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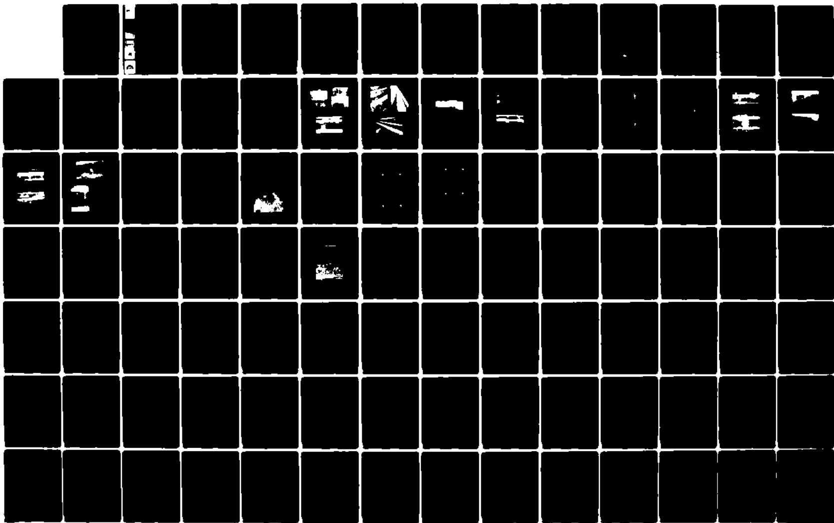

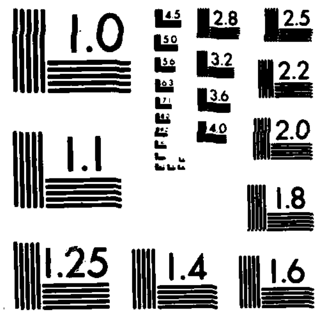
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US Army Corps of Engineers

STRUCTURES LABORATORY

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CONDITION EVALUATION OF SUPERSONIC NAVAL ORDNANCE RESEARCH TRACK (SNORT)

by

Billy R. Sullivan, Carl E. Pace, Roy L. Campbell

Structures Laboratory
U. S. Army Engineer Waterways Experiment Station
P. O. Box 631, Vicksburg, Miss. 39180

February 1984

Final Report

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Prepared for Naval Weapons Center
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In December 1981, the Waterways Experiment Station, at the request of the Naval Weapons Center, began an evaluation of the condition of the Supersonic Naval Ordnance Research Track (SNORT) at China Lake, California. The evaluation included both theoretical analysis and field tests. The concrete, soil, and water were sampled and tested in the laboratory. Nondestructive tests were used to determine locations for coring concrete and to develop a condition profile for the structure.

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20. ABSTRACT (Continued).

Load tests were conducted on the structure to determine deflections for comparison with analytical calculations. These comparisons show that deterioration has not reduced the structural capacity seriously at this time.

Laboratory tests show the concrete to be severely deteriorated at some locations and sound at other locations only inches away. The concrete is severely cracked, corrosion of the reinforcement is occurring, and alkali-silica reaction is evident throughout the structure. The deterioration is expected to progress and accelerate as moisture migration to the interior of the concrete increases due to crack growth and further deterioration.

The deteriorated condition of the existing track dictated a recommendation for replacement; therefore, a preliminary design for a new track was accomplished. The existing track should remain usable at current loading during construction of a new track.

PREFACE

The investigation reported herein was conducted for the Department of the Navy, Naval Weapons Center, China Lake, California, by the Concrete Technology Division (CTD) of the Structures Laboratory (SL), U. S. Army Engineer Waterways Experiment Station (WES). Authorization for the investigation was given in MIPR N60530 80 MP70026 dated 21 March 1980, MIPR N 60530 80 MP70074 dated 22 September 1980, and in a letter from the Commander, Naval Weapons Center, China Lake, California, Ser. No. 9197 dated 20 November 1981.

The investigation was accomplished under the direction of Messrs. Bryant Mather, Chief, SL; William Flathau, Assistant Chief, SL; John M. Scanlon, Chief, CTD; and James E. McDonald, Chief, Evaluation and Monitoring Group, CTD; and under the direct supervision of Mr. Billy R. Sullivan, who served as principal investigator. The concrete coring, soil sampling and characterization, and load and deflection measurements were accomplished by Naval Weapons Center personnel under the supervision of Messrs. Winfred E. Johnson, Head, Track Operations Branch, and Rodney Kanagawa, Public Works Department of the Naval Weapons Center. The in situ pressure meter work was done under contract by Briand Engineers, College Station, Texas.

Members of the WES staff who participated in the performance of the work were Messrs. R. L. Campbell, A. M. Alexander, Tony Husbands, and G. S. Wong and Dr. Carl E. Pace. Dr. Pace was responsible for the structural analysis and supervision of the in situ pressure meter work and analysis. This report was written by Mr. Sullivan, Dr. Pace, and Mr. Campbell.

Commanders and Directors of WES during this investigation and the preparation and publication of this report were COL Nelson P. Conover, CE, and COL Tilford C. Creel, CE. Technical Director was Mr. F. R. Brown.

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CONVERSION FACTORS, NON-SI TO SI (METRIC) UNITS OF MEASUREMENT

Non-SI units of measurement used in this report can be converted to SI (metric) units as follows:

Multiply	By	To Obtain
cubic feet	0.02831685	cubic metres
cubic yards	0.7645549	cubic metres
degrees (angular)	0.1745329	radians
feet	0.3048	metres
feet per minute	0.00508	metres per second
feet per second	0.3048	metres per second
foot-kips (force)	1355.818	joules
foot-pounds	0.04214011	joules
g, standard free fall	9.806650E+00	metres per second squared
gallons	0.003785412	cubic metres
gallons per minute	0.00006309020	cubic metres per second
inches	0.0254	metres
inches per pound (force)	0.00571015	metres per newton
inch-kips	112.98484	newton metres
inch-pounds (force)	0.1129848	newton metres
kips (force)	4448.222	newtons
kips (force) per square foot	47.88026	kilopascals
microinches per inch	1.0	micrometres per metre
miles (U. S. statute)	1.609344	kilometres
pounds (force)	4.448222	newtons
pounds (force) per foot	14.59390	newtons per metre
pounds (force) per cubic inch	271.46	newtons per cubic metre
pounds (force) per square foot	47.88026	pascals
pounds (force) per square inch	6.894757	kilopascals
pounds (mass)	0.4535924	kilograms
pounds (mass) per cubic foot	16.01846	kilograms per cubic metre
pounds (mass) per cubic yard	0.5932764	kilograms per cubic metre
pounds (mass) per yard	0.41476489	kilograms per metre
square feet	0.09290304	square metres
square inches	0.0006452	square metres
tons (force) per square foot	0.09576052	megapascals
tons (2000 lb, mass)	907.1847	kilograms

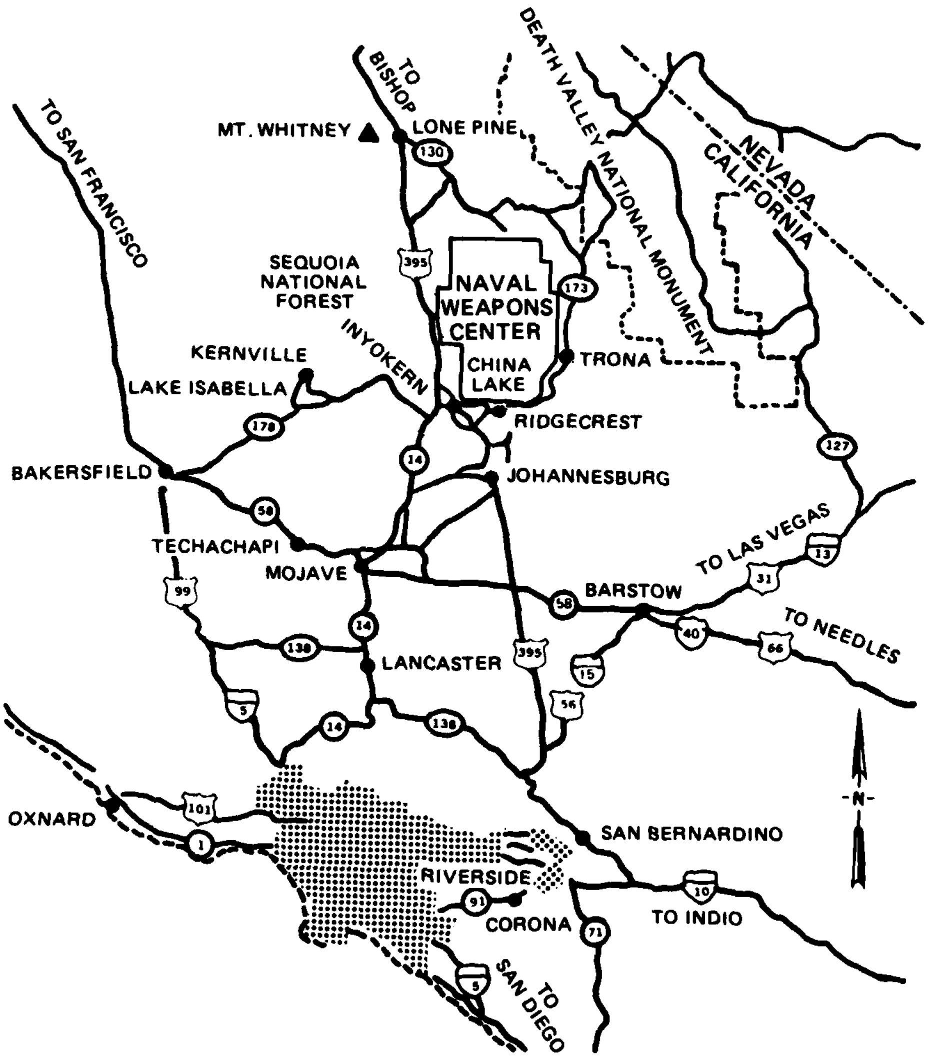

Figure 1. Naval Weapons Center vicinity map

CONDITION EVALUATION OF SUPERSONIC NAVAL ORDNANCE RESEARCH TRACK (SNORT)

PART I: INTRODUCTION

Location

1. The Supersonic Naval Ordnance Research Track (SNORT) is located at the Naval Weapons Center, China Lake, California, in a high desert environment. Figure 1 shows vicinity and location maps for the structure, which is 4.1 miles* in length. It is used for high-speed rocket sled and large payload testing of ordnance, aircraft, missiles, ballistics, etc. Figure 2 is an aerial view of the track.

