation Element = 810 Cum. Iter. = 662 CP = 44728.539
Time = 1.9800 Load Step = 3 Substep = 500 Equilibrium Iteration = 1.
F Convergence Norm = 0.49422E-07 Previous Norm = 0.13839E+08
M Convergence Norm = 0.83391E-07 Previous Norm = 0.89727E-07
FORCE CONVERGENCE VALUE = 0.1355E+08 CRITERION = 0.1362E+05
MOMENT CONVERGENCE VALUE = 0.8339E-07 CRITERION = 145.9
Equation Solution Element = 520 Cum. Iter. = 662 CP = 44738.852
Time = 1.9800 Load Step = 3 Substep = 500 Equilibrium Iteration = 1.
F Convergence Norm = 0.13550E+08 Previous Norm = 0.13550E+08
M Convergence Norm = 0.83391E-07 Previous Norm = 0.83391E-07
EQUIL ITER 1 COMPLETED. NEW TRIANG MATRIX. MAX DOF INC = -0.1423E-01
Element Formation Element = 170 Cum. Iter. = 663 CP = 44749.590
Time = 1.9800 Load Step = 3 Substep = 500 Equilibrium Iteration = 2.

F Convergence Norm = 0.13550E+08 Previous Norm = 0.13550E+08
M Convergence Norm = 0.83391E-07 Previous Norm = 0.83391E-07
Element Formation Element = 590 Cum. Iter. = 663 CP = 44760.129
Time = 1.9800 Load Step = 3 Substep = 500 Equilibrium Iteration = 2.
F Convergence Norm = 0.13550E+08 Previous Norm = 0.13550E+08
M Convergence Norm = 0.83391E-07 Previous Norm = 0.83391E-07
FORCE CONVERGENCE VALUE = 0.5108E-07 CRITERION = 86.43 <<< CONVERGED
MOMENT CONVERGENCE VALUE = 0.8061E-07 CRITERION = 145.9 <<< CONVERGED
>>> SOLUTION CONVERGED AFTER EQUILIBRIUM ITERATION 1
Element Output Element = 40 Cum. Iter. = 662 CP = 44770.059
Time = 1.9800 Load Step = 3 Substep = 500 Equilibrium Iteration = 1.
F Convergence Norm = 0.51077E-07 Previous Norm = 0.13550E+08
M Convergence Norm = 0.80606E-07 Previous Norm = 0.83391E-07
Element Output Element = 710 Cum. Iter. = 662 CP = 44780.512
Time = 1.9800 Load Step = 3 Substep = 500 Equilibrium Iteration = 1.
F Convergence Norm = 0.51077E-07 Previous Norm = 0.13550E+08
M Convergence Norm = 0.80606E-07 Previous Norm = 0.83391E-07
*** LOAD STEP 3 SUBSTEP 500 COMPLETED. CUM ITER = 662
*** TIME = 1.98000 TIME INC = 0.100000E-03
*** RESPONSE FREQ = 106.9 PERIOD = 0.9352E-02 PTS/CYC = 94.

SOLU_LS4:

FINISH SOLUTION PROCESSING

***** ROUTINE COMPLETED ***** CP = 44783.039

*** NOTE *** CP = 44783.051 TIME = 03:01:17
A total of 42 warnings and errors written to file.err.

BEGIN:

PURGE ALL SOLUTION AND POST DATA
SAVE ALL MODEL DATA

*** NOTE *** CP = 44783.551 TIME = 03:01:18
NEW BACKUP FILE NAME = file.dbb.

ALL CURRENT ANSYS DATA WRITTEN TO FILE NAME = file.db
FOR POSSIBLE RESUME FROM THIS POINT

NUMBER OF WARNING MESSAGES ENCOUNTERED = 42
NUMBER OF ERROR MESSAGES ENCOUNTERED = 0

DATA INPUT WRITTEN ON file.log

ANSYS RUN COMPLETED

REV. 5.2

SGI IRIS4D

CP TIME (sec) = 44784.191 TIME = 03:01:19
ELAPSED TIME (sec) = 48279.000 DATE = 09/04/97

41004.3u 3779.8s 13:24:40 92% 0+0k 11444+117211io 750pf+0w
Ran ANSYS 5.2 on workstation: cea7 on: Thu Sep 4 03:01:19 PDT 1997
ANSYS 5.2 has been verified by ICF KH
Class 3 Error Reports are in the directory: /apps/ansys/class3_errors.

POST26 SUMMARY OF VARIABLE EXTREME VALUES

VARI TYPE	IDENTIFIERS	NAME	MINIMUM	AT TIME	MAXIMUM	AT TIME
2 NSOL	104 UZ	uz104	-0.5615	1.948	-0.6351E-02	1.926
3 NSOL	20132 UZ	uz20132	-17.83	1.970	-0.4671E-02	1.926
4 NSOL	23041 UZ	uz23041	-738.6	1.970	-716.1	1.926
5 RFOR	11315 FZ	fz11315	0.0000E+00	1.933	9805.	1.959
6 RFOR	11316 FZ	fz11316	0.0000E+00	1.934	0.1099E+05	1.959
7 RFOR	11317 FZ	fz11317	0.0000E+00	1.942	9208.	1.961
8 RFOR	11318 FZ	fz11318	0.0000E+00	1.953	0.1528E+05	1.949
9 RFOR	11319 FZ	fz11319	0.0000E+00	1.953	7275.	1.949
10 RFOR	11320 FZ	fz11320	0.0000E+00	1.953	5148.	1.962
11 RFOR	11321 FZ	fz11321	0.0000E+00	1.954	5089.	1.968
12 RFOR	11322 FZ	fz11322	0.0000E+00	1.955	8625.	1.960
13 RFOR	11323 FZ	fz11323	0.0000E+00	1.957	0.1027E+05	1.937
14 RFOR	11324 FZ	fz11324	74.34	1.932	8114.	1.937
15 RFOR	11325 FZ	fz11325	0.0000E+00	1.965	5559.	1.961
16 RFOR	11326 FZ	fz11326	71.01	1.932	7077.	1.948
17 RFOR	11327 FZ	fz11327	105.6	1.953	0.1268E+05	1.948
18 RFOR	11328 FZ	fz11328	0.0000E+00	1.953	0.2444E+05	1.944
19 RFOR	11329 FZ	fz11329	0.0000E+00	1.926	0.0000E+00	1.926
20 RFOR	11465 FZ	fz11465	0.0000E+00	1.942	0.3413E+05	1.948
21 RFOR	11479 FZ	fz11479	0.0000E+00	1.926	0.0000E+00	1.926
22 RFOR	11555 FZ	fz11555	0.0000E+00	1.934	0.2388E+05	1.947
23 RFOR	11569 FZ	fz11569	0.0000E+00	1.926	0.0000E+00	1.926
24 RFOR	11618 FZ	fz11618	0.0000E+00	1.934	0.2168E+05	1.946
25 RFOR	11628 FZ	fz11628	0.0000E+00	1.934	0.4765E+05	1.967

