ATTACHMENT 2

ENERCON SERVICES, INC.	ENGINEERING CALCULATION COVER SHEET	Calc. No. PGE-009-CALC-006
		Rev. 1
		Sheet 1 of 64
Title: ISFSI Cask Storage Pad Concrete Shrinkage and Thermal Stresses		Client: PG&E
		Job No. PGE-009

Purpose Of Calculation:

The purpose of this calculation is to compute the forces and moments within the storage pad for the temperatures resulting from the heat of hydration during the curing process and from the shrinkage of the concrete. The ISFSI Facility will contain (7) pads, which will support (20) HI-Storm Storage Casks per pad. The results from this Calculation, along with the results from the seismic analysis, Calculation No. PGE-009-CALC-003, will be used in Calculation No. PGE-009-CALC-007 to evaluate the concrete per the design codes and to determine the size of steel reinforcement.

NOTE: This Calculation is furnished as part of PG&E Contract No. 4600010841, Change Order No. 001

Scope Of Revision:

This revision incorporates an additional thermal analysis for the heat generated during the initial curing of the concrete. It was therefore necessary to differentiate between this additional analysis and the original analysis presented in revision 0. The original analysis presented in revision 0 is referred to herein as the "constrained analysis", and the additional thermal analysis is referred to as the "unconstrained analysis".

Revision Impact On Results:

Provides additional thermal forces for evaluation in subsequent calculations.

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Oct. 31, 2003

☒ Safety Related ☐ Non-Safety Related

☐ Preliminary Calculation ☒ Final

Approvals
(Print Name and Sign)

Originator	S.C. TUMMINELLI		Date March 3, 2003
Reviewer			
Verification Engineer	K.L. WHITMORE		Date March 3, 2003
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ENERCON SERVICES, INC.

ENGINEERING CALCULATION REVISION STATUS SHEET

CALCULATION NO. **PGE-009-CALC-006**

ENGINEERING CALCULATION REVISION SUMMARY

REVISION NO.	DATE	DESCRIPTION
0	9/20/02	Initial Issue
1	3/03/03	Added a thermal analysis

CALCULATION SHEET REVISION STATUS

SHEET NO.	REVISION NO.	SHEET NO.	REVISION NO.
All	0	All	1

APPENDIX AND ATTACHMENT REVISION STATUS

APPENDIX NUMBER	ISSUE DATE	REV. DATE	REISSUE DATE	APPENDIX NUMBER	ISSUE DATE	REV. DATE	REISSUE DATE
TH-Loads	9/20/02	3/03/03		DPad-SH	9/20/02	3/03/03	
RPad-TH	9/20/02	3/03/03		SPad-SH	9/20/02	3/03/03	
EPad-TH	9/20/02	3/03/03		FPad-SH	9/20/02	3/03/03	
DPad-TH	9/20/02	3/03/03		FTPad-SH	9/20/02	3/03/03	
SPad-TH	9/20/02	3/03/03		THNC-Loads	3/03/03		
FPad-TH	9/20/02	3/03/03		RPadNC-TH	3/03/03		
TPad-TH	9/20/02	3/03/03		EPadNC-TH	3/03/03		
LSPad-TH	9/20/02	3/03/03		SPadNC-TH	3/03/03		
LCPad-TH	9/20/02	3/03/03		LSPadNC-TH	3/03/03		
STPad-TH	9/20/02	3/03/03		LCPadNC-TH	3/03/03		
SH-Loads	9/20/02	3/03/03		STPadNC-TH	3/03/03		
RPad-SH	9/20/02	3/03/03					
EPad-SH	9/20/02	3/03/03					

Method of Review: 3/3/03

The calculation has been independently reviewed in accordance with the requirements of ENERCON Corporate Standard Procedure 3.01. The independent verification of the calculation was performed by a detailed review and check of the entire calculation. This included verification of inputs, methodology, results and conclusions as well as a check of the mathematical accuracy of the computations.

Results:

The calculation has been independently verified to be mathematically correct and to be performed in accordance with license and design basis requirements and applicable codes. Inputs are appropriate and are obtained from verified source documents. The calculation is sufficiently documented and detailed to permit independent verification. No assumptions are made other than conservative simplifying assumptions which are identified and do not require confirmation. The methodology used is appropriate and consistent with the purpose of the calculation.

With the exception of the use of non-linear contact elements between the bottom of the concrete support pad and the surface of the rock, the analysis documented in this calculation is a straightforward, first order linear static analysis. The analysis is performed using ANSYS, a computer analysis code that is in widespread use throughout the nuclear industry and that is known to produce accurate results when utilized appropriately.

The use of the non-linear contact elements has been separately verified in computer verification and validation report PGE-009-VVR-003. These elements are designed to transfer compression loads from the concrete pad to the rock but to not transfer any tension loads across the surface. This allows the pad to lift free from the rock in the model if the loads and geometry indicate that liftoff should occur. As documented in PGE-009-VVR-003, these elements have been shown to produce results that are consistent with theoretical values and hand calculations. Thus, the use of these elements in the analysis produces appropriate results.

Thus, the analysis has been independently verified to be technically correct and to be consistent with license and design basis requirements. The results and conclusions accurately reflect the findings of the calculation.

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Body of Calculation

Appendices:

ISFSI Pad Shrinkage and Thermal Analysis

The purpose of this calculation is to determine the thermal and shrinkage stresses of the ISFSI storage pad and to provide thermal and shrinkage forces and moments. These forces and moments, together with the seismic forces and moments from a previous calculation (Reference 1), will be used to demonstrate that the design is compliant with the ACI Code and to size the pad reinforcement.

This calculation follows the same general format as the seismic calculation (Reference 1) and makes extensive use of the analytical strategies presented there. Consequently, frequent references to that calculation will be made herein.

The storage pad analyzed here is 105 feet N-S by 68 feet E-W and nominally 8 feet thick. The seismic calculation analyzed a 7.5-foot thick pad. That thickness is the thinnest that the pad can be, while 8 feet is the thickest. The surface of the pad is contoured to facilitate drainage, while the bottom is at a constant elevation. In a seismic event the design relies upon the mass of the pad to hold the casks and the pad down to the rock. Hence it is appropriate to use the minimum pad thickness for the seismic analysis, since this minimizes the pad mass. The use of the maximum pad thickness in this calculation is appropriate since this maximizes the applied heat and temperatures within the pad.

The pad will be constructed using a leveling pad or "mud" mat. This "mud" mat will be an unreinforced concrete mat that will be placed upon the prepared rock to provide a level surface that will be used to construct the pad. The thickness of the mat will vary depending upon the constructor's technique to excavate the rock to a level surface. However, since the mat is not explicitly modeled, and since its properties are conservatively bounded by the properties of the rock, regardless of its thickness, the actual constructed thickness of the mat does not affect the results of this calculation.

PG&E (Reference 2) provided the shrinkage and thermal data. The temperature data provided are the internal concrete pad temperatures as a function of time that occur as the heat generated by cement hydration is dissipated through the structure to the ambient. That calculation is for a specific concrete mix as specified by PG&E, and for a pad that is cast all at once, i.e., the underlying assumption is that the 105 by 68 by 8 foot concrete pad is instantaneously installed and begins to heat due to cement hydration. The calculation assumes that all the generated heat dissipates both upward to the concrete surface and then to air, and downward to the underlying rock strata. Heat dissipated out to the sides of the concrete is not considered. However, given the shape of the pad, the heat that may dissipate from the sides will be a small portion of the total and hence negligible. The actual amount of heat that will be dissipated from the sides of the pad will be a function of the type of concrete form, steel or wood, that is used. The steel form will allow more heat dissipation than the wood form but both will have a negligible effect on the pad responses computed here, though very some local and inconsequential stresses on the edges of the pad may arise. The heating transient due to cement hydration lasts for eight days.

The shrinkage strains are a result of the moisture loss and the moisture gradient that is established in the concrete. The shrinkage process is very slow, reaching maximum shrinkage at 117 days, and therefore, does not occur within the same time frame as the heat up due to cement hydration. Hence, the two effects can be considered separately.

Three separate analyses are performed; two for the thermal stress analysis and one for the shrinkage stress analysis. The two thermal stress analyses bound the conditions in the field. The first analysis considers the pad to be constrained to the rock in both the horizontal directions while allowing lift-off from the rock if conditions warrant. This is the condition described for slabs in ACI 207 (Reference 4). The second analysis allows the pad to slide freely on the rock surface in both horizontal directions. This is a very conservative assessment. The possibility that the pad will freely slip on the rock is a condition not discussed in ACI 207. This analysis is performed in order to bound the condition where the pad might locally break bond with the rock. These analyses, or models, will be referred to herein as "constrained" and "unconstrained".

Both thermal stress analyses are performed incrementally. Incremental temperatures at selected times are derived from the pad temperatures from PG&E (Reference 2). These are applied to the finite element models and the Young's modulus of the concrete is adjusted, to account for the strength gain and gain in stiffness, for each of the selected times. The total pad response at a selected time is the sum of all the individual responses up to and including the response at that time. The shrinkage stress analysis uses the constrained model and is performed in one execution. More detail is provided below. The nomenclature for the pad analyses Appendices uses no identifier for the constrained models. The unconstrained model Appendices all have the characters "NC", for No Constraint, embedded in their titles.

References

1 ENERCON Calculation PGE-009-CALC-003, ISFSI Cask Storage Pad Seismic Analysis, latest revision.

2 PG&E Calculation 52.27.100.701, ISFSI Foundation Pad – Thermal and Shrinkage Values, Rev 2, November 8, 2001

3 ACI 207.1R-96, Mass Concrete

4 ACI 207.R2-95, Effect of Restraint, Volume Change, and Reinforcement on Cracking of Mass Concrete.

Temperature Data

The pad temperatures through the thickness with respect to time were provided by PG&E (Reference 2). Numerical data is provided at the top surface (see Sheet 58, Reference 2) and in 0.5 foot increments through the pad thickness and for four feet into the rock beneath the pad, (see Table 3, Reference 2). This same data is provided graphically, see plots in Figures 5, 6 and 7 in Reference 2. These plots were examined and eleven times were selected for analysis. The times were chosen because they produce stresses that reasonably bound the maximum demand on the pad resulting from the distribution of temperatures considering the shapes of the curves relative to one another. The following times were selected and are shown in Table 1 below.

Table 1 - Selection of times for Thermal Stress Analysis

Time (days)	Discussion
0.25	Temperature 0.5 feet from the top surface departs from others
0.50	Temperature 0.5 feet from the top surface peaks
0.625	Temperature 1 foot from the top surface peaks
1.125	Temperature 2 feet from the top surface peaks
1.625	Temperature 3 feet from the top surface peaks
2.125	Temperature 4 feet from the top surface peaks. Temperatures at 6, 7 and 7.5 feet from the top surface at or near peak.
2.375	Temperature 5 feet from the top surface peaks. Temperatures at 6, 7 and 7.5 feet from the top surface at or near peak.
3.125	Temperatures 4 and 6 feet from the top surface are equal. This is transition point. Beyond this point the temperature 4 feet from the top surface is colder and is cooling more rapidly than the temperature 6 feet from the top surface.
4.125	Temperature at pad/rock interface peaks
6.125	Temperatures through the thickness are declining at the same rate (more or less)
7.875	Temperatures through the thickness are declining at the same rate (more or less)

The PG&E thermal temperature analysis (Reference 2) and, consequently, the current thermal stress analyses anticipate that the maximum pad forces and moments due to temperature will occur within the first few days of casting the pad. (This will be shown to be true.) This was based, in part, on the discussion provided in Reference 4, Chapters 2 and 2.1. It is especially true for the ISFSI pad because this pad is a high strength mass concrete structure. The concrete has a high proportion of cement and flyash. Therefore, the heat effects and resultant temperatures within the first few days of casting the pad will be the most severe thermal effects the pad will ever experience.

Table 2 provides the temperatures above ambient at the selected times from Table 3 in Reference 2. The PG&E calculation uses a differencing scheme that does not provide temperature values at every depth at every time step. Where that occurred, linear interpolation was used to compute the required value from the data at adjacent depths, holding the time constant. Interpolation from one time to another was not performed.

Table 2 (1/2) – Pad Temperatures Above Ambient (Degrees F) vs. Time

Elevation*	Depth*	Time (days)					
		0.25	0.50	0.625	1.125	1.625	2.125
8	0.0	15.00	12.50	9.50	4.10	2.00	1.20
7.5	0.5	18.00	28.50	27.15	19.71	14.21	11.15
7	1.0	19.67	28.92	38.24	29.43	22.97	18.91
6.5	1.5	21.33	29.33	42.79	39.69	34.96	31.00
6	2.0	21.33	38.00	47.33	49.95	46.95	43.08
5	3.0	21.33	46.66	55.99	70.99	73.24	71.02
4	4.0	21.33	46.66	55.99	76.10	83.42	84.38
3	5.0	21.33	46.66	55.99	76.31	84.76	87.05
2	6.0	21.33	46.45	55.78	73.64	79.96	81.49
1	7.0	20.50	41.91	51.24	63.12	66.86	67.77
0.5	7.5	19.66	37.58	39.62	50.73	55.18	57.05
0.0	8.0	10.67	23.33	28.00	38.33	43.49	46.32
-0.5	8.5	1.67	9.08	16.38	25.93	31.81	35.59
-1	9.0	0.84	4.75	4.75	13.53	20.13	24.85
-2	10.0	0	0.21	0.21	3.02	7.00	10.82
-3	11.0	0	0	0	0.35	1.73	3.71
-4	12.0	0	0	0	0.01	0.26	0.79

* See notes after Table 2 (2/2).

Table 2 (2/2) – Pad Temperatures Above Ambient (Degrees F) vs. Time

Elevation[1,3]	Depth[2,3]	Time (days)				
		2.375	3.125	4.125	6.125	7.875
8	0.0	1.00	0.50	0.20	0.20	0.20
7.5	0.5	10.21	8.08	6.05	4.67	3.98
7	1.0	17.63	14.56	11.42	8.81	7.48
6.5	1.5	29.53	25.63	21.14	16.38	13.87
6	2.0	41.43	36.69	30.85	23.94	20.25
5	3.0	69.51	63.91	55.57	43.79	37.21
4	4.0	83.84	79.64	71.29	57.64	49.52
3	5.0	87.13	84.41	77.30	64.53	56.43
2	6.0	81.58	79.73	74.40	64.58	57.83
1	7.0	67.97	67.31	64.40	58.80	54.24
0.5	7.5	57.68	58.32	57.13	53.77	50.39
0.0	8.0	47.38	49.32	49.86	48.74	46.54
-0.5	8.5	37.05	40.15	42.13	42.79	41.56
-1	9.0	26.71	30.97	34.40	36.83	36.58
-2	10.0	12.55	16.94	21.12	25.18	26.03
-3	11.0	4.76	7.76	10.95	14.47	15.48
-4	12.0	1.12	2.15	3.33	4.70	5.13

1. Elevation 0 is the pad/rock interface. Thus, temperatures for elevations below 0 are for the rock. These temperatures were input to the analyses along with a conservatively chosen value for the coefficient of thermal expansion for the rock, i.e., a low value.
2. Depth is the depth below the top surface of the pad.
3. The data in Reference 2 is presented in two ways. The first is in Table 3 where the elevation is referred to as "Depth,ft". This correlates to the Elevation column here. The second is in Figures 5, 6 and 7, where the data is presented in "ft from Top Surface". This is the Depth column here.

Shrinkage Data

Shrinkage data is provided in the form of microstrain through the pad thickness, see Reference 2 Sheet 52. Rather than revise various analytical input mechanisms, the shrinkage strains were converted to temperatures (see Table 3) through the use of the following equivalency:

$$\varepsilon_{sh} = \alpha \Delta T$$

where: ε_{sh} is the specified shrinkage strain
α is the material coefficient of expansion = 5.18E-6 in/in/degree F
ΔT is the temperature that produces the equivalent shrinkage strain

Table 3 – Applied Equivalent Shrinkage Temperatures (Degrees F)

Elevation*	Equivalency Calculation	
	Specified Shrinkage Micro Strain	Equivalent Temperature (Degrees F)
8	463	-89.38
7.5	128	-24.71
7	35	-6.76
6.5	2.2	-0.42
6	-12	2.32
5	-23	4.44
4	-25	4.83
3	-25	4.83
2	-25	4.83
1	-25	4.83
0.5	-25	4.83
0.0	-25	4.83

* Elevation 0 is the pad/rock interface

Concrete Properties

As the concrete cures, the strength and consequently, Young's modulus, increase. PG&E provided the relationship of concrete strength with respect to time, see Reference 2, Sheet 49. The Young's moduli used in the analyses are based upon the Mix Design, which is expected to bound the values that will be produced in the structure. Table 4 provides the moduli used in the thermal stress analyses.

The 90-day Mix Design strength is 5600 psi, which results in a Young's modulus of 4.265E6 psi. Following the guidance in Section 3.4.2 of Reference 3, 2/3 of this value = 2.844E6 psi is used in the shrinkage stress analysis to account for the effects of creep.

Table 4 – Concrete Strength and Young's Moduli

Time (days)	Specified f'_c	Mix Design f'_c	$E = 57000\sqrt{f'_c}$
0.25*	234	262.5	0.924E6
0.50*	469	525	1.306E6
0.625	586	656	1.460E6
0.75*	703	787.5	
1.00*	937	1050	
1.125	1054	1187	1.964E6
1.625	1523	1712	2.358E6
2.00*	1875	2100	
2.125	1961	2200	2.674E6
2.375	2133	2393	2.788E6
3.00*	2562	2870	
3.125	2604	2919	3.080E6
4.125	2939	3294	3.271E6
5.00*	3232	3620	
6.125	3448	3863	3.543E6
7.00*	3616	4050	
7.875	3699	4143	3.669E6
10.00*	3902	4370	
90.00*	5000	5600	

* Values for specified and mix design f'_c from Reference 2. The other values are obtained by linear interpolation.

Material and Temperature Input Data

Table 5 below provides the material and temperature data (function of elevation) for analysis. The Young's moduli are taken from Table 4. The delta temperatures are the differences in the temperatures (taken from Table 2) computed from time j-1 to j.

Table 5 (1/2) – Analysis Parameters, and Applied Delta Temperatures (F) Vs Elevation

Elevation	Time (days)					
	0.25	0.50	0.625	1.125	1.625	2.125
Ex →	0.924E6	1.306E6	1.460E6	1.964E6	2.358E6	2.674E6
Mat No.→	2	3	4	5	6	7
Load Step→	1	2	3	4	5	6
8	15.00	-2.50	-3.00	-5.40	-2.10	-0.80
7.5	18.00	10.50	-1.35	-7.44	-5.50	-3.06
7	19.67	9.25	9.32	-8.81	-6.46	-4.06
6.5	21.33	8.00	13.46	-3.10	-4.73	-3.96
6	21.33	16.67	9.33	2.62	-3.00	-3.87
5	21.33	25.33	9.33	15.00	2.25	-2.22
4	21.33	25.33	9.33	20.11	7.32	0.96
3	21.33	25.33	9.33	20.32	8.45	2.29
2	21.33	25.12	9.33	17.86	6.32	1.53
1	20.50	21.41	9.33	11.88	3.74	0.91
0.5	19.66	17.92	2.04	11.11	4.45	1.87
0.0	10.67	12.66	4.67	10.33	5.16	2.83
-0.5	1.67	7.41	7.30	9.55	5.88	3.78
-1	0.84	3.91	0	8.78	6.60	4.72
-2	0	0.21	0	2.81	3.98	3.82
-3	0	0	0	0.35	1.38	1.98
-4	0	0	0	0.01	0.25	0.53

Table 5 (2/2) – Analysis Parameters, and Applied Delta Temperatures (F) Vs Elevation

Elevation	Day				
	2.375	3.125	4.125	6.125	7.875
Ex →	2.788E6	3.080E6	3.271E6	3.543E6	3.669E6
Mat. No. →	8	9	10	11	12
Load Step →	7	8	9	10	11
8	-0.20	-0.50	-0.30	0	0
7.5	-0.94	-2.13	-2.03	-1.38	-0.69
7	-1.28	-3.07	-3.14	-2.61	-1.33
6.5	-1.47	-3.90	-4.49	-4.76	-2.51
6	-1.65	-4.74	-5.84	-6.91	-3.69
5	-1.51	-5.60	-8.34	-11.78	-6.58
4	-0.54	-4.20	-8.35	-13.65	-8.12
3	0.08	-2.72	-7.11	-12.77	-8.10
2	0.09	-1.85	-5.33	-9.82	-6.75
1	0.20	-0.66	-2.91	-5.60	-4.56
0.5	0.63	0.64	-1.19	-3.36	-3.38
0.0	1.06	1.94	0.54	-1.12	-2.20
-0.5	1.46	3.10	1.98	0.66	-1.23
-1	1.86	4.26	3.43	2.43	-0.25
-2	1.73	4.39	4.18	4.06	0.85
-3	1.05	3.00	3.19	3.52	1.01
-4	0.33	1.03	1.18	1.37	0.43

The coefficient of thermal expansion is 5.18E-6 in/in/degree F, (Reference 2, Sheet 50). The Poisson's ratio is 0.15.

Thermal Stress Analysis Considerations

Regardless of the actual temperature distribution in the pad, since the pad sits on a rock base, that base will restrain the pad from free axial growth. As shown in Figure 1, the restraining force will produce a negative moment (tension on the top) in the pad. This will tend to lift the pad from the rock thereby altering the uniform dead weight reaction force that would otherwise occur. (The reaction distribution shown in the Figure is one of many that could exist.) This in turn will produce positive moment in the pad, relieving the stresses caused by the restraint of the rock.

Creep, particularly in the first few days after casting, will allow the pad to "settle" down on to the rock thereby reducing the positive moment. Creep will also relieve the applied temperature stresses at the same time. Hence, from an energy perspective on the pad, with the temperatures and dead weight acting at the same time, the effects of creep will be to reduce the net stresses.

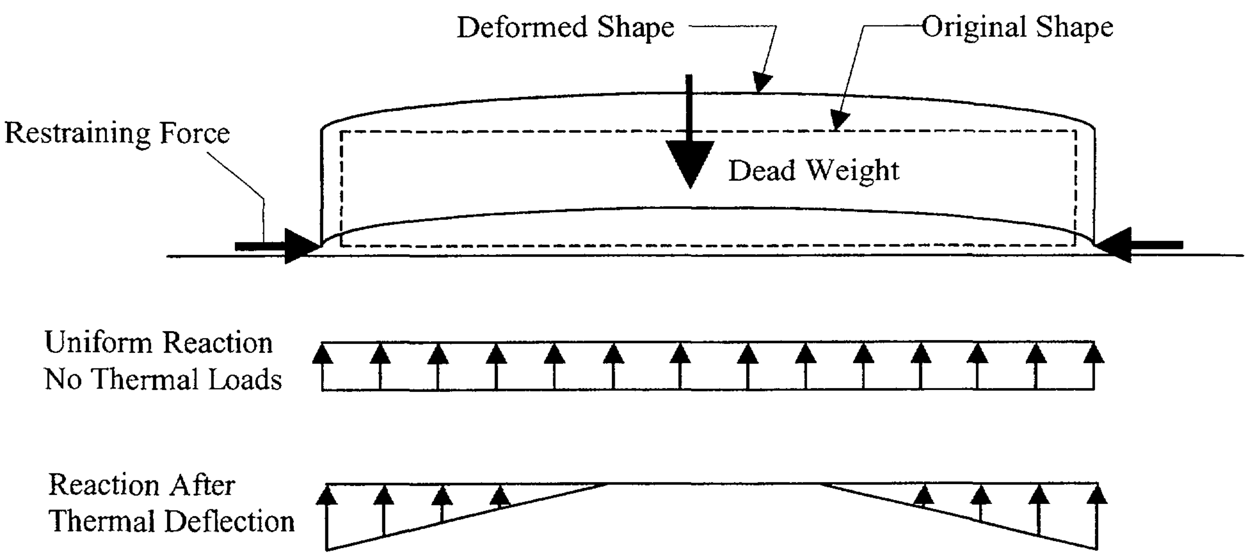

Figure 1 – Dead Weight Reaction Distribution vs. Thermal Displacement

Thus the dead weight can be included in the calculation of the total stress. Both analysis models include contact compression only gap elements between the top of the rock and the bottom of the pad. The models rely upon a net vertical downward load to maintain numerical stability during the solution process. The analyses for the thermal case use eleven separate time steps (see discussion below) with incremental temperatures applied to the model with eleven different values for Young's modulus to model the effects of the concrete hardening with time. The constrained model analysis used 90% of the dead weight of the concrete (90% of 150 pcf) in the first time step and 0.9% of the dead weight in each of the subsequent ten steps. The unconstrained model analysis used 72% of the dead weight of the concrete in the first time step, 18% in the second, and 0.9% of the dead weight in each of the subsequent nine steps. The displacements are then monitored for the summed steps to ensure that the pad is always separated from the rock at the centerline of the pad, thereby maintaining the full effects of the deadweight moments in the analysis.

It is recognized that summing individual nonlinear analytical results is not, in the strictest sense, theoretically correct. However, given that the bulk of the dead weight is included in the first load step, and that the subsequent load steps are for essentially temperature loads only, the additional forces and moments added to this first load step are conservatively computed. This is because the compliance of a stiffer (harder) concrete pad with the rock would have the pad migrating the CG of the dead weight reaction forces toward the edges of the pad, generating more offsetting deadweight moment than is computed here (creep ignored) for the constrained model. Thus, though the specific sums of displacements and moments etc. may not be exactly theoretically correct as in an analysis that could actually invoke a creep law, if one were known, the results here, are conservative.

The unconstrained model results in the pad curling upward at the corners. Thus the dead weight produces a vertical down deflection at the corners which results in moments that simply add to moments generating tension stress on the top of the pad.

Shrinkage Stress Analysis Considerations

Shrinkage of the pad is significant for the top one foot of concrete. This shrinkage causes tensile stresses to occur on the top surface. These stresses will curl the corners of the pad and cause the pad to lift off the rock at the corners. The pad dead weight tries to keep the pad corners down on the rock causing additional tensile stresses on the pad top surface.

Pad ANSYS Static Model Construction Description

Since all loads are symmetric and since the pad is symmetric, only ¼ of the pad and confining rock is modeled. The constrained model is a solid finite element model designed to maximize the confinement that the rock has on the pad. This technique reasonably maximizes the rock's resistance to the pad's shrinkage and expansion, and therefore provides conservative results. The rock is modeled up to the level of the pad surface, and for a sufficient distance in all directions to accurately capture the behavior of the pad. The unconstrained model utilizes only the vertical stiffness of the rock. The constrained and unconstrained models differ only in that in the constrained model the bottom of the pad is "stitched" in both horizontal directions to the top of the rock. In the unconstrained model the stitching is absent.

As in the seismic calculation, rotations of the nodes are not included in the solution. Also, as in the seismic calculation, the model is constructed in the Cartesian coordinate system with X pointing West, Y pointing up and Z pointing North.

The analyses for temperature are incremental wherein the temperature through the thickness and Young's modulus are varied with time, in eleven time steps, to model the heat up as well as the effects of strength gain, i.e., gain in Young's modulus, of the concrete. The analysis for shrinkage is performed in one step where both the equivalent shrinkage temperatures and the dead weight of the pad are applied. Since this model contains contact elements, these analyses are nonlinear and iterative.

The geometry of the pad and rock is shown in Figure 2. The completed model with the finite element mesh is shown in Figure 3. All plots presented are taken from the same viewpoint as that shown in Figures 2 and 3. The viewing direction is X = -1, Y = 0.5, and Z = -1, i.e., looking slightly down and from the pad centerline toward the far corner. Occasionally, the viewing direction will be changed to show pertinent detail. Unless the change in view direction is obvious, it will be noted.

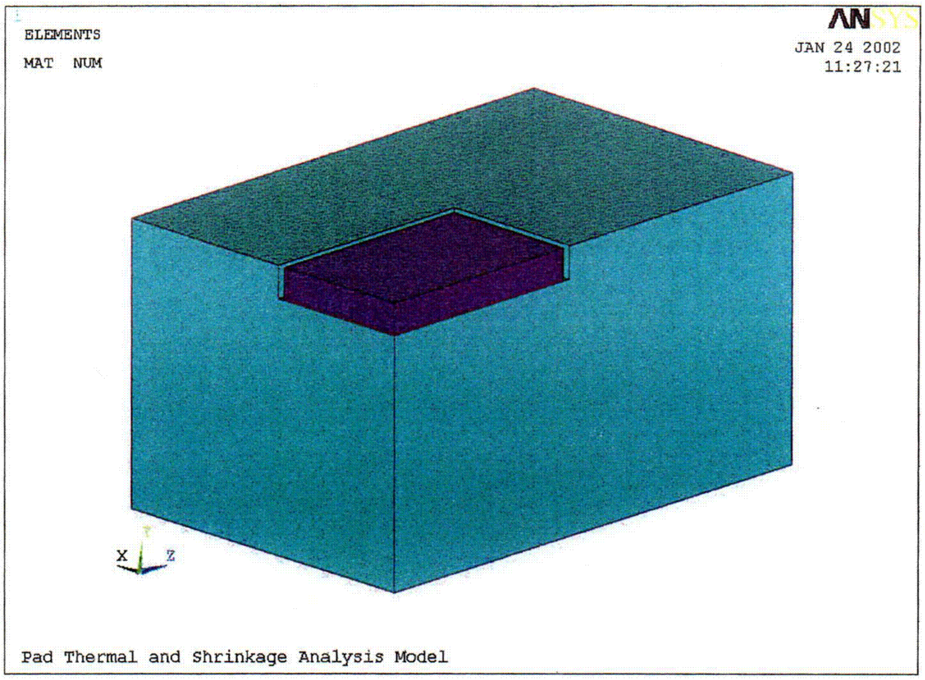

Figure 2 – Basic Pad/Rock Geometry

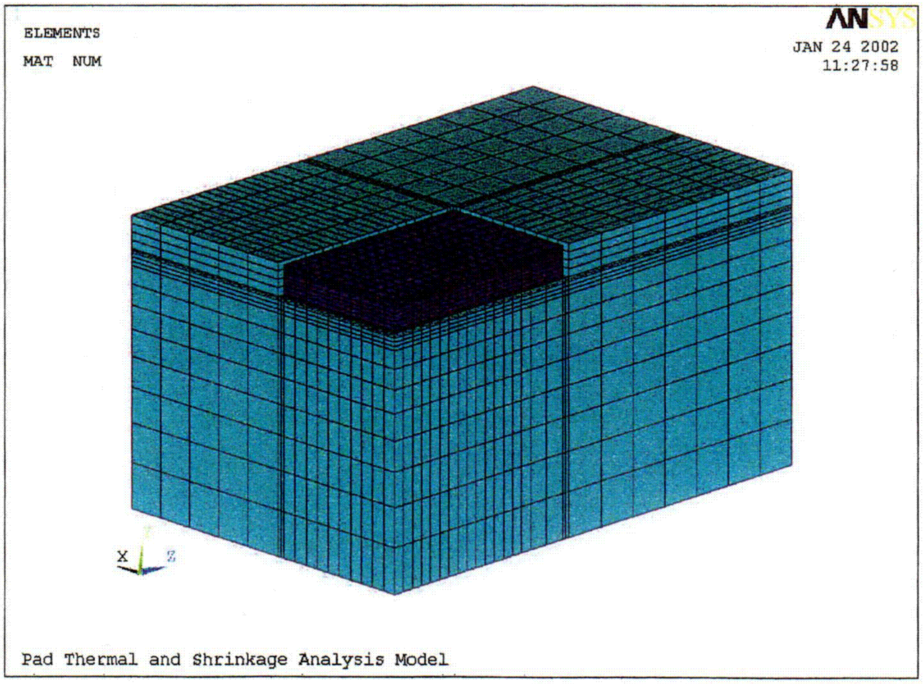

Figure 3 – Finite Element Mesh

C01

Concrete Pad

The concrete pad is modeled with Element Type 2. Element Type 2 is the ANSYS SOLID45 8-noded brick structural sold element. All features invoked in the seismic analysis are invoked here. The material properties are varied with time in that they are modified at each of the eleven load steps.

The pad is modeled 8 feet thick with the thickness of the elements modeled to match the locations where the temperatures are provided. Hence the 8-foot pad is segmented into element layers with the elevations shown in Table 5. In plan, the mesh is designed to match the 17 foot segments and the 10 foot end segments modeled in the seismic calculation.

The pad geometry is shown in Figure 4 below.

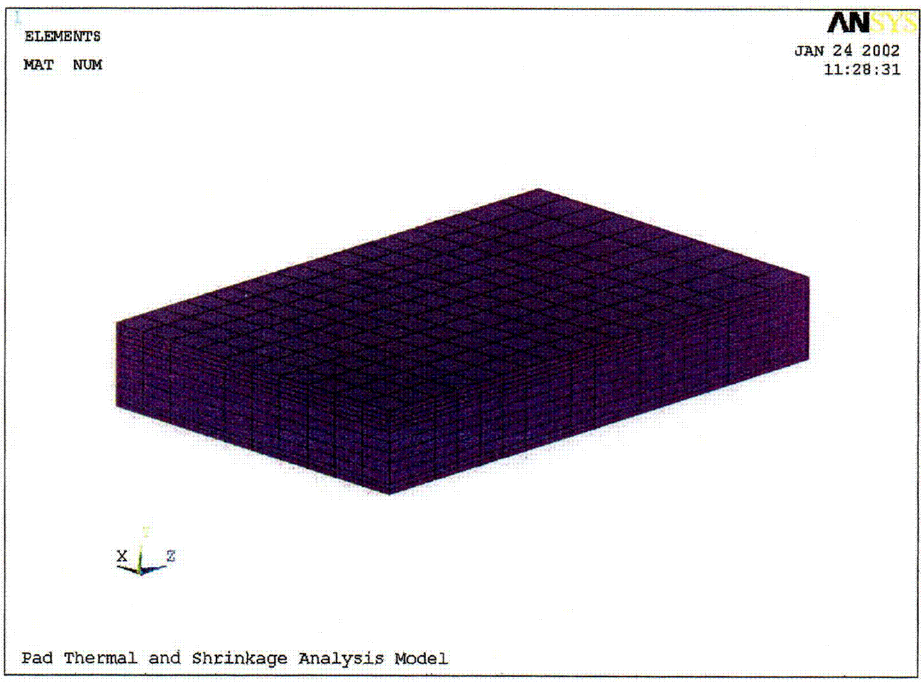

Figure 4 – Pad Mesh

C02

Rock

The rock is modeled with Element Type 1. Element Type 1 is the ANSYS SOLID45 8-noded brick structural solid element. All features invoked in the seismic analysis are invoked here. The rock mass is modeled to 81 feet 4 inches in the X direction, 124 feet 6 inches in the Z direction and 62 feet beneath the pad. Further, a 2-foot gap is provided around the pad to allow for some consideration for construction access. This gap is considered to be a minimum distance that will be required to install the pad. Larger gaps will provide less restraint and hence lower stresses for the constrained model. The element mesh is designed to mate with the pad, and to provide constraint on the boundaries of the pad model. The rock portion of the model is shown in Figure 5 below. A close up of the two-foot gap is provided in Figure 6.