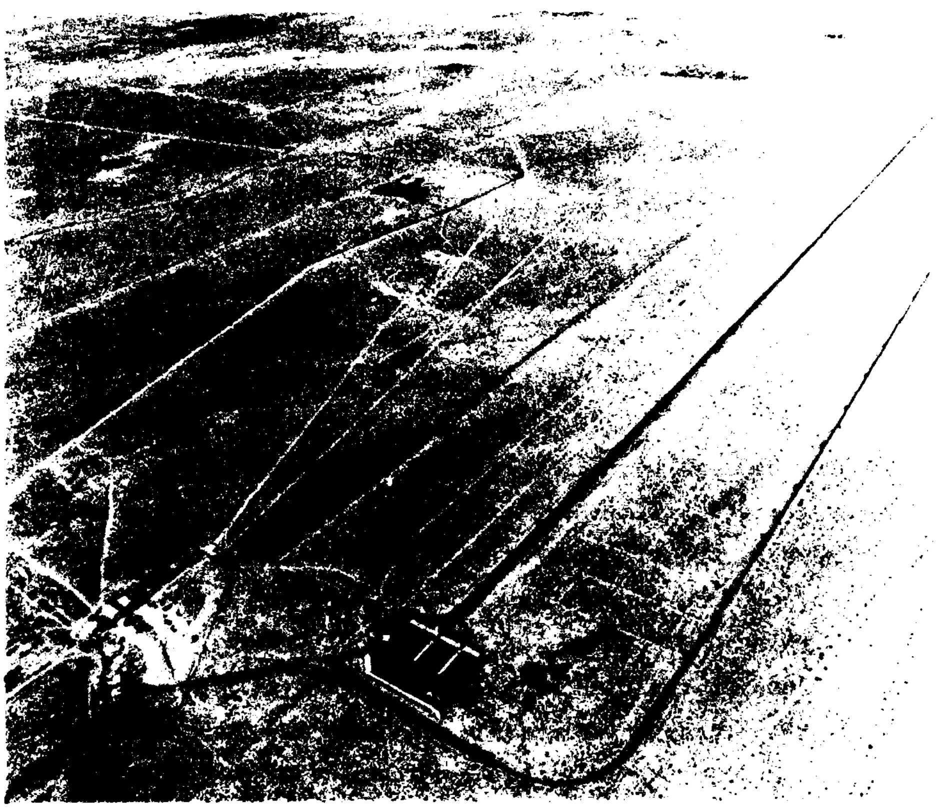

Figure 2. Aerial view of SNORT facility

* A table of factors for converting non-SI units of measurement to SI (metric) units is given on page 3.

Background

2. SNORT was constructed during the early 1950's and is currently being heavily used. No service failures have occurred although extensive cracking in the concrete is evident. Accidental detonations of munitions and derailments have damaged the track in several locations. Removal of damaged portions of the track has revealed serious corrosion of the reinforcing steel and cracking of the subsurface concrete. These findings have prompted studies to determine the causes and extent of damage to the structure and to determine possible repair procedures that will extend its useful life. The U. S. Army Engineer Waterways Experiment Station (WES) was asked to assist in this study by conducting a condition evaluation of the track.

3. A policy decision has been made by the Department of the Navy that SNORT is a necessary facility and should be rehabilitated or replaced.

4. The track is currently being used on a regular basis with no restrictions as to loads or speeds.

Track description

5. SNORT is a 21,550-ft- (4.08-mile-) long two-rail heavy-duty precision track, essentially level except for a slight downgrade toward the muzzle. Heading is 357 deg true. The track is made up of 50-ft lengths of 171-lb/yd crane rail laid at standard railroad gauge and mounted on adjustable sleepers attached to an H-shaped continuous concrete beam. The trough formed by the H has constant dimensions for the length of the track. The rail measures roughly 4 in. wide and 6 in. high and has a 1-1/4-in. web. The rail joints are butt-milled and doweled to retain rail-end alignment. The H-beam is half buried in compacted earth fill.

6. Adjustment of the sleepers permits rail alignment to be maintained vertically to within ± 0.036 in. of the theoretical track profile at any point, horizontally to within ± 0.06 in. of the theoretical centerline, and to ± 0.5 deg deg in rotation. Between the sleepers, the rail groove in the top of the beam is filled with asphalt to bond the rail to the beam and to dampen rail vibration. Of interest here is the fact that earthquakes of moderate intensity in this area have not affected track alignment.

7. Beginning at 11,475 ft downrange, the center of the concrete beam is used as a water-brake trough. The trough extends for 10,075 ft on a very slight downgrade to the end of the track. A storage reservoir adjacent to the

track holds 400,000 gal of water, which can be delivered through four inlets into the water-brake trough at rates up to 1,400 gal per minute. The water is recirculated into the reservoir. The depth of the water in the trough is controlled by (a) the point of entry into the water-brake trough, (b) the rate of water delivery at the entry point, and (c) the use of partial damming strips to retard the flow in the trough, or of frangible weirs to form a series of pools of varying depths. The profile of the water level is usually controlled by using a particular inlet plus partial damming; the flow rate is varied for fine adjustment. Intrusion of a scoop underneath the sled into water of graduated depth in the trough controls deceleration.

8. The sleds have metal slippers for runners which act as the structural link between the sled and rail. The slippers, which are contoured to fit around the rail, usually hold replaceable wear inserts and provide the guidance and restraint necessary to hold the sled on the track during its run.

Loading

9. Loading data were obtained from SNORT personnel and are presented in Table 1. Performance values are presented in Table 2. The test loads currently being used are less than those presented in Table 1. However, recent discussion with track personnel indicates that users want to test heavier items at higher speeds. The consequence is that the loads on the structure are increasing, and the loads in Table 1 along with dynamic load factors and rail roughness coefficients are considered to be reasonable design loads.

Materials of construction

10. The materials of construction described here are for the concrete structure and its supporting backfill. Rail materials are not discussed.

11. From the design drawings, it appears that local soil was used as backfill. It is not clear where the soil used in fill operations came from; it can be assumed that it was probably taken from borrow pits adjacent or close to the point of use.

12. The structural notes on design drawing 502669 call for the reinforcing steel to be intermediate or hard grade (ASTM A15 and A305). These standards would be 1951 or earlier issue. Both A15 and A305 have been discontinued.

13. The concrete specified on construction drawings is Y & D (Yard and Docks), Class S-1, 3000 psi at 28 days with a No. 1 aggregate. This standard would be a 1951 or earlier issue.

14. No mention is made of where the water would come from for mixing the concrete. However, the site has wells and this source was most likely used. Well water at the site was analyzed and the results are listed in Table 3.

15. While various placing sequences and construction joints are called for on the drawings, examination of the structure indicates a variety of non-specified placing practices were used. How much of this is due to repair procedures and how much is the result of actual construction practice is not known.

Previous studies

16. Previous studies have been conducted on the SNORT track by various individuals and consulting engineering firms. A summary of the studies is listed below.

a. 4 May 1975. Letter from Dr. James Myers (AFIT/DE WPAFB) recommending steel-to-concrete potential data and mention of cathodic protection.

b. 24 June 1975. Preliminary report by Van Dyke and Barnes provides possible explanations for causes of cracking and recommends verification of bar locations, concrete strength, existence of cracks below grade, temperature effects, test-run effects, and rail anchor bolt condition.

c. 9 September 1975. Final report by Van Dyke and Barnes provides results of recommended work and provides description of rebars exposed at an unreported number of locations. Recommendations for repairs.

d. 29 October 1975. Letter from China Lake Naval Weapons Center (7036/BJP:rh) summarizes report of Van Dyke and Barnes and recommends modification of suggested repair schedule.

e. 12 April 1976. Letter from China Lake Naval Weapons Center (0736/WCB:gtl) reports moisture content of soil under web at three locations.

f. 6 July 1976. Report from Dr. James Myers (AFIT/DE WPAFB) reports analyses of concrete samples from five locations for chlorides and sulfates.

g. 13 May 1977. Letter (6103E/GRD) reports investigation of failed section and recommends inspection and evaluation of track condition to determine rate of deterioration and feasibility of repair or replacement. Suggests possibility of cathodic protection.

h. 23 September 1977. Letter from Naval Construction Battalion Center, Port Hueneme, California, recommends load testing.

i. 26 April 1978. Letter from R. P. Brown, P. E. (Florida Department of Transportation), reports chloride contents of concrete and recommends further analysis.

j. 10 May 1978. Letter from Dr. Myers again suggests cathodic protection.

k. October 1978. Letter from Dr. Myers reports results of track potential measurements. Suggests that beginning portion of track might not be corroding. Cautions that steel must be continuous for cathodic protection.

l. 28 January 1980. Contract to Waters Consultants for Soil Resistivity, Field Study and Evaluation of Cathodic Protection.

m. 18 December 1980. Visual inspection of track by WESTNAVFACENGCOM personnel.

17. Failure theories include: corrosion-induced cracking, thermal stresses, concrete shrinkage, and bending moments in the track due to aerodynamic loads on the sled.

18. The conclusions of some of the studies are listed below.

a. There is extensive corrosion of the subgrade reinforcing and some corrosion of the abovegrade reinforcing. How much and how badly the structure is affected is unknown.

b. The soil is considered to be very corrosive.

c. The concrete has a high chloride content.

d. Due to the lack of welded reinforcing bar splices and possible discontinuity, cathodic protection probably will not be cost-effective if at all technically feasible.

e. The well water used for braking operations has a high salt (chloride) content.

f. There is extensive cracking of the concrete.

19. From previous work and from preliminary analysis, it seems that corrosion of the reinforcing steel is one of the major causes of concrete deterioration. In order for rusting of reinforcing steel to occur, both water and oxygen must be available at the site of the corrosion. The availability of the reactants is governed by the external environment and the integrity of the concrete. Cracks in the concrete allow ingress of water, oxygen, and electrolytes such as chloride ions or sulfate ions. Chlorides are especially dangerous since they can easily migrate within the concrete to set up differential concentration cells.

20. Chloride ions are sometimes reported to depress the normally high alkaline pH of the pore fluid in the concrete and in sufficient concentration can overcome the passivating effect of hydroxyl ions (formed at the cathodic

reaction) and induce corrosion in even highly alkaline conditions. They also increase the conductivity of the concrete, allowing corrosion currents to increase and hence accelerate the rate of rusting.