POST26 SUMMARY OF VARIABLE EXTREME VALUES							
VARI TYPE	IDENTIFIERS	NAME	MINIMUM	AT TIME	MAXIMUM	AT TIME	
2 ESOL	814 F Z	fz132	-2350.	1.933	29.31	1.930	
3 ESOL	814 F Z	fz20132	-29.31	1.930	2350.	1.933	
4 ESOL	133 F X	fx372	-3532.	1.961	9666.	1.943	
5 ESOL	133 F Y	fy372	-1165.	1.956	6796.	1.944	
6 ESOL	133 F Z	fz372	-5058.	1.938	44.95	1.931	
7 ESOL	136 F X	fx432	614.1	1.932	0.2828E+05	1.945	
8 ESOL	136 F Y	fy432	-3524.	1.945	1302.	1.961	
9 ESOL	136 F Z	fz432	-6744.	1.937	44.65	1.964	
10 ESOL	199 F X	fx456	-0.1071E+05	1.942	2583.	1.956	
11 ESOL	199 F Y	fy456	-0.1451E+05	1.949	2321.	1.958	
12 ESOL	199 F Z	fz456	-6172.	1.959	1188.	1.942	
13 ESOL	205 F X	fx460	-0.2172E+05	1.945	163.1	1.957	
14 ESOL	205 F Y	fy460	-598.6	1.955	0.1434E+05	1.945	
15 ESOL	205 F Z	fz460	-5718.	1.937	1037.	1.941	
16 ESOL	112 F X	fx364	-4630.	1.955	9281.	1.947	
17 ESOL	112 F Y	fy364	-0.1073E+05	1.947	3072.	1.955	
18 ESOL	112 F Z	fz364	-5230.	1.958	859.1	1.961	
19 ESOL	115 F X	fx424	-4622.	1.955	0.1275E+05	1.947	
20 ESOL	115 F Y	fy424	-2774.	1.955	6732.	1.947	
21 ESOL	115 F Z	fz424	-5106.	1.959	2293.	1.949	
22 ESOL	180 F X	fx336	-1929.	1.948	2851.	1.955	
23 ESOL	180 F Y	fy336	-6309.	1.955	5756.	1.948	
24 ESOL	180 F Z	fz336	-6471.	1.937	129.5	1.955	
25 ESOL	186 F X	fx340	-1544.	1.955	4175.	1.949	
26 ESOL	186 F Y	fy340	-2377.	1.955	5276.	1.948	
27 ESOL	186 F Z	fz340	-5556.	1.938	700.6	1.942	
28 NSOL	100 UZ	uz100	-0.5161	1.949	-0.5826E-02	1.926	
29 NSOL	101 UZ	uz101	-0.5287	1.948	-0.6016E-02	1.926	
30 NSOL	103 UZ	uz103	-0.5607	1.948	-0.6298E-02	1.926	
31 NSOL	104 UZ	uz104	-0.5615	1.948	-0.6351E-02	1.926	
32 NSOL	102 UZ	uz102	-0.5471	1.948	-0.6180E-02	1.926	
33 NSOL	105 UZ	uz105	-0.5458	1.948	-0.6320E-02	1.926	
34 NSOL	130 UZ	uz130	-0.5115	1.949	-0.5432E-02	1.926	
35 NSOL	131 UZ	uz131	-0.5123	1.949	-0.5630E-02	1.926	

APPENDIX C
STRUCTURAL CALCULATIONS

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Rev. 0 Appendix - C

Title : Mixer and Transfer pump drop analysis, Project W-211

Designed by : S. Kanjilal *SK* Checked by N. D. Ha *NH* Page C-2

Date 9-16-97

Date 9/16/97

Design qualification of Pump Pit concrete wall for Pump drop impact loading :
Max. reaction from ANSYS analysis = 71.9 kip, Design load for concrete wall is considered as 72 kips.

Define Units for MathCad Program :

kip := 1000-lbf ton := 2-kip ksi := $\frac{\text{kip}}{\text{in}^2}$

Design Base Plate for 72 Kip loading :

W := 72-kip

Section Properties for W12 X 40

A := 11.8-in² bf := 8.005-in dAf := 2.90-in⁻¹ k := 1.25-in
d := 11.94-in tf := 0.515-in Sx := 51.9-in³ Sy := 11.0-in³
tw := 0.295-in rT := 2.14-in rx := 5.13-in ry := 1.93-in

Check load at top of the pit wall (beam end)

Reference to AISC Manual of Steel Construction, Allowable Stress Design, 9th. Edition. (page 2-31)

Compressive Strength of Concrete = 4000 psi

Rebar allowable stress = 60,000 psi.

(Refer Dwg. H - 2 - 76462)

 $\phi_c := 4000\text{-psi}$ $\phi_b := .85$ Allowable Bearing Pressure of Concrete F_p $F_p := \phi_b \cdot 0.7 \cdot \phi_c$ $F_p = 2.38 \cdot 10^3$ psiLength of bearing on concrete wall required = N_p $N_p := \frac{W}{F_p \cdot bf}$ $N_p = 3.779\text{-in}$

Length of bearing actual = 5.75 " > 3.78" O. K

Yield strength of steel = F_y $F_y := 36\text{-ksi}$

(Refer Dwg. H - 2 - 76462)

Check web yielding - (Refer ASD spec. section K1.3)

 $R / tw (N + 2.5k) < .66 F_y$

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Title : Mixer and Transfer pump drop analysis, Project W-211Designed by : S. KanjilalChecked by N. D. HaPage C-3Date 9/16/97Date 9/16/97Find length of bearing required = N_y

$$N_y := \frac{W}{.66 \cdot F_y \cdot t_w} - 2.5 \cdot k \quad N_y = 7.147 \cdot \text{in}$$

Check web crippling : (Ref. ASD Spec. Section K1.4)

$$W = 34 \cdot t_w^2 \cdot \left[1 + 3 \cdot \left(\frac{N}{d} \right) \cdot \left(\frac{t_w}{t_f} \right)^{1.5} \right] \cdot \sqrt{F_y \cdot \frac{t_f}{t_w}}$$

Length of bearing required : N_c

$$N_c := \frac{\frac{W}{34 \cdot t_w^2 \cdot \sqrt{F_y \cdot \frac{t_f}{t_w} \cdot \text{ksi}}} - 1}{\left(\frac{t_w}{t_f} \right)^{1.5}} \cdot \frac{d}{3} \quad N_c = 18.999 \cdot \text{in}$$

The width of wall at top is 5 3/4 " . The flange width is 8" . Try a base plate 8" X 5 3/4" (same as flange width)

set $N := 5.75 \cdot \text{in}$ Bearing Pressure = p_b

$$p_b := \frac{W}{b_f \cdot N} \quad p_b = 1.564 \cdot \text{ksi}$$

Bending stress at face of web

$$\delta := \frac{\frac{1}{2} \cdot p_b \cdot N \cdot \left(\frac{b_f - t_w}{2} \right)^2}{\left(\frac{1}{6} \right) \cdot N \cdot t_w^2} \quad \delta = 801.363 \cdot \text{ksi}$$

Bending stress is too high.

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Title : Mixer and Transfer pump drop analysis, Project W-211

Designed by : S. Kanjilal *SK*Checked by N. D. Ha *N.D.H.*

Page C-4

Date *2/14/97*Date *2/16/97*

Set bearing stress = $0.75 \times F_y$, then

$$p_b := \frac{0.75 \cdot F_y \cdot \frac{1}{6} \cdot t_w^2}{\frac{1}{2} \cdot \left(\frac{b_f - t_w}{2} \right)^2} \quad p_b = 0.053 \cdot \text{ksi}$$

Find length of bearing N_d

$$N_d := \frac{W}{p_b \cdot b_f} \quad N_d = 170.661 \cdot \text{in}$$

Too long.

Add 1/4" stiffener plate on both sides of the web :

Stiffener plate size = 10.91" X 3.855" X 1/4"

Check width-thickness ratio :

$$b_s := 3.855 \cdot \text{in} \quad t_s := 0.25 \cdot \text{in}$$

$$\frac{b_s}{t_s} = 15.42 < 15.8 = 95/\sqrt{F_y} \quad \text{AISC Table B 5.1 O. K.}$$

Effective compression area :

Effective web length = $12 \times t_w$

$$w_{ebl} := 12 \cdot t_w$$

$$w_{ebl} = 3.54 \cdot \text{in}$$

Effective compression area = A_{com}

$$A_{com} := (2 \cdot b_s \cdot t_s) + w_{ebl} \cdot t_w$$

$$A_{com} = 2.972 \cdot \text{in}^2$$

Compressive Stress = δ_a

$$\delta_a := \frac{W}{A_{com}} \quad \delta_a = 24.228 \cdot \text{ksi}$$

The compressive stress is high. Use 2 stiffeners 4" apart.