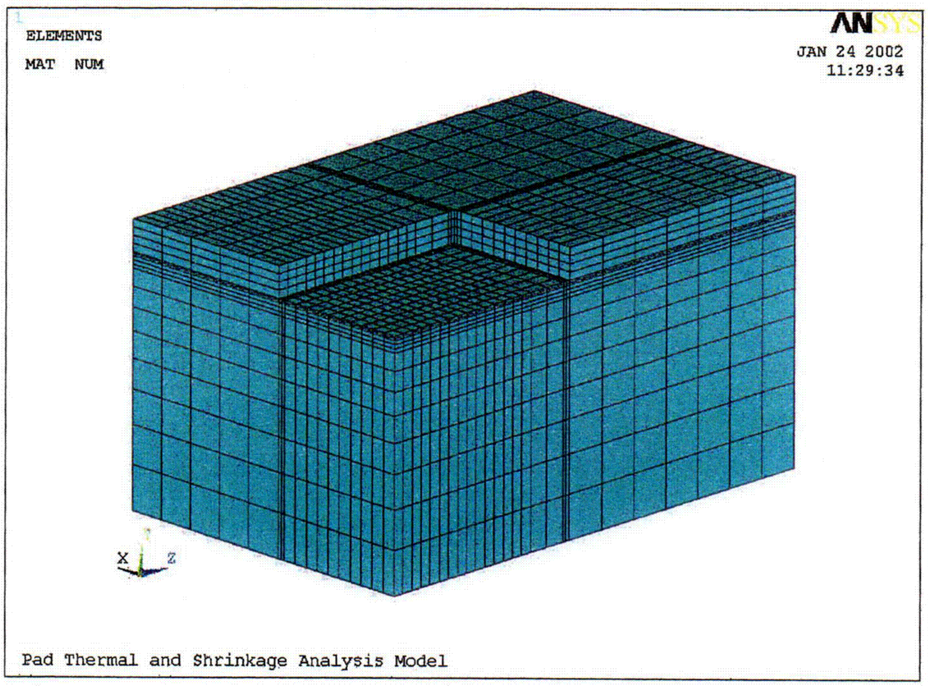

Figure 5 – Rock Mesh

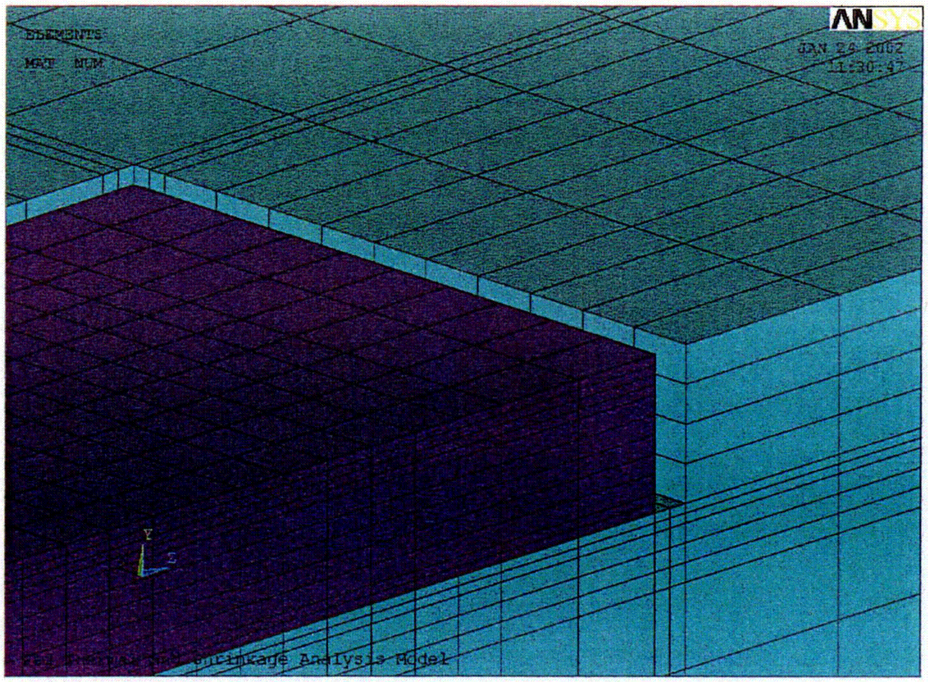

Figure 6 – Close Up of the Two-Foot Gap

The rock is designated as Material Type 1; is assumed to be homogeneous and its properties are not varied with time. The hard rock as described in the seismic report is used for this analysis. This is the stiffest rock that is reasonably expected to exist beneath the pad to an extent that it could affect the thermal response. The stiffest rock is the only rock that needs to be considered since it provides the greatest restraint to the pad. The pad stresses analyzed with the soft rock will be lower than those analyzed with the hard rock. The unconstrained model analysis bounds this condition.

The PG&E temperature calculation provides some modest heat up of the rock directly beneath the pad. A literature search on the Internet provided some values for the coefficients of thermal expansion. The lower bound of these values is the conservative value to use, since this results in the lowest rock thermal expansion, and hence the greatest restraint to the pad. A coefficient of thermal expansion of 5E-6 in/in/degree F is specified for the sandstone (soft rock), taken from the Stone University at www.coldspringgranite.com, and $8.3\text{x}10^{-6}$ in/in/degree F (= $15\text{x}10^{-6}$ in/in/degree K/1.8) is used for the dolomite (hard rock), taken from www.ima-eu.org. Combining properties to arrive at a conservative set to use for analysis, the following values were used for the hard rock (see Table 6). Since the coefficient of thermal expansion of the concrete "mud" mat will be higher than $5.0\text{x}10^{-6}$, the value in Table 6 is conservative, regardless of the final thickness of the "mud" mat since the lower bound is the conservative value to use. Also, since the "mud" mat will be relatively thin and unreinforced, adjusting the Young's Modulus is not justifiable.

Table 6 - Rock Properties Used for Analysis

Rock	Young's Modulus	Poisson's Ratio	Coefficient of Thermal Expansion
Dolomite – Hard	$2.0x10^6$	0.24	$5.0x10^{-6}$

<u>Constraint Equations – Constrained Model Only</u>

The pad model is generated completely separate from the rock model. The pad and rock models have coincident nodes at the bottom of the pad and at the top of the rock beneath the pad. In the constrained model these nodes are then stitched together in a manner that allows the pad to push/pull horizontally on the rock mass but does not allow the resulting curvature to affect the vertical stresses between the pad and the rock. These constraint equations act in combination with the contact elements described below. These constraint equations are absent in the unconstrained model.

Since the nodes are coincident, stitching them together simply produces continuity without any internal moments to consider. Thus, interior to the pad, all the nodes at the bottom of the pad and the top of the rock are stitched in the X and Z directions. Along the edge in the XY plane of symmetry, all nodes are stitched in the X direction, and along the edge in the YZ plane of symmetry, all nodes are stitched in the Z direction. See Figures 7, 8 and 9.

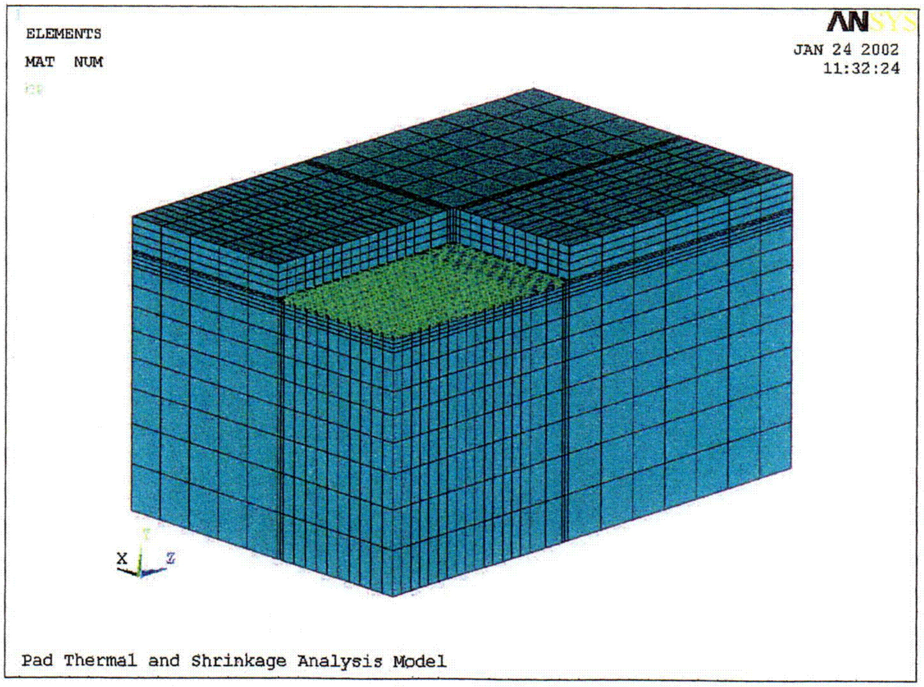

Figure 7 – Pad/Rock Constraints

C05

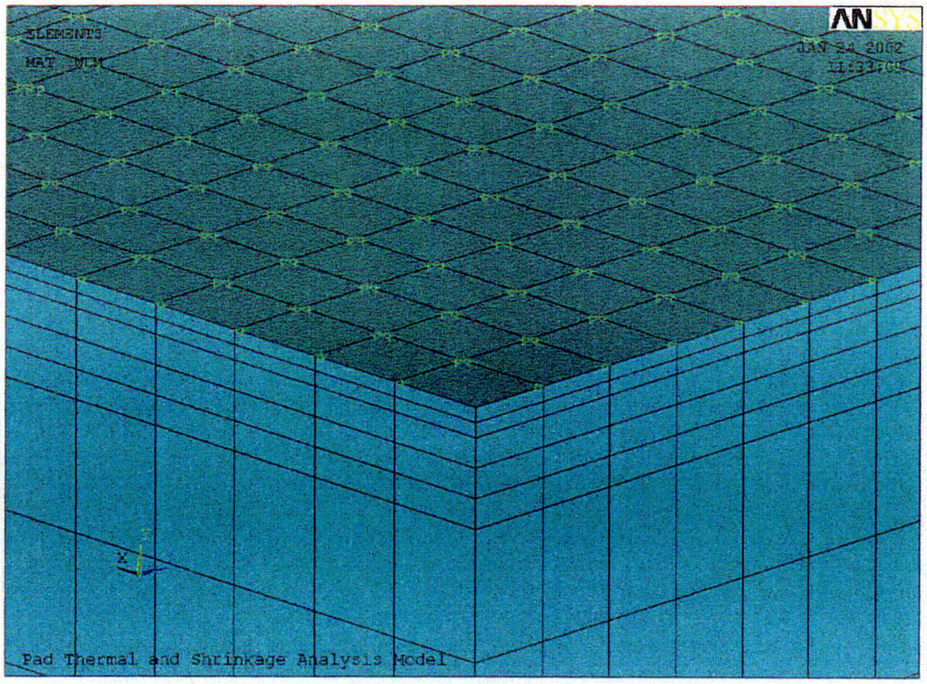

Figure 8 – Close Up of Pad/Rock Constraints on the Rock

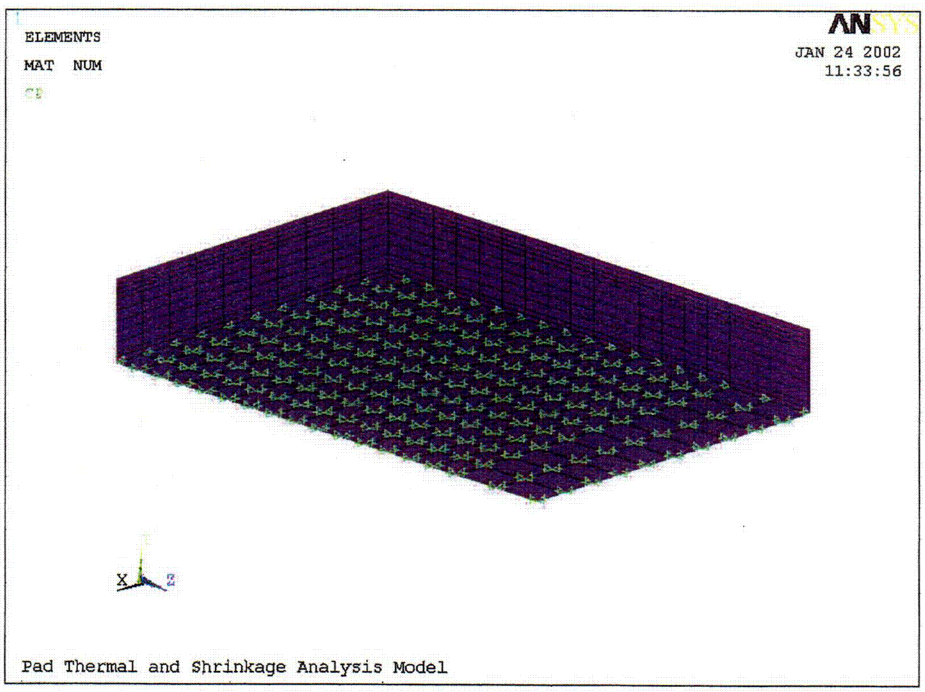

Figure 9 – Pad/Rock Constraints on the Pad – Looking Up

C06

Contact Elements

Both analysis models have a set of contact elements between the bottom of the pad and the top of the rock. The ANSYS contact elements are described in some detail in Reference 1. In this analysis, the CONTA174 is used on the bottom of the pad and the TARGE170 is used on the top of the rock. Since both surfaces have the same mesh refinement and have the same stiffness, the use of these elements on these surfaces is appropriate. See Figure 10.

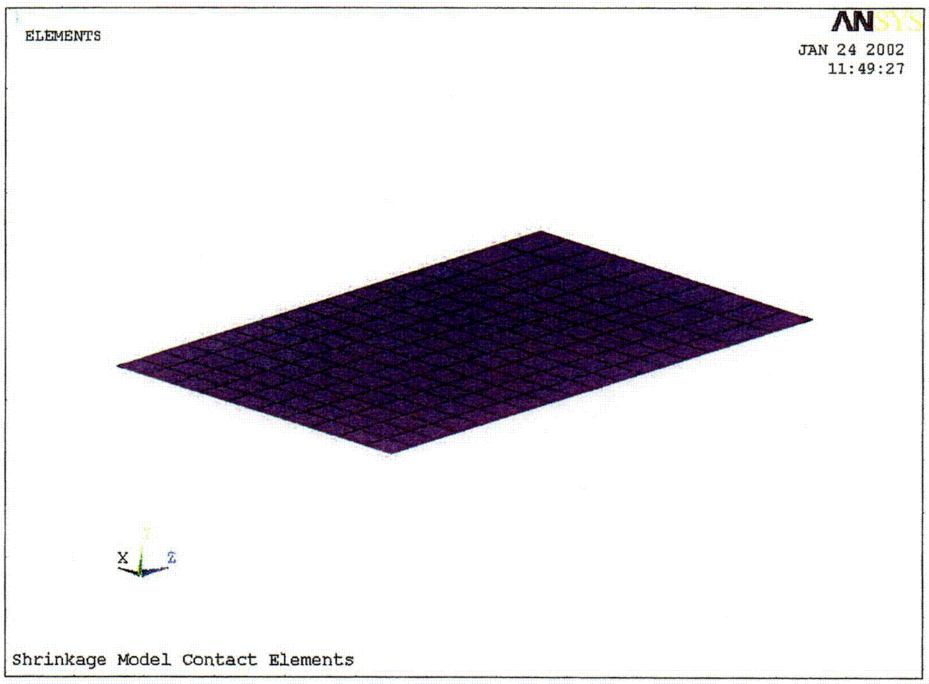

Figure 10 – Pad/Rock Contact Elements

Material Numbers

The completed model with the material numbers is shown in Figure 11. The concrete pad material numbers are varied throughout the analysis. Material number 2 is the initial material number for the pad.

C07

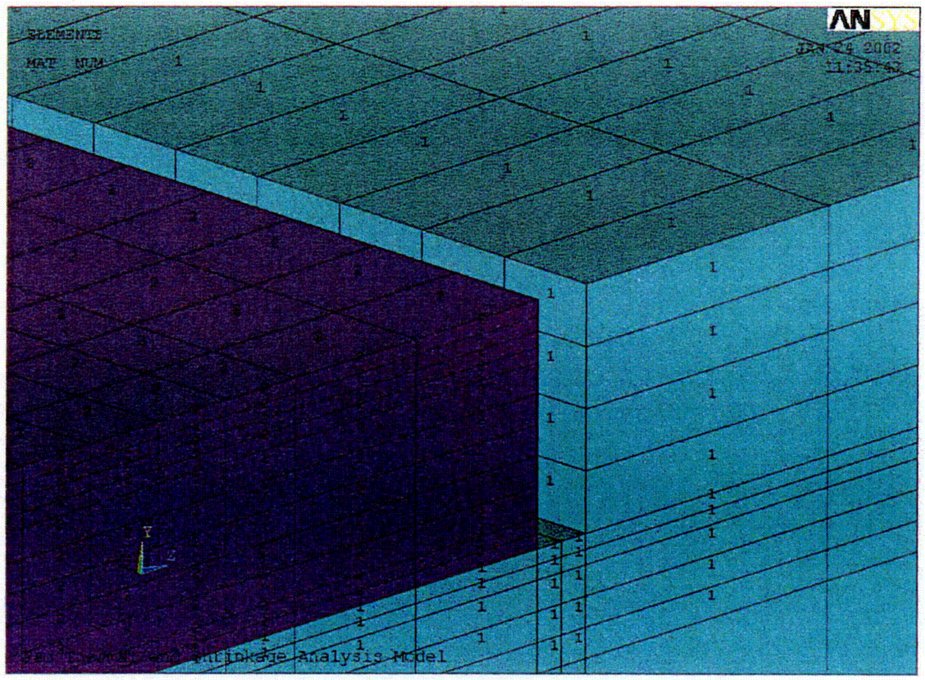

Figure 11 – Material Numbers

Boundary Conditions

The boundary conditions are as follows:

XY plane – Symmetrical BC's on the pad and the rock
YZ plane – Symmetrical BC's on the pad and the rock
X edge of the rock mass at X = 81′- 4″ – X and Y displacements set to zero
Z edge of the rock mass at Z = 124′ - 6″ – Y and Z displacement set to zero
Bottom of the rock mass – X, Y and Z displacement set to zero

These Boundary Conditions are conservative in that they prescribe zero displacements and therefore provide maximum reasonable constraint to the pad.

Plots of the Boundary Conditions are shown in Figures 12 and 13 below.

C08

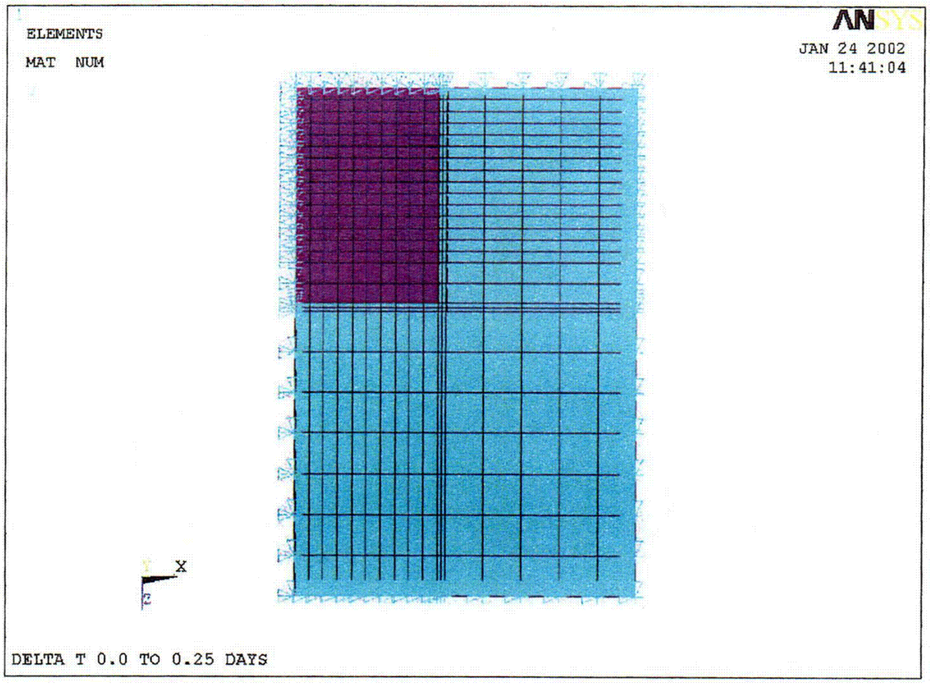

Figure 12 – Boundary Conditions – Looking Down

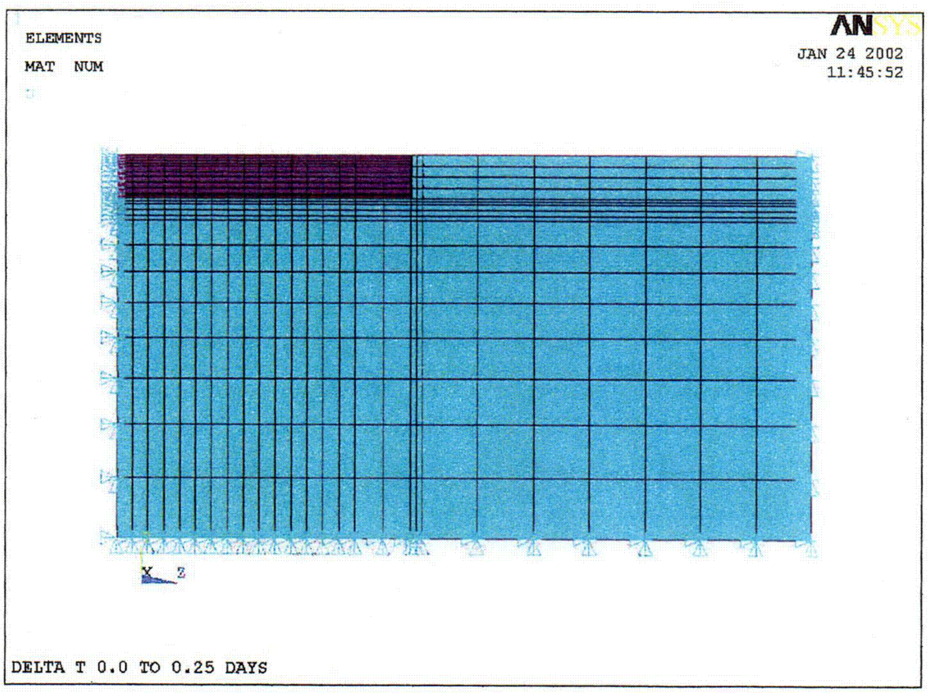

Figure 13 – Boundary Conditions

C09

Loads and Analysis

The thermal stress analyses are conducted using eleven Load Steps. The delta temperatures shown in Table 5 are applied and the pad material properties are specified for each Load Step. In Load Step 1, for the constrained model, 90% of the pad dead weight is applied, and 0.9% of the pad dead weight is applied in each of the ten subsequent Load Steps to maintain numerical stability. (Concrete density was set to 135 pcf (90% of 150) and the vertical acceleration for the first load step set to 1.0G, and 0.01G for each of the ten subsequent load steps.) [The unconstrained model used 72% in Load Step 1, 18% in Load Step 2 and 0.9% in each of the nine subsequent Load Steps.] The results, from each Load Step analysis, are a complete set of pad/rock responses, i.e., reactions, displacements, stresses etc. The results for each time are the algebraic sum of the individual responses to that time. These are summed and stored as Load Cases. As an example, the pad response for the constrained model at 2.125 days is Load Case 6 and it is the sum of Load Steps 1 through 6. As a check, the delta temperatures and summed temperatures are output to provide a means to check the input data back to the source.

The ANSYS output files that document the generation of the loads for each load step are provided in Appendices TH-Loads and THNC-Loads. Plots of the summed applied temperatures are provided in Appendix TPad-TH and are applicable to both thermal models. One plot from the Appendix for Load Case 7 is shown in Figure 14. The ANSYS output files that document the analyses together with the output delta temperatures and summed temperatures are provided in Appendices RPad-TH and RPadNC-TH. A comparison of the output temperatures with the temperatures in Tables 2 and 5 show them to be the same for both models. Each summed Load Case is then checked for equilibrium. The output files that document this check for equilibrium are provided in Appendices EPad-TH and EPadNC-TH. This data demonstrates that the overall equilibrium for the rock and the pad is satisfied.

The shrinkage stress analysis is conducted in one load step. The equivalent shrinkage temperatures from Table 3 are applied along with the acceleration due to gravity. The concrete density was set to the full 150 pcf and the vertical acceleration to 1.0G. The ANSYS output file that documents the generation of the loads is provided in Appendix SH-Loads. The ANSYS output file that documents the analysis together with the output equivalent temperatures is provided in Appendix RPad-SH. A comparison of the output temperatures with the temperatures in Table 3 shows them to be the same. The analysis is then checked for equilibrium. The output file that documents this check for equilibrium is provided in Appendix EPad-SH. This data demonstrates that the overall equilibrium for the rock and the pad is satisfied. The quarter model of the pad weighs (52.5x34x8x150) = 2,142,000 lbs.

Constrained Model - Analysis Results – Thermal Stress Analysis

Since Load Case 7, Pad Response at 2.375 days, results in the highest set of applied moments (see Table 9 below), plots for this Load Case will be used to show response. The other Load Cases all have the same general response shape. The difference is in the magnitude. A plot of the applied summed temperatures is shown in Figure 14. Plots for all Load Cases are in Appendix TPad-TH and the numerical results are in Appendix RPad-TH.

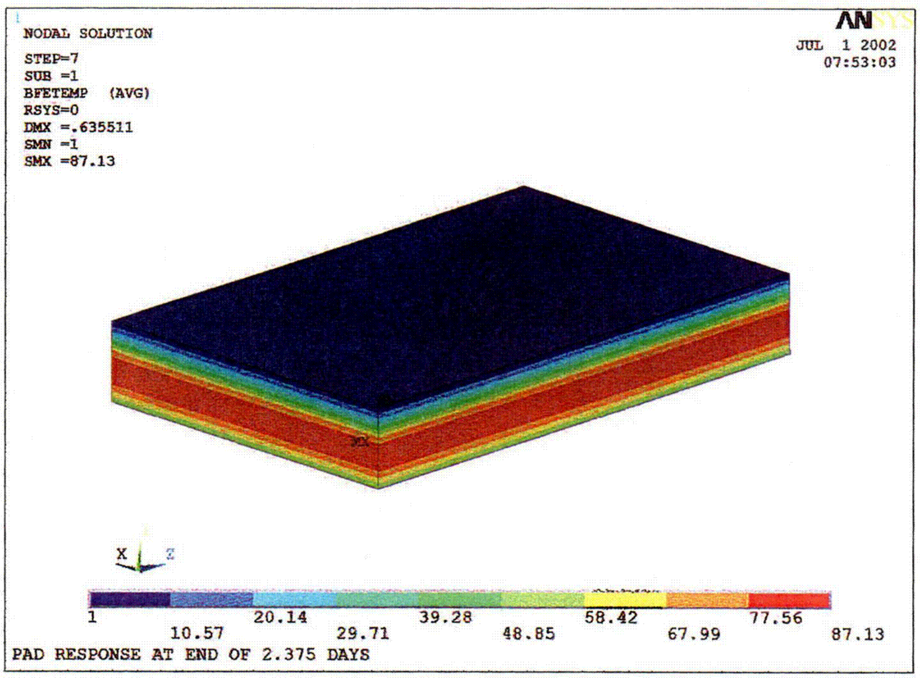

Figure 14 – Applied Temperatures at 2.375 days

C10

Constrained Model - Pad Response – Displacements

The displacements for the individual Load Steps are shown in Appendix LSPad-TH. There are three different displaced shapes. The first is shown in Figures LS-1 and LS-1A. The deadweight in this analysis is not enough to overcome the arching action caused by the restraining forces due to net thermal expansion of the pad (see Figure LS-1). However, enough deadweight is acting to force the pad down on to the rock at its edges, Figure LS-1A. And, the deadweight does affect the displaced shape. The maximum up deflection is not at the centerline of the pad. The second shape is shown in Figures LS-2 through LS-4. In these analyses, the restraining forces cause arching action, as in LS-1, but since the deadweight is very small, the pad arches up in two directions and is only supported at its corners, Figure LS-2A. The third shape is shown in Figures LS-5 to LS-11. In these analyses, the net thermal expansion is not enough to develop restraining forces of sufficient magnitude to overcome the applied temperature upward curvatures. In these cases, the deadweight stresses add to the applied net thermal stresses, i.e., tension on the pad top, but since the deadweight is small its effect is also small.

The summed displacements of the pad for all the Load Cases are plotted in Appendix LCPad-TH to give some sense of expected deformations. The summed displacements at the pad centerline are computed in Appendix DPad-TH. To compare them to acceptable deflections, see Table 7. However, since the analysis is piecewise and sums separate nonlinear analyses, the summed displacements are not analytically exact. However, they do provide a reasonable sense of the pad's total deformation. Table 7 provides displacements for the bottom of the pad (node 113) and the top of the rock (node 133) both at the centerline of the pad. Plots of the pad vertical displacements for Load Cases 1, 2 and 7 are shown in Figures 15, 16 and 17.

The displaced shape for Load Case 1, Figure 15, shows that the dead weight is not enough to force the pad down to the rock at its centerline. However, it does alter the arching action shape. The shape for Load Case 2, Figure 16, shows that the influence of the dead weight is reduced and the arching action dominates the response. In Load Case 7, Figure 7, arching action still dominates even though three Load Steps (5 to 7) were added. In each of these three Load Steps, as discussed before, the restraining forces are not enough to force arching action. However, the magnitudes of the forces involved are not enough to alter the arching action established by the summation of Load Steps 1 through 4. The pad appears to "float" owing to the addition of the vertical displacements at the pad edges from Load Steps 5 through 11.

Table 7 – Analytical Deflections (inches) Vs Time

Time (days)	Load Case	Pad Bot $\delta_{y\,113}$	Rock Top $\delta_{y\,133}$
0.25	1	0.824E-2	0.222E-2
0.50	2	0.348	0.425E-2
0.625	3	0.499	0.516E-2
1.125	4	0.596	0.824E-2
1.625	5	0.598	0.104E-1
2.125	6	0.600	0.116E-1
2.375	7	0.600	0.121E-1
3.125	8	0.601	0.132E-1
4.125	9	0.602	0.138E-1
6.125	10	0.602	0.138E-1
7.875	11	0.601	0.128E-1

The single largest effect not included in the analyses is the effect of creep. Creep will reduce all the calculated deflections and stresses. Hence the expected deformations in the field are much less than these calculated values. Nevertheless, an often used value for deflections due to dead weight is l/320 = 105x12/320 = 3.9 inches. See, for example, ACI 349-97, Table 9.5(a). As the data demonstrates, even these computed deflections are not severe.