21. The rusting of reinforcing steel exerts pressure on the surrounding concrete causing it to crack. As these cracks extend to the surface, they provide an outward sign that may be an indication of what is happening inside the concrete. Results of crack mapping have been used successfully to determine the nature and rate of deterioration and the timing of remedial repairs (Pollock, Kay, and Fookes 1981).

22. Other causes of concrete deterioration will be investigated in this report. The load-carrying capacity of the track in its deteriorated condition will be evaluated. From the findings in the track evaluation, conclusions will be made concerning repair of the existing track and the need for a new supersonic test track.

Purpose and Scope

23. The purpose of this investigation was to determine the structural integrity of the SNORT track and to determine safe service loads and remaining service life. Also, recommendations were to be made on repairs needed and methods of repair to be considered. Finally, this study was to develop a preliminary design and cost estimate for a new test track including enhanced capabilities needed at the facility. The initial phase of the study was to conduct those tests which will enable a decision to be made on repair and rehabilitation of the existing structure versus replacement with a new structure.

Approach

24. The structural integrity of the SNORT track was determined on the basis of field tests and analytical or laboratory work on the concrete foundation system. These tests were conducted in phases, based on the amount and type of data needed to decide on repairs or replacement of the existing test track.

25. The first phase of the study consisted of a field survey and crack mapping of the entire structure. Also, mechanical impedance testing was used to nondestructively compare the relative condition of the concrete-foundation

system along the entire track. Concrete, reinforcing steel, and soil samples were taken for a cursory examination prior to more extensive sampling later.

26. The second phase of the work consisted of concrete coring, soil sampling for laboratory tests, tests on the foundation material, and field-load testing of the structure. Field tests were conducted on the foundation using pressure meter tests and on the concrete-track system using static loads. As the track was load tested, the deflections at the positions of track loading were monitored. Samples of the reinforcing steel and water used for braking were obtained.

27. Analytical work on the structure was begun under Phase 2 for comparison with the results of field tests. This work consisted of beam-on-elastic foundation and finite-element analyses.

28. The third and final phase of the work consisted of completing the structural analysis and laboratory tests, and conducting preliminary design work and cost estimation for a replacement track.

PART II: PRELIMINARY FIELD INVESTIGATION

Field Inspection

29. In January 1982, the field survey of the SNORT structure was conducted. It included visual inspection of the concrete, noting crack size, density, and location by track stations. A written log was prepared along with photographs which documented the surface appearance of the concrete. Several samples of concrete and soil were taken for a preliminary examination prior to more extensive coring and sampling programs.

30. The survey was directed toward documenting surface deficiencies that result from or contribute to the corrosion of the reinforcing steel and threaten the integrity of the structure. The significant findings of the inspection are as follows.

Discoloration and deposits

31. Discoloration of the concrete was noted for the entire length of the structure. Much of the discoloration, especially within the trough of the structure, is believed to be the result of staining action of some of the substances contained in the well water used for deceleration of the test vehicle. The investigation by Van Dyke and Barnes* defines the various constituents contained in the well water.

32. Some of the discoloration in the faces outside the trough of the structure appears to be the result of moisture migration. It is not clear whether discoloration was due to migration of the well water from within the trough, the moisture drawn from the soil, or both. The moisture from the soil, like the well water, contains substances that could result in discoloration of the concrete.

33. In addition to the discoloration, a white "alkali" deposit appears at the waterline mark within the trough. Well water analysis* shows the water to be highly alkaline. Therefore, it appears that the main source of the alkali deposit within the trough is the well water. There are also alkali deposits on the vertical faces outside the trough. These deposits are believed to be the result of moisture migration; however, as with the discoloration of the concrete within the trough, it is not clear whether the source of

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* Preliminary report, 24 June 1975.

migration was from the well water used in the trough, the moisture drawn from the soil, or both.

34. Both the discoloration and the alkali deposits are shown in Figure 3.

Transverse cracking

35. Transverse cracks (depicted in Figure 4) were noted at and between rail anchors. These cracks are generally narrow (having a maximum width of 1/32 in. or less) and extend across the top and down the sides of a wall. Transverse cracks were also noted in the floor of the trough. These cracks enable deleterious agents to enter the concrete and attack the reinforcing steel.

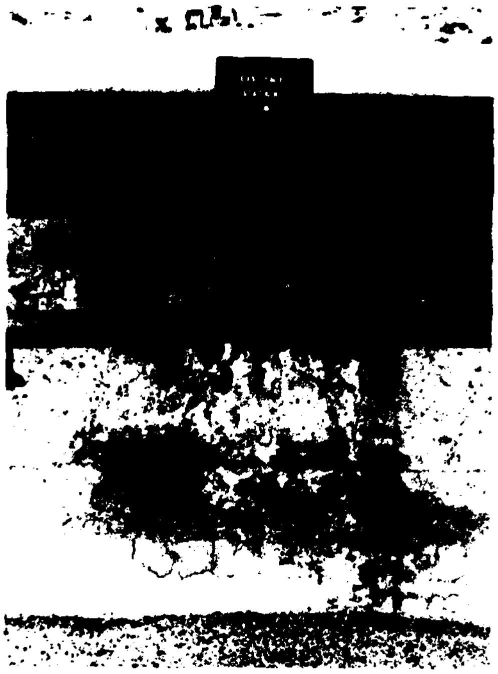
Longitudinal cracking

36. A longitudinal crack was observed in each of the four vertical faces of the structure. These cracks parallel the top longitudinal reinforcing in walls of the structure (Figure 5) and are generally visible for the entire length of the structure. The maximum width of the crack varies along the length of the structure and also between faces at the same stationing. It is believed that these longitudinal cracks are the result of corrosion of the top longitudinal reinforcing and that the wider the crack, the more severe the corrosion.

37. To document the severity of the longitudinal cracking along the length of the structure, each of the vertical faces was partitioned into sections of similar crack widths and assigned an evaluation number based on the frequency and range of the maximum crack widths within the section. An evaluation number for each section was assigned in accordance with the following criteria:

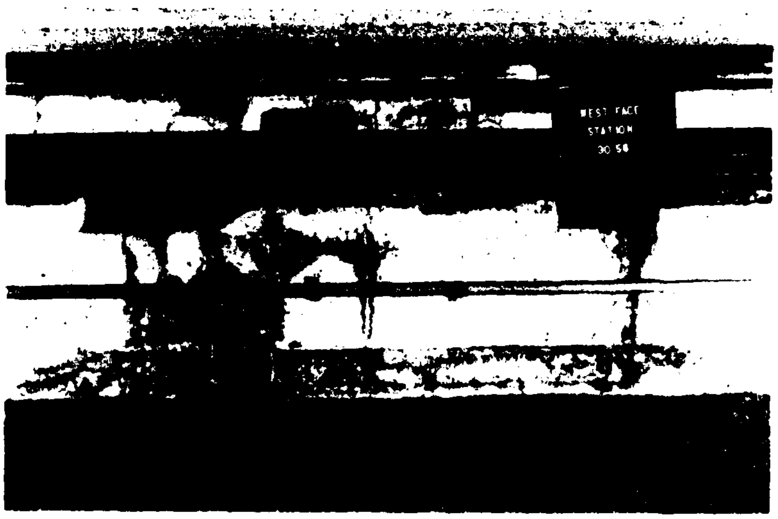
Evaluation Number	Description
0	No crack
1	Mostly a *fine* crack with some areas having no visible cracking
2	A *fine* crack
3	Mostly a *fine* crack with some areas of *medium* cracking
4	Areas of *fine* cracking alternating with areas of *medium* cracking

(Continued)



a. Sta 1.08, east face

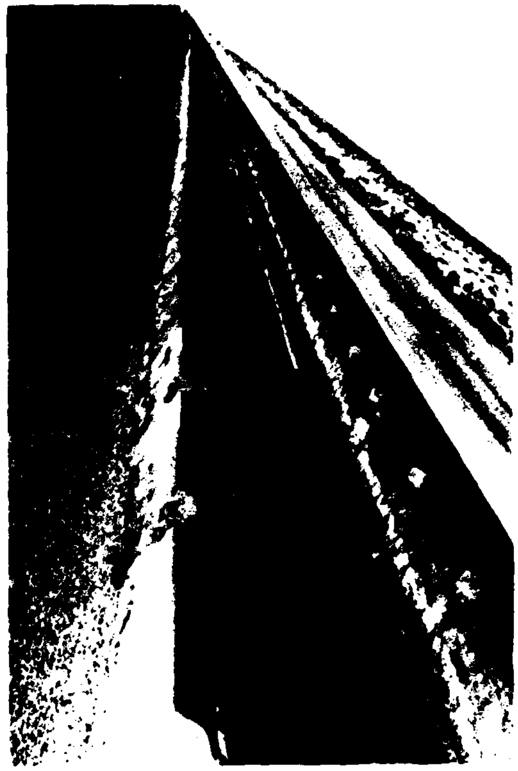
b. Sta 6.00, east face



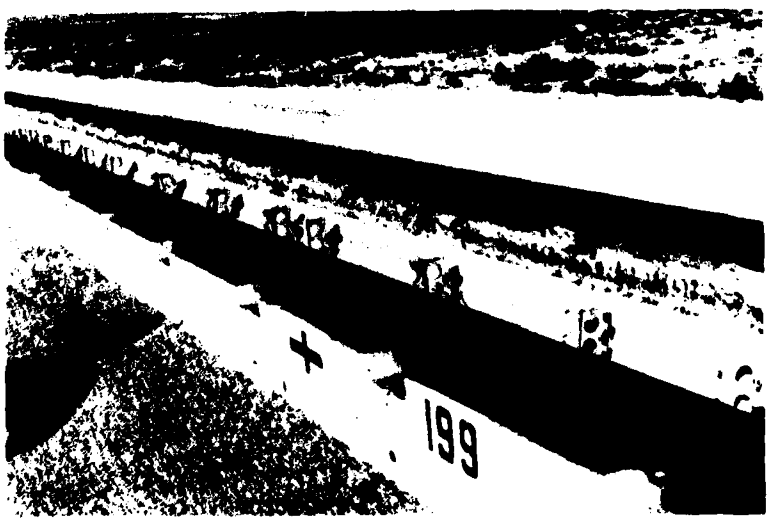
c. Sta 30.56, west face

Figure 3. Discoloration and alkali deposits on concrete surfaces (Continued)

d. Sta 74.00, east face



e. Sta 168.00, west face



f. Sta 199.00, west face

Figure 3. (Concluded)