$$A_{rev} := 2 \cdot (2 \cdot b_s \cdot t_s) + w_{ebl} \cdot t_w$$

$$A_{rev} = 4.899 \cdot \text{in}^2$$

$$\delta_{arev} := \frac{W}{A_{rev}}$$

$$\delta_{arev} = 14.696 \cdot \text{ksi}$$

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Appendix - C

Title : Mixer and Transfer pump drop analysis, Project W-211Designed by : S. KanjilalChecked by N. D. HaPage C-5Date 9/16/07Date 9/16/07Find $K I / r$ for the stiffener section :

$$I_{xx} := 2 \cdot \left(\frac{1}{12} \cdot t_s \cdot b_s^3 \right) \quad I_{xx} = 4.774 \cdot \text{in}^4$$

$$r := \sqrt{\frac{I_{xx}}{A_{rev}}} \quad r = 0.987 \cdot \text{in}$$

$$K := 1 \quad \frac{K \cdot d}{r} = 12.096 \quad E_s := 29 \cdot 10^3 \cdot \text{ksi}$$

$$C_c := \sqrt{\frac{2 \cdot \pi^2 \cdot E_s}{F_y}} \quad C_c = 126.099$$

$$\frac{K \cdot d}{r} = 0.096 \quad C_a := .586 \quad F_a := C_a \cdot F_y$$

$$C_c = 0.096 \quad F_a = 21.096 \cdot \text{ksi} \quad F_a = \text{Allowable compressive stress}$$

Allowable Compressive stress = 21.096 ksi > 14.7 ksi O. K

USE 2 - 1/4" stiffner to the beam with a bearing plate 8" X 5 3/4" . Provide 3/16" all round weld

Check Bolts attaching 2" thick cover plate with beam flange.

Max. reaction at node 534 at the corner of the plate.

This bolt will see shear = 36.852 kips and tension = 7.215 kips.

Provide 2 - 1" dia. A 490 bolts. This is bearing type connection and the bolt is in single shear.

Allowable shear stress (Threads are not included in the shear plane) = 28 ksi (Refer Table J3.2 AISC 9th edition).

Since the bolts carry tension the shear stress allowable is reduced as per Table J3.3, AISC 9th. edition. Allowable Tension stress = F_t Place 2 - 1" dia. bolt at the corner. Area of bolt = A_b

$$A_b := .7854 \cdot \text{in}^2 \quad V := 36852 \cdot \text{lb} \quad T := 7215 \cdot \text{lb}$$

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Appendix - C

Title : Mixer and Transfer pump drop analysis, Project W-211

Designed by : S. Kanjilal *SK*Checked by N. D. Ha *N.D.* Page C-6Date *9/16/97*Date *9/16/97*

$$fv := \frac{\frac{V}{2}}{(Ab)}$$

$$fv = 2.346 \cdot 10^4 \cdot \frac{\text{lb}}{\text{in}^2}$$

Shear stress per bolt = 23.46 kip / sq.in

$$Ft := \sqrt{54^2 - 3.75 \cdot 23.46^2}$$

$$Ft = 29.191$$

Or Tension Allowable Stress = 29.19 ksi
Increase 33 % for occasional loads.

$$Ftallow = 1.33 \times 29.19 = 38.83 \text{ ksi}$$

$$ft := \frac{T}{Ab}$$

$$ft = 4.593 \cdot 10^3 \cdot \frac{\text{lb}}{\text{in}^2}$$

ft = Actual tension stress (= 4.593 ksi) <
Ftallow (= 38.83 ksi) O. K.

Shear stress on this two bolts : 23.46 kip / sq.in

Allowable shear stress 28 ksi X 1.33 = 37.24 ksi >> 23.46 ksi. Hence the shear stress in two corner bolts are O. K

Check bolt at node 514 (Next critical load)

$$V514 := 20096 \cdot \text{lb}$$

$$T514 := 11330 \cdot \text{lb}$$

$$fv514 := \frac{V514}{Ab}$$

$$fv514 = 2.559 \cdot 10^4 \cdot \frac{\text{lb}}{\text{in}^2}$$

Or shear stress in this bolt = 25.59 ksi
Allowable shear stress = 28 ksi X 1.33 =
37.24 ksi (Refer table J3.2 AISC 9th.
Edition)

Tension Allowable (T514)

$$Tens514 := \sqrt{54^2 - 3.75 \cdot 25.59^2}$$

$$Tens514 = 21.455$$

Tension allowable = 21.455 ksi.

Multiplying the allowable by 1.33 for accident condition , Tension allowable = 1.33 X 21.455 =
28.54 ksi

$$t514 := \frac{T514}{Ab}$$

$$t514 = 1.443 \cdot 10^4 \cdot \frac{\text{lb}}{\text{in}^2}$$

< 28.54 ksi (Tension Allowable)

1" dia. bolt is O. K. For other bolts the loads are comparatively smaller, but use 1 " dia. bolt
(conservative.)

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Title : Mixer and Transfer pump drop analysis, Project W-211

Designed by : S. Kanjilal *SK* Checked by : N. D. Ha *NH* Page C-7Date 9/16/97Date 9/16/97

Check 12 wf 40 on the west wall.

Maximum reaction = 28.7 kip / ft.

Consider 1 ft. of the section.

Load on the effective flange width on one side of flange :

$$pf := \frac{28700 \cdot \text{lb}}{\left(\frac{8.005}{12}\right) \cdot \text{ft}} \cdot \frac{3.253}{12} \cdot \text{ft} \quad pf = 1.166 \cdot 10^4 \cdot \text{lb}$$

where pf = load / ft on one side of the flange.

Moment of this load at the root of the flange
(at the point where flange starts curving to web)

$$mf := pf \cdot \frac{3.253}{2} \cdot \text{in}$$

$$mf = 1.897 \cdot 10^4 \cdot \text{lb} \cdot \text{in}$$

Section Modulus for 12" length of the section

$$sf := \frac{1}{6} \cdot 12 \cdot \text{in} \cdot (.515 \cdot \text{in})^2 \quad sf = 0.53 \cdot \text{in}^3$$

$$\delta f := \frac{mf}{sf} \quad \delta f = 3.576 \cdot 10^4 \cdot \frac{\text{lb}}{\text{in}^2}$$

Allowable bending stress = .75 X Fy (=36ksi) = 27 ksi AISC 9th edition.

Increase Allowable stress by 1.33 for dynamic loading.

Design allowable stress = 1.33 X 27 = 35.91 ksi > 35.76 ksi

No stiffener required. The beam flanges are O. K.

Check web compression :

$$Aw := 12 \cdot \text{in} \cdot .295 \cdot \text{in} \quad Aw = 3.54 \cdot \text{in}^2$$

$$\delta fc := \frac{28700 \cdot \text{lb}}{Aw} \quad \delta fc = 8.107 \cdot 10^3 \cdot \frac{\text{lb}}{\text{in}^2}$$

Compressive stress in the web = 8.1 ksi
this is small the web is O. K

Title : Mixer and Transfer pump drop analysis, Project W-211

Designed by : S. Kanjilal *SK* Checked by : N. D. Ha *NH* Page C-8

Date 9/16/97

Date 9/16/97

Check welds at the connection of 12 wf 40 and 12 wf 40 :

Weld forces :

Forces in the beam is generated from the bolt forces. Bolts are approx. 2" from the center of web, considering the max. forces at node # 534.

$$f_x := 31220 \cdot \text{lb} \quad f_y := 19580 \cdot \text{lb}$$

$$f_z := 7215 \cdot \text{lb}$$

Weld Properties :

$$A_w := 4 \cdot 3 \cdot \text{in} + 2 \cdot 8.5 \cdot \text{in} \quad A_w = 29 \cdot \text{in}$$

Find C.G. of the weld in X direction :

$$x := \frac{4 \cdot 3 \cdot \text{in} \cdot 1.5 \cdot \text{in} + 2 \cdot 8.5 \cdot \text{in} \cdot \left(4 \cdot \text{in} - \frac{t_w}{2} \right)}{A_w}$$

$$x = 2.879 \cdot \text{in}$$

$$\text{CG from web face} = (4 - .295/2) - 2.879 = .9735"$$

$$m_y := f_z \cdot (2 + .9735) \cdot \text{in} + f_x \cdot 4.25 \cdot \text{in}$$

$$m_y = 1.541 \cdot 10^5 \cdot \text{lb} \cdot \text{in}$$

Torsional properties of the weld :

$$b_w := 3 \cdot \text{in} \quad d_w := 8.5 \cdot \text{in}$$

$$J_w := 2 \cdot \frac{(2 \cdot b_w + d_w)^3}{12} - b_w^2 \cdot \frac{(b_w + d_w)^2}{2 \cdot b_w + d_w}$$