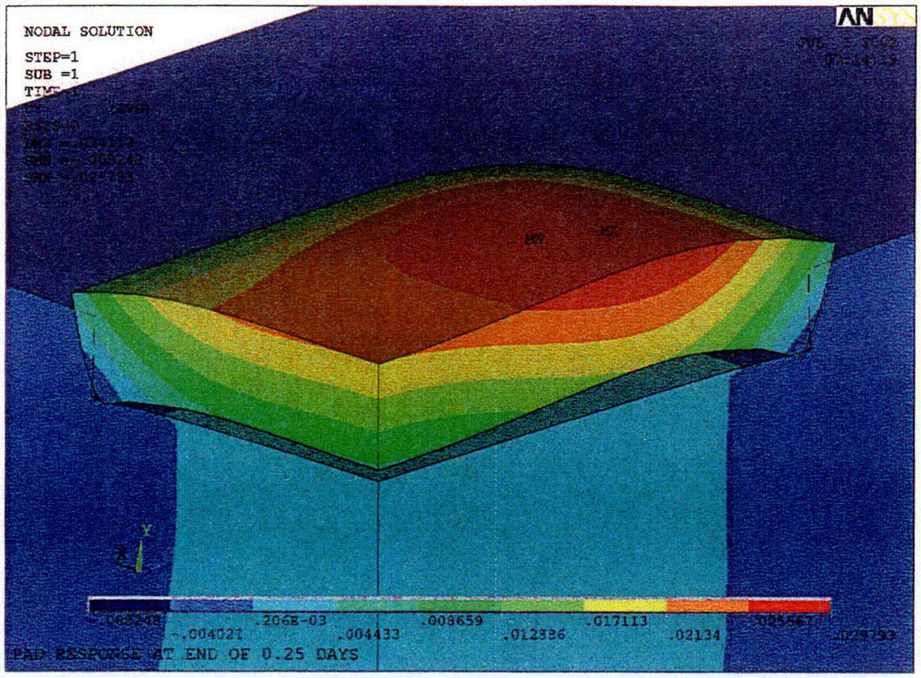

Figure 15 – Pad Vertical Analytical Displacements at 0.25 Days (same as Figure LC-1)

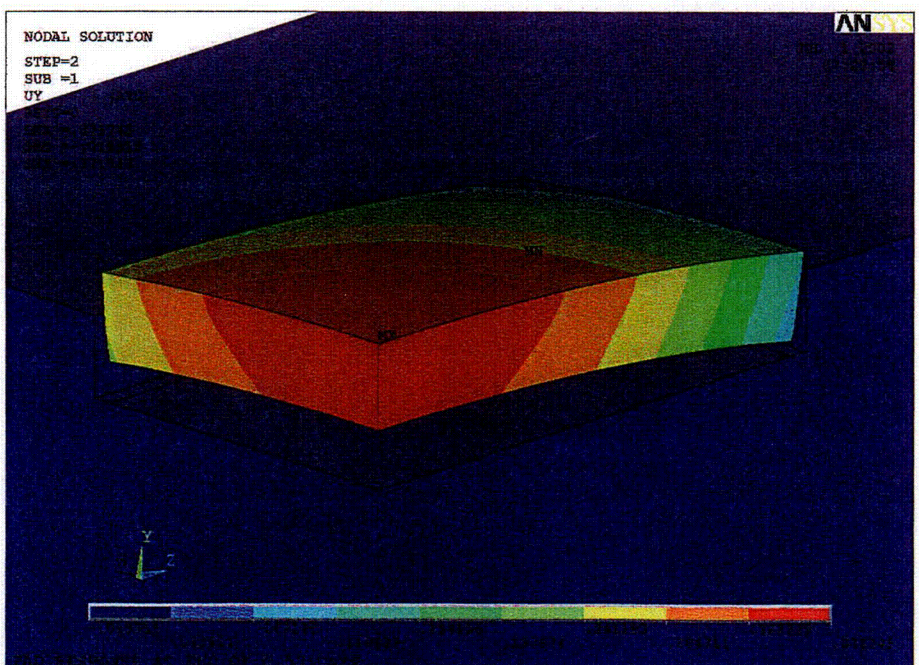

Figure 16 – Pad Vertical Analytical Displacements at 0.5 Days (same as Figure LC-2)

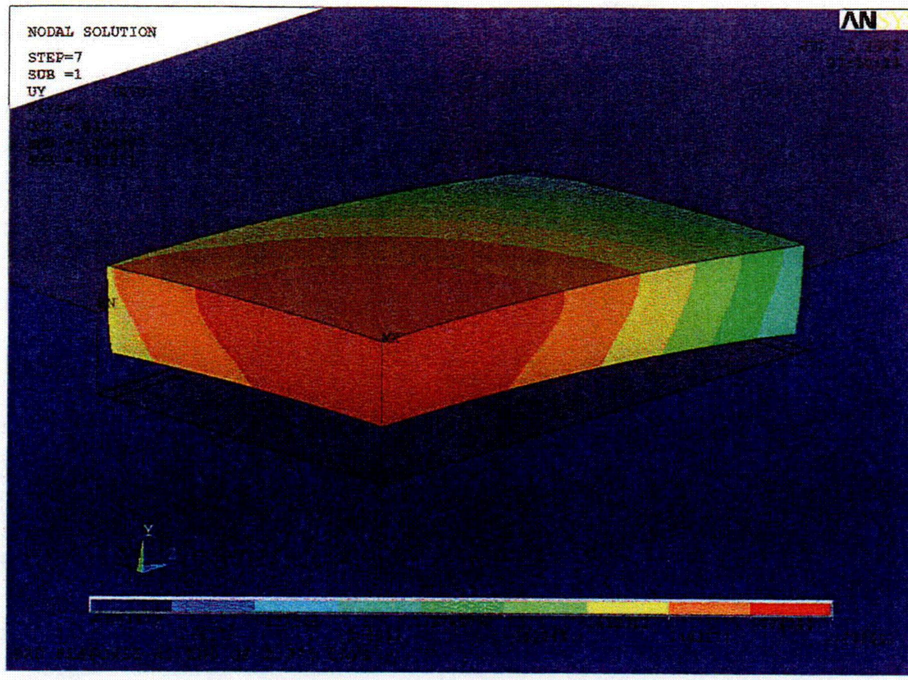

Figure 17 – Pad Vertical Analytical Displacements at 2.375 days (same as Figure LC-7)

Constrained Model - Pad Response – Stresses

Pad stresses are plotted for Load Case 7 in Figures 18 and 19. The SX and SZ tensile stresses occur over nearly the entire top surface of the pad. A complete set of plots for all Load Cases is provided in Appendix STPad-TH. All the plots indicate roughly the same shape of stress field within the pad. This is a biaxial (X-Z) tension stress field at the top surface, and a maximum biaxial (X-Z) compression stress field just below the mid-height of the pad, and a biaxial compression stress field at the bottom of the pad.

Pad stresses are provided in Table 8 to give a sense of the level of expected cracking. The values are the highest tensile and compressive stresses in both the X and Z directions, the maximum tensile principal stress $\sigma_{1\ Max}$, and the minimum compressive principal stress $\sigma_{3\ Min}$. The concrete compressive and tensile strengths are derived from the Specified f'_c from Table 4. The ANSYS output file that documents the post processing for these stresses is provided in Appendix SPad-TH.

The stresses indicate that in the absence of creep, cracking would be expected to occur. However, the data also shows that significant creep and consequent reduction of these stresses will occur. The values of $\sigma_{3\ Min}$ in Load Cases 1 to 3 greatly exceed the expected f'_c. The σ_3 is plotted in Figure 20 for Load Case 3 and again in Figure 21 for Load Case 7. The extent of the stress field is very local and confined to the pad corner throughout the curing heat up. The σ_1 is plotted in Figure 22 for Load Case 3 and Figure 23 for Load Case 7. These show that the σ_1 is not local and the extent of expected cracking, and therefore, required crack control reinforcement is significant.

Table 8 – Pad Stresses (psi) Vs Time

Time (days)	Load Case	$\sigma_{X\ Max}$	$\sigma_{X\ Min}$	$\sigma_{Z\ Max}$	$\sigma_{Z\ Min}$	$\sigma_{1\ Max}$	$\sigma_{3\ Min}$	f'_c	f_t^*
0.25	1	36	-123	35	-117	49	-464	234	102
0.50	2	229	-242	236	-256	247	-613	469	145
0.625	3	351	-300	360	-313	371	-701	586	162
1.125	4	504	-470	511	-493	518	-909	1054	218
1.625	5	525	-568	537	-594	540	-1005	1523	261
2.125	6	488	-616	504	-644	514	-1051	1961	297
2.375	7	465	-624	482	-653	516	-1064	2133	309
3.125	8	379	-607	392	-636	478	-1072	2604	342
4.125	9	274	-526	285	-554	368	-1027	2939	363
6.125	10	130	-464	133	-498	150	-904	3448	393
7.875	11	75	-443	70	-470	84	-803	3699	407

$^*f_t = 6.7\sqrt{f'_c}$

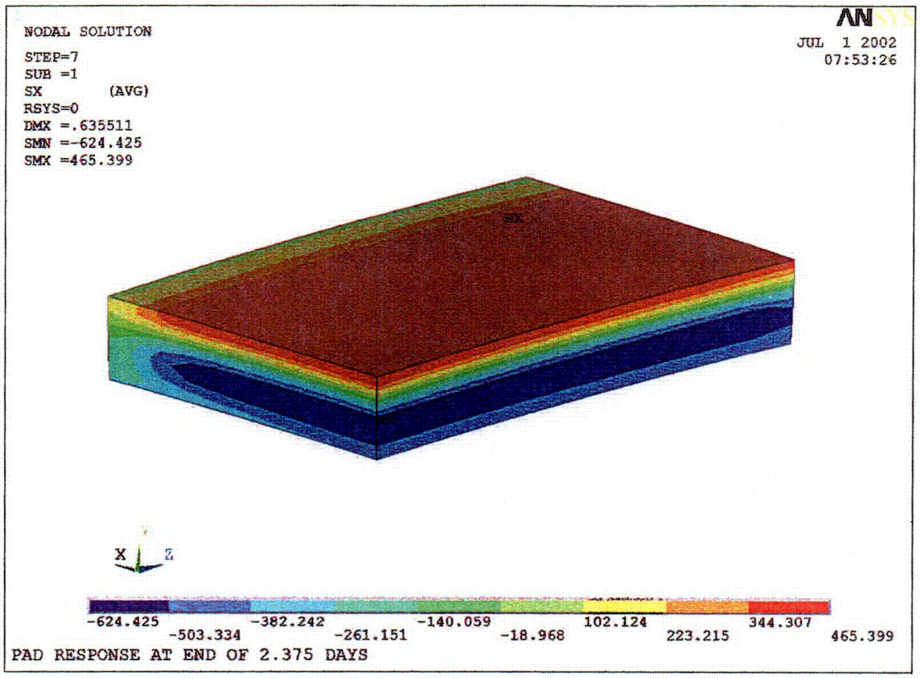

Figure 18 – Pad X Direction Stresses at 2.375 days

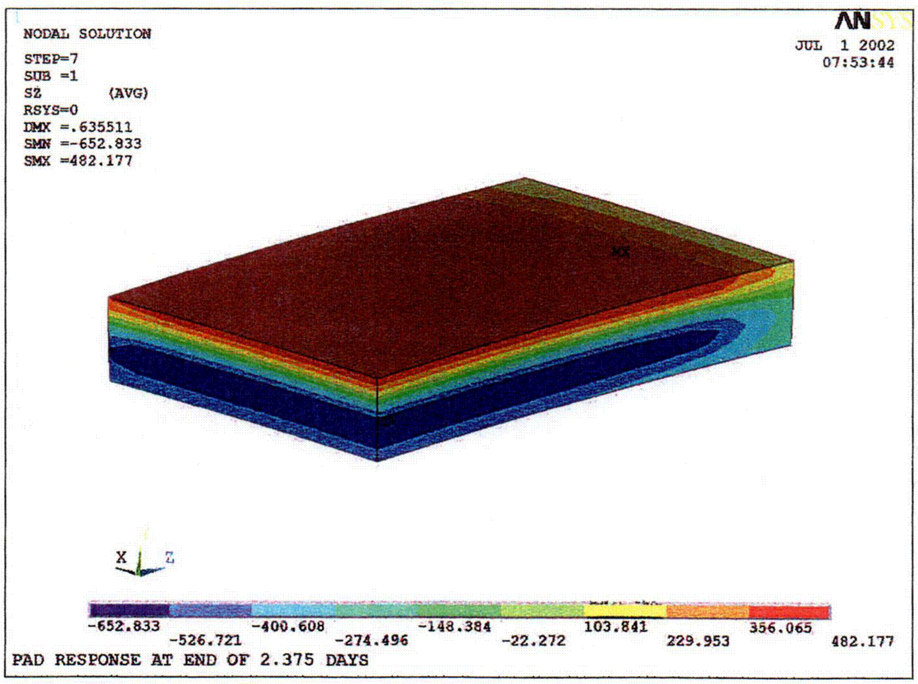

Figure 19 – Pad Z Direction Stresses at 2.375 days

C13

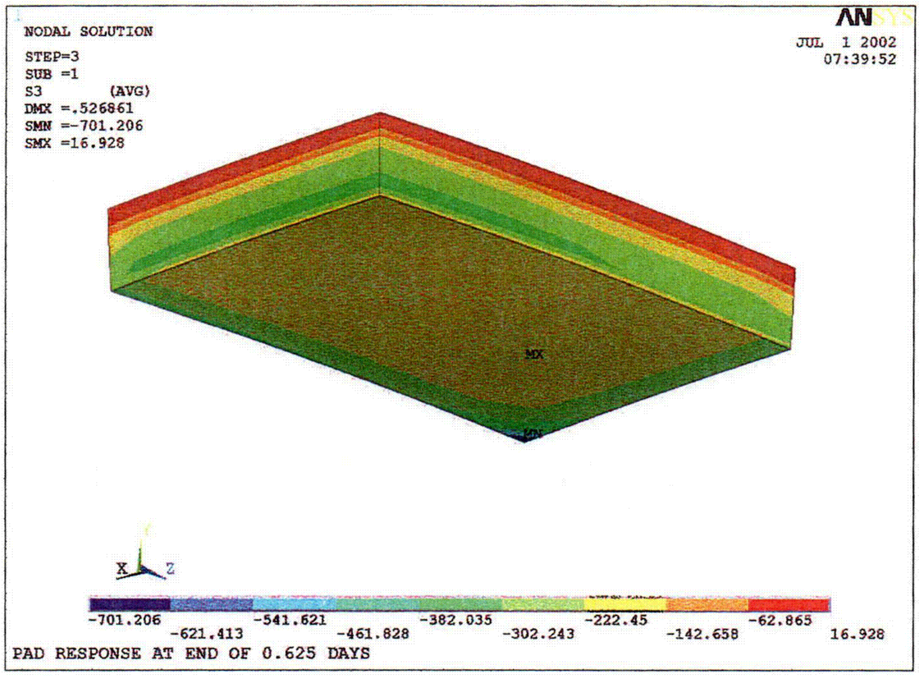

Figure 20 – Pad S3 Stresses – Load Case 3 - Viewing Direction is from -1,-0.5,-1

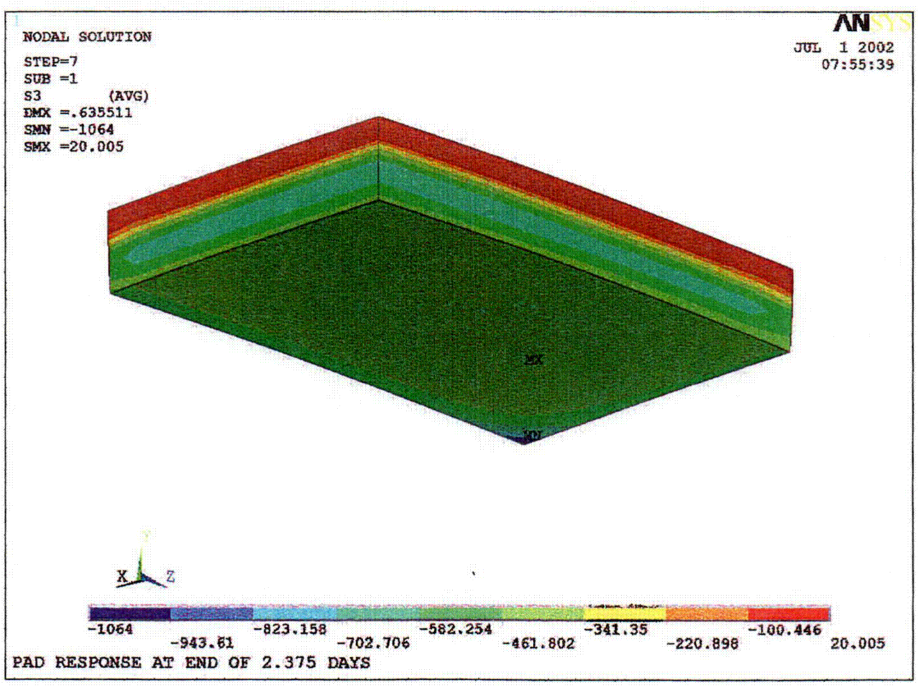

Figure 21 – Pad S3 Stresses – Load Case 7 - Viewing Direction is from –1,-0.5,-1

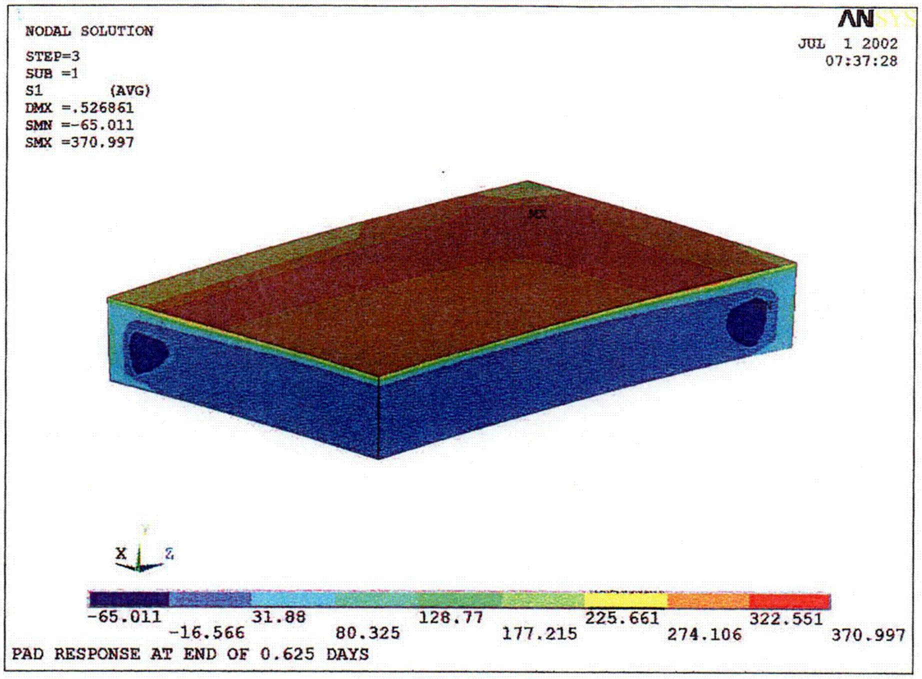

Figure 22 – Pad S1 Stresses – Load Case 3

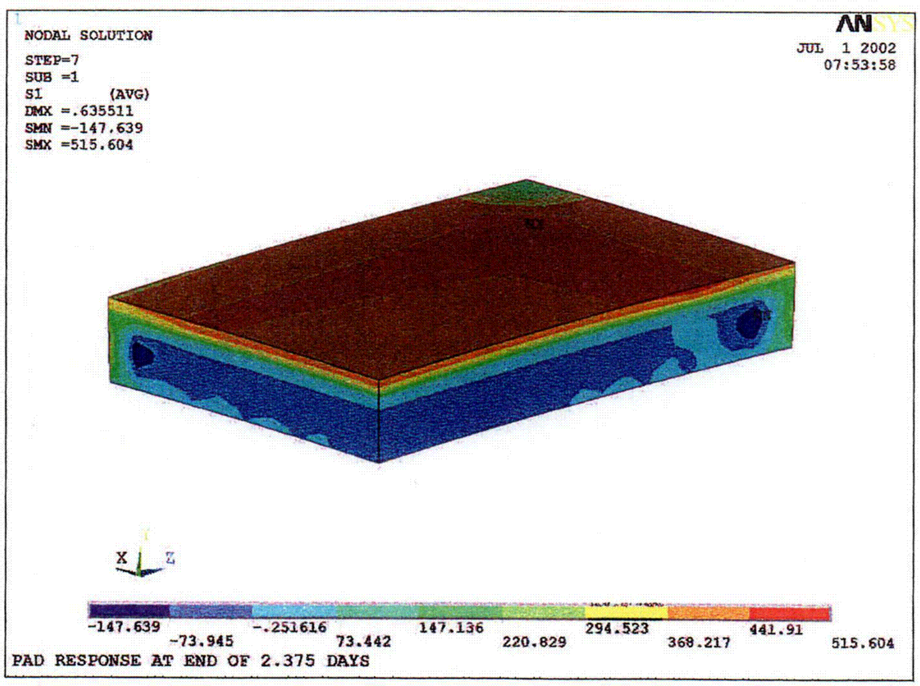

Figure 23 – Pad S1 Stresses – Load Case 7

C15

Constrained Model - Pad Response – Internal Forces

The pad internal forces and moments will be used to size reinforcement and assess the level of expected cracking. The pad was divided into strips as discussed in Reference 1. Since the model here is only ¼ of the model used in the seismic analysis, modeled in the +X, +Z quadrant, the centerlines of this model lie at lines 5 ½ and C of the seismic model, see Figure 29, Reference 1. Since all the maximum stresses occur at the planes of symmetry, or nearly so, only the internal forces on lines 5 ½ and C are computed. (Though the Mx symbol does not appear at the edges in all the plots in Appendix STPad-TH, the stress contour maps indicate that the stresses are very close to the maxima at the edges.) The sign convention for these forces is also discussed in Reference 1. In this analysis, lines 5 ½ and C are the "last section" as described in Reference 1. The forces are provided in Table 9. The ANSYS output file documenting the post processing of these values is provided in Appendix FPad-TH. The values from the model are provided as well as the Design Values to be used for sizing the reinforcement.

Table 9 (1/11)- Load Case 1 - Time 0.25 days

Z Strips - Internal Forces (lbs. and in.-lbs.) - Line 5 ½

Force/ Moment	Strip		Design Values*
	C-D	D-E	
Fy	-18755	-22048	22048
Fz	-2078832	-1982198	2078832
Mx	-1793625	1003623	1793625

X Strips - Internal Forces (lbs. and in.-lbs.) - Line C

Force/ Moment	Strip				Design Values**
	5 ½ - 6	6-7	7-8	8-10	
Fx	-905053	-1781997	-1728982	-987290	1678393
Fy	-4617	-10354	-12857	-6861	12857
Mz	109421	-502375	-2079998	-2053499	3490948

* Application of sign convention to maintain consistency with Reference 1 applied.

** Application of sign convention to maintain consistency with Reference 1 applied. Normalization to a 17-foot wide strip has been performed. Values for strip 5 ½ - 6 factored by 2, and values for strip 8-10 factored by 1.7.

Table 9 (2/11) - Load Case 2 - Time 0.50 days

Z Strips - Internal Forces (lbs. and in.-lbs.) - Line 5 ½

Force/ Moment	Strip		Design Values*
	C-D	D-E	
Fy	-18871	-21932	21932
Fz	-3128490	-3005009	3005009
Mx	0.458E08	0.471E08	-0.471E08

X Strips - Internal Forces (lbs. and in.-lbs.) - Line C

Force/ Moment	Strip				Design Values**
	5 ½ - 6	6-7	7-8	8-10	
Fx	-1403379	-2780583	-2732894	-1557871	2732894
Fy	-4698	-10515	-13007	-6470	13007
Mz	-0.234E08	-0.475E08	-0.490E08	-0.284E08	0.490E08

* Application of sign convention to maintain consistency with Reference 1 applied.

** Application of sign convention to maintain consistency with Reference 1 applied. Normalization to a 17-foot wide strip has been performed. Values for strip 5 ½ - 6 factored by 2, and values for strip 8-10 factored by 1.7.

Table 9 (3/11) - Load Case 3 - Time 0.625 days

Z Strips - Internal Forces (lbs. and in.-lbs.) - Line 5 ½

Force/ Moment	Strip		Design Values*
	C-D	D-E	
Fy	-18977	-21826	21826
Fz	-3537558	-3405193	3405193
Mx	0.626E08	0.633E08	-0.633E08

X Strips - Internal Forces (lbs. and in.-lbs.) - Line C

Force/ Moment	Strip				Design Values**
	5 ½ - 6	6-7	7-8	8-10	
Fx	-1587648	-3151194	-3109534	-1773660	3109534
Fy	-4785	-10678	-13119	-6107	13119
Mz	-0.318E08	-0.643E08	-0.657E08	-0.377E08	0.657E08

* Application of sign convention to maintain consistency with Reference 1 applied.

** Application of sign convention to maintain consistency with Reference 1 applied. Normalization to a 17-foot wide strip has been performed. Values for strip 5 ½ - 6 factored by 2, and values for strip 8-10 factored by 1.7.

Table 9 (4/11) - Load Case 4 - Time 1.125 days

Z Strips - Internal Forces (lbs. and in.-lbs.) - Line 5 ½

Force/ Moment	Strip		Design Values*
	C-D	D-E	
Fy	-19111	-21692	21692
Fz	-4816988	-4648875	4816988
Mx	0.121E09	0.120E09	-0.121E09

X Strips - Internal Forces (lbs. and in.-lbs.) - Line C

Force/ Moment	Strip				Design Values**
	5 ½ - 6	6-7	7-8	8-10	
Fx	-2189505	-4356669	-4319608	-2460584	4319608
Fy	-4856	-10832	-13319	-5682	13319
Mz	-0.602E08	-0.121E09	-0.123E09	-0.700E08	0.123E09

* Application of sign convention to maintain consistency with Reference 1 applied.

** Application of sign convention to maintain consistency with Reference 1 applied. Normalization to a 17-foot wide strip has been performed. Values for strip 5 ½ - 6 factored by 2, and values for strip 8-10 factored by 1.7.

Table 9 (5/11) - Load Case 5 - Time 1.625 days

Z Strips - Internal Forces (lbs. and in.-lbs.) - Line 5 ½

Force/ Moment	Strip		Design Values*
	C-D	D-E	
Fy	-19734	-22181	22181
Fz	-5390017	-5205515	5390017
Mx	0.151E09	0.148E09	-0.151E09

X Strips - Internal Forces (lbs. and in.-lbs.) - Line C

Force/ Moment	Strip				Design Values**
	5 ½ - 6	6-7	7-8	8-10	
Fx	-2463210	-4907754	-4877105	-2777689	4877105
Fy	-7702	-15932	-14180	-5871	15932
Mz	-0.743E08	-0.149E09	-0.150E09	-0.852E08	0.150E09

* Application of sign convention to maintain consistency with Reference 1 applied.

** Application of sign convention to maintain consistency with Reference 1 applied. Normalization to a 17-foot wide strip has been performed. Values for strip 5 ½ - 6 factored by 2, and values for strip 8-10 factored by 1.7.

Table 9 (6/11) - Load Case 6 - Time 2.125 days

Z Strips - Internal Forces (lbs. and in.-lbs.) - Line 5 ½

Force/ Moment	Strip		Design Values*
	C-D	D-E	
Fy	-24522	-22924	24522
Fz	-5574946	-5388926	5574946
Mx	0.163E09	0.159E09	-0.163E09

X Strips - Internal Forces (lbs. and in.-lbs.) - Line C

Force/ Moment	Strip				Design Values**
	5 ½ - 6	6-7	7-8	8-10	
Fx	-2552628	-5092094	-5070757	-2889199	5070757
Fy	-13915	-17643	-14699	-6068	27830
Mz	-0.800E08	-0.159E09	-0.160E09	-0.907E08	0.160E09

* Application of sign convention to maintain consistency with Reference 1 applied.

** Application of sign convention to maintain consistency with Reference 1 applied. Normalization to a 17-foot wide strip has been performed. Values for strip 5 ½ - 6 factored by 2, and values for strip 8-10 factored by 1.7.

Table 9 (7/11) - Load Case 7 - Time 2.375 days

Z Strips - Internal Forces (lbs. and in.-lbs.) - Line 5 ½

Force/ Moment	Strip		Design Values*
	C-D	D-E	
Fy	-28239	-23677	28239
Fz	-5581821	-5399212	5581821
Mx	0.166E09	0.162E09	-0.166E09

X Strips – Internal Forces (lbs. And in.-lbs.) – Line C

Force/ Moment	Strip				Design Values**
	5 ½ - 6	6-7	7-8	8-10	
Fx	-2559557	-5110869	-5098245	-2906518	5119114
Fy	-17982	-19557	-15196	-6280	35964
Mz	-0.816E08	-0.162E09	-0.162E09	-0.918E08	0.163E09

* Application of sign convention to maintain consistency with Reference 1 applied.

** Application of sign convention to maintain consistency with Reference 1 applied. Normalization to a 17-foot wide strip has been performed. Values for strip 5 ½ - 6 factored by 2, and values for strip 8-10 factored by 1.7.

Table 9 (8/11) - Load Case 8 - Time 3.125 days

Z Strips - Internal Forces (lbs. and in.-lbs.) - Line 5 ½

Force/ Moment	Strip		Design Values*
	C-D	D-E	
Fy	-35575	-24446	35575
Fz	-5456216	-5281066	5456216
Mx	0.164E09	0.158E09	-0.164E09

X Strips - Internal Forces (lbs. and in.-lbs.) - Line C

Force/ Moment	Strip				Design Values**
	5 ½ - 6	6-7	7-8	8-10	
Fx	-2498078	-4993234	-4990939	-2847986	4996156
Fy	-24934	-21118	-15672	-6504	49868
Mz	-0.801E08	-0.157E09	-0.157E09	-0.892E08	0.160E09

* Application of sign convention to maintain consistency with Reference 1 applied.
** Application of sign convention to maintain consistency with Reference 1 applied. Normalization to a 17-foot wide strip has been performed. Values for strip 5 ½ - 6 factored by 2, and values for strip 8-10 factored by 1.7.

Table 9 (9/11) - Load Case 9 - Time 4.125 days

Z Strips - Internal Forces (lbs. and in.-lbs.) - Line 5 ½

Force/ Moment	Strip		Design Values*
	C-D	D-E	
Fy	-44128	-25231	44128
Fz	-4973948	-4816150	4973948
Mx	0.144E09	0.138E09	-0.144E09

X Strips - Internal Forces (lbs. and in.-lbs.) - Line C

Force/ Moment	Strip				Design Values**
	5 ½ - 6	6-7	7-8	8-10	
Fx	-2266808	-4535864	-4544699	-2597018	4533616
Fy	-32975	-22679	-16103	-6759	65950
Mz	-0.705E08	-0.137E09	-0.136E09	-0.773E08	0.141E09

* Application of sign convention to maintain consistency with Reference 1 applied.

** Application of sign convention to maintain consistency with Reference 1 applied. Normalization to a 17-foot wide strip has been performed. Values for strip 5 ½ - 6 factored by 2, and values for strip 8-10 factored by 1.7.

Table 9 (10/11) - Load Case 10 - Time 6.125 days

Z Strips - Internal Forces (lbs. and in.-lbs.) - Line 5 ½

Force/ Moment	Strip		Design Values*
	C-D	D-E	
Fy	-54025	-26040	54025
Fz	-3967223	-3841025	3967223
Mx	0.994E08	0.937E08	-0.994E08

X Strips - Internal Forces (lbs. and in.-lbs.) - Line C

Force/ Moment	Strip				Design Values**
	5 ½ - 6	6-7	7-8	8-10	
Fx	-1787383	-3581968	-3603165	-2064483	3574766
Fy	-42357	-24255	-16465	-7061	84714
Mz	-0.492E08	-0.924E08	-0.912E08	-0.519E08	0.984E08

* Application of sign convention to maintain consistency with Reference 1 applied.

** Application of sign convention to maintain consistency with Reference 1 applied. Normalization to a 17-foot wide strip has been performed. Values for strip 5 ½ - 6 factored by 2, and values for strip 8-10 factored by 1.7.

Table 9 (11/11) - Load Case 11 - Time 7.875 days

Z Strips - Internal Forces (lbs. and in.-lbs.) - Line 5 ½

Force/ Moment	Strip		Design Values*
	C-D	D-E	
Fy	-61916	-26847	61916
Fz	-3212272	-3109565	3212272
Mx	0.666E08	0.609E08	-0.666E08

X Strips - Internal Forces (lbs. and in.-lbs.) - Line C

Force/ Moment	Strip				Design Values**
	5 ½ - 6	6-7	7-8	8-10	
Fx	-1434887	-2881157	-2912161	-1673170	2869774
Fy	-49193	-25814	-16855	-7335	98386
Mz	-0.338E08	-0.602E08	-0.584E08	-0.333E08	0.676E08

* Application of sign convention to maintain consistency with Reference 1 applied.

** Application of sign convention to maintain consistency with Reference 1 applied. Normalization to a 17-foot wide strip has been performed. Values for strip 5 ½ - 6 factored by 2, and values for strip 8-10 factored by 1.7.

Unconstrained Model – Analysis Results – Thermal Stress Analysis

The applied temperatures are the same for this model as for the constrained model. The plots shown in Appendix TPad-Th are therefore applicable. The numerical results are provided in Appendix RPadNC-TH.

Unconstrained Model – Pad Response – Displacements

The displacements for the individual load steps are shown in Appendix LSPadNC-TH. The displaced shape for the first nine load steps is the shape typically found in the literature where the free corner curls upward. The last two load steps, 10 and 11, have the opposite shape since these two load steps are for cooling loads. As the shapes show, the dead weight of the pad in not enough to force the pad to be compliant with the rock.

The summed displacements of the pad for all the Load Cases are plotted in Appendix LCPadNC-TH, again to provide some sense of the magnitude of the expected deformations. The displaced shape for all eleven load cases shows that the free corner curls as opposed to the constrained model where the center of the pad arches. A plot of the displacements for Load Case 6 is shown in Figure 24 below. The upward displacements of the pad corner are summarized in Table 10.

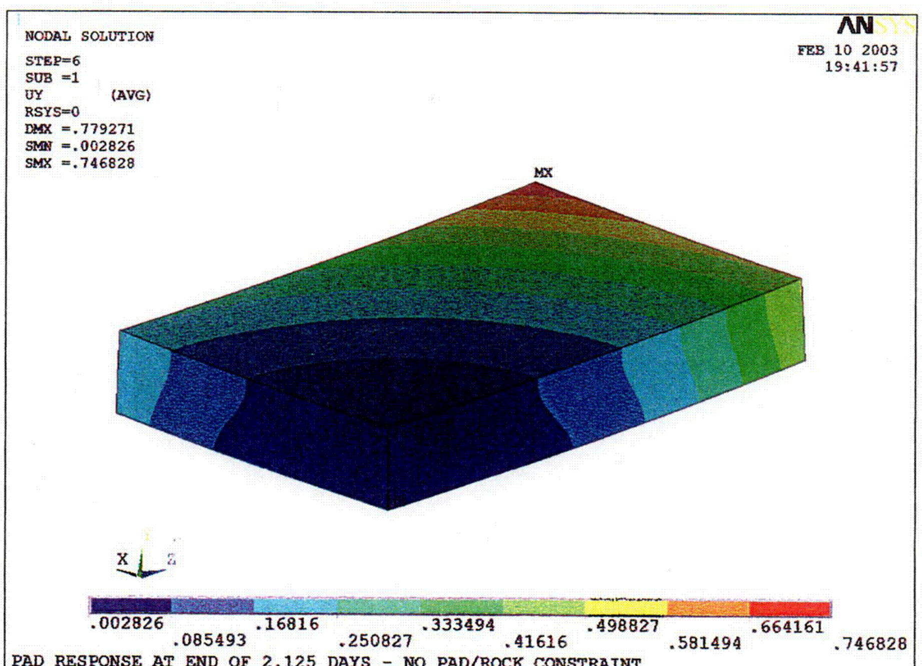

Figure 24 – Pad Vertical Analytical Displacements at 2.125 days (same as Figure LCPadNC – 6)

C16

Table 10 – Analytical Deflections (inches) Vs Time

Time (days)	Load Case	Corner δ
0.25	1	0.0103
0.50	2	0.0774
0.625	3	0.0937
1.125	4	0.452
1.625	5	0.647
2.125	6	0.747
2.375	7	0.774
3.125	8	0.826
4.125	9	0.832
6.125	10	0.825
7.875	11	0.819

These displacements are small compared to the ACI Code suggested limit of 3.9 inches, see below Table 7.

Unconstrained Model – Pad Response – Stresses

The pad stresses are plotted for Load Case 6 in Figures 25 and 26. Plots of Sx and Sz for all the Load Cases are provided in Appendix STPadNC-TH (see Figures STNC-1 through STNC-22). These plots show that from 0.25 days to 3.125 days both the top and bottom surfaces are in biaxial (X-Z) tension and the middle portion of the pad is in biaxial compression (see Figures STNC-1 to STNC-16). The time 4.125 days is a transition where the maximum tension stresses lie beneath the surfaces due to cooling (see Figures STNC-17 and STNC-18). Finally, as the pad cools, and the concrete hardens, the stresses reduce in magnitude and evolve in to a complex stress state (see Figure STNC-19 to STNC-22).