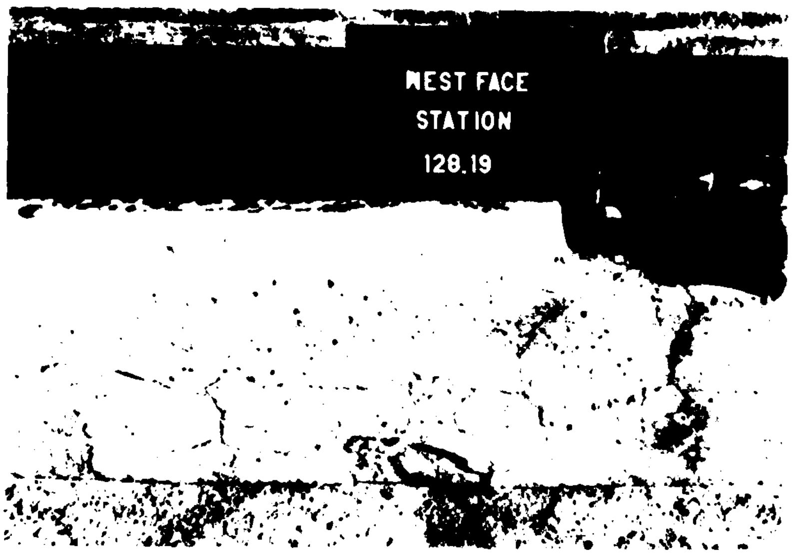


Figure 4. Transverse cracks, Sta 128.19, west face

a. Sta 182.00, west face

b. Sta 182.00, west face (closeup)

Figure 5. Longitudinal crack parallel to longitudinal reinforcing steel in legs of structure

Evaluation Number	Description
5	Mostly a *medium* crack with some areas of *fine* cracking
6	A *medium* crack
7	Mostly a *medium* crack with some areas of *wide* cracking
8	Areas of *medium* cracking alternating with areas of *wide* cracking
9	Mostly a *wide* crack with some areas of *medium* cracking
10	A *wide* crack

Types of cracks are defined below.

Type of Crack	Maximum Crack Width Range
Fine	Less than 1/32 in.
Medium	1/32 in. or greater but less than 4/32 in.
Wide	4/32 in. or greater

38. An evaluation number was obtained for each wall by averaging the evaluation number for each of its faces within a section. Similarly, an evaluation number was obtained for each section of the structure by averaging all four faces within a section. The results of the averaging are presented in Table 4 and are graphically depicted in Figures 6-8. In general, the first 5 stations and the last 100 stations of the structure contain the widest longitudinal cracks and are suspected of having the most severe corrosion in the top longitudinal reinforcing.

Spalling

39. Spalling of the tops and sides of the walls was observed at various locations along the length of the structure. The locations of the most significant areas of spalling are presented in Table 5. Some of the areas noted are depicted in Figure 9. It is believed that these spalls are the direct result of an impact force.

Construction deficiencies

40. At sta 3.07 (Figure 10), the transverse floor reinforcing extends through the outside west face of the structure. In the same area on the opposite face, holes can be seen where the transverse floor reinforcing at one time extended outside the structure. These ports provide deleterious agents with access to the interior of the concrete and its reinforcing. From approximately sta 3.50 to the end of the structure, the elevation of the floor

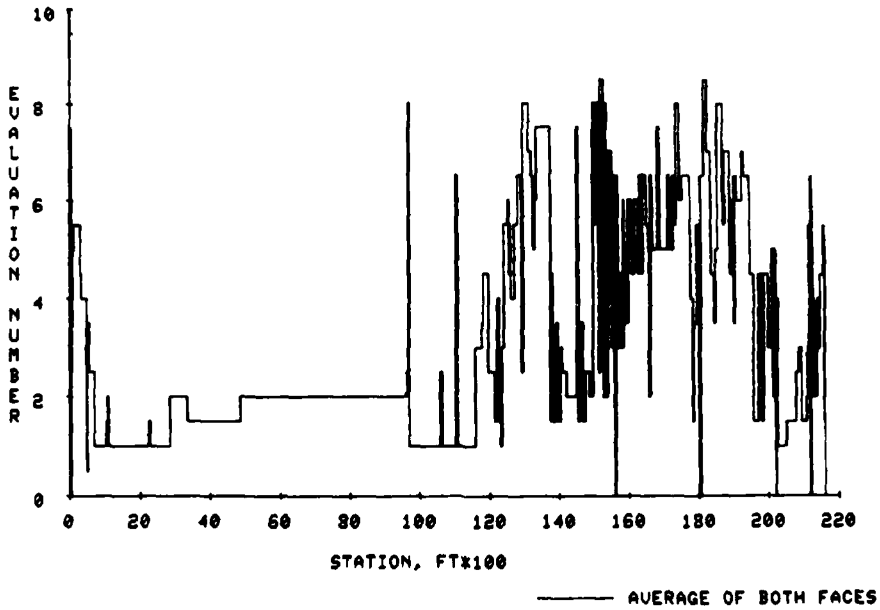


Figure 6. Evaluation of longitudinal cracking in west wall of structure

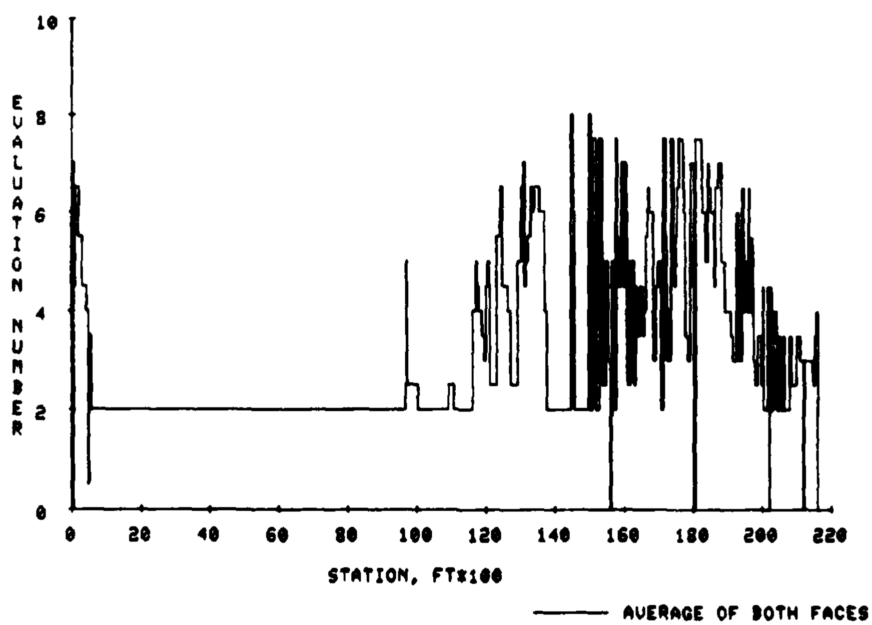


Figure 7. Evaluation of longitudinal cracking in east wall of structure

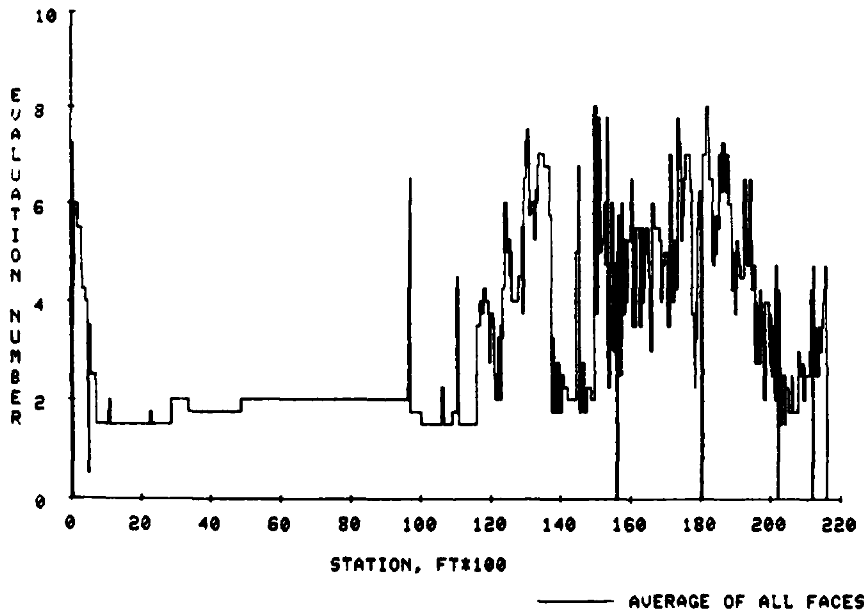
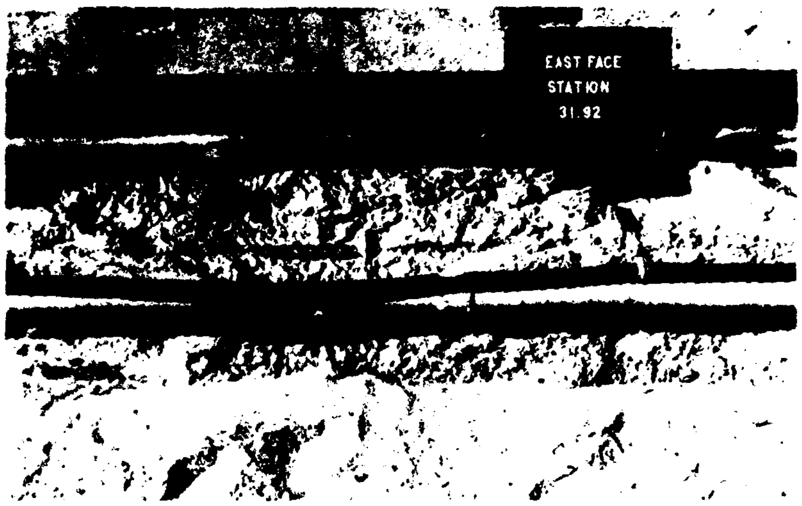
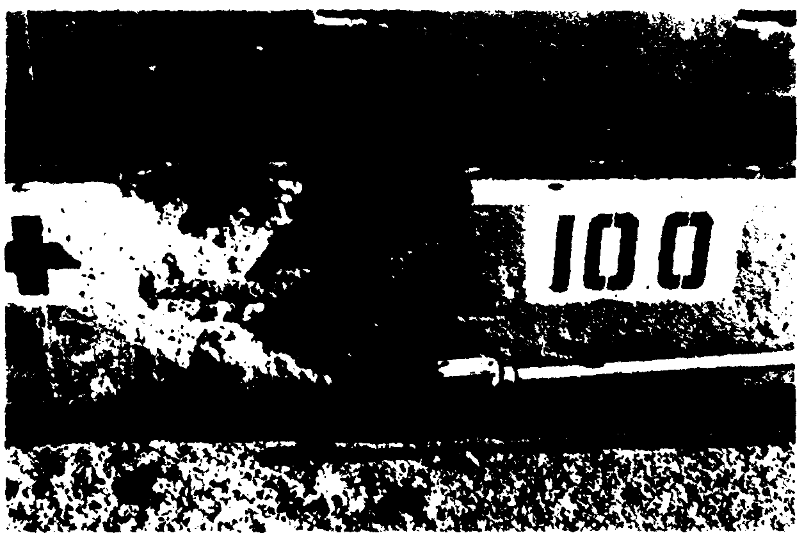