WELD CONFIGURATION

$$J_w = 426.018 \cdot \text{in}^3$$

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Title : Mixer and Transfer pump drop analysis, Project W-211

Designed by : S. Kaniilal ~~SE~~ Checked by N. D. Ha ~~1-1-1-1~~ Page C-9

Date 9/16/97

Date 9/16/97

Weld Stress :

$$f_{xw} := \frac{f_x}{A_w} + \frac{m_y \cdot x}{J_w} \quad f_{xw} = 2.118 \cdot 10^3 \cdot \frac{\text{lb}}{\text{in}}$$

$$f_{yw} := \frac{f_y}{A_w} \quad f_{yw} = 675.172 \cdot \frac{\text{lb}}{\text{in}}$$

$$f_{zw} := \frac{f_z}{A_w} + m_y \cdot \frac{4.25}{J_w} \cdot \text{in} \quad f_{zw} = 1.786 \cdot 10^3 \cdot \frac{\text{lb}}{\text{in}}$$

$$f_r := \sqrt{f_{xw}^2 + f_{yw}^2 + f_{zw}^2} \quad f_r = 2.852 \cdot 10^3 \cdot \frac{\text{lb}}{\text{in}}$$

For 1/4 " weld, weld allowable = .707 X 1/4*in X .3 X 70000 psi = 3711 lb/in > 2852 lb / in.
Weld is O. K.

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Title : Mixer and Transfer pump drop analysis, Project W-211

Designed by : S. Kanjilal Checked by N. D. Ha Page C-10

Date 2/16/97 Date 9/16/97

CHECK CONCRETE WALL :

SECTION OF CONCRETE WALL AT TOP

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Title : Mixer and Transfer pump drop analysis, Project W-211

Designed by : S. Kaniilal *SK* Checked by N. D. Ha *NH* Page C-11

Date 9/16/97

Date 9/16/97

The concrete wall will behave as column of effective width of wall W_b = Width of bearing + 4 X thickness of the wall. (Refer ACI 318/318R - 89 Section 14.2.4)

$t_{wall} := 12\text{-in}$

$b_{wall} := 8\text{-in} + 4 \cdot t_{wall}$

$h_{wall} := 76.75\text{-in} + 6\text{-in}$

Add 6" for fixity
at base.

$b_{wall} = 56\text{-in}$

$h_{wall} = 82.75\text{-in}$

Assumed.

The support reaction is not at the centerline of the wall. As a result, the compressive load will create a moment about the center line of the wall.

Eccentricity = e_{wall}

$$e_{wall} := \left(\frac{5.75}{2} \cdot \text{in} + 6.25\text{-in} \right) - \frac{t_{wall}}{2}$$

Refer sketch of the wall
at top.

$$e_{wall} = 3.125\text{-in}$$

Effective width = 56 inches

TYPICAL WALL REINFORCEMENT

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Title : Mixer and Transfer pump drop analysis. Project W-211

Designed by : S. Kanjilal *SK* Checked by N. D. Ha *N.D.H.* Page C-12

Date 9/16/97

Date 7/16/97

Cross Section of Effective Wall
Width

Weight of concrete = ρ_c in lb/cubic feet

$$\rho_c := 150$$

Compressive strength of Concrete = 4000 psi

$$f_{tc} := 4000$$

Modulus of Elasticity = E_c

$$E_c := \rho_c^{1.5} \cdot 33 \cdot \sqrt{f_{tc}}$$

$$E_c = 3.834 \cdot 10^6$$

Refer Section 8.5 ACI
318 / 318R - 83

$$E_c = 3.834 \times 10^6 \text{ psi}$$

Refer section 9.2.6 ACI 318 / 318R - 83 , the impact load is considered as a live load, hence a load factor of 1.7 will be multiplied to get the required strength of concrete.

Dead weight of concrete at mid height of the wall = D_{wall}

$$bw := \frac{56}{12} \text{ ft}$$

$$tw := 1 \text{ ft}$$

$$hw := \frac{82.75}{12} \text{ ft}$$

$$D_{wall} := bw \cdot tw \cdot \frac{hw}{2} \cdot \rho_c \cdot \frac{\text{lb}}{\text{ft}^3}$$

$$D_{wall} = 2.414 \cdot 10^3 \cdot \text{lb}$$

Ultimate Design Load and Moment = (P_u and M_u)

$$P_{imp} := 70000 \cdot \text{lb}$$

$$P_u := 1.4 \cdot D_{wall} + 1.7 \cdot P_{imp}$$

$$P_u = 1.224 \cdot 10^5 \cdot \text{lb}$$

$$M_u := 1.7 \cdot P_{imp} \cdot e_{wall}$$

$$M_u = 3.719 \cdot 10^5 \cdot \text{lb-in}$$

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Appendix - C

Title : Mixer and Transfer pump drop analysis, Project W-211

Designed by : S. Kaniilal *SK* Checked by : N. D. Ha *N.D.H.* Page C-13

Date : 9/16/97

Date : 9/16/97

Find reinforcement ratio $\rho_r = A_s/bd$

$$\begin{aligned} b_{conc} &:= 12 \cdot \text{in} & d_{conc} &:= 12 \cdot \text{in} - 1.5 \cdot \text{in} - \frac{5}{2} \cdot \text{in} & d_{conc} &= 10.187 \cdot \text{in} \\ A_{st} &:= .31 \cdot \text{in}^2 & A_{st} &= \text{Area of steel per 12" width} & d &= \text{effective depth of conc. section} \\ & & & 2 - \# 5 \text{ bars} & & \text{Clear cover 1.5" (H-2-76462 sh. 1)} \end{aligned}$$

$$\rho_{conc} := \frac{A_{st}}{b_{conc} \cdot d_{conc}} \quad \rho_{conc} = 0.003$$

As the eccentricity 3.125" exceeds wall thickness / 6, the empirical design method is not applicable.

a) Check wall slenderness : kl_u/r where k = effective length factor. For wall laterally restrained and fixed at the base as in this case $k=1$
 l_u effective length = 82.75" r = radius of gyration = .3 X wall thickness (12"). (Refer ACI 318 section 10.11.3)

$$k := 1 \quad l_u := 82.75 \cdot \text{in} \quad r := .3 \cdot 12 \cdot \text{in}$$

$$\frac{k \cdot l_u}{r} = 22.986 < 34, M1b \text{ is zero, slenderness effect is neglected (Refer ACI section 10.11.4.1)}$$

Interaction Diagram for the wall column section :

$$\begin{aligned} f_c &:= 4000 \cdot \frac{\text{lb}}{\text{in}^2} & f_{yt} &:= 60000 \cdot \frac{\text{lb}}{\text{in}^2} & \text{Where } f_c &= \text{concrete compressive strength} \\ & & & & f_{yt} &= \text{steel yield strength} \\ b_{wall} &:= 56 \cdot \text{in} & t_{wall} &:= 12 \cdot \text{in} & b_{wall} &= \text{width of section} \\ & & & & t_{wall} &= \text{thickness of section} \\ A_{s1} &:= 4.67 \cdot .31 \cdot \text{in}^2 & A_{s1} &= 1.448 \cdot \text{in}^2 & & \\ A_{s2} &:= 1.448 \cdot \text{in}^2 & A_{stotal} &:= A_{s1} + A_{s2} & A_{stotal} &= 2.896 \cdot \text{in}^2 \\ A_g &:= b_{wall} \cdot t_{wall} & A_g &= 672 \cdot \text{in}^2 & & \\ \rho_{conc} &:= \frac{A_{stotal}}{A_g} & \rho_{conc} &= 0.003 & & \\ & & & & & A_{s1} \text{ and } A_{s2} \text{ are the steel area on each face of the wall} \\ & & & & & \epsilon_y = \text{the yield strain on steel} \end{aligned}$$