A summary of the applied stresses is provided in Table 11. Comparing the stresses in Table 11 with those in Table 8 show that allowing the pad to slide on the rock reduces the applied stresses, in some cases significantly, compare the $\sigma_{3\ Min}$ columns. The distribution of stress within the pad however, is markedly different. In the constrained model there is a net moment to the pad, hence tension on the top and compression on the bottom. While in the unconstrained model there is no net moment, hence the stress field with tension on both the top and bottom and compression in the middle.

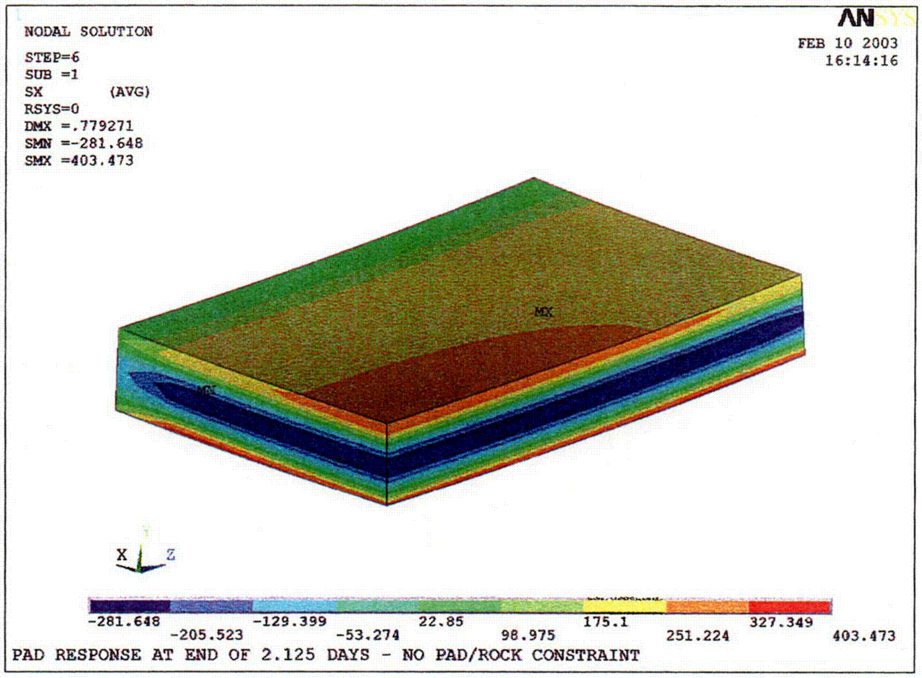

Figure 25 – Sx at time 2.125 days

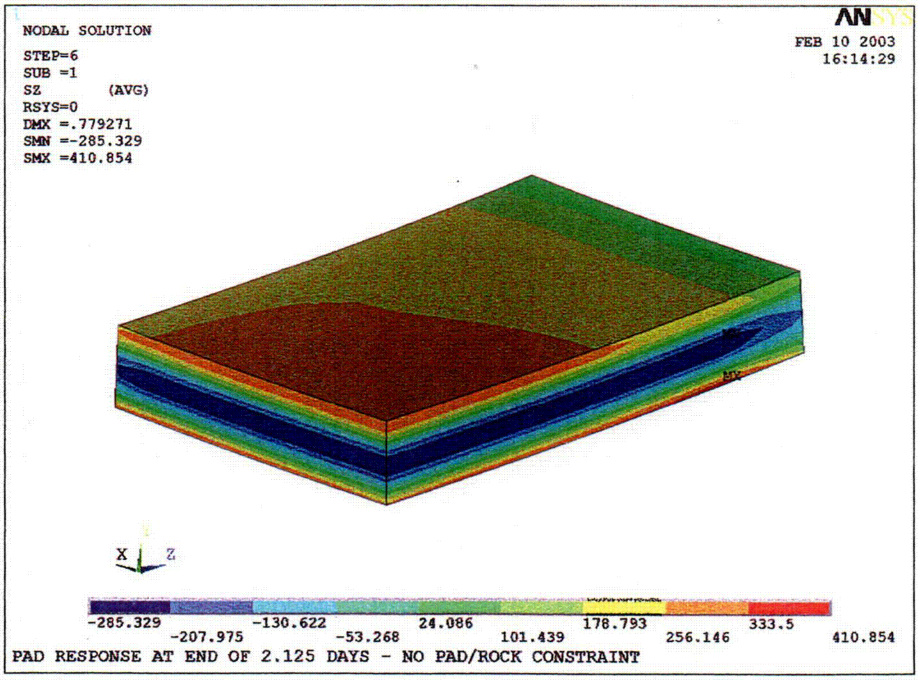

Figure 26 – Sz at time 2.125 days

C17

Table 11 – Pad Stresses (psi) Vs Time

Time (days)	Load Case	$\sigma_{X\,Max}$	$\sigma_{X\,Min}$	$\sigma_{Z\,Max}$	$\sigma_{Z\,Min}$	$\sigma_{1\,Max}$	$\sigma_{3\,Min}$	f_c'	f_t^*
0.25	1	56	-7	55	-7	56	-11	234	102
0.50	2	204	-67	205	-67	205	-68	469	145
0.625	3	300	-82	302	-82	302	-82	586	162
1.125	4	354	-190	360	-190	360	-190	1054	218
1.625	5	399	-261	406	-261	408	-262	1523	261
2.125	6	403	-284	411	-285	413	-285	1961	297
2.375	7	395	-283	403	-285	405	-285	2133	309
3.125	8	342	-256	350	-258	352	-259	2604	342
4.125	9	236	-218	248	-218	248	-219	2939	363
6.125	10	138	-154	152	-147	152	-160	3448	393
7.875	11	124	-220	130	-220	131	-232	3699	407

$^*f_t = 6.7\sqrt{f_c'}$

In order to numerically assess the internal force distributions of the stress field within the pad, use is made of the ANSYS plot path capabilities. This feature allows stresses to be plotted along a specified path, i.e., a line defined within the finite element mesh. An examination of the stress plots, STNC-1 to STNC-22, shows that there are three locations where the stresses reach maximum values for the analyzed load cases. Thus, three paths were established. They are shown in Figure 27 below. The first is referred to as "X side" where X is 285.6 in. and Z is 0.0, the second is called "Center" where both X and Z are 0.0 and the third is called "Z side" where X is 0.0 and Z is 510.0 in. All three paths extend from the top of the pad to the bottom. Thus in the stress path plots, 0.0 is the top of the pad and 96 is the bottom.

A review of the stress contours indicates that the most demanding stresses and hence internal forces will be from Load Cases 5, 6 or 7. Path plots for Sx at X side, Sx and Sz at the Center and Sz at Z side are provided in Appendix STPadNC-TH, see Figures STNC-24 to STNC-32 for these load cases. A review of these plots shows that Load Cases 5 and 6 will govern for the unconstrained analyses. These Cases are plotted in Figures 28 to 33 below.

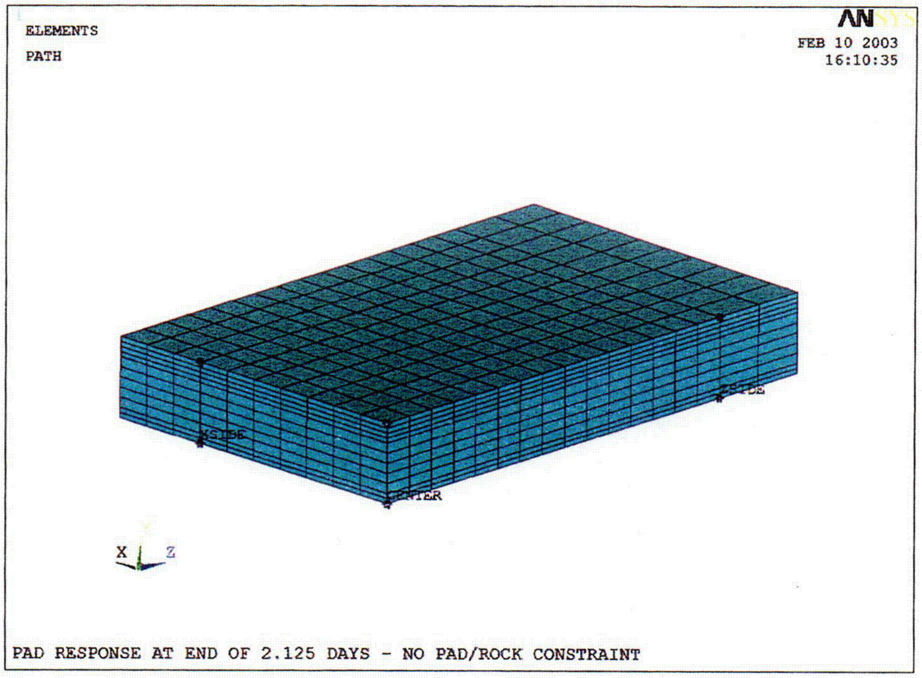

Figure 27 – Locations where stresses are plotted – paths

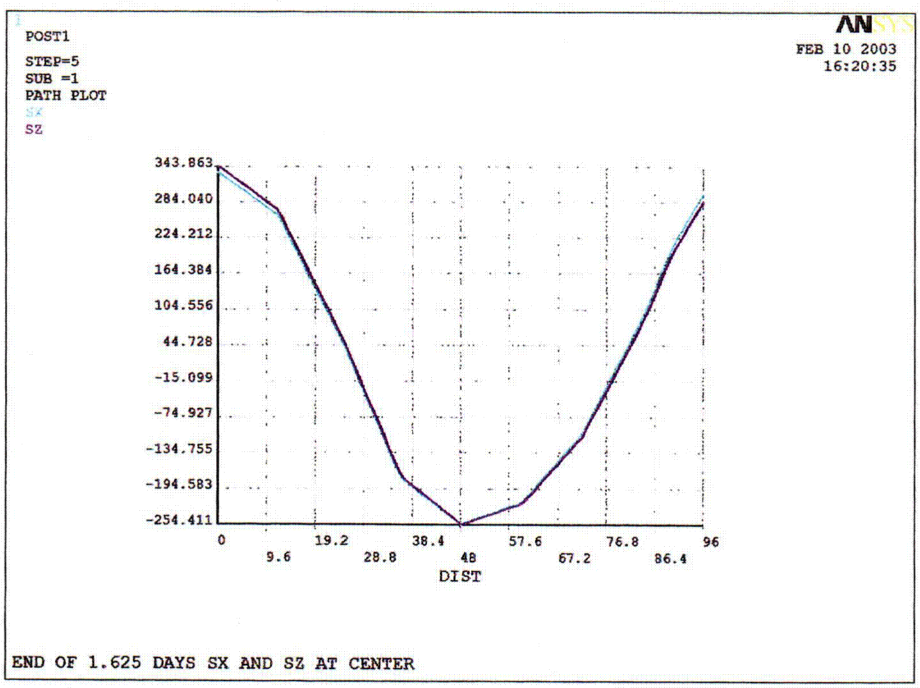

Figure 28 – Sx and Sz at Center at time 1.625 days, see Figure STNC-24

C18

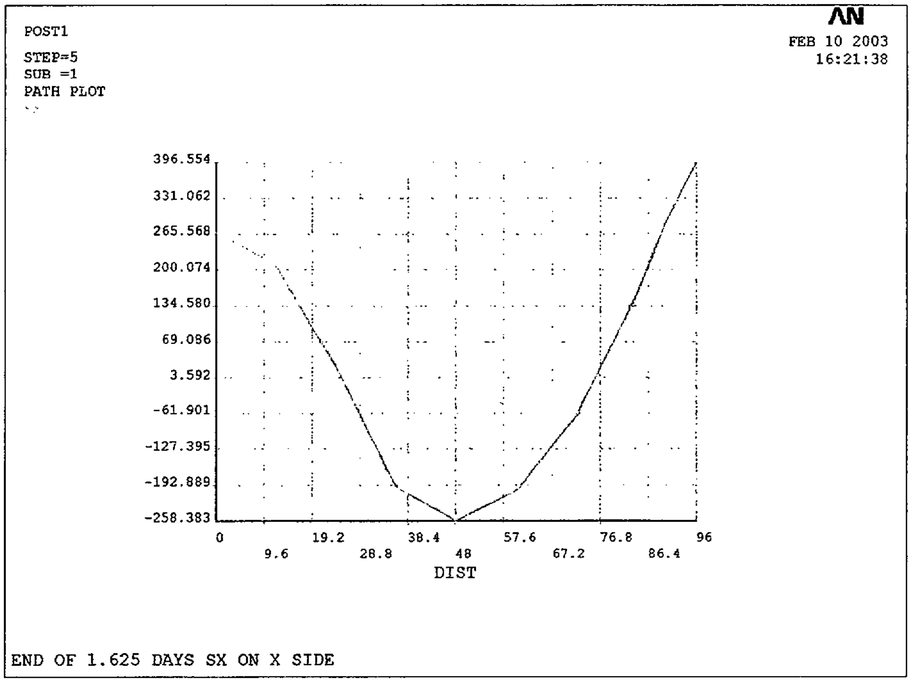

Figure 29 – Sx at X side at time 1.625 days, see Figure STNC-25

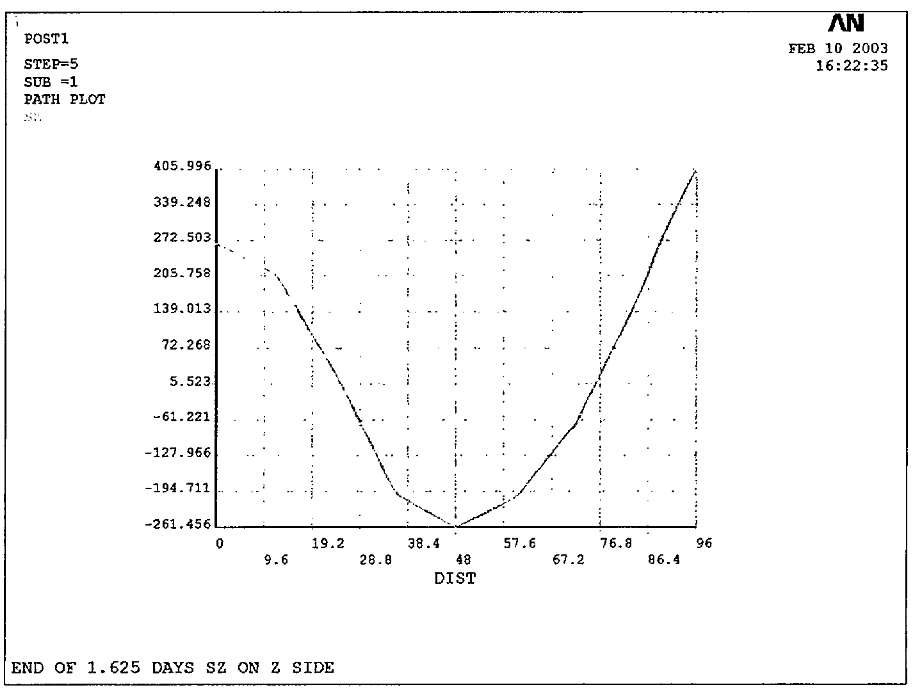

Figure 30 – Sz at Z side at time 1.625 days, see Figure STNC 26

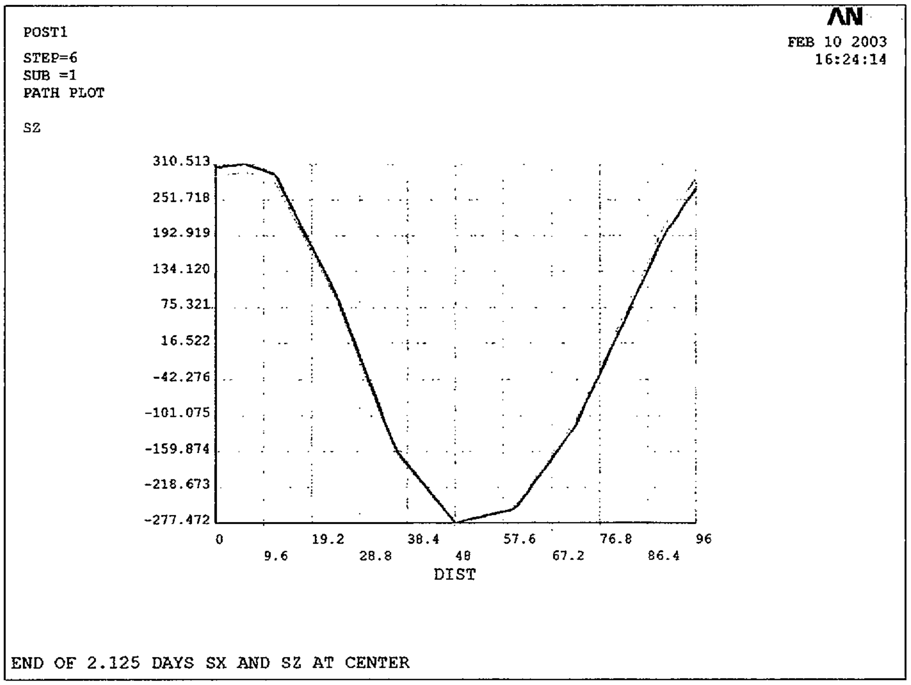

Figure 31 – Sx and Sz at Center at time 2.125 days, see Figure STNC-27

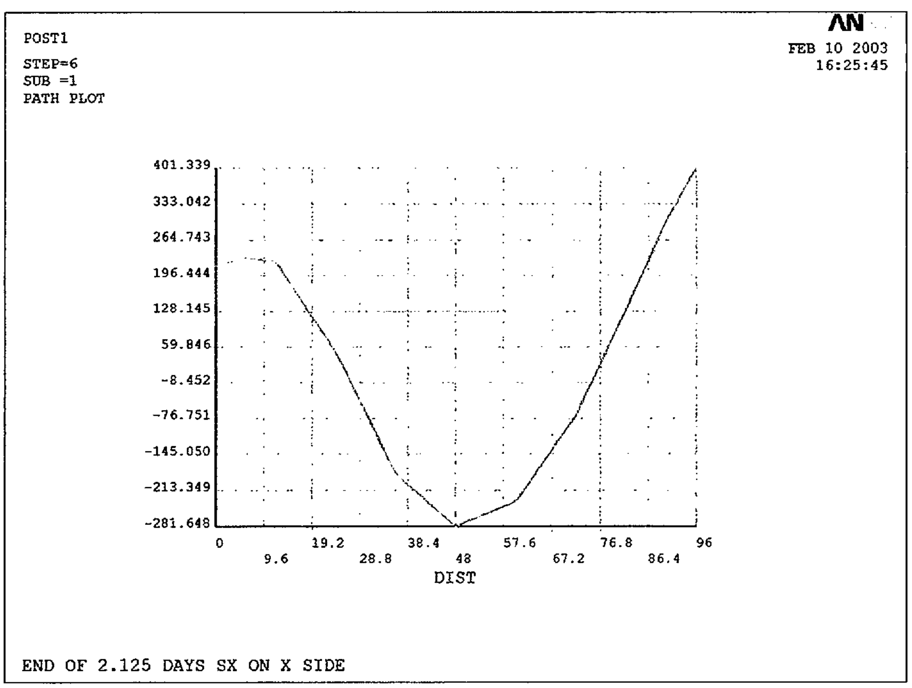

Figure 32 – Sx at X side at time 2.125 days, see Figure STNC-28

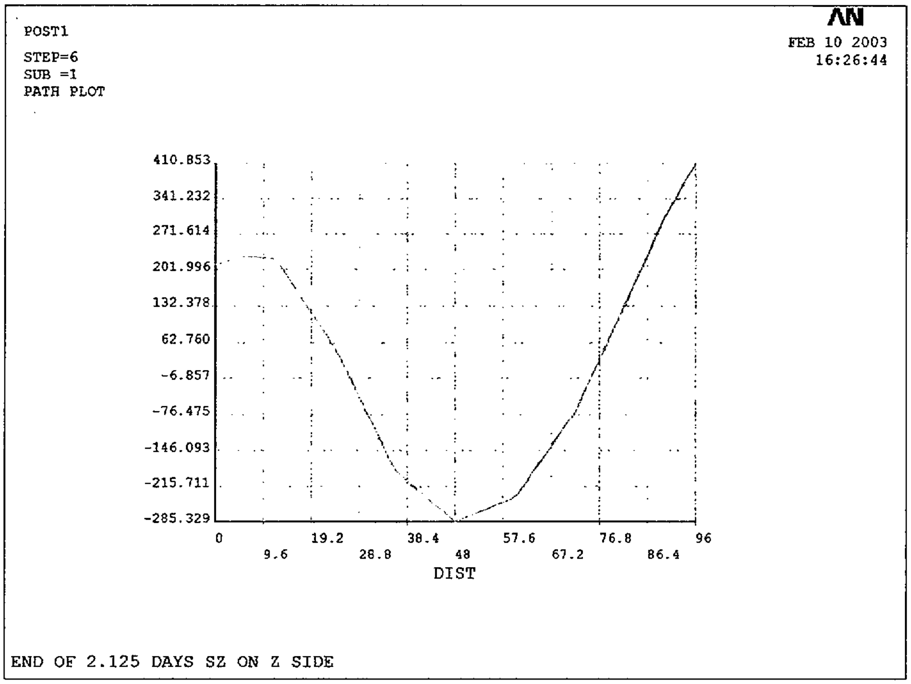

Figure 33 – Sz at Z side at time 2.125 days, see Figure STNC-29

The most demanding stress distributions for both the top and bottom reinforcement are shown in the Figures 28 to 33 above. The determination of reinforcement bar stresses will be made in subsequent calculations.

Analysis Results – Shrinkage Stress Analysis

Pad Response – Displacements

The pad displacements are plotted in Figures 34 and 35 below. The maximum displacement of the pad is 0.0583 inches up at the corner. The displacements are also extracted from the data file and documented in Appendix DPad-SH.

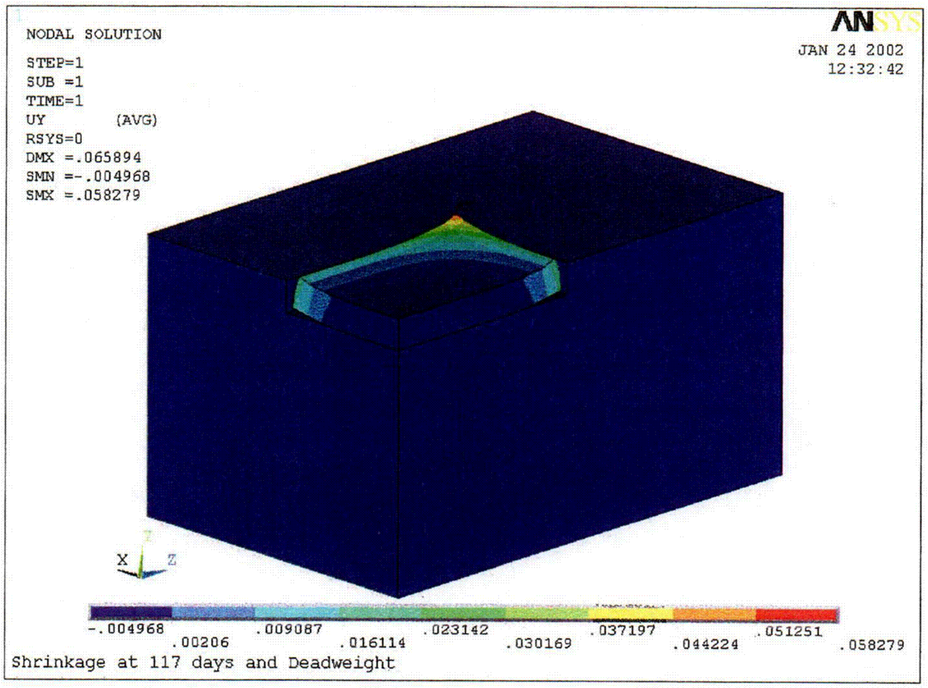

Figure 34 – Pad Shrinkage Vertical Displacements

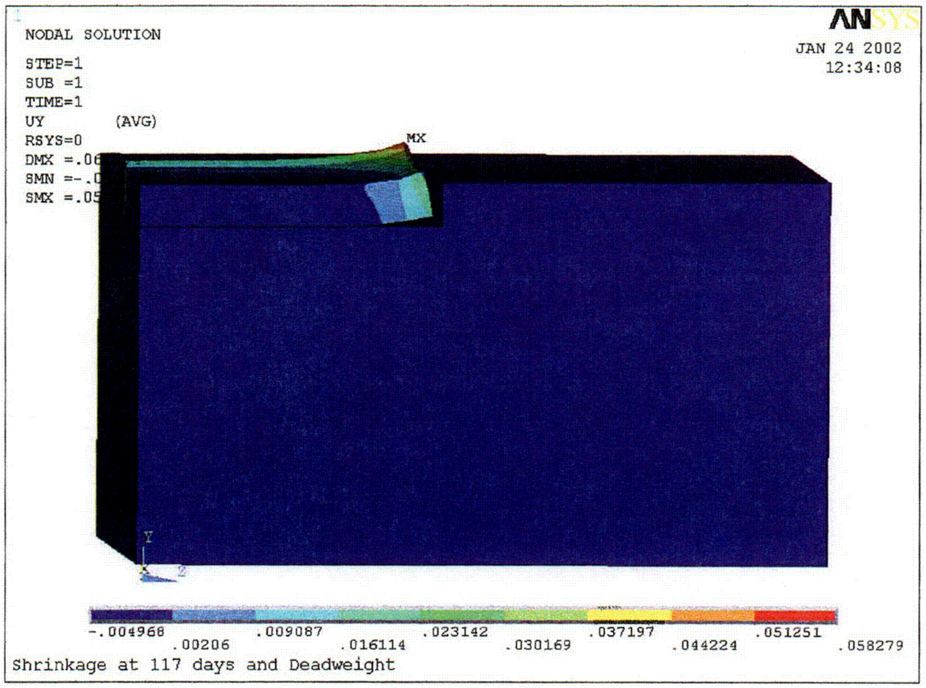

Figure 35 – Pad Shrinkage Vertical Displacements

C20

Pad Response – Stresses

Pad stresses are plotted in Figures 36 to 39 below. The maximum tensile stress S1 is very local to the top surface of the pad and extends almost completely over the surface. The full set of stresses are extracted from the data file and are provided in Table 12. The ANSYS run documenting this data is provided in Appendix SPad-SH.

Table 12 – Pad Stresses (psi)

$\sigma_{X\,Max}$	$\sigma_{X\,Min}$	$\sigma_{Z\,Max}$	$\sigma_{Z\,Min}$	$\sigma_{1\,Max}$	$\sigma_{3\,Min}$	f_c'	f_t *
1506	-189	1524	-183	1524	-230	5000	474

$* f_t = 6.7\sqrt{f_c'}$

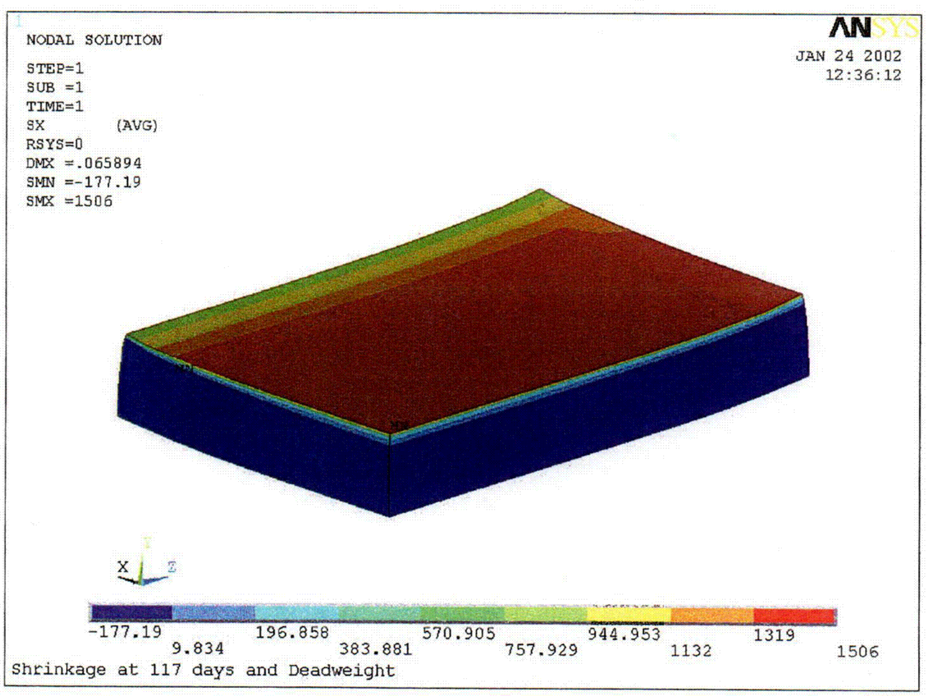

Figure 36 – Pad Shrinkage SX Stresses

C21

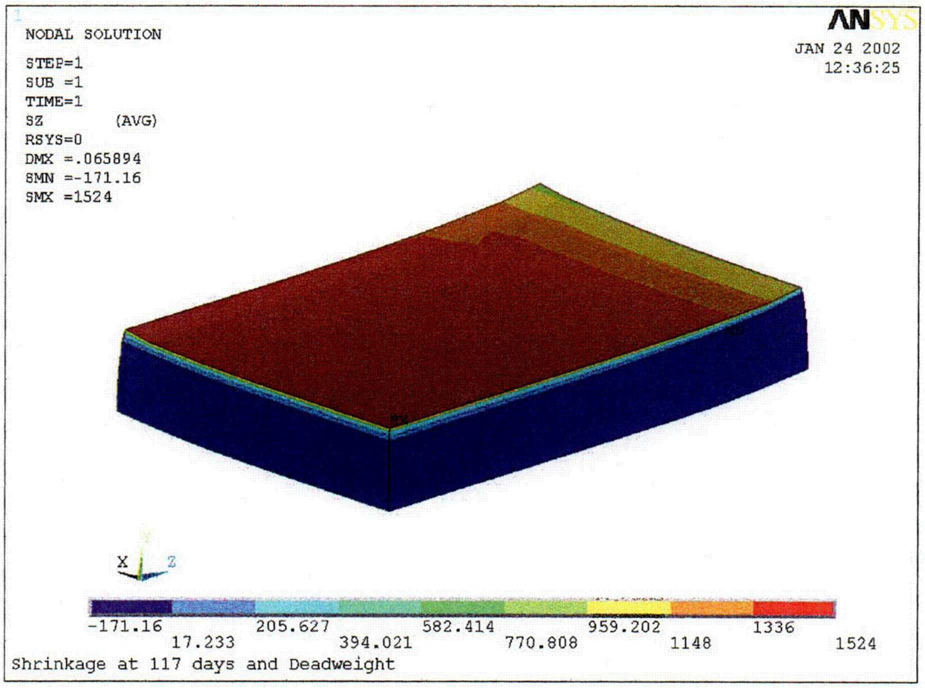

Figure 37 – Pad Shrinkage SZ Stresses

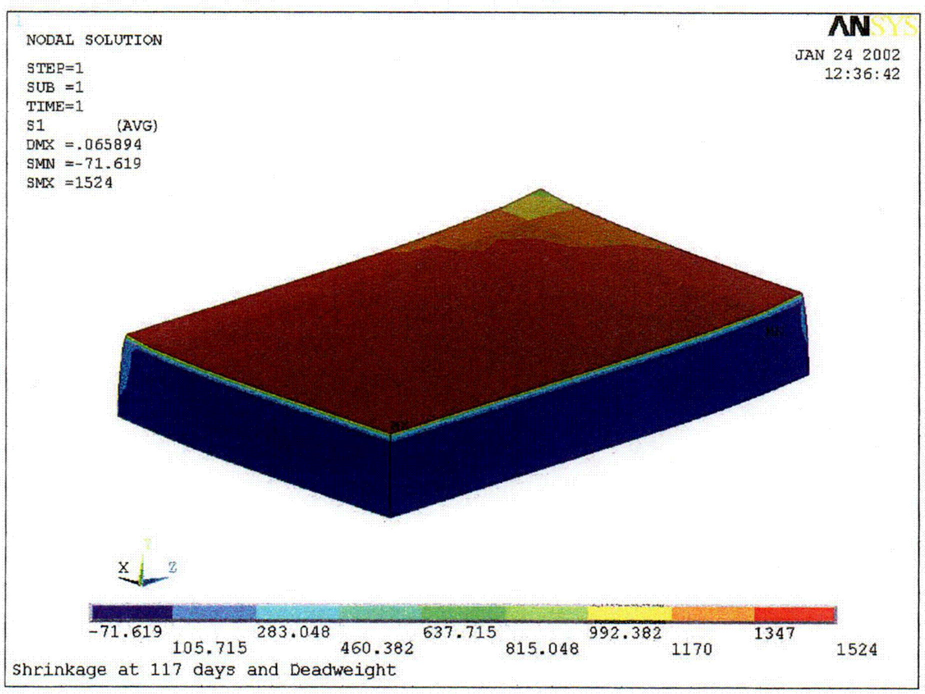

Figure 38 – Pad Shrinkage S1 Stresses

C22

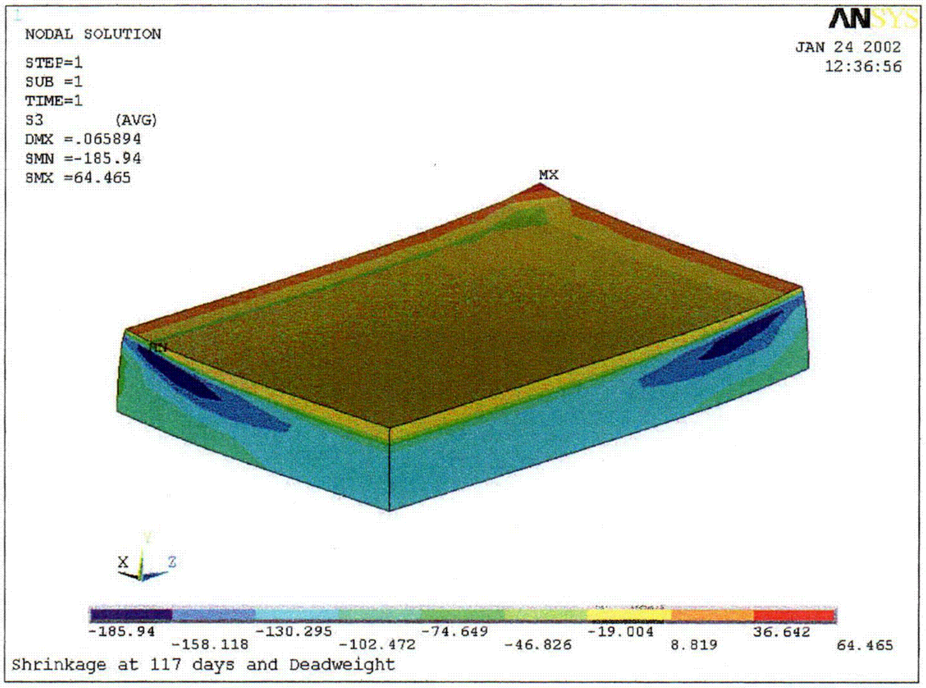

Figure 39 – Pad Shrinkage S3 Stresses

C23

Pad Response – Internal Forces

The pad internal forces are provided in Table 13 for lines 5 ½ and C. The ANSYS output documenting this data extraction is provided in Appendix FPad-SH.