Figure 8. Evaluation of longitudinal cracking along length of structure



a. Sta 31.92, east wall, east face



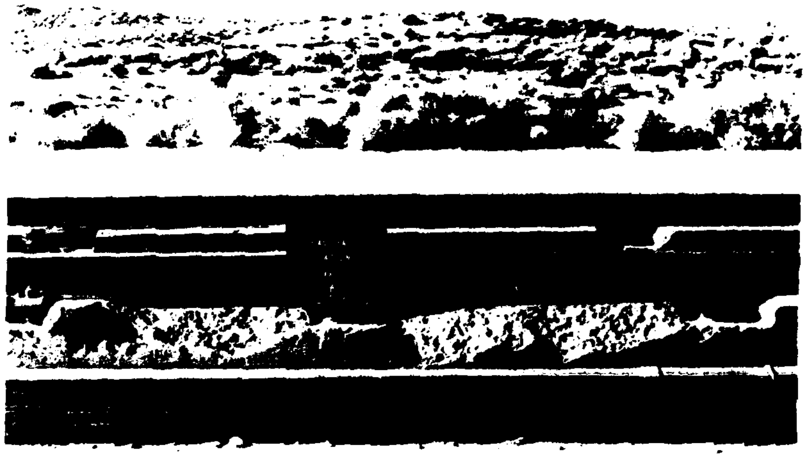
b. Sta 99.98, west wall, west face

Figure 9. Areas of significant spalling (Sheet 1 of 3)

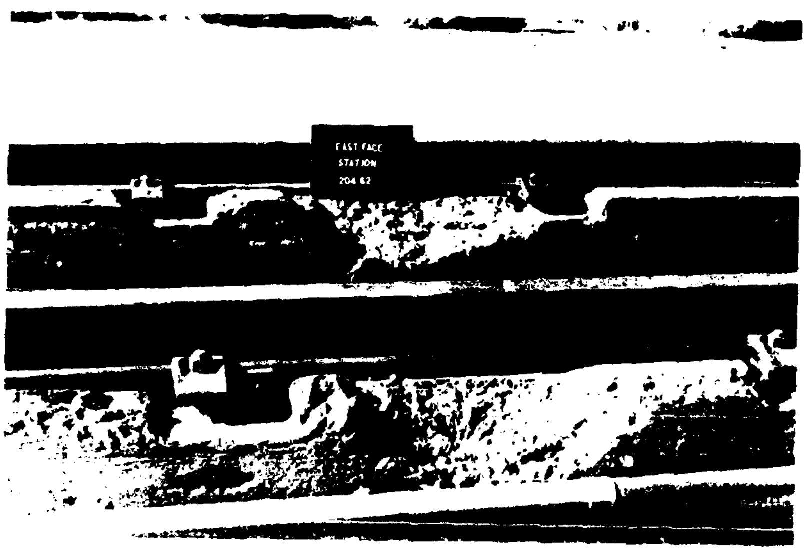
c. Sta 155.98, east wall, east face

d. Sta 170.94, west wall, west face

Figure 9. (Sheet 2 of 3)



e. Sta 199.10, east wall, east face



f. Sta 204.62, west and east walls, east faces

Figure 9. (Sheet 3 of 3)

Figure 10. Transverse floor reinforcing extending outside the structure, sta 3.07, west wall, west face

Figure 11. Construction joint in floor of structure, sta 3.00

reinforcing falls below the elevation of the ground, thereby concealing any other ports of access.

41. A number of construction joints were noted in the floor of the structure (Figure 11); however, the placement of the walls appears to be continuous. No evidence of damage due to this inconsistency was observed.

Mechanical Impedance Testing

42. Mechanical impedance tests using an impulsive loading method were conducted to check for badly deteriorated zones. The structure was excited both vertically and horizontally using an instrumented hammer with impact plates of steel, aluminum, and plastic. The hammer contained a load cell, and

an accelerometer is located on the structure from which signals are recorded on a structural analyzer. This analyzer performs a fast Fourier transform (FFT) of these signals resulting in a mechanical impedance plot or other information, as desired. The response of the structure may be monitored by comparing displacement/force (D/F) versus frequency plots at various locations along the structure.

43. Sections of track which had been replaced when damaged were also tested to provide a comparison with the remainder of the track.

44. Generally, these results show the track to be cracked completely through the vertical legs and web of the H section in many locations. The motion of the structure resulting from impact loads resonated on sections approximately 3 ft in length corresponding to the spacing of vertical cracks of the vertical sections.

45. A modal analysis of the structure was conducted. Any change in the mode of vibration would indicate a change in the mechanical characteristics of the structure. The flexural or torsional mode did not produce a resonant mode of vibration, and the mechanical impedance both vertically and torsionally was inconsistent. For the same impact force, more motion was produced near the cracks. Modal analysis showed the structure to be moving in segments corresponding to the dimension between cracks.

46. The longitudinal mode of vibration across the width of the track did not manifest itself clearly, probably due to the narrow path length joining the two sides of the H section and the large amount of damping produced by the soil. From time to time, resonance would develop and then disappear if the impact point was moved over a few feet. It is believed the resonances that did occur were due to sections in the structure bounded by cracks.

47. At some locations, motions produced in one leg of the structure were not transmitted across the web to the opposite leg, indicating that some segments were not coupled across the web due to cracks.

48. Vibration analysis showed the response of the structure to be that of short segments corresponding to the dimensions between cracks. This response was consistent throughout the structure.

49. Impact tests were used to obtain vertical deflections resulting from vertical impacts along the track.

PART III: SAMPLING OF STRUCTURE AND FOUNDATION

Introduction

50. The 4.1-mile concrete supersonic test track can be seen to have extensive deterioration. Previous studies indicate that salts from the soil and water environment have penetrated the concrete, causing the steel to corrode, and the resulting expansion cracks the concrete.

51. The study reported here was to verify certain aspects of previous studies, to determine the exact causes of the concrete deterioration, and to extrapolate what these causes mean in relation to the future use of the track. To carry out laboratory examinations of the concrete track and foundation, samples were needed. To determine how well the track supports load, structural load tests conducted in the field were needed. A structural analysis of the track was conducted, assuming no cracks and using actual material properties of the concrete and foundation material. From this analysis and comparison with the load test results, conclusions were drawn about the extent to which the track has been damaged by deterioration. The in situ properties of the foundation were determined for use in the structural analysis.

52. The approach in sampling and in situ testing was as follows:

- a. The concrete was sampled by taking 4-in. cores. The cores were obtained horizontally, vertically, and at angles. The cores were tested as follows:
  - (1) Chemical tests to determine deteriorating agents.
  - (2) Petrographic analysis to determine causes of deterioration.
  - (3) Material-properties tests to obtain parameters to use in structural analysis.
- b. The foundation material was sampled to determine its contents and density.
- c. In situ tests were performed in the foundation material to obtain parameters necessary for structural analysis.
- d. Structural load tests were performed along the entire track to determine its consistency in supporting load and to determine deflections to be used in comparisons with analytical results to determine the extent to which deterioration has damaged the track.

Concrete Coring and Sampling

53. The surface concrete of the test track was observed, sampled, and studied. Portions of the surface concrete had a hollow sound when hit with a small hammer. If this concrete was hit repeatedly, it would break away from the rest of the track (Figure 12). For a significant portion of the track, about 1 in. of surface concrete had delaminated from the rest of the track. The track is cracked extensively. The cracked and deteriorated surface concrete was observed and studied, and a condition survey report is presented in Part II giving the results.

54. Although the interior concrete could not be observed, an effort was made to determine the consistency of the interior concrete along the length of the track by using impedance measurements. The track was excited with a hammer which had a load cell behind its impact head. Natural frequencies and impedance parameters were measured and their variations along the track were used in accessing the track's consistency. These results are also presented in Part II.

55. The condition survey, impedance measurements, and observations were used in selecting the locations for coring the concrete along the test track. The coring locations were selected at stations where the concrete

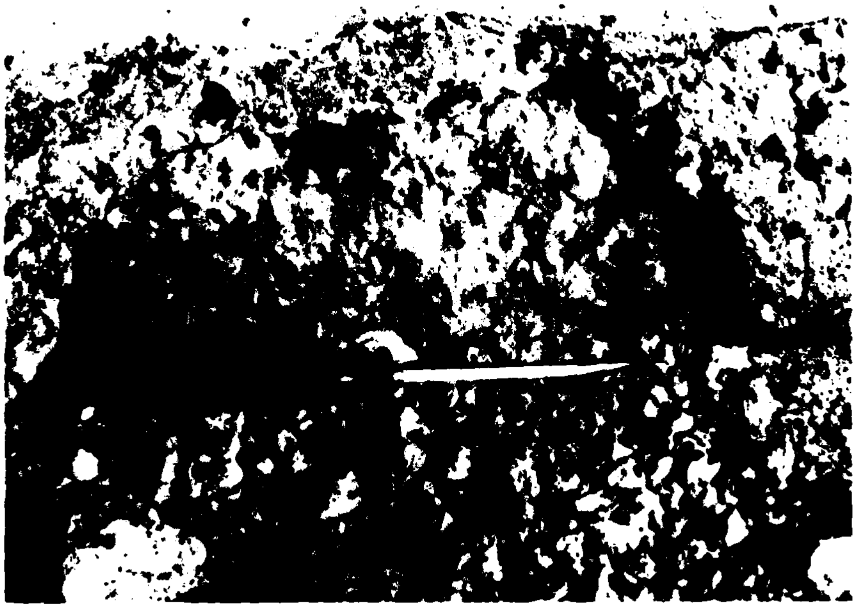


Figure 12. Surface concrete deterioration

was representative of certain lengths of track. Locations were also sele ted at angles and positions in the track to obtain core samples within the various track geometries and to give access to perform in situ testing of the foundation material.