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Title : Mixer and Transfer pump drop analysis, Project W-211

Designed by : S. Kaniilal ~~SK~~ Checked by : N. D. Haffee Page C-14

Date 9/16/97

Date 9/16/97

$$E_{\text{steel}} := 29 \cdot 10^6 \cdot \frac{\text{lb}}{\text{in}^2}$$

$$\epsilon_y := \frac{f_{ys}}{E_{\text{steel}}} \quad \epsilon_y = 0.002$$

$$d1 := 12 \cdot \text{in} - \left(1.5 + \frac{5}{8} + \frac{5}{16} \right) \cdot \text{in} \quad d1 = 9.563 \cdot \text{in}$$

$$d2 := 1.5 \cdot \text{in} + \frac{5}{8} \cdot \text{in} + \frac{5}{16} \cdot \text{in} \quad d2 = 2.438 \cdot \text{in}$$

Calculate max. axial load capacity of this column :

$$\phi P_{n\text{max}} := 0.8 \cdot 7 \cdot (0.85 \cdot f_c \cdot (A_g - A_{\text{stotal}}) + f_{ys} \cdot A_{\text{stotal}})$$

$$\phi P_{n\text{max}} = 1.371 \cdot 10^6 \cdot \text{lb} \quad \text{Or Max axial load} = 1371 \text{ kips.}$$

Compute axial load and moment capacity for balanced failure

$$c := \frac{0.003}{0.003 - (-1 \cdot \epsilon_y)} \cdot d1 \quad c = 5.659 \cdot \text{in} \quad \text{where } c = \text{depth of the neutral axis from the compression face.}$$

$$\epsilon_{s2} := \frac{c - d2}{c} \cdot 0.003 \quad \epsilon_{s2} = 0.002 \quad \text{where } \epsilon_{s1} \text{ and } \epsilon_{s2} \text{ are the strain in the steel in comp and tension face.}$$

$$\epsilon_{s1} := -0.00207$$

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Appendix - C

Title : Mixer and Transfer pump drop analysis, Project W-211

Designed by : S. Kanjilal ~~SA~~ Checked by N. D. Ha ~~NA~~ Page C-15

Date 9/16/97

Date 9/16/97

$$f_s2 := \sigma_{s2} \text{ - Steel}$$

$$f_s2 = 4.953 \cdot 10^4 \cdot \frac{\text{lb}}{\text{in}^2}$$

Stress in steel $f_s2 = 49.53$ kips. < 60 ksi this is the stress in the compressive layer of reinf.

Stress in tension layer is 60 ksi

$$\beta_1 := 1.05 - .05 \cdot \frac{4000 \text{ - psi}}{1000 \text{ - psi}}$$

$$\beta_1 = 0.85$$

a = depth of the equivalent rectangular stress block

$$a := \beta_1 \cdot c$$

$$a = 4.811 \cdot \text{in}$$

Compute forces in the concrete and steel

$$C_c := 0.85 \cdot f_c \cdot a \cdot b_{\text{wall}}$$

$$C_c = 9.159 \cdot 10^5 \cdot \text{lb}$$

Where C_c = force in the concrete
= 915.9 kips.

$$F_{s1} := f_{ys} \cdot A_{s1}$$

$$F_{s1} = 8.686 \cdot 10^4 \cdot \text{lb}$$

Force on reinf. layer on the compressive side

$$F_{s2} := \left(f_s2 - .85 \cdot 4000 \cdot \frac{\text{lb}}{\text{in}^2} \right) \cdot A_{s2}$$

$$F_{s2} = 6.68 \cdot 10^4 \cdot \text{lb}$$

$$P_{n1} := C_c - F_{s1} + F_{s2}$$

$$P_{n1} = 8.959 \cdot 10^5 \cdot \text{lb}$$

ϕP_{n1} = Design axial force
= 627 kips

$$\phi := .7$$

$$\phi \cdot P_{n1} = 6.271 \cdot 10^5 \cdot \text{lb}$$

$$\phi P_{n1} = 627 \text{ kips}$$

Compute M_n

$$M_n := C_c \cdot \left(\frac{t_{\text{wall}}}{2} - \frac{a}{2} \right) + F_{s1} \cdot \left(\frac{t_{\text{wall}}}{2} - d_1 \right) + F_{s2} \cdot \left(\frac{t_{\text{wall}}}{2} - d_2 \right)$$

$$M_n = 3.84 \cdot 10^6 \cdot \text{lb} \cdot \text{in}$$

$$\phi \cdot M_n = 2.688 \cdot 10^6 \cdot \text{lb} \cdot \text{in}$$

$$\phi M_n = 2688 \text{ kip} \cdot \text{in or } 224 \text{ ft} \cdot \text{kip}$$

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Title : Mixer and Transfer pump drop analysis, Project W-211

Designed by : S. Kaniilal *SK* Checked by : N. D. Ha *NH* Page C-16Date *9/16/97*Date *9/16/97*

Compute axial load and moment for the strain is -3 times the balanced strain

$$c := \frac{.003}{.003 - (-3 \cdot \epsilon_y)} \cdot d1$$

$$c = 3.116 \cdot \text{in}$$

where c = depth of the neutral axis
from the compression face.

$$\epsilon s2 := \frac{c - d2}{c} \cdot .003$$

$$\epsilon s2 = 6.531 \cdot 10^{-4}$$

where $\epsilon s1$ and $\epsilon s2$ are the strain in the steel in
comp and tension face.

$$\epsilon s1 := -3 \cdot 0.00207$$

$$\epsilon s1 = -0.006$$

Stress in the reinforcing layers

$$fss2 := \epsilon s2 \cdot E_{\text{steel}}$$

$$fss2 = 1.894 \cdot 10^4 \cdot \frac{\text{lb}}{\text{in}^2}$$

$$fss1 := 60000 \cdot \frac{\text{lb}}{\text{in}^2}$$

$$a1 := \beta1 \cdot c$$

$$a1 = 2.648 \cdot \text{in}$$

Compute forces in concrete and steel

$$Cc1 := .85 \cdot f_c \cdot a1 \cdot b_{\text{wall}}$$

$$Cc1 = 5.043 \cdot 10^5 \cdot \text{lb}$$

Steel

$$Fss1 := f_{ys} \cdot A_s1$$

$$Fss1 = 8.686 \cdot 10^4 \cdot \text{lb}$$

Since $a1$ is greater than $d2$

$$Fss2 := (fss2 - 0.85 \cdot f_c) \cdot A_s2$$

$$Fss2 = 2.25 \cdot 10^4 \cdot \text{lb}$$

Compute $Pn2$

$$Pn2 := Cc1 - Fss1 + Fss2$$

$$Pn2 = 4.399 \cdot 10^5 \cdot \text{lb}$$

$$\phi \cdot Pn2 = 3.079 \cdot 10^5 \cdot \text{lb}$$

$$\text{Axial load allowable} = 308 \text{ kips}$$

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Appendix - C

Title : Mixer and Transfer pump drop analysis, Project W-211

Designed by : S. Kaniilal ~~SB~~ Checked by N. D. Ha ~~Lee~~ Page C-17

Date 9/16/97 Date 9/16/97

Compute Mn

$$Mn1 := \left[Cc1 \cdot \left(\frac{t_{wall}}{2} - \frac{a1}{2} \right) - Fss1 \cdot \left(\frac{t_{wall}}{2} - d1 \right) \right] + Fss2 \cdot \left(\frac{t_{wall}}{2} - d2 \right)$$

$$Mn1 = 2.747 \cdot 10^6 \cdot \text{lb} \cdot \text{in} \quad \phi \cdot Mn1 = 1.923 \cdot 10^6 \cdot \text{lb} \cdot \text{in} \quad \text{Moment} = 1923 \text{ kip} \cdot \text{in} \\ \text{OR } 160.25 \text{ ft kips}$$