Table 13 - Shrinkage Stress Analysis

Z Strips - Internal Forces (lbs. and in.-lbs.) - Line 5 ½

Force/ Moment	Strip		Design Values*
	C-D	D-E	
Fy	-33078	-35415	35415
Fz	-39019	–18571	39019
Mx	0.854E8	0.792E8	–0.854E8

X Strips - Internal Forces (lbs. and in.-lbs.) - Line C

Force/ Moment	Strip				Design Values**
	5 ½ - 6	6-7	7-8	8-10	
Fx	-137830	-314890	-448136	-288218	489971
Fy	–28244	–57891	–63084	–31288	63084
Mz	–0.420E8	–0.838E8	–0.796E8	–0.405E8	0.840E8

* Application of sign convention to maintain consistency with Reference 1 applied.

** Application of sign convention to maintain consistency with Reference 1 applied. Normalization to a 17-foot wide strip has been performed. Values for strip 5 ½ - 6 factored by 2, and values for strip 8-10 factored by 1.7.

Also, pad internal forces for the top 12 inches and the top 6 inches are provided in Table 14 for lines 5 ½ and C. This data is extracted from the database to provide a sense for the tension force calculated in the top sections of the pad. The ANSYS output documenting this data extraction is provided in Appendix FTPad-SH.

Table 14 - Shrinkage Stress Analysis

Z Strips - Internal Forces for top 12 inches and top 6 inches (lbs.) - Line 5 ½

Force	Strip		Design Values*
	C-D	D-E	
Fz 12 inches Fz 6 inches	1510694 1358678	1419874 1143045	-1510694 -1358678

X Strips - Internal Forces for top 12 inches and top 6 inches (lbs.) - Line C

Force	Strip				Design Values**
	5 ½ - 6	6-7	7-8	8-10	
Fx12 inches Fx 6 inches	718835 578436	1430751 1153356	1384017 1128242	752669 629499	-1437670 -1156872

* Application of sign convention to maintain consistency with Reference 1 applied.
** Application of sign convention to maintain consistency with Reference 1 applied. Normalization to a 17-foot wide strip has been performed. Values for strip 5 ½ - 6 factored by 2, and values for strip 8-10 factored by 1.7.

Summary and Conclusions

This calculation computes applied internal forces due to pad heat up due to cement hydration and subsequent pad shrinkage. The values to be used in subsequent calculations to assess the probability of expected cracking and to size the reinforcement are provided in Tables 9, 13 and 14, and Figures 28 to 33.

ENERCON
SERVICES, INC. **Appendix TH-Loads to Calculation PGE-009-CALC-006**

Originator: S. C. Tumminelli
Date: September 20, 2002
Revised: March 3, 2003

Appendix TH-Loads

This Appendix presents the ANSYS file documenting the applied loads for the constrained model thermal stress analysis.

ANSYS Input File:

```
/FILE,PAD-TH
RESUME
EALL
NALL
MPLI
CMLI
/PREP7
LSCLEAR,ALL
/title,DELTA T 0.0 TO 0.25 DAYS
/COM, BC'S ALL LOAD STEPS
ACEL,0,1,0
D,SYMXY,UZ,0.0
D,SYMYZ,UX,0.0
D,XEDGE,UX,0.0
D,XEDGE,UY,0.0
D,XEDGE,UZ,0.0
D,ZEDGE,UX,0.0
D,ZEDGE,UY,0.0
D,ZEDGE,UZ,0.0
D,BOT,UX,0.0
D,BOT,UY,0.0
D,BOT,UZ,0.0
BFUNIF,TEMP,0.0
BF,CONC80,TEMP,15.00
BF,CONC75,TEMP,18.00
BF,CONC70,TEMP,19.67
BF,CONC65,TEMP,21.33
BF,CONC60,TEMP,21.33
BF,CONC50,TEMP,21.33
BF,CONC40,TEMP,21.33
BF,CONC30,TEMP,21.33
BF,CONC20,TEMP,21.33
BF,CONC10,TEMP,20.50
BF,CONC05,TEMP,19.66
BF,CONC00,TEMP,10.67
BF,ROCK05,TEMP,1.67
BF,ROCK10,TEMP,0.84
BF,ROCK20,TEMP,0.0
BF,ROCK30,TEMP,0.0
BF,ROCK40,TEMP,0.0
LSWRITE,1
/title,DELTA T 0.25 TO 0.50 DAYS
/COM, NO DEAD WEIGHT AFTER FISRT LOAD STEP
ACEL,0,0.01,0
BF,CONC80,TEMP,-2.50
BF,CONC75,TEMP,10.50
BF,CONC70,TEMP,9.25
BF,CONC65,TEMP,8.00
BF,CONC60,TEMP,16.67
BF,CONC50,TEMP,25.33
BF,CONC40,TEMP,25.33
BF,CONC30,TEMP,25.33
BF,CONC20,TEMP,25.12
BF,CONC10,TEMP,21.41
```

```
BF,CONC05,TEMP,17.92
BF,CONC00,TEMP,12.66
BF,ROCK05,TEMP,7.41
BF,ROCK10,TEMP,3.91
BF,ROCK20,TEMP,0.21
BF,ROCK30,TEMP,0.0
BF,ROCK40,TEMP,0.0
LSWRITE,2
/title,DELTA T 0.50 TO 0.625 DAYS
BF,CONC80,TEMP,-3.00
BF,CONC75,TEMP,-1.35
BF,CONC70,TEMP,9.32
BF,CONC65,TEMP,13.46
BF,CONC60,TEMP,9.33
BF,CONC50,TEMP,9.33
BF,CONC40,TEMP,9.33
BF,CONC30,TEMP,9.33
BF,CONC20,TEMP,9.33
BF,CONC10,TEMP,9.33
BF,CONC05,TEMP,2.04
BF,CONC00,TEMP,4.67
BF,ROCK05,TEMP,7.30
BF,ROCK10,TEMP,0.0
BF,ROCK20,TEMP,0.0
BF,ROCK30,TEMP,0.0
BF,ROCK40,TEMP,0.0
LSWRITE,3
/title,DELTA T 0.625 TO 1.125 DAYS
BF,CONC80,TEMP,-5.40
BF,CONC75,TEMP,-7.44
BF,CONC70,TEMP,-8.81
BF,CONC65,TEMP,-3.10
BF,CONC60,TEMP,2.62
BF,CONC50,TEMP,15.00
BF,CONC40,TEMP,20.11
BF,CONC30,TEMP,20.32
BF,CONC20,TEMP,17.86
BF,CONC10,TEMP,11.88
BF,CONC05,TEMP,11.11
BF,CONC00,TEMP,10.33
BF,ROCK05,TEMP,9.55
BF,ROCK10,TEMP,8.78
BF,ROCK20,TEMP,2.81
BF,ROCK30,TEMP,0.35
BF,ROCK40,TEMP,0.01
LSWRITE,4
/title,DELTA T 1.125 TO 1.625 DAYS
BF,CONC80,TEMP,-2.10
BF,CONC75,TEMP,-5.50
BF,CONC70,TEMP,-6.46
BF,CONC65,TEMP,-4.73
BF,CONC60,TEMP,-3.00
BF,CONC50,TEMP,2.25
BF,CONC40,TEMP,7.32
BF,CONC30,TEMP,8.45
BF,CONC20,TEMP,6.32
BF,CONC10,TEMP,3.74
```

```
BF,CONC05,TEMP,4.45
BF,CONC00,TEMP,5.16
BF,ROCK05,TEMP,5.88
BF,ROCK10,TEMP,6.60
BF,ROCK20,TEMP,3.98
BF,ROCK30,TEMP,1.38
BF,ROCK40,TEMP,0.25
LSWRITE,5
/title,DELTA T 1.625 TO 2.125 DAYS
BF,CONC80,TEMP,-0.80
BF,CONC75,TEMP,-3.06
BF,CONC70,TEMP,-4.06
BF,CONC65,TEMP,-3.96
BF,CONC60,TEMP,-3.87
BF,CONC50,TEMP,-2.22
BF,CONC40,TEMP,0.96
BF,CONC30,TEMP,2.29
BF,CONC20,TEMP,1.53
BF,CONC10,TEMP,0.91
BF,CONC05,TEMP,1.87
BF,CONC00,TEMP,2.83
BF,ROCK05,TEMP,3.78
BF,ROCK10,TEMP,4.72
BF,ROCK20,TEMP,3.82
BF,ROCK30,TEMP,1.98
BF,ROCK40,TEMP,0.53
LSWRITE,6
/title,DELTA T 2.125 TO 2.375 DAYS
BF,CONC80,TEMP,-0.20
BF,CONC75,TEMP,-0.94
BF,CONC70,TEMP,-1.28
BF,CONC65,TEMP,-1.47
BF,CONC60,TEMP,-1.65
BF,CONC50,TEMP,-1.51
BF,CONC40,TEMP,-0.54
BF,CONC30,TEMP,0.08
BF,CONC20,TEMP,0.09
BF,CONC10,TEMP,0.20
BF,CONC05,TEMP,0.63
BF,CONC00,TEMP,1.06
BF,ROCK05,TEMP,1.46
BF,ROCK10,TEMP,1.86
BF,ROCK20,TEMP,1.73
BF,ROCK30,TEMP,1.05
BF,ROCK40,TEMP,0.33
LSWRITE,7
/title,DELTA T 2.375 TO 3.125 DAYS
BF,CONC80,TEMP,-0.50
BF,CONC75,TEMP,-2.13
BF,CONC70,TEMP,-3.07
BF,CONC65,TEMP,-3.90
BF,CONC60,TEMP,-4.74
BF,CONC50,TEMP,-5.60
BF,CONC40,TEMP,-4.20
BF,CONC30,TEMP,-2.72
BF,CONC20,TEMP,-1.85
BF,CONC10,TEMP,-0.66
```

```
BF,CONC05,TEMP,0.64
BF,CONC00,TEMP,1.94
BF,ROCK05,TEMP,3.10
BF,ROCK10,TEMP,4.26
BF,ROCK20,TEMP,4.39
BF,ROCK30,TEMP,3.00
BF,ROCK40,TEMP,1.03
LSWRITE,8
/title,DELTA T 3.125 TO 4.125 DAYS
BF,CONC80,TEMP,-0.30
BF,CONC75,TEMP,-2.03
BF,CONC70,TEMP,-3.14
BF,CONC65,TEMP,-4.49
BF,CONC60,TEMP,-5.84
BF,CONC50,TEMP,-8.34
BF,CONC40,TEMP,-8.35
BF,CONC30,TEMP,-7.11
BF,CONC20,TEMP,-5.33
BF,CONC10,TEMP,-2.91
BF,CONC05,TEMP,-1.19
BF,CONC00,TEMP,0.54
BF,ROCK05,TEMP,1.98
BF,ROCK10,TEMP,3.43
BF,ROCK20,TEMP,4.18
BF,ROCK30,TEMP,3.19
BF,ROCK40,TEMP,1.18
LSWRITE,9
/title,DELTA T 4.125 TO 6.125 DAYS
BF,CONC80,TEMP,0.0
BF,CONC75,TEMP,-1.38
BF,CONC70,TEMP,-2.61
BF,CONC65,TEMP,-4.76
BF,CONC60,TEMP,-6.91
BF,CONC50,TEMP,-11.78
BF,CONC40,TEMP,-13.65
BF,CONC30,TEMP,-12.77
BF,CONC20,TEMP,-9.82
BF,CONC10,TEMP,-5.60
BF,CONC05,TEMP,-3.36
BF,CONC00,TEMP,-1.12
BF,ROCK05,TEMP,0.66
BF,ROCK10,TEMP,2.43
BF,ROCK20,TEMP,4.06
BF,ROCK30,TEMP,3.52
BF,ROCK40,TEMP,1.37
LSWRITE,10
/title,DELTA T 6.125 TO 7.875 DAYS
BF,CONC80,TEMP,0.0
BF,CONC75,TEMP,-0.69
BF,CONC70,TEMP,-1.33
BF,CONC65,TEMP,-2.51
BF,CONC60,TEMP,-3.69
BF,CONC50,TEMP,-6.58
BF,CONC40,TEMP,-8.12
BF,CONC30,TEMP,-8.10
BF,CONC20,TEMP,-6.75
BF,CONC10,TEMP,-4.56
```

```
BF,CONC05,TEMP,-3.38
BF,CONC00,TEMP,-2.20
BF,ROCK05,TEMP,-1.23
BF,ROCK10,TEMP,-0.25
BF,ROCK20,TEMP,0.85
BF,ROCK30,TEMP,1.01
BF,ROCK40,TEMP,0.43
LSWRITE,11
FINISH
/EXIT,NOSAVE
```

ENCERCON
SERVICES, INC. Appendix RPad-TH to Calculation PGE-009-CALC-006

Originator: S. C. Tumminelli
Date: September 20, 2002
Revised: March 3, 2003

Appendix RPad-TH

This Appendix presents the ANSYS output file documenting the execution of the constrained model thermal stress analysis and the output temperatures for checking.