56. The general locations where the cores were taken are presented in Figure 13. Detail core orientations for the slant hole (angle) and the hole

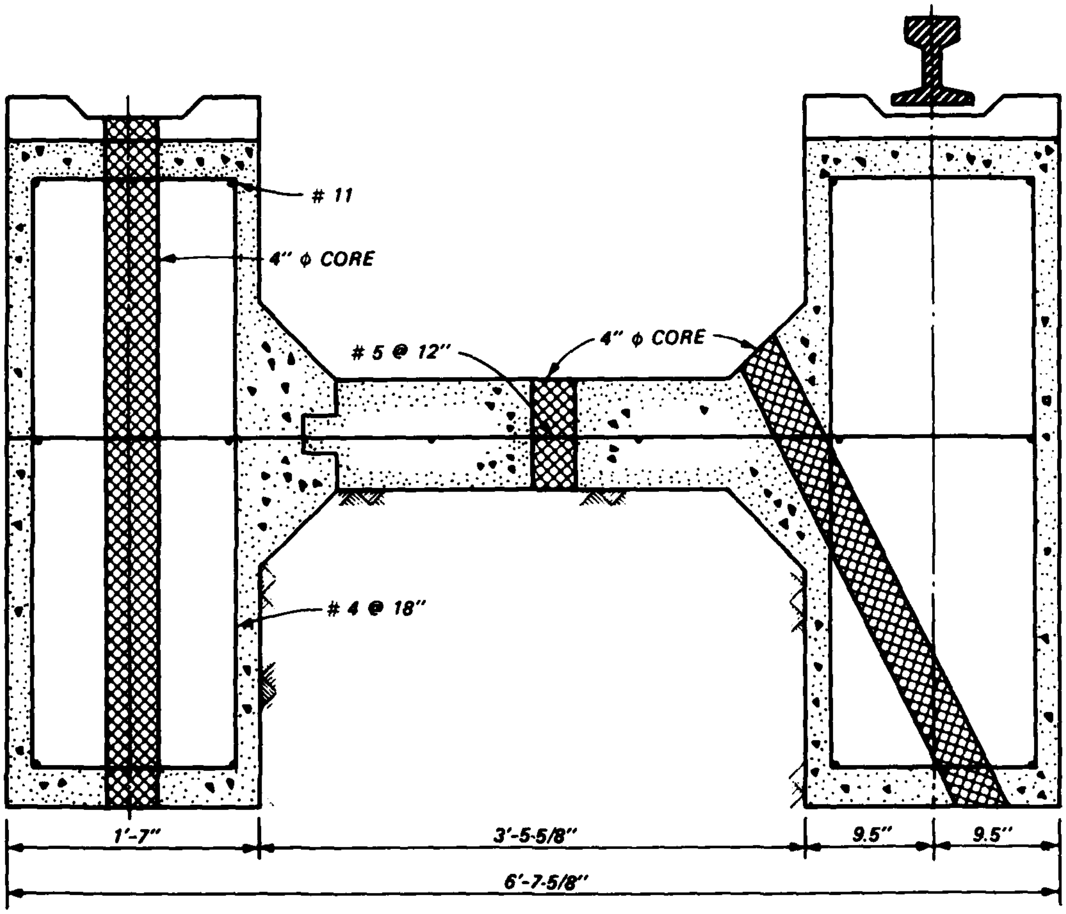


Figure 13. General core orientations

through the entire leg (access) are presented in Figures 14 and 15. The cores and the locations of the cores along the track are presented in Table 6.

Foundation Sampling

57. Sampling and characterization of the foundation material were performed by personnel of the Public Works Department at the Naval Weapons