Compute axial load and moment for the strain is -5 times the balanced strain

$$c := \frac{.003}{.003 - (-5 \cdot \epsilon_y)} \cdot d1 \quad c = 2.15 \cdot \text{in} \quad \text{where } c = \text{depth of the neutral axis from the compression face.}$$

$$\epsilon s2 := \frac{c - d2}{c} \cdot .003 \quad \epsilon s2 = -4.016 \cdot 10^{-4} \quad \text{where } \epsilon s1 \text{ and } \epsilon s2 \text{ are the strain in the steel in comp and tension face.}$$

$$\epsilon s1 := -5 \cdot 0.00207$$

$$\epsilon s1 = -0.01$$

Stress in the reinforcing layers

$$fss2 := \epsilon s2 \cdot E_{\text{steel}} \quad fss2 = -1.165 \cdot 10^4 \cdot \frac{\text{lb}}{\text{in}^2}$$

$$fss1 := 60000 \cdot \frac{\text{lb}}{\text{in}^2}$$

$$a1 := \beta_1 \cdot c \quad a1 = 1.827 \cdot \text{in}$$

Compute forces in concrete and steel

$$Cc1 := .85 \cdot f_c \cdot a1 \cdot b_{\text{wall}} \quad Cc1 = 3.479 \cdot 10^5 \cdot \text{lb}$$

Steel

$$Fss1 := f_{ys} \cdot A_{s1} \quad Fss1 = 8.686 \cdot 10^4 \cdot \text{lb}$$

Title : Mixer and Transfer pump drop analysis, Project W-211

Designed by : S. Kanjilal Checked by N. D. Ha Page C-18

Date 2/16/97

Date 9/16/97

Since $a1$ is less than $d2$

$$Fss2 := (fss2) \cdot As2$$

$$Fss2 = -1.686 \cdot 10^4 \cdot lb$$

Compute $Pn2$

$$Pn2 := Cc1 - Fss1 + Fss2$$

$$Pn2 = 2.442 \cdot 10^5 \cdot lb$$

$$\phi \cdot Pn2 = 1.709 \cdot 10^5 \cdot lb$$

Axial load allowable = 171 kips

Compute Mn

$$Mn1 := \left[Cc1 \cdot \left(\frac{t_{wall}}{2} - \frac{a1}{2} \right) - Fss1 \cdot \left(\frac{t_{wall}}{2} - d1 \right) \right] + Fss2 \cdot \left(\frac{t_{wall}}{2} - d2 \right)$$

$$Mn1 = 2.019 \cdot 10^6 \cdot lb \cdot in$$

$$\phi \cdot Mn1 = 1.413 \cdot 10^6 \cdot lb \cdot in$$

Moment = 1413 kip.in
OR 117.75 ft.kips

Title : Mixer and Transfer pump drop analysis, Project W-211

Designed by : S. Kaniyal SK Checked by N. D. Ha Nke Page C-19

Date 9/16/97 Date 9/16/97

Check west wall with reaction forces 28.7 kips/ft. loading.

Load for 56 inches length = $28.7 \times 56 / 12 = 133.93$ kip

With 1.7 ACI load factor the impact load is $1.7 \times 133.93 = 227.7$ kip

Factored moment $M_{uw} = 227.7 \times 3.125$ (eccentricity) = 711.5 kip.in or 59.29 ft.kip

Factored dead load : $1.4 \times D_w$

$P_{uwest} := 1.4 \cdot D_{wall} + 227700 \cdot lb$

$P_{uwest} = 2.311 \cdot 10^5 \cdot lb$

Total factored axial load = 230 kip

$\frac{P_{uwest}}{\phi} = 3.301 \cdot 10^5 \cdot lb$

Design load axial = 328.7 kip

$M_{uw} := 711500 \cdot lb \cdot in$

$\frac{M_{uw}}{\phi} = 1.016 \cdot 10^6 \cdot lb \cdot in$

Design Moment = 1016 kip.in or 85 kip.ft

Both the axial load and the design moment fall inside the Interaction diagram, Hence O. K.

Lateral pressure Moment on wall : This wall will behave as a plate fixed on three sides. the depth of soil around the side of this pit is 3.5 ft. approx. Hence the moment due to lateral pressure is small. Comparing with the interaction diagram, the wall is capable of taking the lateral pressure moment and the moment created by the eccentric loading together with the axial loads. Hence the wall is considered adequate for the impact loadings.

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Title : Mixer and Transfer pump drop analysis, Project W-211

Designed by : S. Kanjilal

Checked by : N. D. Ha

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Date 9/16/97

Date 9/16/97

02D PUMP PIT DESIGN EVALUATION FOR IMPACT LOADS:
241-AP TANK FARM.

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Title : Mixer and Transfer pump drop analysis, Project W-211

Designed by : S. Kanjilal

Checked by : N. D. Ha

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Date 9/16/97

Date 9/16/97

The concrete wall will behave as a column of effective width b_w = width of bearing + 4 X thickness of wall.

$$b_w := 8\text{-in} + 4 \cdot 12\text{-in}$$

$$b_w = 56\text{-in}$$

Find reinforcement ratio $\rho_r = A_s/bd$

$$b_{conc} := 12\text{-in} \quad d_{conc} := 12\text{-in} - \left(2 + \frac{3}{4} + \frac{4}{2} \right) \text{-in} \quad d_{conc} = 8.875\text{-in}$$

d = effective depth of conc. section
Clear cover 2" (H-2-76462 sh. 1)

$$A_{st} := 0.88\text{-in}^2$$

A_{st} = Area of steel per 12" width
2 - # 6 bars

$$\rho_{conc} := \frac{A_{st}}{b_{conc} \cdot d_{conc}}$$

$$\rho_{conc} = 0.008$$

As the eccentricity 3.125" exceeds wall thickness / 6, the empirical design method is not applicable.

- a) Check wall slenderness : $k l_u / r$ where k = effective length factor. For wall laterally restrained and fixed at the base as in this case $k=1$
 l_u effective length = 135.75" r = radius of gyration = .3 X wall thickness (12"). (Refer ACI 318 section 10.11.3)

$$k := 1$$

$$l_u := 135.75\text{-in}$$

$$r := .3 \cdot 12\text{-in}$$

$$\frac{k \cdot l_u}{r} = 37.708$$

> 34, M1b is zero, slenderness effect need to be considered. (Refer ACI section 10.11.4.1)

Interaction Diagram for the wall column section :

$$f_c := 4000 \cdot \frac{\text{lb}}{\text{in}^2}$$

$$f_{ys} := 60000 \cdot \frac{\text{lb}}{\text{in}^2}$$

Where

f_c = concrete compressive strength

f_{yt} = steel yield strength.

b_{wall} = width of section

t_{wall} = thickness of section

$$b_{wall} := 56\text{-in}$$

$$t_{wall} := 12\text{-in}$$

$$A_{s1} := 4.67 \cdot 44\text{-in}^2$$

$$A_{s1} = 2.055\text{-in}^2$$

$$A_{s2} := 2.055\text{-in}^2$$

$$A_{stotal} := A_{s1} + A_{s2}$$

$$A_{stotal} = 4.11\text{-in}^2$$

$$A_g := b_{wall} \cdot t_{wall}$$

$$A_g = 672\text{-in}^2$$

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Title : Mixer and Transfer pump drop analysis, Project W-211

Designed by : S. Kanjilal *SK*Checked by : N. D. Ha *NHa*

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Date 9/16/97

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$$p_{conc} := \frac{A_{stotal}}{A_g} \quad p_{conc} = 0.006$$

As1 and As2 are the steel area on each face
of the wall
sy = the yield strain on steel

$$E_{steel} := 29 \cdot 10^6 \frac{\text{lb}}{\text{in}^2}$$

$$\epsilon_y := \frac{f_{ys}}{E_{steel}} \quad \epsilon_y = 0.002$$

$$d1 := 12 \cdot \text{in} - \left(2 + \frac{3}{4} + \frac{3}{8} \right) \cdot \text{in} \quad d1 = 8.875 \cdot \text{in}$$

$$d2 := 2 \cdot \text{in} + \frac{3}{4} \cdot \text{in} + \frac{3}{8} \cdot \text{in} \quad d2 = 3.125 \cdot \text{in}$$