ANSYS Output File:

```
ANSYS/Mechanical U

*-------------------------------------------------------------*
|                                                             |
|   W E L C O M E   T O   T H E   A N S Y S   P R O G R A M   |
|                                                             |
*-------------------------------------------------------------*



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***************************************************************
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****************************************************************

                    Completing ANSYS Load Process.


         *****  ANSYS COMMAND LINE ARGUMENTS  *****
 INITIAL JOBNAME              = PAD-TH
 BATCH MODE REQUESTED         = LIST
 MEMORY REQUESTED (MB)        = 800
 DATABASE SIZE REQUESTED (MB) = 250

*** WARNING ***                         CP=       0.180   TIME= 16:49:19
Use of the -M switch is no longer recommended for normal ANSYS use.
ANSYS now dynamically allocates memory as needed.  Only use the -M
 switch if you are certain that you need to do so.

PARAMETER STATUS-           (     1 PARAMETERS DEFINED)
                  (INCLUDING      1 INTERNAL PARAMETERS)

00245050          VERSION=INTEL NT        RELEASE= 6.1     UP20020321
CURRENT JOBNAME=PAD-TH  16:49:19  JUN 10, 2002 CP=       0.180
```

```
resume
nall
eall
mpli
/com start, change the material properties for each time step, initial
/com property is no. 2. Change back to no. 2 at end and save.
/solu
/HEADER,ON,OFF,OFF,OFF,ON,OFF
elist,530
lssolve,1
esel,type,2
mpchg,3,all
eall
elist,530
lssolve,2
esel,type,2
mpchg,4,all
eall
elist,530
lssolve,3
esel,type,2
mpchg,5,all
eall
elist,530
lssolve,4
esel,type,2
mpchg,6,all
eall
elist,530
lssolve,5
esel,type,2
mpchg,7,all
```

```
eall
elist,530
lssolve,6
esel,type,2
mpchg,8,all
eall
elist,530
lssolve,7
esel,type,2
mpchg,9,all
eall
elist,530
lssolve,8
esel,type,2
mpchg,10,all
eall
elist,530
lssolve,9
esel,type,2
mpchg,11,all
eall
elist,530
lssolve,10
esel,type,2
mpchg,12,all
eall
elist,530
lssolve,11
esel,type,2
mpchg,2,all
eall
elist,530
finish
save
/POST1
/HEADER,ON,OFF,OFF,OFF,ON,OFF
/COM
/COM SUM RESULTS, SET TITLES AND WRITE LOAD CASE FILES FOR FURTHER PROCESSING
/COM
LCSUM,ALL
LCDEF,1,1
LCDEF,2,2
LCDEF,3,3
LCDEF,4,4
LCDEF,5,5
LCDEF,6,6
LCDEF,7,7
LCDEF,8,8
LCDEF,9,9
LCDEF,10,10
LCDEF,11,11
LCASE,1
/TITLE,PAD RESPONSE AT END OF 0.25 DAYS
LCWRITE,1
LCOPER,ADD,2
/TITLE,PAD RESPONSE AT END OF 0.50 DAYS
```

```
LCWRITE,2
LCOPER,ADD,3
/TITLE,PAD RESPONSE AT END OF 0.625 DAYS
LCWRITE,3
LCOPER,ADD,4
/TITLE,PAD RESPONSE AT END OF 1.125 DAYS
LCWRITE,4
LCOPER,ADD,5
/TITLE,PAD RESPONSE AT END OF 1.625 DAYS
LCWRITE,5
LCOPER,ADD,6
/TITLE,PAD RESPONSE AT END OF 2.125 DAYS
LCWRITE,6
LCOPER,ADD,7
/TITLE,PAD RESPONSE AT END OF 2.375 DAYS
LCWRITE,7
LCOPER,ADD,8
/TITLE,PAD RESPONSE AT END OF 3.125 DAYS
LCWRITE,8
LCOPER,ADD,9
/TITLE,PAD RESPONSE AT END OF 4.125 DAYS
LCWRITE,9
LCOPER,ADD,10
/TITLE,PAD RESPONSE AT END OF 6.125 DAYS
LCWRITE,10
LCOPER,ADD,11
/TITLE,PAD RESPONSE AT END OF 7.875 DAYS
LCWRITE,11
FINISH
/com print the temperatures for checking
EALL
NALL
/POST1
/HEADER,ON,OFF,OFF,OFF,ON,OFF
NSEL,S,LOC,X,0.0
NSEL,R,LOC,Z,0.0
NSEL,R,LOC,Y,0.0,-145.0
NLIS
SET,1
NSORT,LOC,Y
PRNSOL,BFE
SET,2
NSORT,LOC,Y
PRNSOL,BFE
SET,3
NSORT,LOC,Y
PRNSOL,BFE
SET,4
NSORT,LOC,Y
PRNSOL,BFE
SET,5
NSORT,LOC,Y
PRNSOL,BFE
SET,6
NSORT,LOC,Y
PRNSOL,BFE
SET,7
```

```
NSORT,LOC,Y
PRNSOL,BFE
SET,8
NSORT,LOC,Y
PRNSOL,BFE
SET,9
NSORT,LOC,Y
PRNSOL,BFE
SET,10
NSORT,LOC,Y
PRNSOL,BFE
SET,11
NSORT,LOC,Y
PRNSOL,BFE
LCASE,1
NSORT,LOC,Y
PRNSOL,BFE
LCASE,2
NSORT,LOC,Y
PRNSOL,BFE
LCASE,3
NSORT,LOC,Y
PRNSOL,BFE
LCASE,4
NSORT,LOC,Y
PRNSOL,BFE
LCASE,5
NSORT,LOC,Y
PRNSOL,BFE
LCASE,6
NSORT,LOC,Y
PRNSOL,BFE
LCASE,7
NSORT,LOC,Y
PRNSOL,BFE
LCASE,8
NSORT,LOC,Y
PRNSOL,BFE
LCASE,9
NSORT,LOC,Y
PRNSOL,BFE
LCASE,10
NSORT,LOC,Y
PRNSOL,BFE
LCASE,11
NSORT,LOC,Y
PRNSOL,BFE
NUSORT
FINISH
eall
nall
/EXIT,NOSAVE
```

```
 RUN SETUP PROCEDURE FROM FILE= C:\Program Files\Ansys
Inc\ANSYS61\docu\start61.ans

 /INPUT FILE= C:\Program Files\Ansys Inc\ANSYS61\docu\start61.ans  LINE=       0
```

```
RESUME ANSYS DATA FROM FILE NAME=PAD-TH.db

*** ANSYS GLOBAL STATUS ***

TITLE = Pad thermal analysis model
NUMBER OF ELEMENT TYPES =       5
   8812 ELEMENTS CURRENTLY SELECTED.  MAX ELEMENT NUMBER =     9341
  10212 NODES CURRENTLY SELECTED.     MAX NODE NUMBER =       10212
    166 KEYPOINTS CURRENTLY SELECTED. MAX KEYPOINT NUMBER =     166
    339 LINES CURRENTLY SELECTED.     MAX LINE NUMBER =         339
      2 AREAS CURRENTLY SELECTED.     MAX AREA NUMBER =         224
     48 VOLUMES CURRENTLY SELECTED.   MAX VOL. NUMBER =          48
    22 COMPONENTS CURRENTLY DEFINED
MAXIMUM LINEAR PROPERTY NUMBER        =      12
MAXIMUM REAL CONSTANT SET NUMBER      =       1
ACTIVE COORDINATE SYSTEM              =       0  (CARTESIAN)
MAXIMUM COUPLED D.O.F. SET NUMBER     =     367

INITIAL JOBNAME = PAD-TH
CURRENT JOBNAME = PAD-TH

   10212  NODES (OF    10212  DEFINED) SELECTED BY NALL  COMMAND.

    8812  ELEMENTS (OF     8812  DEFINED) SELECTED BY  EALL  COMMAND.

LIST MATERIALS       1 TO       12 BY       1
 PROPERTY= ALL

PROPERTY TABLE EX     MAT=        1  NUM. POINTS=  1
  TEMPERATURE     DATA    TEMPERATURE     DATA    TEMPERATURE     DATA
    0.0000     0.20000E+07

PROPERTY TABLE NUXY  MAT=        1  NUM. POINTS=  1
  TEMPERATURE     DATA    TEMPERATURE     DATA    TEMPERATURE     DATA
    0.0000     0.24000

PROPERTY TABLE ALPX  MAT=        1  NUM. POINTS=  1
  TEMPERATURE     DATA    TEMPERATURE     DATA    TEMPERATURE     DATA
    0.0000     0.50000E-05

PROPERTY TABLE DENS  MAT=        1  NUM. POINTS=  1
  TEMPERATURE     DATA    TEMPERATURE     DATA    TEMPERATURE     DATA
    0.0000      0.0000

PROPERTY TABLE EX     MAT=        2  NUM. POINTS=  1
  TEMPERATURE     DATA    TEMPERATURE     DATA    TEMPERATURE     DATA
    0.0000     0.92400E+06

PROPERTY TABLE NUXY  MAT=        2  NUM. POINTS=  1
  TEMPERATURE     DATA    TEMPERATURE     DATA    TEMPERATURE     DATA
    0.0000     0.15000

PROPERTY TABLE ALPX  MAT=        2  NUM. POINTS=  1
  TEMPERATURE     DATA    TEMPERATURE     DATA    TEMPERATURE     DATA
    0.0000     0.51800E-05
```

```
PROPERTY TABLE DENS  MAT=       2  NUM. POINTS=  1
  TEMPERATURE      DATA    TEMPERATURE     DATA    TEMPERATURE     DATA
    0.0000     0.78100E-01

PROPERTY TABLE EX    MAT=       3  NUM. POINTS=  1
  TEMPERATURE      DATA    TEMPERATURE     DATA    TEMPERATURE     DATA
    0.0000     0.13060E+07

PROPERTY TABLE NUXY  MAT=       3  NUM. POINTS=  1
  TEMPERATURE      DATA    TEMPERATURE     DATA    TEMPERATURE     DATA
    0.0000     0.15000

PROPERTY TABLE ALPX  MAT=       3  NUM. POINTS=  1
  TEMPERATURE      DATA    TEMPERATURE     DATA    TEMPERATURE     DATA
    0.0000     0.51800E-05

PROPERTY TABLE DENS  MAT=       3  NUM. POINTS=  1
  TEMPERATURE      DATA    TEMPERATURE     DATA    TEMPERATURE     DATA
    0.0000     0.78100E-01

PROPERTY TABLE EX    MAT=       4  NUM. POINTS=  1
  TEMPERATURE      DATA    TEMPERATURE     DATA    TEMPERATURE     DATA
    0.0000     0.14600E+07

PROPERTY TABLE NUXY  MAT=       4  NUM. POINTS=  1
  TEMPERATURE      DATA    TEMPERATURE     DATA    TEMPERATURE     DATA
    0.0000     0.15000

PROPERTY TABLE ALPX  MAT=       4  NUM. POINTS=  1
  TEMPERATURE      DATA    TEMPERATURE     DATA    TEMPERATURE     DATA
    0.0000     0.51800E-05

PROPERTY TABLE DENS  MAT=       4  NUM. POINTS=  1
  TEMPERATURE      DATA    TEMPERATURE     DATA    TEMPERATURE     DATA
    0.0000     0.78100E-01

PROPERTY TABLE EX    MAT=       5  NUM. POINTS=  1
  TEMPERATURE      DATA    TEMPERATURE     DATA    TEMPERATURE     DATA
    0.0000     0.19640E+07

PROPERTY TABLE NUXY  MAT=       5  NUM. POINTS=  1
  TEMPERATURE      DATA    TEMPERATURE     DATA    TEMPERATURE     DATA
    0.0000     0.15000

PROPERTY TABLE ALPX  MAT=       5  NUM. POINTS=  1
  TEMPERATURE      DATA    TEMPERATURE     DATA    TEMPERATURE     DATA
    0.0000     0.51800E-05

PROPERTY TABLE DENS  MAT=       5  NUM. POINTS=  1
  TEMPERATURE      DATA    TEMPERATURE     DATA    TEMPERATURE     DATA
    0.0000     0.78100E-01

PROPERTY TABLE EX    MAT=       6  NUM. POINTS=  1
  TEMPERATURE      DATA    TEMPERATURE     DATA    TEMPERATURE     DATA
    0.0000     0.23580E+07

PROPERTY TABLE NUXY  MAT=       6  NUM. POINTS=  1
```

```
  TEMPERATURE      DATA    TEMPERATURE      DATA    TEMPERATURE      DATA
    0.0000     0.15000

PROPERTY TABLE ALPX  MAT=        6  NUM. POINTS=  1
  TEMPERATURE      DATA    TEMPERATURE      DATA    TEMPERATURE      DATA
    0.0000     0.51800E-05

PROPERTY TABLE DENS  MAT=        6  NUM. POINTS=  1
  TEMPERATURE      DATA    TEMPERATURE      DATA    TEMPERATURE      DATA
    0.0000     0.78100E-01

PROPERTY TABLE EX    MAT=        7  NUM. POINTS=  1
  TEMPERATURE      DATA    TEMPERATURE      DATA    TEMPERATURE      DATA
    0.0000     0.26740E+07

PROPERTY TABLE NUXY  MAT=        7  NUM. POINTS=  1
  TEMPERATURE      DATA    TEMPERATURE      DATA    TEMPERATURE      DATA
    0.0000     0.15000

PROPERTY TABLE ALPX  MAT=        7  NUM. POINTS=  1
  TEMPERATURE      DATA    TEMPERATURE      DATA    TEMPERATURE      DATA
    0.0000     0.51800E-05

PROPERTY TABLE DENS  MAT=        7  NUM. POINTS=  1
  TEMPERATURE      DATA    TEMPERATURE      DATA    TEMPERATURE      DATA
    0.0000     0.78100E-01

PROPERTY TABLE EX    MAT=        8  NUM. POINTS=  1
  TEMPERATURE      DATA    TEMPERATURE      DATA    TEMPERATURE      DATA
    0.0000     0.27880E+07

PROPERTY TABLE NUXY  MAT=        8  NUM. POINTS=  1
  TEMPERATURE      DATA    TEMPERATURE      DATA    TEMPERATURE      DATA
    0.0000     0.15000

PROPERTY TABLE ALPX  MAT=        8  NUM. POINTS=  1
  TEMPERATURE      DATA    TEMPERATURE      DATA    TEMPERATURE      DATA
    0.0000     0.51800E-05

PROPERTY TABLE DENS  MAT=        8  NUM. POINTS=  1
  TEMPERATURE      DATA    TEMPERATURE      DATA    TEMPERATURE      DATA
    0.0000     0.78100E-01

PROPERTY TABLE EX    MAT=        9  NUM. POINTS=  1
  TEMPERATURE      DATA    TEMPERATURE      DATA    TEMPERATURE      DATA
    0.0000     0.30800E+07

PROPERTY TABLE NUXY  MAT=        9  NUM. POINTS=  1
  TEMPERATURE      DATA    TEMPERATURE      DATA    TEMPERATURE      DATA
    0.0000     0.15000

PROPERTY TABLE ALPX  MAT=        9  NUM. POINTS=  1
  TEMPERATURE      DATA    TEMPERATURE      DATA    TEMPERATURE      DATA
    0.0000     0.51800E-05

PROPERTY TABLE DENS  MAT=        9  NUM. POINTS=  1
  TEMPERATURE      DATA    TEMPERATURE      DATA    TEMPERATURE      DATA
```

```
    0.0000      0.78100E-01

 PROPERTY TABLE EX     MAT=       10  NUM. POINTS=  1
   TEMPERATURE      DATA     TEMPERATURE      DATA     TEMPERATURE      DATA
    0.0000      0.32710E+07

 PROPERTY TABLE NUXY  MAT=       10  NUM. POINTS=  1
   TEMPERATURE      DATA     TEMPERATURE      DATA     TEMPERATURE      DATA
    0.0000      0.15000

 PROPERTY TABLE ALPX  MAT=       10  NUM. POINTS=  1
   TEMPERATURE      DATA     TEMPERATURE      DATA     TEMPERATURE      DATA
    0.0000      0.51800E-05

 PROPERTY TABLE DENS  MAT=       10  NUM. POINTS=  1
   TEMPERATURE      DATA     TEMPERATURE      DATA     TEMPERATURE      DATA
    0.0000      0.78100E-01

 PROPERTY TABLE EX     MAT=       11  NUM. POINTS=  1
   TEMPERATURE      DATA     TEMPERATURE      DATA     TEMPERATURE      DATA
    0.0000      0.35430E+07

 PROPERTY TABLE NUXY  MAT=       11  NUM. POINTS=  1
   TEMPERATURE      DATA     TEMPERATURE      DATA     TEMPERATURE      DATA
    0.0000      0.15000

 PROPERTY TABLE ALPX  MAT=       11  NUM. POINTS=  1
   TEMPERATURE      DATA     TEMPERATURE      DATA     TEMPERATURE      DATA
    0.0000      0.51800E-05

 PROPERTY TABLE DENS  MAT=       11  NUM. POINTS=  1
   TEMPERATURE      DATA     TEMPERATURE      DATA     TEMPERATURE      DATA
    0.0000      0.78100E-01

 PROPERTY TABLE EX     MAT=       12  NUM. POINTS=  1
   TEMPERATURE      DATA     TEMPERATURE      DATA     TEMPERATURE      DATA
    0.0000      0.36690E+07

 PROPERTY TABLE NUXY  MAT=       12  NUM. POINTS=  1
   TEMPERATURE      DATA     TEMPERATURE      DATA     TEMPERATURE      DATA
    0.0000      0.15000

 PROPERTY TABLE ALPX  MAT=       12  NUM. POINTS=  1
   TEMPERATURE      DATA     TEMPERATURE      DATA     TEMPERATURE      DATA
    0.0000      0.51800E-05

 PROPERTY TABLE DENS  MAT=       12  NUM. POINTS=  1
   TEMPERATURE      DATA     TEMPERATURE      DATA     TEMPERATURE      DATA
    0.0000      0.78100E-01
 start, change the material properties for each time step, initial
 property is no. 2. Change back to no. 2 at end and save.

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


 PRINT HEADER
 DO NOT PRINT SUBTITLE(S)
```

```
 DO NOT PRINT LOAD STEP ID
 DO NOT PRINT NOTE LINE(S)
 PRINT COLUMN HEADER LABELS
 DO NOT PRINT REPORT TOTALS

 LIST ALL SELECTED ELEMENTS IN RANGE     530  TO     530  STEP       1
1

 ***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1     *****
 ANSYS/Mechanical U
 00245050          VERSION=INTEL NT      16:49:19  JUN 10, 2002 CP=      0.391

 Pad thermal analysis model


    ELEM MAT TYP REL ESY SEC TSHA       NODES

     530   2   2   1   0   1          1    28    29     3   672  1050  1064   728
 ANSYS RELEASE  6.1     UP20020321       16:47:47    06/10/2002

 PRINTOUT RESUMED BY /GOP

  Load step file number 1.  Begin solution ...

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

 *** NOTE ***                            CP=      1.662   TIME= 16:49:21
 Real constant 1 has been referenced by element types 4 and 5.
   We assume it identifies a contact pair.
1

 ***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1     *****
 ANSYS/Mechanical U
 00245050          VERSION=INTEL NT      16:49:21  JUN 10, 2002 CP=      1.853

 DELTA T 0.0 TO 0.25 DAYS


                       S O L U T I O N   O P T I O N S

   PROBLEM DIMENSIONALITY. . . . . . . . . . . . .3-D
   DEGREES OF FREEDOM. . . . . . UX   UY   UZ
   ANALYSIS TYPE . . . . . . . . . . . . . . . . .STATIC (STEADY-STATE)
   NEWTON-RAPHSON OPTION . . . . . . . . . . . . .PROGRAM CHOSEN

 *** NOTE ***                            CP=      1.883   TIME= 16:49:21
 Present time 0 is less than or equal to the previous time.
   Time will default to 1.

 *** NOTE ***                            CP=      1.893   TIME= 16:49:21
 Nonlinear analysis, NROPT set to the FULL Newton-Raphson solution
  procedure for ALL DOFs.

 SOLCONTROL,ON uses sparse matrix direct solver

 *** NOTE ***                            CP=      1.893   TIME= 16:49:21
 The conditions for direct assembly have been met.  No .emat or .erot
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 files will be produced.

*** WARNING ***                         CP=      1.893   TIME= 16:49:21
The program chosen initial timestep/load-factor is arbitrary.  It is
necessary for the user to supply a suitable initial
timestep/load-factor through the NSUB or DELTIM command for
 convergence and overall efficiency.

                     L O A D   S T E P   O P T I O N S

  LOAD STEP NUMBER. . . . . . . . . . . . . . . . .     1
  TIME AT END OF THE LOAD STEP. . . . . . . . . . .  1.0000
  AUTOMATIC TIME STEPPING . . . . . . . . . . . . .    ON
     INITIAL NUMBER OF SUBSTEPS . . . . . . . . . .     1
     MAXIMUM NUMBER OF SUBSTEPS . . . . . . . . . .  5000
     MINIMUM NUMBER OF SUBSTEPS . . . . . . . . . .     1
     START WITH TIME STEP FROM PREVIOUS SUBSTEP .   YES
  MAXIMUM NUMBER OF EQUILIBRIUM ITERATIONS. . . .    15
  STEP CHANGE BOUNDARY CONDITIONS . . . . . . . .    NO
  TERMINATE ANALYSIS IF NOT CONVERGED . . . . . .YES (EXIT)
  CONVERGENCE CONTROLS. . . . . . . . . . . . . .USE DEFAULTS
  INERTIA LOADS                     X           Y            Z
     ACEL . . . . . . . . . . . . . 0.0000      1.0000       0.0000
  PRINT OUTPUT CONTROLS . . . . . . . . . . . . .NO PRINTOUT
  DATABASE OUTPUT CONTROLS. . . . . . . . . . . .ALL DATA WRITTEN
                                                 FOR THE LAST SUBSTEP


NONLINEAR MONITORING INFO IS WRITTEN TO FILE= PAD-TH.mntr
MAXIMUM NUMBER OF EQUILIBRIUM ITERATIONS HAS BEEN MODIFIED
  TO BE, NEQIT = 26, BY SOLUTION CONTROL LOGIC.

*** NOTE ***                            CP=      2.644   TIME= 16:49:22
Deformable-deformable contact pair identified by real constant set 1
 and contact element type 5 has been set up.
Contact algorithm: Augmented Lagrange method
Contact detection at: Gauss integration point
Default contact stiffness factor FKN         1.0000
The resulting contact stiffness             0.15725E+07
Default penetration tolerance factor FTOLN  0.10000
The resulting penetration tolerance          1.1752
User define tangent contact stiffness FKT   0.10000E-08
Default Max. friction stress TAUMAX         0.10000E+21
Average contact surface length               39.172
Average contact pair depth                   11.752
Default pinball region factor PINB           1.0000
The resulting pinball region                 11.752
User define initial closure ICONT           0.10000E-05
*WARNING*: Initial penetration is included.

*** NOTE ***                            CP=      2.644   TIME= 16:49:22
Max.  Initial penetration 1.421085472E-14 was detected between contact
 element 9172 and target element 9002.
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        **** CENTER OF MASS, MASS, AND MASS MOMENTS OF INERTIA ****

 CALCULATIONS ASSUME ELEMENT MASS AT ELEMENT CENTROID

 TOTAL MASS =  0.19272E+07

                           MOM. OF INERTIA         MOM. OF INERTIA
 CENTER OF MASS             ABOUT ORIGIN         ABOUT CENTER OF MASS

 XC =   204.00           IXX =   0.2606E+12       IXX =   0.6494E+11
 YC =  -48.000           IYY =   0.3614E+12       IYY =   0.8995E+11
 ZC =   315.00           IZZ =   0.1126E+12       IZZ =   0.2793E+11
                         IXY =   0.1887E+11       IXY =  -0.2327E-03
                         IYZ =   0.2914E+11       IYZ =  -0.3052E-04
                         IZX =  -0.1238E+12       IZX =   0.2487E-02


 *** MASS SUMMARY BY ELEMENT TYPE ***

 TYPE      MASS
    2  0.192718E+07

Range of element maximum matrix coefficients in global coordinates
Maximum= 549511638 at element 7329.
Minimum= 4772865.79 at element 5330.

  *** ELEMENT MATRIX FORMULATION TIMES
 TYPE  NUMBER   ENAME      TOTAL CP  AVE CP

    1    6602  SOLID45       2.383   0.000361
    2    1870  SOLID45       0.761   0.000407
    4     170  TARGE170      0.000   0.000000
    5     170  CONTA174      0.240   0.001414
Time at end of element matrix formulation CP= 6.34912968.

ALL CURRENT ANSYS DATA WRITTEN TO FILE NAME= PAD-TH.rdb
 FOR POSSIBLE RESUME FROM THIS POINT
    FORCE CONVERGENCE VALUE  = 0.4319E+07  CRITERION= 0.2204E+05

SPARSE MATRIX DIRECT SOLVER.
 Number of equations =  25612,    Maximum wavefront =     83
 Memory available for solver =             110.74 MB
 Memory required for in-core =             110.74 MB
 Optimal memory required for out-of-core =  19.96 MB
 Minimum memory required for out-of-core =  11.21 MB
   EQUIL ITER   1 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.2413E-01
    LINE SEARCH PARAMETER =  1.000     SCALED MAX DOF INC =  0.2413E-01
    FORCE CONVERGENCE VALUE  = 0.1837E+06  CRITERION=  3888.
   EQUIL ITER   2 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.4418E-02
    LINE SEARCH PARAMETER = 0.8312     SCALED MAX DOF INC =  0.3672E-02
    FORCE CONVERGENCE VALUE  = 0.8657E+06  CRITERION=  3987.
   EQUIL ITER   3 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.2601E-02
    LINE SEARCH PARAMETER =  1.000     SCALED MAX DOF INC =  0.2601E-02
    FORCE CONVERGENCE VALUE  = 0.2533E+06  CRITERION=  4083.
   EQUIL ITER   4 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.3694E-02
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 LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC =  0.3694E-02
 FORCE CONVERGENCE VALUE  = 0.4250E+06  CRITERION=  4176.
EQUIL ITER   5 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.3577E-02
 LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC =  0.3577E-02
 FORCE CONVERGENCE VALUE  = 0.1575E+06  CRITERION=  4265.
EQUIL ITER   6 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.4873E-02
 LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC =  0.4873E-02
 FORCE CONVERGENCE VALUE  = 0.2214E+06  CRITERION=  4339.
EQUIL ITER   7 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.2651E-02
 LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC =  0.2651E-02
 FORCE CONVERGENCE VALUE  = 0.1319E+06  CRITERION=  4425.
EQUIL ITER   8 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.3189E-02
 LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC =  0.3189E-02
 FORCE CONVERGENCE VALUE  = 0.1458E+06  CRITERION=  4511.
EQUIL ITER   9 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.2689E-02
 LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC =  0.2689E-02
 FORCE CONVERGENCE VALUE  = 0.9357E+05  CRITERION=  4598.
EQUIL ITER  10 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.3610E-02
 LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC =  0.3610E-02
 FORCE CONVERGENCE VALUE  = 0.8573E+05  CRITERION=  4684.
EQUIL ITER  11 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.1675E-02
 LINE SEARCH PARAMETER =  0.8603      SCALED MAX DOF INC =  0.1441E-02
 FORCE CONVERGENCE VALUE  = 0.9602E+05  CRITERION=  4776.
EQUIL ITER  12 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.8076E-03
 LINE SEARCH PARAMETER =  0.7546      SCALED MAX DOF INC =  0.6094E-03
 FORCE CONVERGENCE VALUE  = 0.1254E+06  CRITERION=  4870.
EQUIL ITER  13 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.1567E-02
 LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC =  0.1567E-02
 FORCE CONVERGENCE VALUE  = 0.2742E+05  CRITERION=  4963.
EQUIL ITER  14 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.1974E-02
 LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC =  0.1974E-02
 FORCE CONVERGENCE VALUE  = 0.2014E+05  CRITERION=  5053.
EQUIL ITER  15 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.1794E-02
 LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC =  0.1794E-02
 FORCE CONVERGENCE VALUE  = 0.1529E+05  CRITERION=  5138.
EQUIL ITER  16 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.5897E-02
 LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC =  0.5897E-02
 FORCE CONVERGENCE VALUE  = 0.3377E-01  CRITERION=  5189.     <<< CONVERGED
>>> SOLUTION CONVERGED AFTER EQUILIBRIUM ITERATION  16

 *** ELEMENT RESULT CALCULATION TIMES
TYPE  NUMBER   ENAME      TOTAL CP  AVE CP

   1    6602   SOLID45       1.763   0.000267
   2    1870   SOLID45       0.651   0.000348
   4     170   TARGE170      0.010   0.000059
   5     170   CONTA174      0.080   0.000472

 *** NODAL LOAD CALCULATION TIMES
TYPE  NUMBER   ENAME      TOTAL CP  AVE CP

   1    6602   SOLID45       0.120   0.000018
   2    1870   SOLID45       0.050   0.000027
   4     170   TARGE170      0.000   0.000000
   5     170   CONTA174      0.000   0.000000
*** LOAD STEP     1   SUBSTEP     1  COMPLETED.    CUM ITER =      16
*** TIME =   1.00000          TIME INC =   1.00000
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*** ANSYS BINARY FILE STATISTICS
 BUFFER SIZE USED= 16384
      45.062 MB WRITTEN ON ELEMENT SAVED DATA FILE: PAD-TH.esav
       8.188 MB WRITTEN ON ASSEMBLED MATRIX FILE: PAD-TH.full
      19.750 MB WRITTEN ON RESULTS FILE: PAD-TH.rst

ESEL  FOR LABEL= TYPE  FROM       2 TO       2 BY       1

    1870  ELEMENTS (OF     8812  DEFINED) SELECTED BY  ESEL  COMMAND.

SET MATERIAL OF SELECTED ELEMENTS TO     3

    8812  ELEMENTS (OF     8812  DEFINED) SELECTED BY  EALL  COMMAND.

LIST ALL SELECTED ELEMENTS IN RANGE     530  TO     530  STEP       1
1

***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1     *****
ANSYS/Mechanical U
00245050          VERSION=INTEL NT      16:56:35  JUN 10, 2002 CP=    343.404

DELTA T 0.0 TO 0.25 DAYS


   ELEM MAT TYP REL ESY SEC TSHA       NODES

    530   3   2   1   0   1          1    28    29     3   672  1050  1064   728
ANSYS RELEASE  6.1    UP20020321       16:47:47    06/10/2002

PRINTOUT RESUMED BY /GOP

 Load step file number 2.  Begin solution ...

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

*** NOTE ***                            CP=    344.646   TIME= 16:56:37
Present time 0 is less than or equal to the previous time.
  Time will default to 2.

*** NOTE ***                            CP=    344.646   TIME= 16:56:37
Nonlinear analysis, NROPT set to the FULL Newton-Raphson solution
 procedure for ALL DOFs.

SOLCONTROL,ON uses sparse matrix direct solver
1

***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1     *****
ANSYS/Mechanical U
00245050          VERSION=INTEL NT      16:56:37  JUN 10, 2002 CP=    344.786

DELTA T 0.25 TO 0.50 DAYS

                    L O A D   S T E P   O P T I O N S
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 LOAD STEP NUMBER. . . . . . . . . . . . . . . . .        2
 TIME AT END OF THE LOAD STEP. . . . . . . . . . .   2.0000
 AUTOMATIC TIME STEPPING . . . . . . . . . . . . .      ON
    INITIAL NUMBER OF SUBSTEPS . . . . . . . . . .        1
    MAXIMUM NUMBER OF SUBSTEPS . . . . . . . . . .     1000
    MINIMUM NUMBER OF SUBSTEPS . . . . . . . . . .        1
 MAXIMUM NUMBER OF EQUILIBRIUM ITERATIONS. . . .        15
 STEP CHANGE BOUNDARY CONDITIONS . . . . . . . . .      NO
 TERMINATE ANALYSIS IF NOT CONVERGED . . . . . .YES (EXIT)
 CONVERGENCE CONTROLS. . . . . . . . . . . . . .USE DEFAULTS
 INERTIA LOADS                      X            Y           Z
    ACEL . . . . . . . . . . . .  0.0000     0.10000E-01   0.0000
 PRINT OUTPUT CONTROLS . . . . . . . . . . . . .NO PRINTOUT
 DATABASE OUTPUT CONTROLS. . . . . . . . . . . .ALL DATA WRITTEN
                                                FOR THE LAST SUBSTEP


NONLINEAR MONITORING INFO IS WRITTEN TO FILE= PAD-TH.mntr
MAXIMUM NUMBER OF EQUILIBRIUM ITERATIONS HAS BEEN MODIFIED
  TO BE, NEQIT = 26, BY SOLUTION CONTROL LOGIC.

    FORCE CONVERGENCE VALUE  = 0.3698E+07  CRITERION= 0.1935E+05
   EQUIL ITER   1 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.1099
    LINE SEARCH PARAMETER =  1.000     SCALED MAX DOF INC =  0.1099
    FORCE CONVERGENCE VALUE  = 0.1765E+06  CRITERION=  4420.
   EQUIL ITER   2 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.1231
    LINE SEARCH PARAMETER =  1.000     SCALED MAX DOF INC =  0.1231
    FORCE CONVERGENCE VALUE  = 0.1096E+07  CRITERION=  3999.
   EQUIL ITER   3 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.2059E-01
    LINE SEARCH PARAMETER = 0.4326     SCALED MAX DOF INC =  0.8907E-02
    FORCE CONVERGENCE VALUE  = 0.1938E+07  CRITERION=  4052.
   EQUIL ITER   4 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.1197E-01
    LINE SEARCH PARAMETER =  1.000     SCALED MAX DOF INC =  0.1197E-01
    FORCE CONVERGENCE VALUE  = 0.5270E+06  CRITERION=  4099.
   EQUIL ITER   5 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.5671E-01
    LINE SEARCH PARAMETER =  1.000     SCALED MAX DOF INC =  0.5671E-01
    FORCE CONVERGENCE VALUE  = 0.4011E+06  CRITERION=  4066.
   EQUIL ITER   6 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.3222E-01
    LINE SEARCH PARAMETER =  1.000     SCALED MAX DOF INC =  0.3222E-01
    FORCE CONVERGENCE VALUE  = 0.2222E+06  CRITERION=  4099.
   EQUIL ITER   7 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.1427E-01
    LINE SEARCH PARAMETER =  1.000     SCALED MAX DOF INC =  0.1427E-01
    FORCE CONVERGENCE VALUE  = 0.2244E-04  CRITERION=  4167.     <<< CONVERGED
   >>> SOLUTION CONVERGED AFTER EQUILIBRIUM ITERATION   7
*** LOAD STEP     2   SUBSTEP     1  COMPLETED.    CUM ITER =     23
*** TIME =   2.00000         TIME INC =   1.00000

ESEL  FOR LABEL= TYPE  FROM       2 TO       2 BY       1

    1870  ELEMENTS (OF     8812  DEFINED) SELECTED BY  ESEL  COMMAND.

SET MATERIAL OF SELECTED ELEMENTS TO     4

    8812  ELEMENTS (OF     8812  DEFINED) SELECTED BY  EALL  COMMAND.

LIST ALL SELECTED ELEMENTS IN RANGE     530  TO     530  STEP      1
1
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***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1      *****
ANSYS/Mechanical U
00245050          VERSION=INTEL NT      16:59:46  JUN 10, 2002 CP=    485.618

DELTA T 0.25 TO 0.50 DAYS


   ELEM MAT TYP REL ESY SEC TSHA        NODES

    530   4   2   1   0   1          1    28    29     3   672  1050  1064   728
ANSYS RELEASE  6.1    UP20020321       16:47:47    06/10/2002

PRINTOUT RESUMED BY /GOP

 Load step file number 3.  Begin solution ...

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

*** NOTE ***                           CP=     486.850   TIME= 16:59:47
Present time 0 is less than or equal to the previous time.
  Time will default to 3.

*** NOTE ***                           CP=     486.860   TIME= 16:59:47
Nonlinear analysis, NROPT set to the FULL Newton-Raphson solution
 procedure for ALL DOFs.

SOLCONTROL,ON uses sparse matrix direct solver
1

***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1      *****
ANSYS/Mechanical U
00245050          VERSION=INTEL NT      16:59:47  JUN 10, 2002 CP=    487.010

DELTA T 0.50 TO 0.625 DAYS


                     L O A D   S T E P   O P T I O N S

  LOAD STEP NUMBER. . . . . . . . . . . . . . . . .      3
  TIME AT END OF THE LOAD STEP. . . . . . . . . . .  3.0000
  AUTOMATIC TIME STEPPING . . . . . . . . . . . . .     ON
     INITIAL NUMBER OF SUBSTEPS . . . . . . . . . .      1
     MAXIMUM NUMBER OF SUBSTEPS . . . . . . . . . .   1000
     MINIMUM NUMBER OF SUBSTEPS . . . . . . . . . .      1
  MAXIMUM NUMBER OF EQUILIBRIUM ITERATIONS. . . .       15
  STEP CHANGE BOUNDARY CONDITIONS . . . . . . . .       NO
  TERMINATE ANALYSIS IF NOT CONVERGED . . . . . .YES (EXIT)
  CONVERGENCE CONTROLS. . . . . . . . . . . . . .USE DEFAULTS
  INERTIA LOADS                        X            Y            Z
     ACEL . . . . . . . . . . . . .  0.0000      0.10000E-01  0.0000
  PRINT OUTPUT CONTROLS . . . . . . . . . . . . .NO PRINTOUT
  DATABASE OUTPUT CONTROLS. . . . . . . . . . . .ALL DATA WRITTEN
                                                 FOR THE LAST SUBSTEP


NONLINEAR MONITORING INFO IS WRITTEN TO FILE= PAD-TH.mntr
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MAXIMUM NUMBER OF EQUILIBRIUM ITERATIONS HAS BEEN MODIFIED
  TO BE, NEQIT = 26, BY SOLUTION CONTROL LOGIC.

    FORCE CONVERGENCE VALUE  = 0.4663E+07  CRITERION= 0.2412E+05
   EQUIL ITER   1 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.1954
    LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC = -0.1954
    FORCE CONVERGENCE VALUE  = 0.8838      CRITERION=  1531.      <<< CONVERGED
   >>> SOLUTION CONVERGED AFTER EQUILIBRIUM ITERATION   1
*** LOAD STEP     3   SUBSTEP     1  COMPLETED.    CUM ITER =     24
*** TIME =   3.00000         TIME INC =   1.00000

ESEL  FOR LABEL= TYPE  FROM       2 TO       2 BY       1

    1870  ELEMENTS (OF     8812  DEFINED) SELECTED BY  ESEL  COMMAND.

SET MATERIAL OF SELECTED ELEMENTS TO     5

    8812  ELEMENTS (OF     8812  DEFINED) SELECTED BY  EALL  COMMAND.

LIST ALL SELECTED ELEMENTS IN RANGE     530  TO     530  STEP       1
1

***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1      *****
ANSYS/Mechanical U
00245050          VERSION=INTEL NT      17:00:37  JUN 10, 2002 CP=    515.141

DELTA T 0.50 TO 0.625 DAYS


   ELEM MAT TYP REL ESY SEC TSHA       NODES

    530   5   2   1   0   1          1    28    29     3   672  1050  1064   728
ANSYS RELEASE  6.1    UP20020321       16:47:47    06/10/2002

PRINTOUT RESUMED BY /GOP

 Load step file number 4.  Begin solution ...

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

*** NOTE ***                            CP=    516.403   TIME= 17:00:38
Present time 0 is less than or equal to the previous time.
  Time will default to 4.

*** NOTE ***                            CP=    516.403   TIME= 17:00:38
Nonlinear analysis, NROPT set to the FULL Newton-Raphson solution
 procedure for ALL DOFs.

SOLCONTROL,ON uses sparse matrix direct solver
1

***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1      *****
ANSYS/Mechanical U
00245050          VERSION=INTEL NT      17:00:39  JUN 10, 2002 CP=    516.593

DELTA T 0.625 TO 1.125 DAYS
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                    L O A D   S T E P   O P T I O N S

 LOAD STEP NUMBER. . . . . . . . . . . . . . . . .        4
 TIME AT END OF THE LOAD STEP. . . . . . . . . . .   4.0000
 AUTOMATIC TIME STEPPING . . . . . . . . . . . . .       ON
    INITIAL NUMBER OF SUBSTEPS . . . . . . . . .        1
    MAXIMUM NUMBER OF SUBSTEPS . . . . . . . . .     1000
    MINIMUM NUMBER OF SUBSTEPS . . . . . . . . .        1
 MAXIMUM NUMBER OF EQUILIBRIUM ITERATIONS. . . .       15
 STEP CHANGE BOUNDARY CONDITIONS . . . . . . . .       NO
 TERMINATE ANALYSIS IF NOT CONVERGED . . . . . .YES (EXIT)
 CONVERGENCE CONTROLS. . . . . . . . . . . . . .USE DEFAULTS
 INERTIA LOADS                          X            Y            Z
    ACEL . . . . . . . . . . . .   0.0000     0.10000E-01   0.0000
 PRINT OUTPUT CONTROLS . . . . . . . . . . . . .NO PRINTOUT
 DATABASE OUTPUT CONTROLS. . . . . . . . . . . .ALL DATA WRITTEN
                                                FOR THE LAST SUBSTEP


NONLINEAR MONITORING INFO IS WRITTEN TO FILE= PAD-TH.mntr
MAXIMUM NUMBER OF EQUILIBRIUM ITERATIONS HAS BEEN MODIFIED
  TO BE, NEQIT = 26, BY SOLUTION CONTROL LOGIC.

    FORCE CONVERGENCE VALUE  = 0.6213E+07  CRITERION= 0.3175E+05
   EQUIL ITER   1 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.5309E-01
    LINE SEARCH PARAMETER =  1.000     SCALED MAX DOF INC = -0.5309E-01
    FORCE CONVERGENCE VALUE  = 0.6322      CRITERION=  5058.     <<< CONVERGED
   >>> SOLUTION CONVERGED AFTER EQUILIBRIUM ITERATION   1
*** LOAD STEP    4   SUBSTEP    1  COMPLETED.    CUM ITER =     25
*** TIME =   4.00000         TIME INC =   1.00000

ESEL  FOR LABEL= TYPE  FROM       2 TO       2 BY       1

    1870  ELEMENTS (OF     8812  DEFINED) SELECTED BY  ESEL  COMMAND.

SET MATERIAL OF SELECTED ELEMENTS TO     6

    8812  ELEMENTS (OF     8812  DEFINED) SELECTED BY  EALL  COMMAND.

LIST ALL SELECTED ELEMENTS IN RANGE     530  TO     530  STEP      1
1

***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1      *****
ANSYS/Mechanical U
00245050         VERSION=INTEL NT      17:01:28  JUN 10, 2002 CP=    544.403

DELTA T 0.625 TO 1.125 DAYS


   ELEM MAT TYP REL ESY SEC TSHA       NODES

    530   6   2   1   0   1          1     28     29      3    672   1050   1064    728
ANSYS RELEASE  6.1    UP20020321       16:47:48    06/10/2002

PRINTOUT RESUMED BY /GOP
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 Load step file number 5.  Begin solution ...

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

 *** NOTE ***                            CP=     545.635   TIME= 17:01:30
 Present time 0 is less than or equal to the previous time.
   Time will default to 5.

 *** NOTE ***                            CP=     545.635   TIME= 17:01:30
 Nonlinear analysis, NROPT set to the FULL Newton-Raphson solution
  procedure for ALL DOFs.

 SOLCONTROL,ON uses sparse matrix direct solver
1

 ***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1      *****
 ANSYS/Mechanical U
 00245050          VERSION=INTEL NT      17:01:30  JUN 10, 2002 CP=    545.835

 DELTA T 1.125 TO 1.625 DAYS


                      L O A D   S T E P   O P T I O N S

   LOAD STEP NUMBER. . . . . . . . . . . . . . . . .       5
   TIME AT END OF THE LOAD STEP. . . . . . . . . . .  5.0000
   AUTOMATIC TIME STEPPING . . . . . . . . . . . . .     ON
      INITIAL NUMBER OF SUBSTEPS . . . . . . . . . .      1
      MAXIMUM NUMBER OF SUBSTEPS . . . . . . . . . .   1000
      MINIMUM NUMBER OF SUBSTEPS . . . . . . . . . .      1
   MAXIMUM NUMBER OF EQUILIBRIUM ITERATIONS. . . .       15
   STEP CHANGE BOUNDARY CONDITIONS . . . . . . . .       NO
   TERMINATE ANALYSIS IF NOT CONVERGED . . . . . .YES (EXIT)
   CONVERGENCE CONTROLS. . . . . . . . . . . . . .USE DEFAULTS
   INERTIA LOADS                         X            Y            Z
      ACEL . . . . . . . . . . . . .  0.0000      0.10000E-01  0.0000
   PRINT OUTPUT CONTROLS . . . . . . . . . . . . .NO PRINTOUT
   DATABASE OUTPUT CONTROLS. . . . . . . . . . . .ALL DATA WRITTEN
                                                  FOR THE LAST SUBSTEP


 NONLINEAR MONITORING INFO IS WRITTEN TO FILE= PAD-TH.mntr
 MAXIMUM NUMBER OF EQUILIBRIUM ITERATIONS HAS BEEN MODIFIED
   TO BE, NEQIT = 26, BY SOLUTION CONTROL LOGIC.

     FORCE CONVERGENCE VALUE   = 0.4293E+07   CRITERION= 0.2265E+05
    EQUIL ITER   1 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.1210
     LINE SEARCH PARAMETER =  0.5074E-01 SCALED MAX DOF INC = -0.6139E-02
     FORCE CONVERGENCE VALUE   = 0.4075E+07   CRITERION=   3196.
    EQUIL ITER   2 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.1149
     LINE SEARCH PARAMETER =  0.5070E-01 SCALED MAX DOF INC = -0.5823E-02
     FORCE CONVERGENCE VALUE   = 0.3869E+07   CRITERION=   3173.
    EQUIL ITER   3 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.1090
     LINE SEARCH PARAMETER =  0.5067E-01 SCALED MAX DOF INC = -0.5524E-02
     FORCE CONVERGENCE VALUE   = 0.3673E+07   CRITERION=   3156.
    EQUIL ITER   4 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.1035
     LINE SEARCH PARAMETER =  0.5063E-01 SCALED MAX DOF INC = -0.5241E-02
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 FORCE CONVERGENCE VALUE   = 0.3487E+07   CRITERION=  3146.
EQUIL ITER    5 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.9827E-01
 LINE SEARCH PARAMETER =  0.5060E-01 SCALED MAX DOF INC = -0.4972E-02
 FORCE CONVERGENCE VALUE   = 0.3310E+07   CRITERION=  3143.
EQUIL ITER    6 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.9330E-01
 LINE SEARCH PARAMETER =  0.5057E-01 SCALED MAX DOF INC = -0.4718E-02
 FORCE CONVERGENCE VALUE   = 0.3143E+07   CRITERION=  3145.
EQUIL ITER    7 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.8858E-01
 LINE SEARCH PARAMETER =  0.5054E-01 SCALED MAX DOF INC = -0.4477E-02
 FORCE CONVERGENCE VALUE   = 0.2984E+07   CRITERION=  3154.
EQUIL ITER    8 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.8410E-01
 LINE SEARCH PARAMETER =  0.5051E-01 SCALED MAX DOF INC = -0.4248E-02
 FORCE CONVERGENCE VALUE   = 0.2833E+07   CRITERION=  3169.
EQUIL ITER    9 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.7985E-01
 LINE SEARCH PARAMETER =  0.5049E-01 SCALED MAX DOF INC = -0.4032E-02
 FORCE CONVERGENCE VALUE   = 0.2690E+07   CRITERION=  3189.
EQUIL ITER   10 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.7582E-01
 LINE SEARCH PARAMETER =  0.5046E-01 SCALED MAX DOF INC = -0.3826E-02
 FORCE CONVERGENCE VALUE   = 0.2555E+07   CRITERION=  3215.
EQUIL ITER   11 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.7200E-01
 LINE SEARCH PARAMETER =  0.5044E-01 SCALED MAX DOF INC = -0.3631E-02
 FORCE CONVERGENCE VALUE   = 0.2426E+07   CRITERION=  3246.
EQUIL ITER   12 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.6836E-01
 LINE SEARCH PARAMETER =  0.5042E-01 SCALED MAX DOF INC = -0.3447E-02
 FORCE CONVERGENCE VALUE   = 0.2303E+07   CRITERION=  3282.
EQUIL ITER   13 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.6492E-01
 LINE SEARCH PARAMETER =  0.5040E-01 SCALED MAX DOF INC = -0.3272E-02
 FORCE CONVERGENCE VALUE   = 0.2187E+07   CRITERION=  3322.
EQUIL ITER   14 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.6165E-01
 LINE SEARCH PARAMETER =  0.5038E-01 SCALED MAX DOF INC = -0.3105E-02
 FORCE CONVERGENCE VALUE   = 0.2077E+07   CRITERION=  3368.
EQUIL ITER   15 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.5854E-01
 LINE SEARCH PARAMETER =  0.5036E-01 SCALED MAX DOF INC = -0.2948E-02
 FORCE CONVERGENCE VALUE   = 0.1973E+07   CRITERION=  3417.
EQUIL ITER   16 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.5559E-01
 LINE SEARCH PARAMETER =  0.5034E-01 SCALED MAX DOF INC = -0.2798E-02
 FORCE CONVERGENCE VALUE   = 0.1873E+07   CRITERION=  3471.
EQUIL ITER   17 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.5279E-01
 LINE SEARCH PARAMETER =  0.5032E-01 SCALED MAX DOF INC = -0.2657E-02
 FORCE CONVERGENCE VALUE   = 0.1779E+07   CRITERION=  3529.
EQUIL ITER   18 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.5014E-01
 LINE SEARCH PARAMETER =  0.5031E-01 SCALED MAX DOF INC = -0.2522E-02
 FORCE CONVERGENCE VALUE   = 0.1690E+07   CRITERION=  3591.
EQUIL ITER   19 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.4761E-01
 LINE SEARCH PARAMETER =  0.5029E-01 SCALED MAX DOF INC = -0.2395E-02
 FORCE CONVERGENCE VALUE   = 0.1605E+07   CRITERION=  3656.
EQUIL ITER   20 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.4522E-01
 LINE SEARCH PARAMETER =  0.5028E-01 SCALED MAX DOF INC = -0.2274E-02
 FORCE CONVERGENCE VALUE   = 0.1524E+07   CRITERION=  3725.
EQUIL ITER   21 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.4295E-01
 LINE SEARCH PARAMETER =  0.5026E-01 SCALED MAX DOF INC = -0.2159E-02
 FORCE CONVERGENCE VALUE   = 0.1447E+07   CRITERION=  3797.
EQUIL ITER   22 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.4079E-01
 LINE SEARCH PARAMETER =  0.5025E-01 SCALED MAX DOF INC = -0.2050E-02
 FORCE CONVERGENCE VALUE   = 0.1375E+07   CRITERION=  3873.
EQUIL ITER   23 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.3874E-01
 LINE SEARCH PARAMETER =  0.5024E-01 SCALED MAX DOF INC = -0.1946E-02
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 FORCE CONVERGENCE VALUE  = 0.1307E+07  CRITERION=  3951.
EQUIL ITER  24 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.3436E-01
 LINE SEARCH PARAMETER =  0.5029E-01 SCALED MAX DOF INC = -0.1728E-02
 FORCE CONVERGENCE VALUE  = 0.1243E+07  CRITERION=  4033.
EQUIL ITER  25 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.3206E-01
 LINE SEARCH PARAMETER =  0.5029E-01 SCALED MAX DOF INC = -0.1613E-02
 FORCE CONVERGENCE VALUE  = 0.1181E+07  CRITERION=  4035.
EQUIL ITER  26 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.3045E-01
 LINE SEARCH PARAMETER =  0.5028E-01 SCALED MAX DOF INC = -0.1531E-02
 FORCE CONVERGENCE VALUE  = 0.1123E+07  CRITERION=  4037.
>>> SOLUTION NOT CONVERGED AFTER  26 EQUILIBRIUM ITERATIONS
*** LOAD STEP     5   SUBSTEP     1  NOT COMPLETED.  CUM ITER =     51
*** BEGIN BISECTION NUMBER   1    NEW TIME INCREMENT=  0.50000

 FORCE CONVERGENCE VALUE  = 0.2149E+07  CRITERION= 0.1238E+05
EQUIL ITER   1 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.6246E-01
 LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC = -0.6246E-01
 FORCE CONVERGENCE VALUE  = 0.4572E-04  CRITERION=  4282.     <<< CONVERGED
>>> SOLUTION CONVERGED AFTER EQUILIBRIUM ITERATION   1
*** LOAD STEP     5   SUBSTEP     1  COMPLETED.    CUM ITER =     52
*** TIME =   4.50000          TIME INC =   0.500000
*** AUTO STEP TIME:  NEXT TIME INC = 0.50000      UNCHANGED

 FORCE CONVERGENCE VALUE  = 0.7410E+09  CRITERION= 0.1203E+05
EQUIL ITER   1 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.2448E-01
 LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC =  0.2448E-01
 FORCE CONVERGENCE VALUE  = 0.1289E+06  CRITERION=  2599.
EQUIL ITER   2 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.2088E-02
 LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC =  0.2088E-02
 FORCE CONVERGENCE VALUE  = 0.2623E+06  CRITERION=  2667.
EQUIL ITER   3 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.1729E-02
 LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC =  0.1729E-02
 FORCE CONVERGENCE VALUE  = 0.3391E+06  CRITERION=  2729.
EQUIL ITER   4 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.1367E-02
 LINE SEARCH PARAMETER =  0.9879      SCALED MAX DOF INC =  0.1350E-02
 FORCE CONVERGENCE VALUE  = 0.3089E+06  CRITERION=  2800.
EQUIL ITER   5 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.1404E-02
 LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC =  0.1404E-02
 FORCE CONVERGENCE VALUE  = 0.2155E+06  CRITERION=  2865.
EQUIL ITER   6 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.1080E-02
 LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC =  0.1080E-02
 FORCE CONVERGENCE VALUE  = 0.8170E+05  CRITERION=  2936.
EQUIL ITER   7 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.1067E-02
 LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC =  0.1067E-02
 FORCE CONVERGENCE VALUE  = 0.1217E+06  CRITERION=  3003.
EQUIL ITER   8 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.1207E-02
 LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC =  0.1207E-02
 FORCE CONVERGENCE VALUE  = 0.7488E+05  CRITERION=  3077.
EQUIL ITER   9 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.4289E-03
 LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC =  0.4289E-03
 FORCE CONVERGENCE VALUE  = 0.9288E+05  CRITERION=  3143.
EQUIL ITER  10 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.1226E-02
 LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC =  0.1226E-02
 FORCE CONVERGENCE VALUE  = 0.4559E+05  CRITERION=  3217.
EQUIL ITER  11 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.5802E-03
 LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC =  0.5802E-03
 FORCE CONVERGENCE VALUE  = 0.8540E+05  CRITERION=  3285.
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   EQUIL ITER  12 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.5834E-03
    LINE SEARCH PARAMETER =   1.000     SCALED MAX DOF INC =  0.5834E-03
    FORCE CONVERGENCE VALUE  = 0.3679E+05  CRITERION=  3356.
   EQUIL ITER  13 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.3587E-03
    LINE SEARCH PARAMETER =   1.000     SCALED MAX DOF INC =  0.3587E-03
    FORCE CONVERGENCE VALUE  = 0.5743E+05  CRITERION=  3425.
   EQUIL ITER  14 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.4073E-03
    LINE SEARCH PARAMETER =   1.000     SCALED MAX DOF INC =  0.4073E-03
    FORCE CONVERGENCE VALUE  = 0.3201E+05  CRITERION=  3495.
   EQUIL ITER  15 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.1592E-03
    LINE SEARCH PARAMETER =   1.000     SCALED MAX DOF INC =  0.1592E-03
    FORCE CONVERGENCE VALUE  = 0.2783E+05  CRITERION=  3565.
   EQUIL ITER  16 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.3916E-03
    LINE SEARCH PARAMETER =   1.000     SCALED MAX DOF INC =  0.3916E-03
    FORCE CONVERGENCE VALUE  = 0.2008E+05  CRITERION=  3634.
   EQUIL ITER  17 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.1693E-03
    LINE SEARCH PARAMETER =   1.000     SCALED MAX DOF INC =  0.1693E-03
    FORCE CONVERGENCE VALUE  =  7903.      CRITERION=  3709.
   EQUIL ITER  18 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.1500E-03
    LINE SEARCH PARAMETER =   1.000     SCALED MAX DOF INC =  0.1500E-03
    FORCE CONVERGENCE VALUE  =  5934.      CRITERION=  3783.
   EQUIL ITER  19 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.1575E-03
    LINE SEARCH PARAMETER =   1.000     SCALED MAX DOF INC =  0.1575E-03
    FORCE CONVERGENCE VALUE  =  2298.      CRITERION=  3860.     <<< CONVERGED
   >>> SOLUTION CONVERGED AFTER EQUILIBRIUM ITERATION  19
*** LOAD STEP     5   SUBSTEP     2  COMPLETED.    CUM ITER =     71
*** TIME =   5.00000         TIME INC =  0.500000

ESEL  FOR LABEL= TYPE  FROM        2 TO        2 BY        1

    1870  ELEMENTS (OF     8812  DEFINED) SELECTED BY  ESEL  COMMAND.

SET MATERIAL OF SELECTED ELEMENTS TO      7

    8812  ELEMENTS (OF     8812  DEFINED) SELECTED BY  EALL  COMMAND.

LIST ALL SELECTED ELEMENTS IN RANGE     530  TO     530  STEP       1
1

***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1      *****
ANSYS/Mechanical U
00245050          VERSION=INTEL NT      17:20:58  JUN 10, 2002 CP=   1446.770

DELTA T 1.125 TO 1.625 DAYS


   ELEM MAT TYP REL ESY SEC TSHA       NODES

    530   7   2   1   0   1          1     28     29      3    672   1050   1064    728
ANSYS RELEASE  6.1    UP20020321       16:47:48    06/10/2002

PRINTOUT RESUMED BY /GOP

 Load step file number 6.  Begin solution ...

*****  ANSYS SOLVE    COMMAND  *****
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*** NOTE ***                            CP=    1448.002   TIME= 17:21:00
Present time 0 is less than or equal to the previous time.
  Time will default to 6.

*** NOTE ***                            CP=    1448.002   TIME= 17:21:00
Nonlinear analysis, NROPT set to the FULL Newton-Raphson solution
 procedure for ALL DOFs.

SOLCONTROL,ON uses sparse matrix direct solver
1

***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1      *****
ANSYS/Mechanical U
00245050          VERSION=INTEL NT      17:21:00  JUN 10, 2002 CP=   1448.243

DELTA T 1.625 TO 2.125 DAYS


                      L O A D   S T E P   O P T I O N S

  LOAD STEP NUMBER. . . . . . . . . . . . . . . . .      6
  TIME AT END OF THE LOAD STEP. . . . . . . . . . .  6.0000
  AUTOMATIC TIME STEPPING . . . . . . . . . . . . .     ON
     INITIAL NUMBER OF SUBSTEPS . . . . . . . . .      1
     MAXIMUM NUMBER OF SUBSTEPS . . . . . . . . .   1000
     MINIMUM NUMBER OF SUBSTEPS . . . . . . . . .      1
  MAXIMUM NUMBER OF EQUILIBRIUM ITERATIONS. . . .     15
  STEP CHANGE BOUNDARY CONDITIONS . . . . . . . .     NO
  TERMINATE ANALYSIS IF NOT CONVERGED . . . . . .YES (EXIT)
  CONVERGENCE CONTROLS. . . . . . . . . . . . . .USE DEFAULTS
  INERTIA LOADS                        X            Y            Z
     ACEL . . . . . . . . . . . . .  0.0000     0.10000E-01  0.0000
  PRINT OUTPUT CONTROLS . . . . . . . . . . . . .NO PRINTOUT
  DATABASE OUTPUT CONTROLS. . . . . . . . . . . .ALL DATA WRITTEN
                                                 FOR THE LAST SUBSTEP


NONLINEAR MONITORING INFO IS WRITTEN TO FILE= PAD-TH.mntr
MAXIMUM NUMBER OF EQUILIBRIUM ITERATIONS HAS BEEN MODIFIED
  TO BE, NEQIT = 26, BY SOLUTION CONTROL LOGIC.

    FORCE CONVERGENCE VALUE   = 0.2462E+07  CRITERION= 0.1289E+05
   EQUIL ITER   1 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.2759E-01
    LINE SEARCH PARAMETER =  0.9949     SCALED MAX DOF INC =  0.2745E-01
    FORCE CONVERGENCE VALUE   = 0.9228E+06  CRITERION=  1367.
   EQUIL ITER   2 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.1158E-02
    LINE SEARCH PARAMETER =   1.000     SCALED MAX DOF INC =  0.1158E-02
    FORCE CONVERGENCE VALUE   = 0.5910E+05  CRITERION=  1395.
   EQUIL ITER   3 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.1424E-02
    LINE SEARCH PARAMETER =   1.000     SCALED MAX DOF INC =  0.1424E-02
    FORCE CONVERGENCE VALUE   = 0.7264E+05  CRITERION=  1418.
   EQUIL ITER   4 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.9024E-03
    LINE SEARCH PARAMETER =   1.000     SCALED MAX DOF INC =  0.9024E-03
    FORCE CONVERGENCE VALUE   = 0.3472E+05  CRITERION=  1445.
   EQUIL ITER   5 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.1651E-02
    LINE SEARCH PARAMETER =   1.000     SCALED MAX DOF INC =  0.1651E-02
    FORCE CONVERGENCE VALUE   = 0.3764E+05  CRITERION=  1469.
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   EQUIL ITER   6 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.4908E-03
    LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC =  0.4908E-03
    FORCE CONVERGENCE VALUE   = 0.1974E+05  CRITERION=  1494.
   EQUIL ITER   7 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.2077E-03
    LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC =  0.2077E-03
    FORCE CONVERGENCE VALUE   = 0.3068E+05  CRITERION=  1522.
   EQUIL ITER   8 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.2244E-03
    LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC =  0.2244E-03
    FORCE CONVERGENCE VALUE   =  8068.      CRITERION=  1549.
   EQUIL ITER   9 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.7462E-04
    LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC =  0.7462E-04
    FORCE CONVERGENCE VALUE   =  7216.      CRITERION=  1580.
   EQUIL ITER  10 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.5422E-04
    LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC =  0.5422E-04
    FORCE CONVERGENCE VALUE   =  866.9      CRITERION=  1612.     <<< CONVERGED
   >>> SOLUTION CONVERGED AFTER EQUILIBRIUM ITERATION  10
*** LOAD STEP     6   SUBSTEP     1  COMPLETED.    CUM ITER =     81
*** TIME =    6.00000          TIME INC =    1.00000

ESEL  FOR LABEL= TYPE  FROM       2 TO       2 BY       1

    1870  ELEMENTS (OF     8812  DEFINED) SELECTED BY  ESEL  COMMAND.

SET MATERIAL OF SELECTED ELEMENTS TO     8

    8812  ELEMENTS (OF     8812  DEFINED) SELECTED BY  EALL  COMMAND.

LIST ALL SELECTED ELEMENTS IN RANGE     530  TO     530  STEP       1
1

***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1     *****
ANSYS/Mechanical U
00245050          VERSION=INTEL NT      17:25:31  JUN 10, 2002 CP=   1654.369

DELTA T 1.625 TO 2.125 DAYS


   ELEM MAT TYP REL ESY SEC TSHA       NODES

    530   8   2   1   0   1          1    28    29     3   672  1050  1064   728
ANSYS RELEASE  6.1    UP20020321       16:47:48    06/10/2002

PRINTOUT RESUMED BY /GOP

 Load step file number 7.  Begin solution ...

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

*** NOTE ***                           CP=    1655.631   TIME= 17:25:32
Present time 0 is less than or equal to the previous time.
  Time will default to 7.

*** NOTE ***                           CP=    1655.631   TIME= 17:25:32
Nonlinear analysis, NROPT set to the FULL Newton-Raphson solution
 procedure for ALL DOFs.

SOLCONTROL,ON uses sparse matrix direct solver
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1

***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1      *****
ANSYS/Mechanical U
00245050          VERSION=INTEL NT      17:25:32  JUN 10, 2002 CP=   1655.881

DELTA T 2.125 TO 2.375 DAYS


                    L O A D   S T E P   O P T I O N S

  LOAD STEP NUMBER. . . . . . . . . . . . . . . . .       7
  TIME AT END OF THE LOAD STEP. . . . . . . . . . .  7.0000
  AUTOMATIC TIME STEPPING . . . . . . . . . . . . .      ON
     INITIAL NUMBER OF SUBSTEPS . . . . . . . . . .       1
     MAXIMUM NUMBER OF SUBSTEPS . . . . . . . . . .    1000
     MINIMUM NUMBER OF SUBSTEPS . . . . . . . . . .       1
  MAXIMUM NUMBER OF EQUILIBRIUM ITERATIONS. . . .       15
  STEP CHANGE BOUNDARY CONDITIONS . . . . . . . .       NO
  TERMINATE ANALYSIS IF NOT CONVERGED . . . . . .YES (EXIT)
  CONVERGENCE CONTROLS. . . . . . . . . . . . . .USE DEFAULTS
  INERTIA LOADS                      X            Y            Z
     ACEL . . . . . . . . . . . .  0.0000     0.10000E-01  0.0000
  PRINT OUTPUT CONTROLS . . . . . . . . . . . . .NO PRINTOUT
  DATABASE OUTPUT CONTROLS. . . . . . . . . . . .ALL DATA WRITTEN
                                                 FOR THE LAST SUBSTEP


NONLINEAR MONITORING INFO IS WRITTEN TO FILE= PAD-TH.mntr
MAXIMUM NUMBER OF EQUILIBRIUM ITERATIONS HAS BEEN MODIFIED
  TO BE, NEQIT = 26, BY SOLUTION CONTROL LOGIC.

    FORCE CONVERGENCE VALUE  = 0.1711E+07  CRITERION=  8833.
   EQUIL ITER   1 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.2557E-01
    LINE SEARCH PARAMETER =  0.9946     SCALED MAX DOF INC = -0.2543E-01
    FORCE CONVERGENCE VALUE  = 0.2740E+06  CRITERION=  495.3
   EQUIL ITER   2 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.1640E-03
    LINE SEARCH PARAMETER =   1.000     SCALED MAX DOF INC = -0.1640E-03
    FORCE CONVERGENCE VALUE  = 0.1375E+05  CRITERION=  507.4
   EQUIL ITER   3 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.7619E-04
    LINE SEARCH PARAMETER =   1.000     SCALED MAX DOF INC =  0.7619E-04
    FORCE CONVERGENCE VALUE  =  5821.      CRITERION=  516.8
   EQUIL ITER   4 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.3730E-04
    LINE SEARCH PARAMETER =   1.000     SCALED MAX DOF INC =  0.3730E-04
    FORCE CONVERGENCE VALUE  =  1485.      CRITERION=  526.7
   EQUIL ITER   5 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.4652E-05
    LINE SEARCH PARAMETER =   1.000     SCALED MAX DOF INC =  0.4652E-05
    FORCE CONVERGENCE VALUE  = 0.1407E-03  CRITERION=  537.4    <<< CONVERGED
   >>> SOLUTION CONVERGED AFTER EQUILIBRIUM ITERATION   5
 *** LOAD STEP     7   SUBSTEP     1  COMPLETED.    CUM ITER =      86
 *** TIME =   7.00000          TIME INC =   1.00000

 ESEL  FOR LABEL= TYPE  FROM       2 TO       2 BY       1

     1870  ELEMENTS (OF     8812  DEFINED) SELECTED BY  ESEL  COMMAND.

 SET MATERIAL OF SELECTED ELEMENTS TO      9
```

```
    8812  ELEMENTS (OF     8812  DEFINED) SELECTED BY  EALL  COMMAND.

 LIST ALL SELECTED ELEMENTS IN RANGE     530  TO     530  STEP       1
1

 ***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1      *****
 ANSYS/Mechanical U
 00245050          VERSION=INTEL NT      17:28:06  JUN 10, 2002 CP=   1765.889

 DELTA T 2.125 TO 2.375 DAYS


    ELEM MAT TYP REL ESY SEC TSHA       NODES

     530   9   2   1   0   1          1    28    29     3   672  1050  1064   728
 ANSYS RELEASE  6.1    UP20020321       16:47:48    06/10/2002

 PRINTOUT RESUMED BY /GOP

  Load step file number 8.  Begin solution ...

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

 *** NOTE ***                            CP=    1767.131   TIME= 17:28:07
 Present time 0 is less than or equal to the previous time.
   Time will default to 8.

 *** NOTE ***                            CP=    1767.131   TIME= 17:28:07
 Nonlinear analysis, NROPT set to the FULL Newton-Raphson solution
  procedure for ALL DOFs.

 SOLCONTROL,ON uses sparse matrix direct solver
1

 ***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1      *****
 ANSYS/Mechanical U
 00245050          VERSION=INTEL NT      17:28:08  JUN 10, 2002 CP=   1767.421

 DELTA T 2.375 TO 3.125 DAYS


                      L O A D   S T E P   O P T I O N S

   LOAD STEP NUMBER. . . . . . . . . . . . . . . .      8
   TIME AT END OF THE LOAD STEP. . . . . . . . . .  8.0000
   AUTOMATIC TIME STEPPING . . . . . . . . . . . .     ON
      INITIAL NUMBER OF SUBSTEPS . . . . . . . . .      1
      MAXIMUM NUMBER OF SUBSTEPS . . . . . . . . .   1000
      MINIMUM NUMBER OF SUBSTEPS . . . . . . . . .      1
   MAXIMUM NUMBER OF EQUILIBRIUM ITERATIONS. . . .     15
   STEP CHANGE BOUNDARY CONDITIONS . . . . . . . .     NO
   TERMINATE ANALYSIS IF NOT CONVERGED . . . . . .YES (EXIT)
   CONVERGENCE CONTROLS. . . . . . . . . . . . . .USE DEFAULTS
   INERTIA LOADS                       X           Y            Z
      ACEL . . . . . . . . . . . .  0.0000      0.10000E-01  0.0000
   PRINT OUTPUT CONTROLS . . . . . . . . . . . . .NO PRINTOUT
```

```
  DATABASE OUTPUT CONTROLS. . . . . . . . . . . .ALL DATA WRITTEN
                                                 FOR THE LAST SUBSTEP


 NONLINEAR MONITORING INFO IS WRITTEN TO FILE= PAD-TH.mntr
 MAXIMUM NUMBER OF EQUILIBRIUM ITERATIONS HAS BEEN MODIFIED
   TO BE, NEQIT = 26, BY SOLUTION CONTROL LOGIC.

     FORCE CONVERGENCE VALUE  = 0.1434E+07  CRITERION=  7332.
    EQUIL ITER   1 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.5927E-01
     LINE SEARCH PARAMETER =  1.000     SCALED MAX DOF INC =  0.5927E-01
     FORCE CONVERGENCE VALUE  = 0.2973E+05  CRITERION=  1353.
    EQUIL ITER   2 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.2397E-03
     LINE SEARCH PARAMETER =  1.000     SCALED MAX DOF INC =  0.2397E-03
     FORCE CONVERGENCE VALUE  = 0.3235E+05  CRITERION=  1379.
    EQUIL ITER   3 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.2445E-03
     LINE SEARCH PARAMETER =  1.000     SCALED MAX DOF INC =  0.2445E-03
     FORCE CONVERGENCE VALUE  = 0.1612E+05  CRITERION=  1405.
    EQUIL ITER   4 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.1145E-03
     LINE SEARCH PARAMETER =  1.000     SCALED MAX DOF INC =  0.1145E-03
     FORCE CONVERGENCE VALUE  =  3510.      CRITERION=  1433.
    EQUIL ITER   5 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.2665E-04
     LINE SEARCH PARAMETER =  1.000     SCALED MAX DOF INC =  0.2665E-04
     FORCE CONVERGENCE VALUE  = 0.6556E-03  CRITERION=  1462.    <<< CONVERGED
    >>> SOLUTION CONVERGED AFTER EQUILIBRIUM ITERATION   5
 *** LOAD STEP     8   SUBSTEP     1  COMPLETED.    CUM ITER =     91
 *** TIME =   8.00000          TIME INC =   1.00000

 ESEL  FOR LABEL= TYPE  FROM       2 TO       2 BY       1

     1870  ELEMENTS (OF     8812  DEFINED) SELECTED BY  ESEL  COMMAND.

 SET MATERIAL OF SELECTED ELEMENTS TO    10

     8812  ELEMENTS (OF     8812  DEFINED) SELECTED BY  EALL  COMMAND.

 LIST ALL SELECTED ELEMENTS IN RANGE     530  TO     530  STEP       1
1

 ***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1      *****
 ANSYS/Mechanical U
 00245050          VERSION=INTEL NT      17:30:32  JUN 10, 2002 CP=   1870.370

 DELTA T 2.375 TO 3.125 DAYS


    ELEM MAT TYP REL ESY SEC TSHA       NODES

     530  10   2   1   0   1          1    28    29     3   672  1050  1064   728
 ANSYS RELEASE  6.1    UP20020321       16:47:48    06/10/2002

 PRINTOUT RESUMED BY /GOP

  Load step file number 9.  Begin solution ...

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