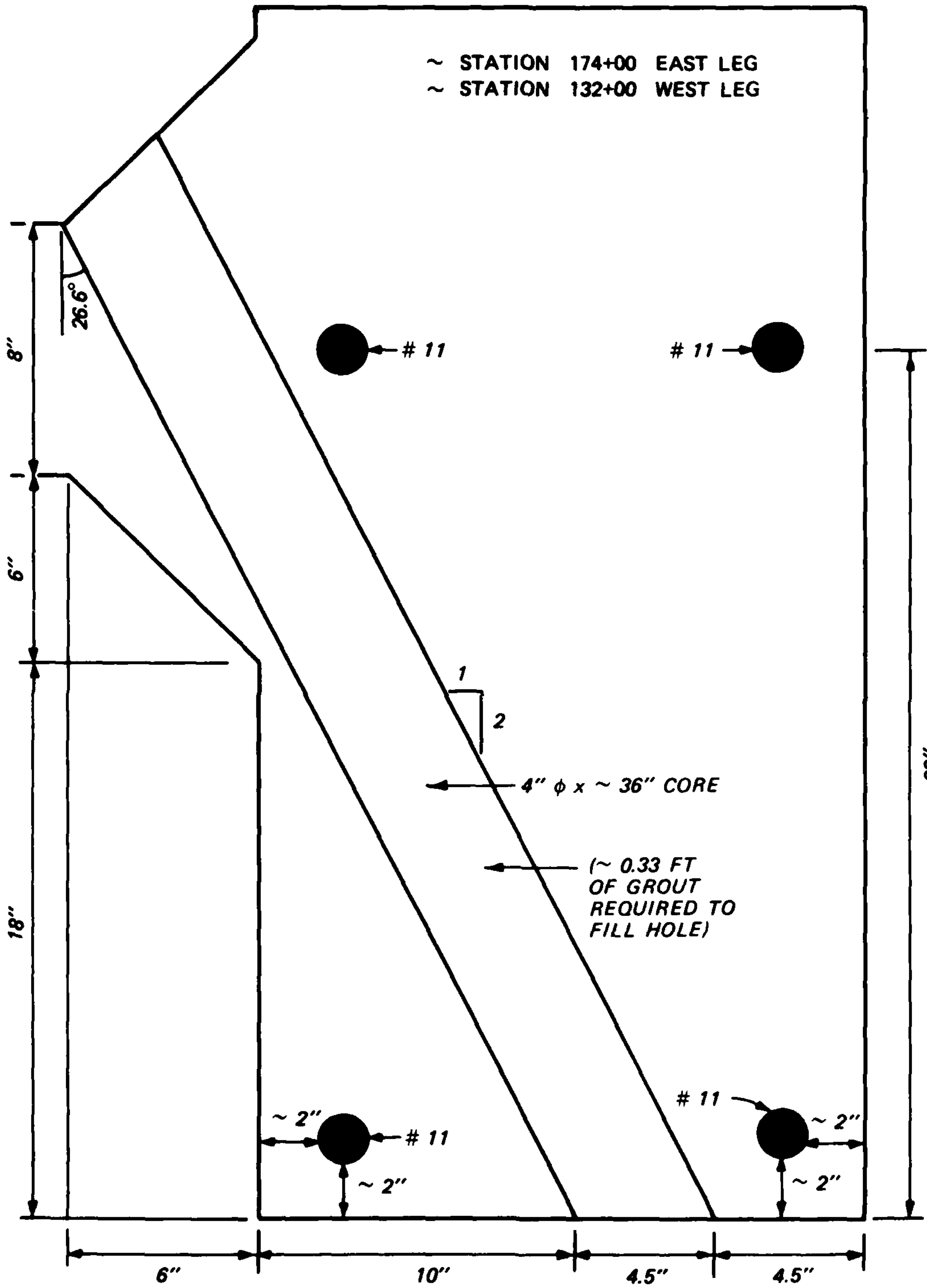


Figure 14. Detail, slant-core orientation

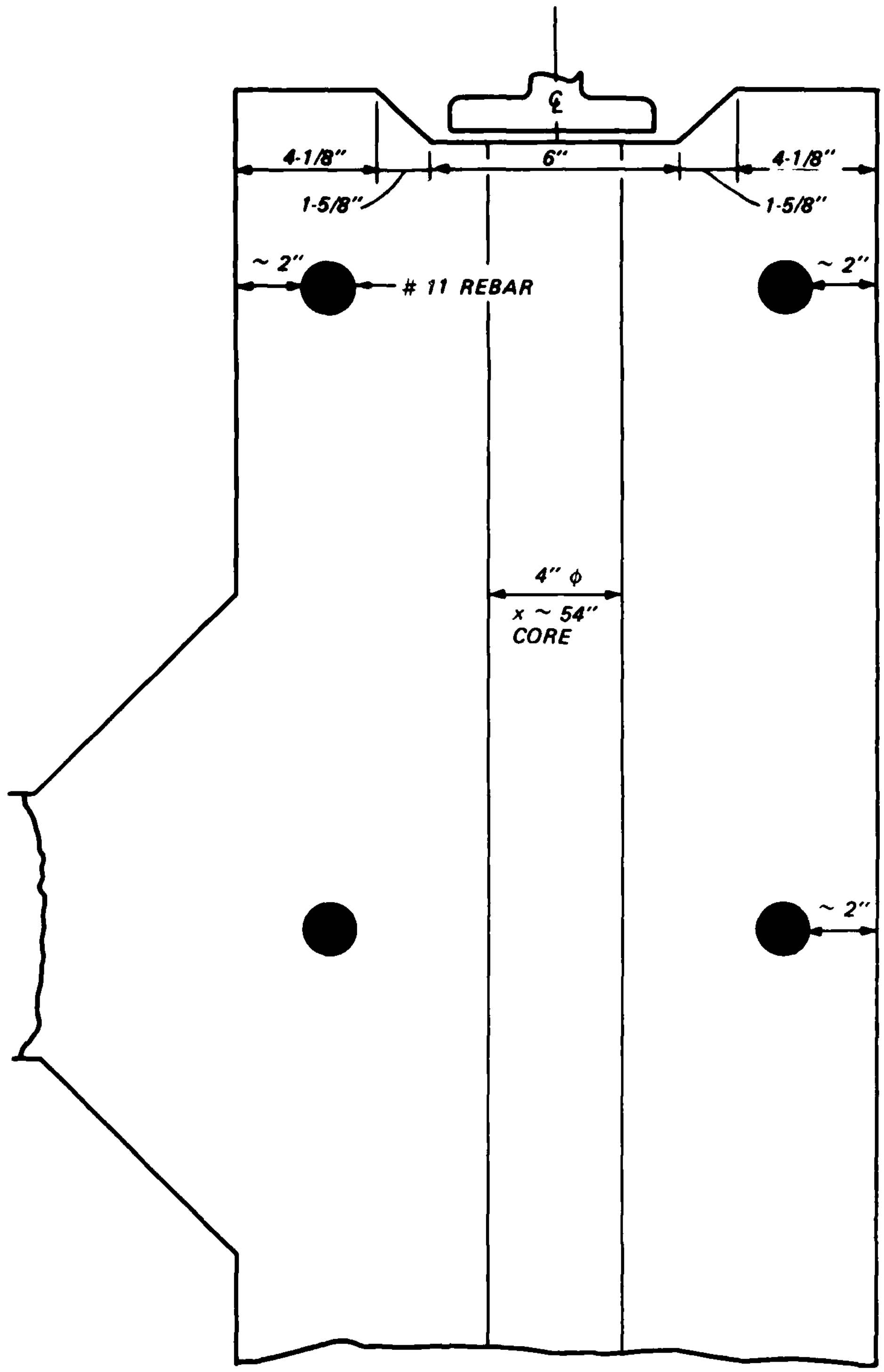


Figure 15. Detail, core location through track vertical leg

Center, China Lake. A backhoe was used to excavate to the base of the test track. At each station where an excavation was made the sand-cone method was used to determine the density of the material at the base and beside the track. Also, moisture contents were determined at various depths.

58. An auger was used to obtain samples below the bottom of the test track.

PART IV: LABORATORY TEST RESULTS

Concrete-Core Tests

59. The location and orientation of the concrete-core specimens are presented in Part III.

60. The ultimate tensile and compressive strengths of the concrete specimens were obtained in order to compare any stresses in the track to these allowables. It was necessary to have the modulus of elasticity (E), Poisson's ratio (μ), and the shear modulus (G) for finite-element analysis. The results of the tests on the specimens which were strain gaged are presented in Table 7 and Figures 16-19. All core testing results are presented in Table 8.

61. The tensile strength is a little less than 10 percent of the ultimate compressive strength, but it is still adequate. The ultimate unconfined compressive strength is adequate and substantiates previous unconfined compressive test results. There is a variation in the modulus of elasticity results which could be a reflection of the deterioration in the concrete track.

62. The physical properties of the concrete are adequate and will be used in analytical and comparative studies.

Foundation Characterization

63. Samples of the foundation material at China Lake were tested. The results are presented in Table 9. The in-place density of the foundation material was determined, and samples of the foundation material were obtained and classified.

64. The density of the foundation material varies from 94.8 to 132 lb/ft^3. This is a wide variation and indicates some change in foundation material along the track length.

65. The water content, soil classification, liquid limit, plastic limit, and plasticity index are presented in Table 9. The variations in these values are mainly dependent on the section of the hard strata of caliche. The caliche would trap and hold moisture above its location because of its density and impermeability.