Calculate max. axial load capacity of this column :

$$\phi P_{nmax} := 8 \cdot 7 \cdot (.85 \cdot f_c \cdot (A_g - A_{stotal}) + f_{ys} \cdot A_{stotal})$$

$$\phi P_{nmax} = 1.41 \cdot 10^6 \cdot \text{lb} \quad \text{Or Max axial load} = 1410 \text{ kips.}$$

Compute axial load and moment capacity for balanced failure

$$c := \frac{.003}{.003 - (-1 \cdot \epsilon_y)} \cdot d1$$

$$c = 5.253 \cdot \text{in}$$

where c = depth of the neutral axis
from the compression face.

$$\epsilon_{s2} := \frac{c - d2}{c} \cdot .003$$

$$\epsilon_{s2} = 0.001$$

where ϵ_{s1} and ϵ_{s2} are the strain in the steel in
comp and tension face.

$$\epsilon_{s1} := -.00207$$

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Designed by : S. Kanjilal

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Date 9/16/97

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 $f_{s2} := \sigma_{s2} \text{ Esteel}$

$$f_{s2} = 3.524 \cdot 10^4 \cdot \frac{\text{lb}}{\text{in}^2}$$

Stress in steel $f_{s2} = 35.24$ kips. < 60 ksi this is the stress in the compressive layer of reinf.

Stress in tension layer is 60 ksi

$$\beta_1 := 1.05 - .05 \cdot \frac{4000 \cdot \text{psi}}{1000 \cdot \text{psi}}$$

$$\beta_1 = 0.85$$

a = depth of the equivalent rectangular stress block

$$a := \beta_1 \cdot c$$

$$a = 4.465 \cdot \text{in}$$

Compute forces in the concrete and steel

$$C_c := 0.85 \cdot f_c \cdot a \cdot b_{\text{wall}}$$

$$C_c = 8.501 \cdot 10^5 \cdot \text{lb}$$

Where C_c = force in the concrete
= 850.1 kips.

$$F_{s1} := f_{ys} \cdot A_{s1}$$

$$F_{s1} = 1.233 \cdot 10^5 \cdot \text{lb}$$

Force on reinf. layer on the compressive side

$$F_{s2} := \left(f_{s2} - .85 \cdot 4000 \cdot \frac{\text{lb}}{\text{in}^2} \right) \cdot A_{s2}$$

$$F_{s2} = 6.543 \cdot 10^4 \cdot \text{lb}$$

$$P_{n1} := C_c - F_{s1} + F_{s2}$$

$$P_{n1} = 7.922 \cdot 10^5 \cdot \text{lb}$$

P_{n1} = Nominal axial force
= 792.2 kips

$$\phi := .7$$

$$\phi \cdot P_{n1} = 5.546 \cdot 10^5 \cdot \text{lb}$$

$$\phi P_{n1} = 554.6 \text{ kips}$$

Compute M_n

$$M_n := C_c \cdot \left(\frac{t_{\text{wall}}}{2} - \frac{a}{2} \right) + F_{s1} \cdot \frac{d_1 - d_2}{2} + F_{s2} \cdot \frac{d_1 - d_2}{2}$$

$$M_n = 3.036 \cdot 10^6 \cdot \text{lb} \cdot \text{in}$$

$$\phi \cdot M_n = 2.126 \cdot 10^6 \cdot \text{lb} \cdot \text{in}$$

$$\phi M_n = 2126 \text{ kip} \cdot \text{in or } 175 \text{ ft} \cdot \text{kip}$$

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Rev. 0 Appendix - C

Title : Mixer and Transfer pump drop analysis, Project W-211

Designed by : S. Kanjilal Checked by : N. D. Ha Page C-24

Date : 9/16/97

Date : 9/16/97

Compute axial load and moment for the strain is -3 times the balanced strain

$$c := \frac{.003}{.003 - (-3 \cdot \epsilon_y)} d1$$

$$c = 2.892 \cdot \text{in}$$

where c = depth of the neutral axis
from the compression face.

$$\epsilon s2 := \frac{c - d2}{c} \cdot .003$$

$$\epsilon s2 = -2.419 \cdot 10^{-4}$$

where $\epsilon s1$ and $\epsilon s2$ are the strain in the steel in
comp and tension face.

$$\epsilon s1 := -3 \cdot 0.00207$$

$$\epsilon s1 = -0.006$$

Stress in the reinforcing layers

$$fss2 := \epsilon s2 \cdot E_{\text{steel}}$$

$$fss2 = -7.014 \cdot 10^3 \cdot \frac{\text{lb}}{\text{in}^2}$$

$$fss1 := 60000 \cdot \frac{\text{lb}}{\text{in}^2}$$

$$a1 := \beta1 \cdot c$$

$$a1 = 2.458 \cdot \text{in}$$

Compute forces in concrete and steel

$$Cc1 := .85 \cdot f_c \cdot a1 \cdot b_{\text{wall}}$$

$$Cc1 = 4.68 \cdot 10^5 \cdot \text{lb}$$

Steel

$$Fss1 := f_{ys} \cdot A_{s1}$$

$$Fss1 = 1.233 \cdot 10^5 \cdot \text{lb}$$

Since $a1$ is greater than $d2$

$$Fss2 := fss2 \cdot A_{s2}$$

$$Fss2 = -1.441 \cdot 10^4 \cdot \text{lb}$$

Compute $Pn2$

$$Pn2 := Cc1 - Fss1 + Fss2$$

$$Pn2 = 3.303 \cdot 10^5 \cdot \text{lb}$$

$$\phi \cdot Pn2 = 2.312 \cdot 10^5 \cdot \text{lb}$$

$$\text{Axial load allowable} = 210.6 \text{ kips}$$

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Title : Mixer and Transfer pump drop analysis, Project W-211Designed by : S. KanjilalChecked by : N. D. HaPage C-25Date 9/16/97Date 9/16/97

Compute Mn

$$Mn1 := Cc1 \cdot \left(\frac{t_{wall}}{2} - \frac{a1}{2} \right) - Fss1 \cdot \left(\frac{d1 - d2}{2} \right) + Fss2 \cdot \left(\frac{d1 - d2}{2} \right)$$

$$Mn1 = 1.837 \cdot 10^6 \cdot \text{lb} \cdot \text{in}$$

Moment = 1286 kip.in

OR 107 ft kips

$$\phi \cdot Mn1 = 1.286 \cdot 10^6 \cdot \text{lb} \cdot \text{in}$$

Compute axial load and moment for the strain is -5 times the balanced strain

$$c := \frac{.003}{.003 - (-5 \cdot \epsilon_y)} \cdot d1$$

$$c = 1.995 \cdot \text{in}$$

where c = depth of the neutral axis
from the compression face.

$$\epsilon s2 := \frac{c - d2}{c} \cdot .003$$

$$\epsilon s2 = -0.002$$

where $\epsilon s1$ and $\epsilon s2$ are the strain in the steel in
comp and tension face.

$$\epsilon s1 := -5 \cdot 0.00207$$

$$\epsilon s1 = -0.01$$

Stress in the reinforcing layers

$$fss2 := \epsilon s2 \cdot E_{steel}$$

$$fss2 = -4.927 \cdot 10^4 \cdot \frac{\text{lb}}{\text{in}^2}$$

$$fss1 := 60000 \cdot \frac{\text{lb}}{\text{in}^2}$$

$$a1 := \beta1 \cdot c$$

$$a1 = 1.696 \cdot \text{in}$$

Compute forces in concrete and steel

$$Cc1 := .85 \cdot f_c \cdot a1 \cdot b_{wall}$$

$$Cc1 = 3.229 \cdot 10^5 \cdot \text{lb}$$

Steel

$$Fss1 := f_{ys} \cdot A_{s1}$$

$$Fss1 = 1.233 \cdot 10^5 \cdot \text{lb}$$

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Title : Mixer and Transfer pump drop analysis, Project W-211