```
*** NOTE ***                              CP=    1871.681   TIME= 17:30:35
Present time 0 is less than or equal to the previous time.
  Time will default to 9.

*** NOTE ***                              CP=    1871.691   TIME= 17:30:35
Nonlinear analysis, NROPT set to the FULL Newton-Raphson solution
 procedure for ALL DOFs.

SOLCONTROL,ON uses sparse matrix direct solver
1

***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1      *****
ANSYS/Mechanical U
00245050         VERSION=INTEL NT      17:30:35  JUN 10, 2002 CP=   1872.002

DELTA T 3.125 TO 4.125 DAYS


                     L O A D   S T E P   O P T I O N S

  LOAD STEP NUMBER. . . . . . . . . . . . . . . . .        9
  TIME AT END OF THE LOAD STEP. . . . . . . . . . .   9.0000
  AUTOMATIC TIME STEPPING . . . . . . . . . . . . .      ON
     INITIAL NUMBER OF SUBSTEPS . . . . . . . . . .        1
     MAXIMUM NUMBER OF SUBSTEPS . . . . . . . . . .     1000
     MINIMUM NUMBER OF SUBSTEPS . . . . . . . . . .        1
  MAXIMUM NUMBER OF EQUILIBRIUM ITERATIONS. . . .        15
  STEP CHANGE BOUNDARY CONDITIONS . . . . . . . .        NO
  TERMINATE ANALYSIS IF NOT CONVERGED . . . . . .YES (EXIT)
  CONVERGENCE CONTROLS. . . . . . . . . . . . . .USE DEFAULTS
  INERTIA LOADS                     X            Y            Z
     ACEL . . . . . . . . . . . . . 0.0000     0.10000E-01  0.0000
  PRINT OUTPUT CONTROLS . . . . . . . . . . . . .NO PRINTOUT
  DATABASE OUTPUT CONTROLS. . . . . . . . . . . .ALL DATA WRITTEN
                                                 FOR THE LAST SUBSTEP


NONLINEAR MONITORING INFO IS WRITTEN TO FILE= PAD-TH.mntr
MAXIMUM NUMBER OF EQUILIBRIUM ITERATIONS HAS BEEN MODIFIED
  TO BE, NEQIT = 26, BY SOLUTION CONTROL LOGIC.

    FORCE CONVERGENCE VALUE  = 0.1579E+07  CRITERION=  8170.
   EQUIL ITER   1 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.3392E-01
    LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC =  0.3392E-01
    FORCE CONVERGENCE VALUE  =  5444.      CRITERION=  2303.
   EQUIL ITER   2 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.5112E-04
    LINE SEARCH PARAMETER =   1.000      SCALED MAX DOF INC =  0.5112E-04
    FORCE CONVERGENCE VALUE  = 0.7658E-03  CRITERION=  2350.     <<< CONVERGED
   >>> SOLUTION CONVERGED AFTER EQUILIBRIUM ITERATION   2
*** LOAD STEP     9   SUBSTEP     1  COMPLETED.    CUM ITER =     93
*** TIME =   9.00000         TIME INC =   1.00000

ESEL  FOR LABEL= TYPE  FROM       2 TO       2 BY       1

    1870  ELEMENTS (OF     8812  DEFINED) SELECTED BY  ESEL  COMMAND.

SET MATERIAL OF SELECTED ELEMENTS TO    11
```

```
    8812  ELEMENTS (OF     8812  DEFINED) SELECTED BY  EALL  COMMAND.

 LIST ALL SELECTED ELEMENTS IN RANGE     530  TO     530  STEP       1
1

 ***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1      *****
 ANSYS/Mechanical U
 00245050          VERSION=INTEL NT      17:31:49  JUN 10, 2002 CP=   1920.491

 DELTA T 3.125 TO 4.125 DAYS


   ELEM MAT TYP REL ESY SEC TSHA       NODES

    530  11   2   1   0   1          1    28    29     3   672  1050  1064   728
 ANSYS RELEASE  6.1    UP20020321       16:47:48    06/10/2002

 PRINTOUT RESUMED BY /GOP

  Load step file number 10.  Begin solution ...

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

 *** NOTE ***                            CP=    1921.853   TIME= 17:31:51
 Present time 0 is less than or equal to the previous time.
   Time will default to 10.

 *** NOTE ***                            CP=    1921.853   TIME= 17:31:51
 Nonlinear analysis, NROPT set to the FULL Newton-Raphson solution
  procedure for ALL DOFs.

 SOLCONTROL,ON uses sparse matrix direct solver
1

 ***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1      *****
 ANSYS/Mechanical U
 00245050          VERSION=INTEL NT      17:31:52  JUN 10, 2002 CP=   1922.184

 DELTA T 4.125 TO 6.125 DAYS


                      L O A D   S T E P   O P T I O N S

   LOAD STEP NUMBER. . . . . . . . . . . . . . . .     10
   TIME AT END OF THE LOAD STEP. . . . . . . . . .  10.000
   AUTOMATIC TIME STEPPING . . . . . . . . . . . .     ON
      INITIAL NUMBER OF SUBSTEPS . . . . . . . . .      1
      MAXIMUM NUMBER OF SUBSTEPS . . . . . . . . .   1000
      MINIMUM NUMBER OF SUBSTEPS . . . . . . . . .      1
   MAXIMUM NUMBER OF EQUILIBRIUM ITERATIONS. . . .     15
   STEP CHANGE BOUNDARY CONDITIONS . . . . . . . .     NO
   TERMINATE ANALYSIS IF NOT CONVERGED . . . . . .YES (EXIT)
   CONVERGENCE CONTROLS. . . . . . . . . . . . . .USE DEFAULTS
   INERTIA LOADS                         X            Y            Z
      ACEL . . . . . . . . . . . . .  0.0000     0.10000E-01  0.0000
   PRINT OUTPUT CONTROLS . . . . . . . . . . . . .NO PRINTOUT
```

```
  DATABASE OUTPUT CONTROLS. . . . . . . . . . . .ALL DATA WRITTEN
                                                 FOR THE LAST SUBSTEP


 NONLINEAR MONITORING INFO IS WRITTEN TO FILE= PAD-TH.mntr
 MAXIMUM NUMBER OF EQUILIBRIUM ITERATIONS HAS BEEN MODIFIED
   TO BE, NEQIT = 26, BY SOLUTION CONTROL LOGIC.

    FORCE CONVERGENCE VALUE  = 0.2253E+07  CRITERION= 0.1174E+05
   EQUIL ITER   1 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.3675E-01
    LINE SEARCH PARAMETER =  1.000     SCALED MAX DOF INC =  0.3675E-01
    FORCE CONVERGENCE VALUE  =  69.09      CRITERION=  4270.     <<< CONVERGED
   >>> SOLUTION CONVERGED AFTER EQUILIBRIUM ITERATION   1
 *** LOAD STEP    10   SUBSTEP     1  COMPLETED.    CUM ITER =     94
 *** TIME =   10.0000         TIME INC =   1.00000

 ESEL  FOR LABEL= TYPE  FROM       2 TO       2 BY       1

    1870  ELEMENTS (OF     8812  DEFINED) SELECTED BY  ESEL  COMMAND.

 SET MATERIAL OF SELECTED ELEMENTS TO    12

    8812  ELEMENTS (OF     8812  DEFINED) SELECTED BY  EALL  COMMAND.

 LIST ALL SELECTED ELEMENTS IN RANGE     530  TO     530  STEP       1
1

 ***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1     *****
 ANSYS/Mechanical U
 00245050          VERSION=INTEL NT      17:32:40  JUN 10, 2002 CP=   1950.104

 DELTA T 4.125 TO 6.125 DAYS


   ELEM MAT TYP REL ESY SEC TSHA       NODES

    530  12   2   1   0   1          1    28    29     3   672  1050  1064   728
 ANSYS RELEASE  6.1    UP20020321      16:47:48    06/10/2002

 PRINTOUT RESUMED BY /GOP

  Load step file number 11.  Begin solution ...

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

 *** NOTE ***                             CP=   1951.446   TIME= 17:32:43
 Present time 0 is less than or equal to the previous time.
   Time will default to 11.

 *** NOTE ***                             CP=   1951.446   TIME= 17:32:43
 Nonlinear analysis, NROPT set to the FULL Newton-Raphson solution
  procedure for ALL DOFs.

 SOLCONTROL,ON uses sparse matrix direct solver
1

 ***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1     *****
```

```
ANSYS/Mechanical U
00245050          VERSION=INTEL NT      17:32:43  JUN 10, 2002 CP=   1951.797

DELTA T 6.125 TO 7.875 DAYS


                      L O A D   S T E P   O P T I O N S

  LOAD STEP NUMBER. . . . . . . . . . . . . . . .      11
  TIME AT END OF THE LOAD STEP. . . . . . . . . .  11.000
  AUTOMATIC TIME STEPPING . . . . . . . . . . . .      ON
     INITIAL NUMBER OF SUBSTEPS . . . . . . . . .       1
     MAXIMUM NUMBER OF SUBSTEPS . . . . . . . . .    1000
     MINIMUM NUMBER OF SUBSTEPS . . . . . . . . .       1
  MAXIMUM NUMBER OF EQUILIBRIUM ITERATIONS. . . .      15
  STEP CHANGE BOUNDARY CONDITIONS . . . . . . . .      NO
  TERMINATE ANALYSIS IF NOT CONVERGED . . . . . .YES (EXIT)
  CONVERGENCE CONTROLS. . . . . . . . . . . . . .USE DEFAULTS
  INERTIA LOADS                        X           Y            Z
     ACEL . . . . . . . . . . . . . 0.0000     0.10000E-01  0.0000
  PRINT OUTPUT CONTROLS . . . . . . . . . . . . .NO PRINTOUT
  DATABASE OUTPUT CONTROLS. . . . . . . . . . . .ALL DATA WRITTEN
                                                 FOR THE LAST SUBSTEP


NONLINEAR MONITORING INFO IS WRITTEN TO FILE= PAD-TH.mntr
MAXIMUM NUMBER OF EQUILIBRIUM ITERATIONS HAS BEEN MODIFIED
  TO BE, NEQIT = 26, BY SOLUTION CONTROL LOGIC.

    FORCE CONVERGENCE VALUE  = 0.2269E+07  CRITERION= 0.1235E+05
   EQUIL ITER   1 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.7043E-01
    LINE SEARCH PARAMETER =  0.9999     SCALED MAX DOF INC = -0.7042E-01
    FORCE CONVERGENCE VALUE  = 0.8921E+05  CRITERION=  2811.
   EQUIL ITER   2 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC= -0.7337E-04
    LINE SEARCH PARAMETER =   1.000     SCALED MAX DOF INC = -0.7337E-04
    FORCE CONVERGENCE VALUE  = 0.1105E+05  CRITERION=  2868.
   EQUIL ITER   3 COMPLETED.  NEW TRIANG MATRIX.  MAX DOF INC=  0.8880E-04
    LINE SEARCH PARAMETER =   1.000     SCALED MAX DOF INC =  0.8880E-04
    FORCE CONVERGENCE VALUE  = 0.5739E-04  CRITERION=  2927.     <<< CONVERGED
   >>> SOLUTION CONVERGED AFTER EQUILIBRIUM ITERATION   3
*** LOAD STEP    11   SUBSTEP     1  COMPLETED.    CUM ITER =     97
*** TIME =   11.0000          TIME INC =   1.00000

ESEL  FOR LABEL= TYPE  FROM      2 TO       2 BY       1

    1870  ELEMENTS (OF     8812  DEFINED) SELECTED BY  ESEL  COMMAND.

SET MATERIAL OF SELECTED ELEMENTS TO     2

    8812  ELEMENTS (OF     8812  DEFINED) SELECTED BY  EALL  COMMAND.

LIST ALL SELECTED ELEMENTS IN RANGE     530  TO     530  STEP       1
1

***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1     *****
ANSYS/Mechanical U
00245050          VERSION=INTEL NT      17:34:23  JUN 10, 2002 CP=   2020.535
```

```
DELTA T 6.125 TO 7.875 DAYS


   ELEM MAT TYP REL ESY SEC TSHA       NODES

    530   2   2   1   0   1          1     28     29     3   672  1050  1064   728

FINISH SOLUTION PROCESSING


***** ROUTINE COMPLETED *****  CP =      2020.545



ALL CURRENT ANSYS DATA WRITTEN TO FILE NAME= PAD-TH.db
 FOR POSSIBLE RESUME FROM THIS POINT
1

***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1     *****
ANSYS/Mechanical U
00245050          VERSION=INTEL NT      17:34:29  JUN 10, 2002 CP=   2021.026

DELTA T 6.125 TO 7.875 DAYS


         ***** ANSYS RESULTS INTERPRETATION (POST1) *****

*** WARNING ***                         CP=    2021.026   TIME= 17:34:29
The current solution may have been produced using different model or
boundary condition data than is currently stored.  POST1 results may
 be erroneous unless you perform a new solution using the stored data.

*** NOTE ***                            CP=    2021.026   TIME= 17:34:30
Reading results into the database (SET command) will update the current
displacement and force boundary conditions in the database with the
values from the results file for that load set.  Note that any
subsequent solutions will use these values unless action is taken to
 either SAVE the current values or not overwrite them (/EXIT,NOSAVE).


PRINT HEADER
DO NOT PRINT SUBTITLE(S)
DO NOT PRINT LOAD STEP ID
DO NOT PRINT NOTE LINE(S)
PRINT COLUMN HEADER LABELS
DO NOT PRINT REPORT TOTALS

SUM RESULTS, SET TITLES AND WRITE LOAD CASE FILES FOR FURTHER PROCESSING


COMBINE ALL RECORDS INCLUDING NON-SUMMABLE

LOAD CASE    1 IS LOAD STEP     1  SUBSTEP     1  COMPLEX=  0
FILE= PAD-TH.rst
DELTA T 0.0 TO 0.25 DAYS
```

```
LOAD CASE   2 IS LOAD STEP     2  SUBSTEP     1  COMPLEX=  0
FILE= PAD-TH.rst
DELTA T 0.25 TO 0.50 DAYS


LOAD CASE   3 IS LOAD STEP     3  SUBSTEP     1  COMPLEX=  0
FILE= PAD-TH.rst
DELTA T 0.50 TO 0.625 DAYS


LOAD CASE   4 IS LOAD STEP     4  SUBSTEP     1  COMPLEX=  0
FILE= PAD-TH.rst
DELTA T 0.625 TO 1.125 DAYS


LOAD CASE   5 IS LOAD STEP     5  SUBSTEP     2  COMPLEX=  0
FILE= PAD-TH.rst
DELTA T 1.125 TO 1.625 DAYS


LOAD CASE   6 IS LOAD STEP     6  SUBSTEP     1  COMPLEX=  0
FILE= PAD-TH.rst
DELTA T 1.625 TO 2.125 DAYS


LOAD CASE   7 IS LOAD STEP     7  SUBSTEP     1  COMPLEX=  0
FILE= PAD-TH.rst
DELTA T 2.125 TO 2.375 DAYS


LOAD CASE   8 IS LOAD STEP     8  SUBSTEP     1  COMPLEX=  0
FILE= PAD-TH.rst
DELTA T 2.375 TO 3.125 DAYS


LOAD CASE   9 IS LOAD STEP     9  SUBSTEP     1  COMPLEX=  0
FILE= PAD-TH.rst
DELTA T 3.125 TO 4.125 DAYS


LOAD CASE  10 IS LOAD STEP    10  SUBSTEP     1  COMPLEX=  0
FILE= PAD-TH.rst
DELTA T 4.125 TO 6.125 DAYS


LOAD CASE  11 IS LOAD STEP    11  SUBSTEP     1  COMPLEX=  0
FILE= PAD-TH.rst
DELTA T 6.125 TO 7.875 DAYS


COPY LOAD CASE   1 FROM FILE TO DATABASE

*** WARNING ***                         CP=    2021.056   TIME= 17:34:30
Cumulative iteration 16 may have been solved using different model or
boundary condition data than currently stored.  POST1 results may be
 erroneous unless you RESUME from a Jobname.DB file for this substep.
```

```
TITLE=
PAD RESPONSE AT END OF 0.25 DAYS


WRITE LOAD CASE    1 TO FILE PAD-TH.101

*** WARNING ***                         CP=    2021.917   TIME= 17:34:35
Cumulative iteration 23 may have been solved using different model or
boundary condition data than currently stored.  POST1 results may be
 erroneous unless you RESUME from a Jobname.DB file for this substep.

LCOPER OPERATION ADD  USING LOAD CASE=    2 FACTOR=  1.0000     ABS=    0

*** NOTE ***                            CP=    2022.438   TIME= 17:34:39
Load case combination data may not be correct unless viewed in the
 solution phase coordinate system (RSYS=SOLU).