Designed by : S. Kanjilal ~~S~~ Checked by : N. D. Ha ~~1/10~~ Page C-26

Date 01/16/97

Date 9/16/97

Since a_1 is less than d_2

$$F_{ss2} := (f_{ss2}) \cdot A_{s2}$$

$$F_{ss2} = -1.012 \cdot 10^5 \text{ lb}$$

Compute P_{n2}

$$P_{n2} := C_{c1} - F_{ss1} + F_{ss2}$$

$$P_{n2} = 9.836 \cdot 10^4 \text{ lb}$$

$$\phi P_{n2} = 6.885 \cdot 10^4 \text{ lb}$$

$$\text{Axial load allowable} = 68.85 \text{ kips}$$

Compute M_n

$$M_{n1} := \left[C_{c1} \cdot \left(\frac{t_{wall}}{2} - \frac{a_1}{2} \right) - F_{ss1} \cdot \left(\frac{t_{wall}}{2} - d_1 \right) \right] + F_{ss2} \cdot \left(\frac{t_{wall}}{2} - d_2 \right)$$

$$M_{n1} = 1.727 \cdot 10^6 \text{ lb-in}$$

$$\phi M_{n1} = 1.209 \cdot 10^6 \text{ lb-in}$$

$$\text{Moment} = 1209 \text{ kip.in} \\ \text{OR } 100.75 \text{ ft kips}$$

Compute axial load and moment for the strain is -5.5 times the balanced strain

$$c := \frac{.003}{.003 - (-5.5 \cdot \epsilon_y)} \cdot d_1$$

$$c = 1.852 \cdot \text{in}$$

where c = depth of the neutral axis
from the compression face.

$$\epsilon_{s2} := \frac{c - d_2}{c} \cdot .003$$

$$\epsilon_{s2} = -0.002$$

where ϵ_{s1} and ϵ_{s2} are the strain in the steel in
comp and tension face.

$$\epsilon_{s1} := -5 \cdot 0.00207$$

$$\epsilon_{s1} = -0.01$$

Stress in the reinforcing layers

$$f_{ss2} := \epsilon_{s2} \cdot E_{\text{steel}}$$

$$f_{ss2} = -5.983 \cdot 10^4 \frac{\text{lb}}{\text{in}^2}$$

$$f_{ss1} := 60000 \frac{\text{lb}}{\text{in}^2}$$

$$a_1 := \beta_1 \cdot c$$

$$a_1 = 1.574 \cdot \text{in}$$

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HNF-SD-TWR-CN-002

Rev. 0 Appendix - C

Title : Mixer and Transfer pump drop analysis, Project W-211

Designed by : S. Kanilla Checked by : N. D. Ha Page C-27

Date : 2/16/97

Date : 9/16/97

Compute forces in concrete and steel

$$C_{c1} := 0.85 \cdot f_c \cdot a_1 \cdot b_{wall} \quad C_{c1} = 2.997 \cdot 10^5 \text{ lb}$$

Steel

$$F_{ss1} := f_{ys} \cdot A_{s1} \quad F_{ss1} = 1.233 \cdot 10^5 \text{ lb}$$

Since a_1 is less than d_2

$$F_{ss2} := (f_{ss2}) \cdot A_{s2} \quad F_{ss2} = -1.23 \cdot 10^5 \text{ lb}$$

Compute P_{n2}

$$P_{n2} := C_{c1} - F_{ss1} + F_{ss2} \quad P_{n2} = 5.343 \cdot 10^4 \text{ lb}$$

$$\phi \cdot P_{n2} = 3.74 \cdot 10^4 \text{ lb} \quad \text{Axial load allowable} = 37.4 \text{ kips}$$

Compute M_n

$$M_{n1} := \left[C_{c1} \cdot \left(\frac{t_{wall}}{2} - \frac{a_1}{2} \right) - F_{ss1} \cdot \left(\frac{t_{wall}}{2} - d_1 \right) \right] + F_{ss2} \cdot \left(\frac{t_{wall}}{2} - d_2 \right)$$

$$M_{n1} = 1.563 \cdot 10^6 \text{ lb-in} \quad \phi \cdot M_{n1} = 1.094 \cdot 10^6 \text{ lb-in} \quad \text{Moment} = 1094 \text{ kip-in} \\ \text{OR } 91.2 \text{ ft kips}$$

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Rev. 0 Appendix - C

Title : Mixer and Transfer pump drop analysis, Project W-211

Designed by : S. Kanjilal *SK* Checked by : N. D. Ha *N.D.H.* Page C-28

Date *9/16/97* Date *9/16/97*

Maximum reaction at the north wall support = 47.66 kips.

P_u = Ultimate reaction load on wall = 1.7×47.66

$P_n = P_u / \phi = 1.7 \times 47.66 / .7 = 116$ kips.

Moment due to eccentricity = $47.66 \times 3.125 = 148.94$ kip. in. = 12.42 ft. kip

$M_u = 1.7 \times 12.42 = 21.11$ ft. kip

$M_n = 21.11 / \phi = 21.11 / .7 = 30.16$ ft. kip

From the interaction diagram the wall can carry $[101 + \{(107-101) / (231-69) \times (116 - 69)\}]$

= 102.7 ft. kip > 12.42 ft. kip GOOD

The self weight will increase the compression and will increase the moment capacity hence ignored. (conservative)

There will be some moment magnification due to $KL/r > 34$, since the allowable moment is much greater than the actual moment, the magnified moment should be well within the allowable. No further calculation is necessary.

The wall is good to carry the impact loading.

Title : Mixer and Transfer pump drop analysis, Project W-211

Designed by : S. Kanjilal *SK* Checked by : N. D. Ha *NH* Page C-29

Date _____

Date 10/11/97**Check sliding of the tank pit due to impact forces.**

Approximate weight of the pump pit concrete assuming 12 " constant thickness of the wall ;

Center line length = $2 \times (12' - 0" + 7' - 0") = 38' - 0"$
$$\text{Weight @ 150 lb / cft of concrete} = 1 \times 38' - 0" \times 1' - 0" \times \{ 679' - 6" - 668' - 5.25" = 11' - 3/4" \}$$
$$\text{(average) X 150 lb/cft}$$
$$= 63056 \text{ lbs.}$$
$$\text{Weight of base of the tank} = 1 \times 13' - 0" \times 8' - 0" \times 1.5' \text{ (average thickness) X 150 lb/cft}$$
$$= 23400 \text{ lbs.}$$
$$\text{Total weight of the concrete pit} = 63056 \text{ lb.} + 23400 \text{ lb.} = 86456 \text{ lbs.}$$

Add 10 % for fixtures and platforms etc. = 8646 lbs.

Total gross weight = $86456 + 8646 = 95102 \text{ lbs}$

Sum of the reactions from pump drop : 143500 (west wall) + 71900 (North wall) = 215400 lbf. The ANSYS model is symmetrical about East / West. Hence, the total reaction forces are doubled to take care of the whole pit. The Impact force on the East wall is small because of its location away from the impact location and ignored.

The total reaction forces = $2 \times 215400 = 430800 \text{ lbs.}$ The reaction on the east wall is not significant and ignored.

Total downward force from impact and dead weight of pit = $430800 + 95102 = 525902 \text{ lbs.}$

Assuming a 3ft. drop (based on scaling of the drawing dimensions) in 7ft. width of the tank, the slope of the tank = $\tan^{-1} 3/7 = 23.2 \text{ degrees.}$

The sliding force = $525902 \sin 23.2 = 207175 \text{ lb.}$ **Friction force against sliding**

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Designed by : S. Kanjilal Checked by N. D. Ha Page C-30

Date 6/11/47

The Coefficient of Friction of new concrete against hardened concrete which is true in this case,
= 1 (Refer Reinforced Concrete Design, Third Edition, by Wang and Salmon
Section 5.16)

Hence the total resisting force = 1 X 525902 lbs.

Margin of safety against sliding = 1 - 207175/525902 = .606

GOOD.

Check Tank Dome :

Refer WHC-SD-WM-DA-111, Rev. 1, Page 7, maximum allowable concentrated load on the tank dome placed anywhere on the dome is 600 kips.

Considering the pump pit as a concentrated load on the dome (which is very conservative), the total vertical reaction from the impact loading and the concrete dead weight is 525902 lb or 526 kips. which is less than the capacity of the tank.

The tank dome is safe

O. K.