TITLE=
PAD RESPONSE AT END OF 0.50 DAYS


WRITE LOAD CASE    2 TO FILE PAD-TH.102

*** WARNING ***                         CP=    2022.739   TIME= 17:34:39
Cumulative iteration 24 may have been solved using different model or
boundary condition data than currently stored.  POST1 results may be
 erroneous unless you RESUME from a Jobname.DB file for this substep.

LCOPER OPERATION ADD  USING LOAD CASE=    3 FACTOR=  1.0000     ABS=    0

TITLE=
PAD RESPONSE AT END OF 0.625 DAYS


WRITE LOAD CASE    3 TO FILE PAD-TH.103

*** WARNING ***                         CP=    2023.590   TIME= 17:34:45
Cumulative iteration 25 may have been solved using different model or
boundary condition data than currently stored.  POST1 results may be
 erroneous unless you RESUME from a Jobname.DB file for this substep.

LCOPER OPERATION ADD  USING LOAD CASE=    4 FACTOR=  1.0000     ABS=    0

TITLE=
PAD RESPONSE AT END OF 1.125 DAYS


WRITE LOAD CASE    4 TO FILE PAD-TH.104

*** WARNING ***                         CP=    2024.431   TIME= 17:34:50
Cumulative iteration 71 may have been solved using different model or
boundary condition data than currently stored.  POST1 results may be
 erroneous unless you RESUME from a Jobname.DB file for this substep.

LCOPER OPERATION ADD  USING LOAD CASE=    5 FACTOR=  1.0000     ABS=    0
```

```
TITLE=
PAD RESPONSE AT END OF 1.625 DAYS


WRITE LOAD CASE    5 TO FILE PAD-TH.105

*** WARNING ***                         CP=    2025.292   TIME= 17:34:52
Cumulative iteration 81 may have been solved using different model or
boundary condition data than currently stored.  POST1 results may be
 erroneous unless you RESUME from a Jobname.DB file for this substep.

LCOPER OPERATION ADD  USING LOAD CASE=   6 FACTOR=  1.0000     ABS=   0

TITLE=
PAD RESPONSE AT END OF 2.125 DAYS


WRITE LOAD CASE    6 TO FILE PAD-TH.106

*** WARNING ***                         CP=    2026.203   TIME= 17:34:57
Cumulative iteration 86 may have been solved using different model or
boundary condition data than currently stored.  POST1 results may be
 erroneous unless you RESUME from a Jobname.DB file for this substep.

LCOPER OPERATION ADD  USING LOAD CASE=   7 FACTOR=  1.0000     ABS=   0

TITLE=
PAD RESPONSE AT END OF 2.375 DAYS


WRITE LOAD CASE    7 TO FILE PAD-TH.107

*** WARNING ***                         CP=    2027.025   TIME= 17:35:01
Cumulative iteration 91 may have been solved using different model or
boundary condition data than currently stored.  POST1 results may be
 erroneous unless you RESUME from a Jobname.DB file for this substep.

LCOPER OPERATION ADD  USING LOAD CASE=   8 FACTOR=  1.0000     ABS=   0

TITLE=
PAD RESPONSE AT END OF 3.125 DAYS


WRITE LOAD CASE    8 TO FILE PAD-TH.108

*** WARNING ***                         CP=    2027.926   TIME= 17:35:05
Cumulative iteration 93 may have been solved using different model or
boundary condition data than currently stored.  POST1 results may be
 erroneous unless you RESUME from a Jobname.DB file for this substep.

LCOPER OPERATION ADD  USING LOAD CASE=   9 FACTOR=  1.0000     ABS=   0

TITLE=
PAD RESPONSE AT END OF 4.125 DAYS


WRITE LOAD CASE    9 TO FILE PAD-TH.109
```

```
*** WARNING ***                        CP=    2028.627   TIME= 17:35:09
Cumulative iteration 94 may have been solved using different model or
boundary condition data than currently stored.  POST1 results may be
 erroneous unless you RESUME from a Jobname.DB file for this substep.

LCOPER OPERATION ADD  USING LOAD CASE=  10 FACTOR=  1.0000     ABS=   0

TITLE=
PAD RESPONSE AT END OF 6.125 DAYS


WRITE LOAD CASE   10 TO FILE PAD-TH.l10

*** WARNING ***                        CP=    2029.418   TIME= 17:35:13
Cumulative iteration 97 may have been solved using different model or
boundary condition data than currently stored.  POST1 results may be
 erroneous unless you RESUME from a Jobname.DB file for this substep.

LCOPER OPERATION ADD  USING LOAD CASE=  11 FACTOR=  1.0000     ABS=   0

TITLE=
PAD RESPONSE AT END OF 7.875 DAYS


WRITE LOAD CASE   11 TO FILE PAD-TH.l11

EXIT THE ANSYS POST1 DATABASE PROCESSOR


***** ROUTINE COMPLETED *****  CP =      2030.279


print the temperatures for checking

    8812  ELEMENTS (OF     8812  DEFINED) SELECTED BY  EALL  COMMAND.

   10212  NODES (OF    10212  DEFINED) SELECTED BY NALL  COMMAND.
1

***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1     *****
ANSYS/Mechanical U
00245050          VERSION=INTEL NT      17:35:19  JUN 10, 2002 CP=   2030.279

PAD RESPONSE AT END OF 7.875 DAYS


         ***** ANSYS RESULTS INTERPRETATION (POST1) *****

*** WARNING ***                        CP=    2030.279   TIME= 17:35:19
The current solution may have been produced using different model or
boundary condition data than is currently stored.  POST1 results may
 be erroneous unless you perform a new solution using the stored data.


PRINT HEADER
DO NOT PRINT SUBTITLE(S)
```

```
DO NOT PRINT LOAD STEP ID
DO NOT PRINT NOTE LINE(S)
PRINT COLUMN HEADER LABELS
DO NOT PRINT REPORT TOTALS

SELECT       FOR ITEM=LOC  COMPONENT=X     BETWEEN  0.0000     AND   0.0000
  KABS=  0.  TOLERANCE= 0.100000E-05

     626  NODES (OF    10212  DEFINED) SELECTED BY  NSEL  COMMAND.

RESELECT     FOR ITEM=LOC  COMPONENT=Z     BETWEEN  0.0000     AND   0.0000
  KABS=  0.  TOLERANCE= 0.100000E-05

      26  NODES (OF    10212  DEFINED) SELECTED BY  NSEL  COMMAND.

RESELECT     FOR ITEM=LOC  COMPONENT=Y     BETWEEN -145.00     AND   0.0000
  KABS=  0.  TOLERANCE= 0.145000E-05

      18  NODES (OF    10212  DEFINED) SELECTED BY  NSEL  COMMAND.

LIST ALL SELECTED NODES.   DSYS=  0
1

***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1     *****
ANSYS/Mechanical U
00245050          VERSION=INTEL NT      17:35:19  JUN 10, 2002 CP=   2030.289

PAD RESPONSE AT END OF 7.875 DAYS
```

NODE	X	Y	Z	THXY	THYZ	THZX
1	0.0000	0.0000	0.0000	0.00	0.00	0.00
16	0.0000	-24.000	0.0000	0.00	0.00	0.00
26	0.0000	-18.000	0.0000	0.00	0.00	0.00
27	0.0000	-12.000	0.0000	0.00	0.00	0.00
28	0.0000	-6.0000	0.0000	0.00	0.00	0.00
61	0.0000	-84.000	0.0000	0.00	0.00	0.00
71	0.0000	-72.000	0.0000	0.00	0.00	0.00
72	0.0000	-60.000	0.0000	0.00	0.00	0.00
73	0.0000	-48.000	0.0000	0.00	0.00	0.00
74	0.0000	-36.000	0.0000	0.00	0.00	0.00
113	0.0000	-96.000	0.0000	0.00	0.00	0.00
123	0.0000	-90.000	0.0000	0.00	0.00	0.00
133	0.0000	-96.000	0.0000	0.00	0.00	0.00
146	0.0000	-108.00	0.0000	0.00	0.00	0.00
156	0.0000	-102.00	0.0000	0.00	0.00	0.00
169	0.0000	-144.00	0.0000	0.00	0.00	0.00
179	0.0000	-132.00	0.0000	0.00	0.00	0.00
180	0.0000	-120.00	0.0000	0.00	0.00	0.00

```
USE LOAD STEP     1  SUBSTEP     0  FOR LOAD CASE 0

*** WARNING ***                         CP=    2030.289   TIME= 17:35:20
Cumulative iteration 16 may have been solved using different model or
boundary condition data than currently stored.  POST1 results may be
 erroneous unless you RESUME from a Jobname.DB file for this substep.
```

```
SET COMMAND GOT LOAD STEP=     1  SUBSTEP=     1  CUMULATIVE ITERATION=    16
  TIME/FREQUENCY=  1.0000
TITLE= DELTA T 0.0 TO 0.25 DAYS

SORT ON ITEM=LOC   COMPONENT=Y    ORDER= 0  KABS= 0  NMAX=   10212

SORT COMPLETED FOR      18 VALUES.

PRINT BFE  NODAL SOLUTION PER NODE
1

***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1     *****
ANSYS/Mechanical U
00245050          VERSION=INTEL NT     17:35:23  JUN 10, 2002 CP=   2030.980

DELTA T 0.0 TO 0.25 DAYS


   NODE    BFETEMP
      1   15.000
     28   18.000
     27   19.670
     26   21.330
     16   21.330
     74   21.330
     73   21.330
     72   21.330
     71   21.330
     61   20.500
    123   19.660
    113   10.670
    133   10.670
    156   1.6700
    146  0.84000
    180   0.0000
    179   0.0000
    169   0.0000


USE LOAD STEP     2  SUBSTEP     0  FOR LOAD CASE 0

*** WARNING ***                         CP=    2030.980   TIME= 17:35:23
Cumulative iteration 23 may have been solved using different model or
boundary condition data than currently stored.  POST1 results may be
 erroneous unless you RESUME from a Jobname.DB file for this substep.

SET COMMAND GOT LOAD STEP=     2  SUBSTEP=     1  CUMULATIVE ITERATION=    23
  TIME/FREQUENCY=  2.0000
TITLE= DELTA T 0.25 TO 0.50 DAYS

SORT ON ITEM=LOC   COMPONENT=Y    ORDER= 0  KABS= 0  NMAX=   10212

SORT COMPLETED FOR      18 VALUES.

PRINT BFE  NODAL SOLUTION PER NODE
1
```

```
***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1      *****
ANSYS/Mechanical U
00245050          VERSION=INTEL NT      17:35:25  JUN 10, 2002 CP=    2031.521

DELTA T 0.25 TO 0.50 DAYS


   NODE    BFETEMP
      1  -2.5000
     28   10.500
     27   9.2500
     26   8.0000
     16   16.670
     74   25.330
     73   25.330
     72   25.330
     71   25.120
     61   21.410
    123   17.920
    113   12.660
    133   12.660
    156   7.4100
    146   3.9100
    180  0.21000
    179   0.0000
    169   0.0000


 USE LOAD STEP      3  SUBSTEP      0  FOR LOAD CASE 0

 *** WARNING ***                           CP=    2031.521   TIME= 17:35:25
 Cumulative iteration 24 may have been solved using different model or
 boundary condition data than currently stored.  POST1 results may be
  erroneous unless you RESUME from a Jobname.DB file for this substep.

 SET COMMAND GOT LOAD STEP=      3  SUBSTEP=      1  CUMULATIVE ITERATION=     24
   TIME/FREQUENCY=  3.0000
 TITLE= DELTA T 0.50 TO 0.625 DAYS

 SORT ON ITEM=LOC    COMPONENT=Y     ORDER= 0  KABS= 0  NMAX=    10212

 SORT COMPLETED FOR       18 VALUES.

 PRINT BFE  NODAL SOLUTION PER NODE
1

 ***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1      *****
 ANSYS/Mechanical U
 00245050          VERSION=INTEL NT      17:35:27  JUN 10, 2002 CP=    2032.132

 DELTA T 0.50 TO 0.625 DAYS


    NODE    BFETEMP
       1  -3.0000
      28  -1.3500
```

```
     27   9.3200
     26   13.460
     16   9.3300
     74   9.3300
     73   9.3300
     72   9.3300
     71   9.3300
     61   9.3300
    123   2.0400
    113   4.6700
    133   4.6700
    156   7.3000
    146   0.0000
    180   0.0000
    179   0.0000
    169   0.0000


 USE LOAD STEP     4  SUBSTEP     0  FOR LOAD CASE 0

 *** WARNING ***                         CP=    2032.142   TIME= 17:35:27
 Cumulative iteration 25 may have been solved using different model or
 boundary condition data than currently stored.  POST1 results may be
  erroneous unless you RESUME from a Jobname.DB file for this substep.

 SET COMMAND GOT LOAD STEP=     4  SUBSTEP=     1  CUMULATIVE ITERATION=    25
   TIME/FREQUENCY=  4.0000
 TITLE= DELTA T 0.625 TO 1.125 DAYS

 SORT ON ITEM=LOC   COMPONENT=Y     ORDER= 0  KABS= 0  NMAX=   10212

 SORT COMPLETED FOR      18 VALUES.

 PRINT BFE  NODAL SOLUTION PER NODE
1

 ***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1     *****
 ANSYS/Mechanical U
 00245050           VERSION=INTEL NT      17:35:29  JUN 10, 2002 CP=   2032.763

 DELTA T 0.625 TO 1.125 DAYS


    NODE    BFETEMP
       1  -5.4000
      28  -7.4400
      27  -8.8100
      26  -3.1000
      16   2.6200
      74   15.000
      73   20.110
      72   20.320
      71   17.860
      61   11.880
     123   11.110
     113   10.330
     133   10.330
```

```
    156   9.5500
    146   8.7800
    180   2.8100
    179  0.35000
    169  0.10000E-01


 USE LOAD STEP     5  SUBSTEP     0  FOR LOAD CASE 0

 *** WARNING ***                         CP=    2032.763   TIME= 17:35:29
 Cumulative iteration 71 may have been solved using different model or
 boundary condition data than currently stored.  POST1 results may be
  erroneous unless you RESUME from a Jobname.DB file for this substep.

 SET COMMAND GOT LOAD STEP=     5  SUBSTEP=     2  CUMULATIVE ITERATION=    71
   TIME/FREQUENCY=  5.0000
 TITLE= DELTA T 1.125 TO 1.625 DAYS

 SORT ON ITEM=LOC   COMPONENT=Y     ORDER= 0  KABS= 0  NMAX=   10212

 SORT COMPLETED FOR      18 VALUES.

 PRINT BFE  NODAL SOLUTION PER NODE
1

 ***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1     *****
 ANSYS/Mechanical U
 00245050         VERSION=INTEL NT      17:35:29  JUN 10, 2002 CP=   2033.264

 DELTA T 1.125 TO 1.625 DAYS


    NODE    BFETEMP
       1  -2.1000
      28  -5.5000
      27  -6.4600
      26  -4.7300
      16  -3.0000
      74   2.2500
      73   7.3200
      72   8.4500
      71   6.3200
      61   3.7400
     123   4.4500
     113   5.1600
     133   5.1600
     156   5.8800
     146   6.6000
     180   3.9800
     179   1.3800
     169  0.25000


 USE LOAD STEP     6  SUBSTEP     0  FOR LOAD CASE 0

 *** WARNING ***                         CP=    2033.274   TIME= 17:35:29
 Cumulative iteration 81 may have been solved using different model or
```

```
boundary condition data than currently stored.  POST1 results may be
 erroneous unless you RESUME from a Jobname.DB file for this substep.

SET COMMAND GOT LOAD STEP=      6  SUBSTEP=      1  CUMULATIVE ITERATION=     81
  TIME/FREQUENCY=  6.0000
TITLE= DELTA T 1.625 TO 2.125 DAYS

SORT ON ITEM=LOC   COMPONENT=Y     ORDER= 0  KABS= 0  NMAX=    10212

SORT COMPLETED FOR       18 VALUES.

PRINT BFE  NODAL SOLUTION PER NODE
1

***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1      *****
ANSYS/Mechanical U
00245050          VERSION=INTEL NT      17:35:30  JUN 10, 2002 CP=    2033.795

DELTA T 1.625 TO 2.125 DAYS


   NODE    BFETEMP
      1 -0.80000
     28  -3.0600
     27  -4.0600
     26  -3.9600
     16  -3.8700
     74  -2.2200
     73  0.96000
     72   2.2900
     71   1.5300
     61  0.91000
    123   1.8700
    113   2.8300
    133   2.8300
    156   3.7800
    146   4.7200
    180   3.8200
    179   1.9800
    169  0.53000


USE LOAD STEP     7  SUBSTEP     0  FOR LOAD CASE 0

*** WARNING ***                         CP=    2033.795   TIME= 17:35:30
Cumulative iteration 86 may have been solved using different model or
boundary condition data than currently stored.  POST1 results may be
 erroneous unless you RESUME from a Jobname.DB file for this substep.

SET COMMAND GOT LOAD STEP=      7  SUBSTEP=      1  CUMULATIVE ITERATION=     86
  TIME/FREQUENCY=  7.0000
TITLE= DELTA T 2.125 TO 2.375 DAYS

SORT ON ITEM=LOC   COMPONENT=Y     ORDER= 0  KABS= 0  NMAX=    10212

SORT COMPLETED FOR       18 VALUES.
```

```
 PRINT BFE  NODAL SOLUTION PER NODE
1

 ***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1     *****
 ANSYS/Mechanical U
 00245050           VERSION=INTEL NT      17:35:30  JUN 10, 2002 CP=   2034.315

 DELTA T 2.125 TO 2.375 DAYS


    NODE     BFETEMP
       1 -0.20000
      28 -0.94000
      27  -1.2800
      26  -1.4700
      16  -1.6500
      74  -1.5100
      73 -0.54000
      72  0.80000E-01
      71  0.90000E-01
      61  0.20000
     123  0.63000
     113   1.0600
     133   1.0600
     156   1.4600
     146   1.8600
     180   1.7300
     179   1.0500
     169  0.33000


 USE LOAD STEP     8  SUBSTEP     0  FOR LOAD CASE 0

 *** WARNING ***                         CP=   2034.315   TIME= 17:35:30
 Cumulative iteration 91 may have been solved using different model or
 boundary condition data than currently stored.  POST1 results may be
  erroneous unless you RESUME from a Jobname.DB file for this substep.

 SET COMMAND GOT LOAD STEP=     8  SUBSTEP=     1  CUMULATIVE ITERATION=    91
   TIME/FREQUENCY=  8.0000
 TITLE= DELTA T 2.375 TO 3.125 DAYS

 SORT ON ITEM=LOC   COMPONENT=Y     ORDER= 0  KABS= 0  NMAX=   10212

 SORT COMPLETED FOR      18 VALUES.

 PRINT BFE  NODAL SOLUTION PER NODE
1

 ***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1     *****
 ANSYS/Mechanical U
 00245050           VERSION=INTEL NT      17:35:31  JUN 10, 2002 CP=   2034.826

 DELTA T 2.375 TO 3.125 DAYS


    NODE     BFETEMP
```

```
      1 -0.50000
     28  -2.1300
     27  -3.0700
     26  -3.9000
     16  -4.7400
     74  -5.6000
     73  -4.2000
     72  -2.7200
     71  -1.8500
     61 -0.66000
    123  0.64000
    113   1.9400
    133   1.9400
    156   3.1000
    146   4.2600
    180   4.3900
    179   3.0000
    169   1.0300


 USE LOAD STEP     9  SUBSTEP     0  FOR LOAD CASE 0

 *** WARNING ***                         CP=    2034.836   TIME= 17:35:31
 Cumulative iteration 93 may have been solved using different model or
 boundary condition data than currently stored.  POST1 results may be
  erroneous unless you RESUME from a Jobname.DB file for this substep.

 SET COMMAND GOT LOAD STEP=     9  SUBSTEP=     1  CUMULATIVE ITERATION=    93
   TIME/FREQUENCY=  9.0000
 TITLE= DELTA T 3.125 TO 4.125 DAYS

 SORT ON ITEM=LOC   COMPONENT=Y     ORDER= 0  KABS= 0  NMAX=   10212

 SORT COMPLETED FOR      18 VALUES.

 PRINT BFE  NODAL SOLUTION PER NODE
1

 ***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1     *****
 ANSYS/Mechanical U
 00245050          VERSION=INTEL NT      17:35:32  JUN 10, 2002 CP=   2035.357

 DELTA T 3.125 TO 4.125 DAYS


    NODE    BFETEMP
       1 -0.30000
      28  -2.0300
      27  -3.1400
      26  -4.4900
      16  -5.8400
      74  -8.3400
      73  -8.3500
      72  -7.1100
      71  -5.3300
      61  -2.9100
     123  -1.1900
```

```
    113  0.54000
    133  0.54000
    156   1.9800
    146   3.4300
    180   4.1800
    179   3.1900
    169   1.1800


 USE LOAD STEP    10  SUBSTEP     0  FOR LOAD CASE 0

 *** WARNING ***                         CP=    2035.357   TIME= 17:35:32
 Cumulative iteration 94 may have been solved using different model or
 boundary condition data than currently stored.  POST1 results may be
  erroneous unless you RESUME from a Jobname.DB file for this substep.

 SET COMMAND GOT LOAD STEP=    10  SUBSTEP=     1  CUMULATIVE ITERATION=    94
   TIME/FREQUENCY=  10.000
 TITLE= DELTA T 4.125 TO 6.125 DAYS

 SORT ON ITEM=LOC   COMPONENT=Y     ORDER= 0  KABS= 0  NMAX=   10212

 SORT COMPLETED FOR      18 VALUES.

 PRINT BFE  NODAL SOLUTION PER NODE
1

 ***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1      *****
 ANSYS/Mechanical U
 00245050          VERSION=INTEL NT      17:35:32  JUN 10, 2002 CP=   2035.877

 DELTA T 4.125 TO 6.125 DAYS


    NODE    BFETEMP
       1   0.0000
      28  -1.3800
      27  -2.6100
      26  -4.7600
      16  -6.9100
      74  -11.780
      73  -13.650
      72  -12.770
      71  -9.8200
      61  -5.6000
     123  -3.3600
     113  -1.1200
     133  -1.1200
     156  0.66000
     146   2.4300
     180   4.0600
     179   3.5200
     169   1.3700


 USE LOAD STEP    11  SUBSTEP     0  FOR LOAD CASE 0
```

```
*** WARNING ***                         CP=    2035.877   TIME= 17:35:32
Cumulative iteration 97 may have been solved using different model or
boundary condition data than currently stored.  POST1 results may be
 erroneous unless you RESUME from a Jobname.DB file for this substep.

SET COMMAND GOT LOAD STEP=     11   SUBSTEP=      1  CUMULATIVE ITERATION=     97
  TIME/FREQUENCY=  11.000
TITLE= DELTA T 6.125 TO 7.875 DAYS

SORT ON ITEM=LOC    COMPONENT=Y      ORDER= 0  KABS= 0  NMAX=    10212

SORT COMPLETED FOR       18 VALUES.

PRINT BFE  NODAL SOLUTION PER NODE
1

***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1      *****
ANSYS/Mechanical U
00245050          VERSION=INTEL NT      17:35:33  JUN 10, 2002 CP=    2036.398

DELTA T 6.125 TO 7.875 DAYS


   NODE    BFETEMP
      1   0.0000
     28 -0.69000
     27  -1.3300
     26  -2.5100
     16  -3.6900
     74  -6.5800
     73  -8.1200
     72  -8.1000
     71  -6.7500
     61  -4.5600
    123  -3.3800
    113  -2.2000
    133  -2.2000
    156  -1.2300
    146 -0.25000
    180  0.85000
    179   1.0100
    169  0.43000

COPY LOAD CASE    1 FROM FILE TO DATABASE

SORT ON ITEM=LOC    COMPONENT=Y      ORDER= 0  KABS= 0  NMAX=    10212

SORT COMPLETED FOR       18 VALUES.

PRINT BFE  NODAL SOLUTION PER NODE
1

***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1      *****
ANSYS/Mechanical U
00245050          VERSION=INTEL NT      17:35:34  JUN 10, 2002 CP=    2037.099

PAD RESPONSE AT END OF 0.25 DAYS
```

NODE	BFETEMP
1	15.000
28	18.000
27	19.670
26	21.330
16	21.330
74	21.330
73	21.330
72	21.330
71	21.330
61	20.500
123	19.660
113	10.670
133	10.670
156	1.6700
146	0.84000
180	0.0000
179	0.0000
169	0.0000

```
 COPY LOAD CASE   2 FROM FILE TO DATABASE

 SORT ON ITEM=LOC   COMPONENT=Y     ORDER= 0  KABS= 0  NMAX=   10212

 SORT COMPLETED FOR      18 VALUES.

 PRINT BFE  NODAL SOLUTION PER NODE
1

 ***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1     *****
 ANSYS/Mechanical U
 00245050          VERSION=INTEL NT      17:35:36  JUN 10, 2002 CP=   2037.830

 PAD RESPONSE AT END OF 0.50 DAYS
```

NODE	BFETEMP
1	12.500
28	28.500
27	28.920
26	29.330
16	38.000
74	46.660
73	46.660
72	46.660
71	46.450
61	41.910
123	37.580
113	23.330
133	23.330
156	9.0800
146	4.7500
180	0.21000
179	0.0000
169	0.0000

```
 COPY LOAD CASE   3 FROM FILE TO DATABASE

 SORT ON ITEM=LOC   COMPONENT=Y     ORDER= 0  KABS= 0  NMAX=    10212

 SORT COMPLETED FOR      18 VALUES.

 PRINT BFE  NODAL SOLUTION PER NODE
1

 ***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1     *****
 ANSYS/Mechanical U
 00245050          VERSION=INTEL NT      17:35:37  JUN 10, 2002 CP=    2038.581

 PAD RESPONSE AT END OF 0.625 DAYS


    NODE    BFETEMP
       1   9.5000
      28   27.150
      27   38.240
      26   42.790
      16   47.330
      74   55.990
      73   55.990
      72   55.990
      71   55.780
      61   51.240
     123   39.620
     113   28.000
     133   28.000
     156   16.380
     146   4.7500
     180  0.21000
     179   0.0000
     169   0.0000

 COPY LOAD CASE   4 FROM FILE TO DATABASE

 SORT ON ITEM=LOC   COMPONENT=Y     ORDER= 0  KABS= 0  NMAX=    10212

 SORT COMPLETED FOR      18 VALUES.

 PRINT BFE  NODAL SOLUTION PER NODE
1

 ***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1     *****
 ANSYS/Mechanical U
 00245050          VERSION=INTEL NT      17:35:39  JUN 10, 2002 CP=    2039.332

 PAD RESPONSE AT END OF 1.125 DAYS


    NODE    BFETEMP
       1   4.1000
      28   19.710
      27   29.430
```

```
      26   39.690
      16   49.950
      74   70.990
      73   76.100
      72   76.310
      71   73.640
      61   63.120
     123   50.730
     113   38.330
     133   38.330
     156   25.930
     146   13.530
     180   3.0200
     179  0.35000
     169  0.10000E-01

 COPY LOAD CASE   5 FROM FILE TO DATABASE

 SORT ON ITEM=LOC   COMPONENT=Y     ORDER= 0  KABS= 0  NMAX=    10212

 SORT COMPLETED FOR       18 VALUES.

 PRINT BFE  NODAL SOLUTION PER NODE
1

 ***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1      *****
 ANSYS/Mechanical U
 00245050          VERSION=INTEL NT      17:35:40  JUN 10, 2002 CP=   2040.124

 PAD RESPONSE AT END OF 1.625 DAYS


    NODE    BFETEMP
       1   2.0000
      28   14.210
      27   22.970
      26   34.960
      16   46.950
      74   73.240
      73   83.420
      72   84.760
      71   79.960
      61   66.860
     123   55.180
     113   43.490
     133   43.490
     156   31.810
     146   20.130
     180   7.0000
     179   1.7300
     169  0.26000

 COPY LOAD CASE   6 FROM FILE TO DATABASE

 SORT ON ITEM=LOC   COMPONENT=Y     ORDER= 0  KABS= 0  NMAX=    10212

 SORT COMPLETED FOR       18 VALUES.
```

```
 PRINT BFE  NODAL SOLUTION PER NODE
1

 ***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1     *****
 ANSYS/Mechanical U
 00245050          VERSION=INTEL NT      17:35:42  JUN 10, 2002 CP=   2040.935

 PAD RESPONSE AT END OF 2.125 DAYS


    NODE     BFETEMP
       1   1.2000
      28   11.150
      27   18.910
      26   31.000
      16   43.080
      74   71.020
      73   84.380
      72   87.050
      71   81.490
      61   67.770
     123   57.050
     113   46.320
     133   46.320
     156   35.590
     146   24.850
     180   10.820
     179   3.7100
     169  0.79000

 COPY LOAD CASE   7 FROM FILE TO DATABASE

 SORT ON ITEM=LOC   COMPONENT=Y     ORDER= 0  KABS= 0  NMAX=   10212

 SORT COMPLETED FOR      18 VALUES.

 PRINT BFE  NODAL SOLUTION PER NODE
1

 ***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1     *****
 ANSYS/Mechanical U
 00245050          VERSION=INTEL NT      17:35:43  JUN 10, 2002 CP=   2041.676

 PAD RESPONSE AT END OF 2.375 DAYS


    NODE     BFETEMP
       1   1.0000
      28   10.210
      27   17.630
      26   29.530
      16   41.430
      74   69.510
      73   83.840
      72   87.130
      71   81.580
```

```
    61   67.970
   123   57.680
   113   47.380
   133   47.380
   156   37.050
   146   26.710
   180   12.550
   179   4.7600
   169   1.1200

 COPY LOAD CASE   8 FROM FILE TO DATABASE

 SORT ON ITEM=LOC   COMPONENT=Y     ORDER= 0  KABS= 0  NMAX=   10212

 SORT COMPLETED FOR       18 VALUES.

 PRINT BFE  NODAL SOLUTION PER NODE
1

 ***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1     *****
 ANSYS/Mechanical U
 00245050          VERSION=INTEL NT      17:35:45  JUN 10, 2002 CP=   2042.467

 PAD RESPONSE AT END OF 3.125 DAYS


    NODE    BFETEMP
       1  0.50000
      28   8.0800
      27   14.560
      26   25.630
      16   36.690
      74   63.910
      73   79.640
      72   84.410
      71   79.730
      61   67.310
     123   58.320
     113   49.320
     133   49.320
     156   40.150
     146   30.970
     180   16.940
     179   7.7600
     169   2.1500

 COPY LOAD CASE   9 FROM FILE TO DATABASE

 SORT ON ITEM=LOC   COMPONENT=Y     ORDER= 0  KABS= 0  NMAX=   10212

 SORT COMPLETED FOR       18 VALUES.

 PRINT BFE  NODAL SOLUTION PER NODE
1

 ***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1     *****
 ANSYS/Mechanical U
```

```
00245050          VERSION=INTEL NT      17:35:46  JUN 10, 2002 CP=   2043.138

PAD RESPONSE AT END OF 4.125 DAYS


   NODE    BFETEMP
      1  0.20000
     28   6.0500
     27   11.420
     26   21.140
     16   30.850
     74   55.570
     73   71.290
     72   77.300
     71   74.400
     61   64.400
    123   57.130
    113   49.860
    133   49.860
    156   42.130
    146   34.400
    180   21.120
    179   10.950
    169   3.3300

COPY LOAD CASE  10 FROM FILE TO DATABASE

SORT ON ITEM=LOC   COMPONENT=Y     ORDER= 0  KABS= 0  NMAX=    10212

SORT COMPLETED FOR       18 VALUES.

PRINT BFE  NODAL SOLUTION PER NODE
1

***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1      *****
ANSYS/Mechanical U
00245050          VERSION=INTEL NT      17:35:48  JUN 10, 2002 CP=   2043.839

PAD RESPONSE AT END OF 6.125 DAYS


   NODE    BFETEMP
      1  0.20000
     28   4.6700
     27   8.8100
     26   16.380
     16   23.940
     74   43.790
     73   57.640
     72   64.530
     71   64.580
     61   58.800
    123   53.770
    113   48.740
    133   48.740
    156   42.790
    146   36.830
```

```
    180   25.180
    179   14.470
    169   4.7000

 COPY LOAD CASE  11 FROM FILE TO DATABASE

 SORT ON ITEM=LOC   COMPONENT=Y     ORDER= 0  KABS= 0  NMAX=    10212

 SORT COMPLETED FOR      18 VALUES.

 PRINT BFE  NODAL SOLUTION PER NODE
1

 ***** ANSYS - ENGINEERING ANALYSIS SYSTEM  RELEASE 6.1      *****
 ANSYS/Mechanical U
 00245050          VERSION=INTEL NT      17:35:49  JUN 10, 2002 CP=   2044.550

 PAD RESPONSE AT END OF 7.875 DAYS


   NODE    BFETEMP
      1  0.20000
     28   3.9800
     27   7.4800
     26   13.870
     16   20.250
     74   37.210
     73   49.520
     72   56.430
     71   57.830
     61   54.240
    123   50.390
    113   46.540
    133   46.540
    156   41.560
    146   36.580
    180   26.030
    179   15.480
    169   5.1300

 NODE SORT REMOVED

 EXIT THE ANSYS POST1 DATABASE PROCESSOR


 ***** ROUTINE COMPLETED *****  CP =      2044.550


     8812  ELEMENTS (OF     8812  DEFINED) SELECTED BY  EALL  COMMAND.

    10212  NODES (OF    10212  DEFINED) SELECTED BY NALL  COMMAND.

 EXIT ANSYS WITHOUT SAVING DATABASE


 NUMBER OF WARNING MESSAGES ENCOUNTERED=         26
```

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Appendix RPad-TH to Calculation PGE-009-CALC-006

```
NUMBER OF ERROR   MESSAGES ENCOUNTERED=          0

*-----------------------------------------------------------------------------*
|                                                                             |
|                           ANSYS RUN COMPLETED                               |
|                                                                             |
|-----------------------------------------------------------------------------|
|                                                                             |
|          Release 6.1              UP20020321          INTEL NT              |
|                                                                             |
|-----------------------------------------------------------------------------|
|                                                                             |
|   Maximum Scratch Memory Used        =    61921432 Words      236.212 MB    |
|                                                                             |
|-----------------------------------------------------------------------------|
|                                                                             |
|       CP Time      (sec) =        2044.560       Time  =  17:35:49          |
|       Elapsed Time (sec) =        2792.000       Date  =  06/10/2002        |
|                                                                             |
*-----------------------------------------------------------------------------*
```