Petrographic Analysis

66. Twenty-two concrete cores and ten soil samples from SNORT were

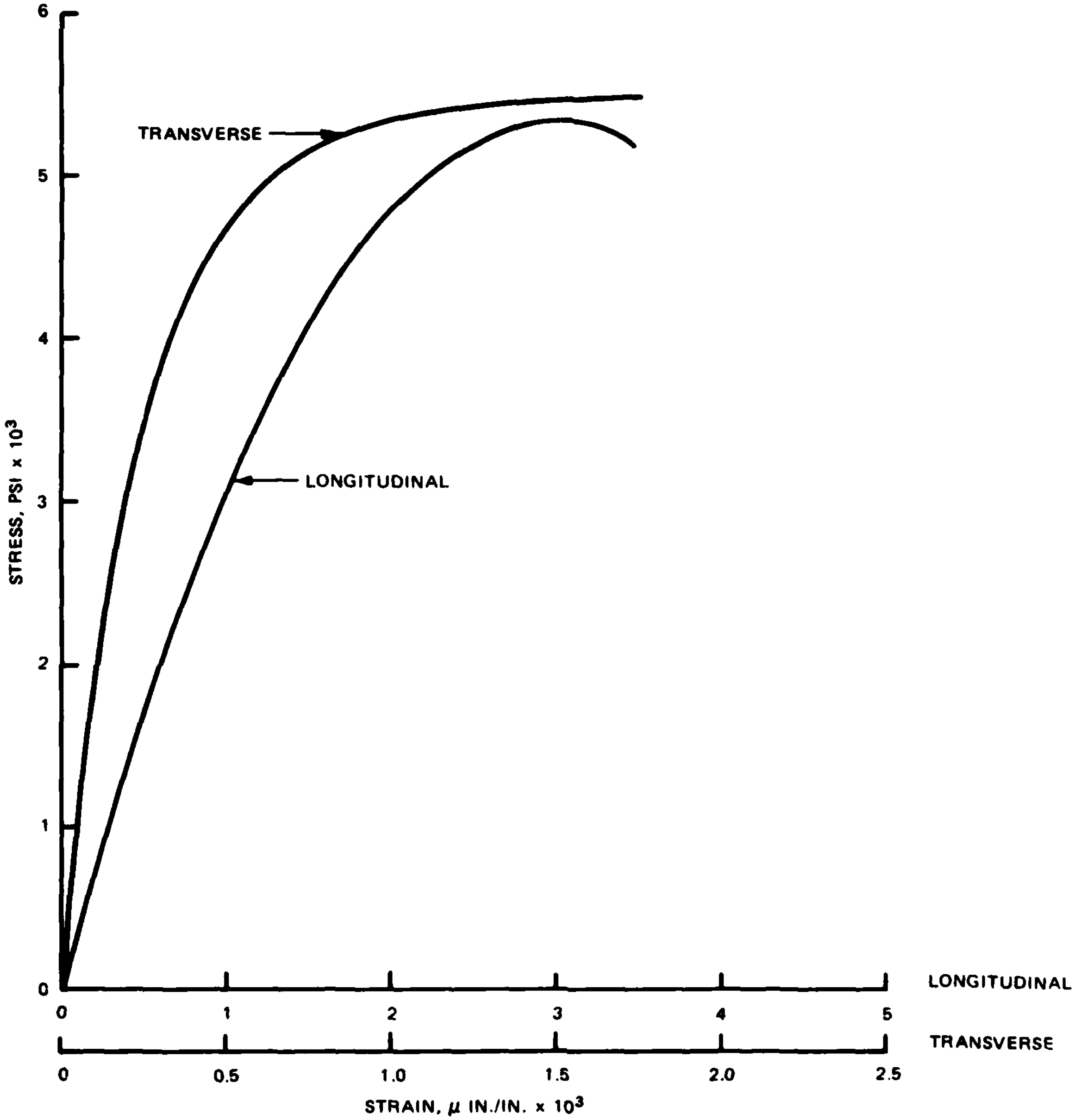


Figure 16. Stress versus strain, specimen HC 96

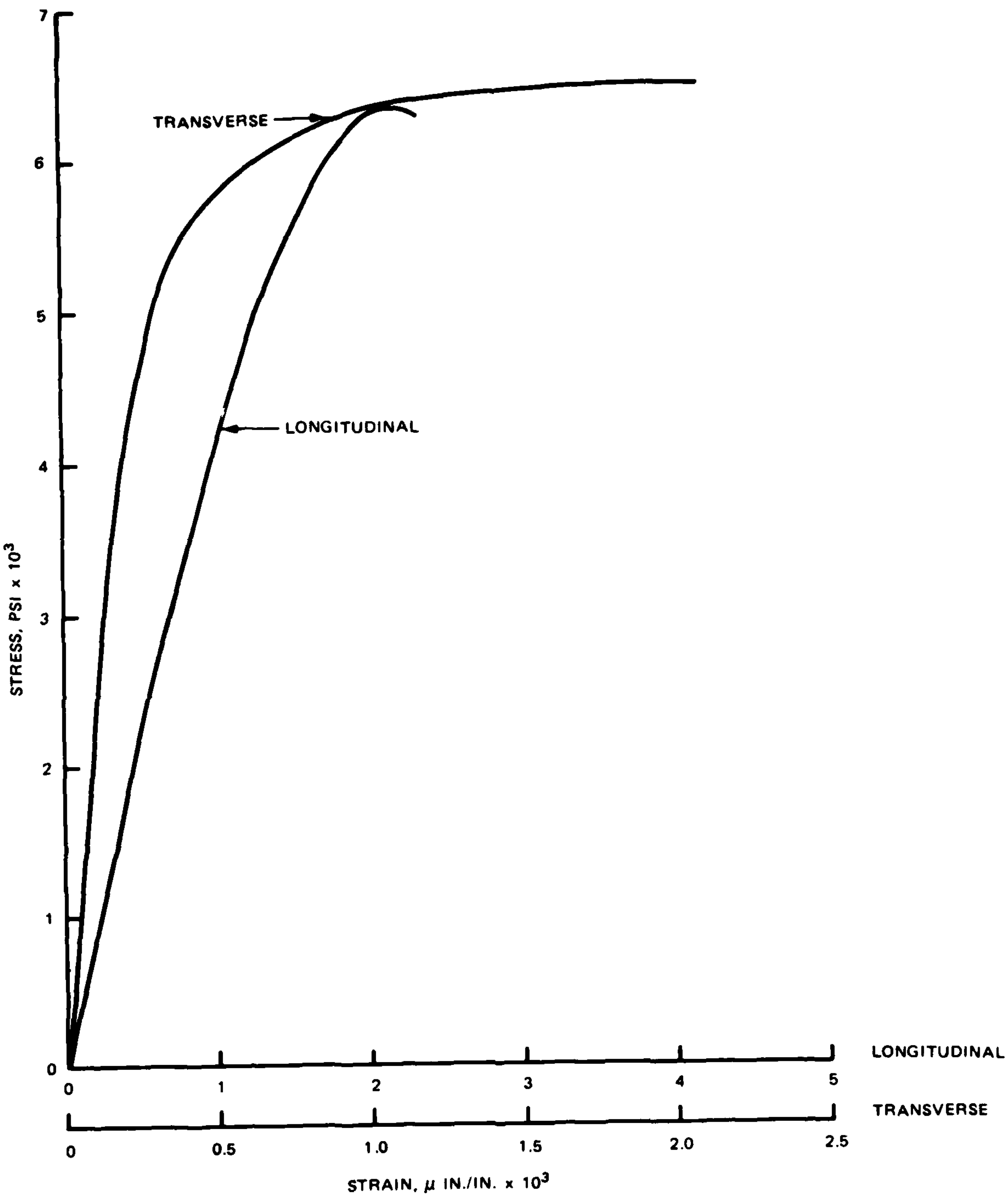


Figure 17. Stress versus strain, specimen VC 12000

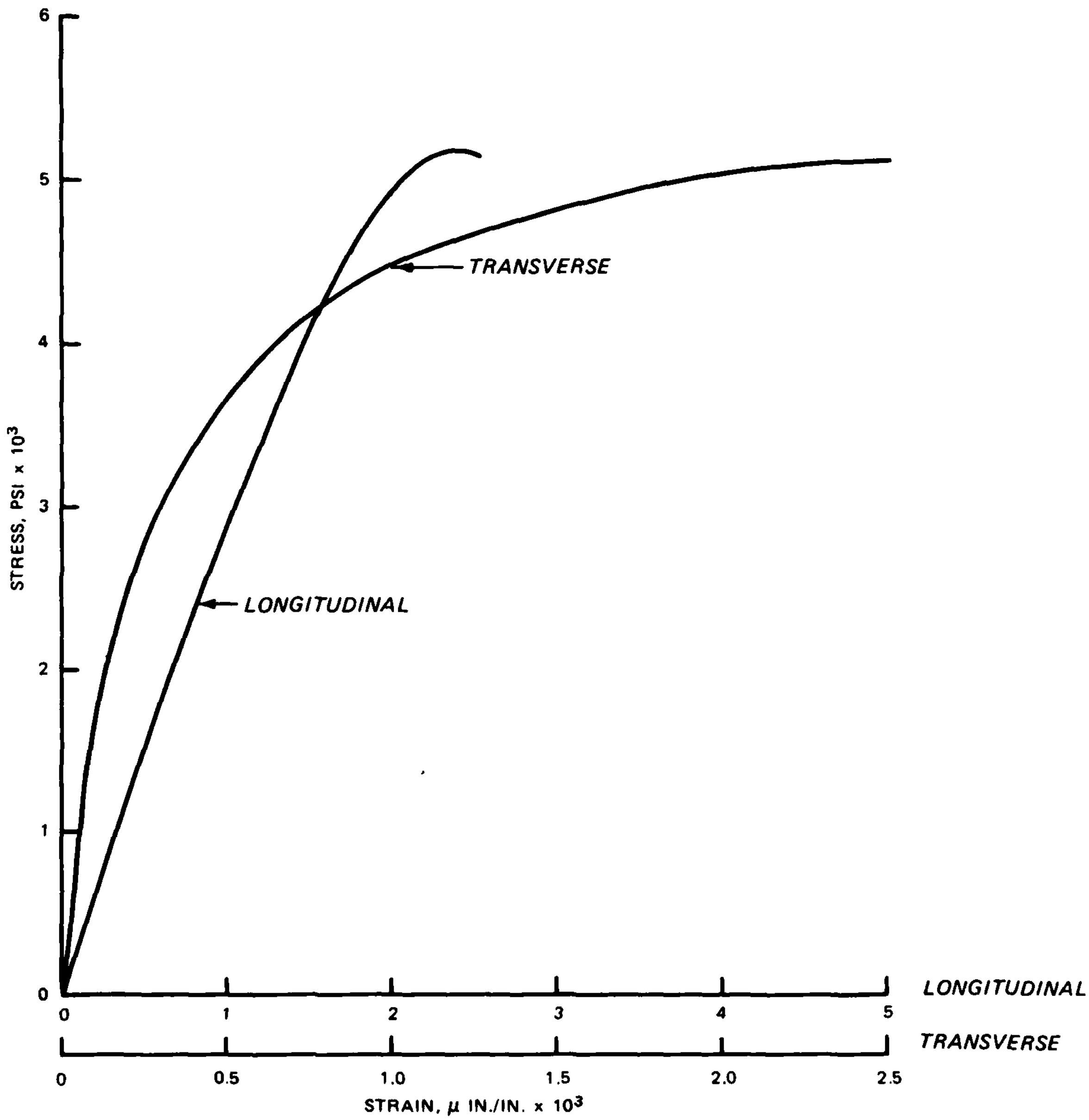


Figure 18. Stress versus strain, specimen VC 13996

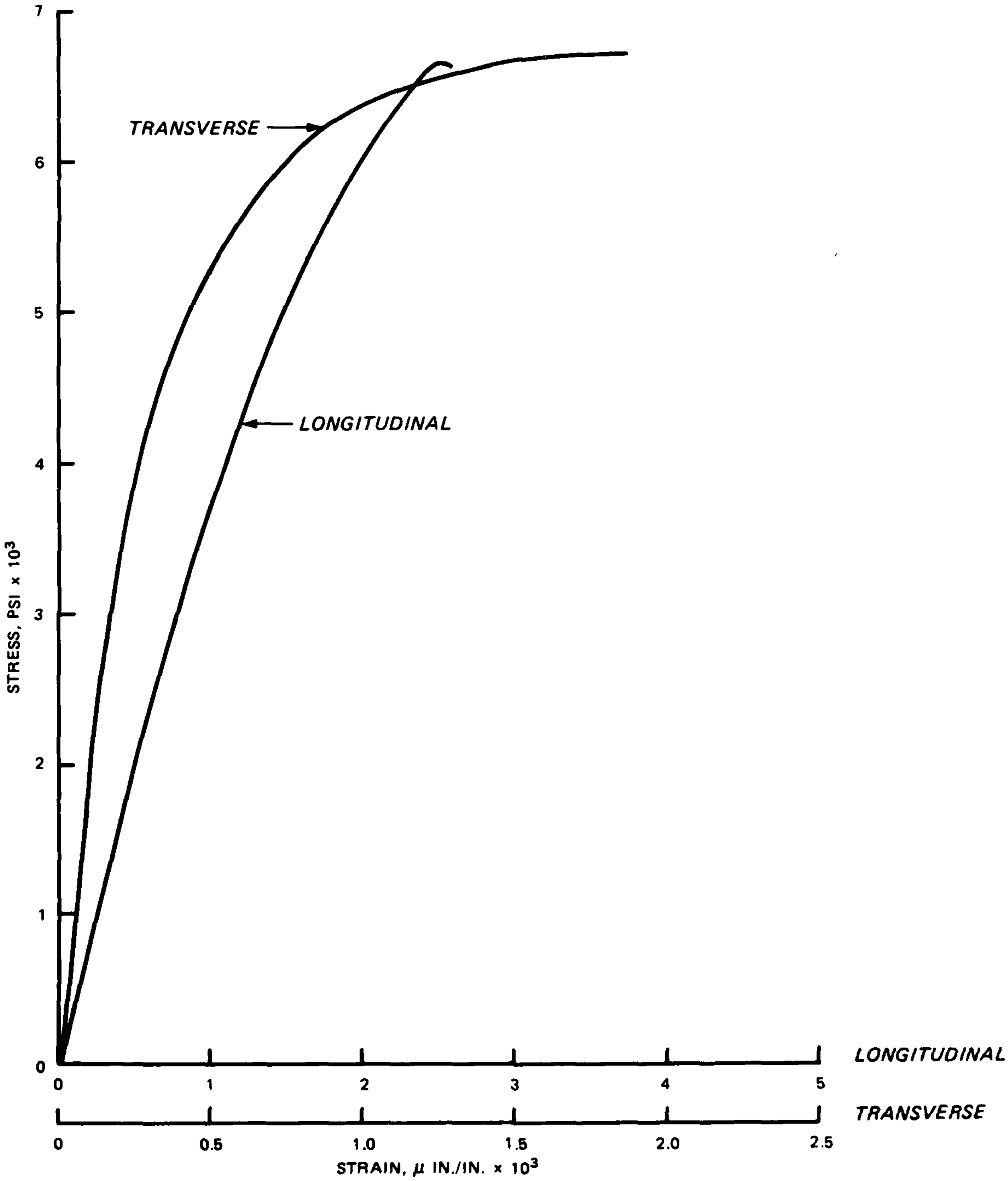


Figure 19. Stress versus strain, specimen VC 21496

received at WES from the Naval Weapons Center on 2 June 1982. The samples were assigned the SL serial numbers indicated:

4-in.-Diameter Concrete Cores

SL Serial No. CL-39*	Field Identification: Sta No.	Field Identification: Location	Boring Direction
CON-7	0+96	East wall	Horizontal
CON-8	24+50	Floor	Vertical
CON-9	79+52	Floor	Vertical
CON-10	96+96	West wall	Horizontal
CON-11	120+00	Floor	Vertical
CON-12	129+99	West wall	Horizontal
CON-13	129+96	East wall	Horizontal
CON-14	139+96	East wall	Vertical
CON-15**	150+96	West wall	Horizontal
CON-16	150+96	East wall	Horizontal
CON-17	155+00	Floor	Vertical
CON-18	164+98	Floor	Vertical
CON-19	173+99	West wall	Horizontal
CON-20	173+99	East side	Inclined
CON-21	180+00	Floor	Vertical
CON-22	181+94	East wall	Horizontal
CON-23	181+99	West side	Inclined
CON-24	200+00	Floor	Vertical
CON-25	210+00	Floor	Vertical
CON-26	214+96	West wall	Horizontal
CON-27	214+96	West wall	Vertical
CON-28	214+96	East wall	Horizontal

Soil Samples

SL Serial No. CL-39†	Sta No.
SS-3	1+08
SS-4	24+50
SS-5	24+56
SS-6	79+50
SS-7	120+00
SS-8	155+00
SS-9	165+00
SS-10	180+00
SS-11	200+00
SS-12	210+00

* CON-1 through -6 were hand samples.

** One short core was terminated by major reinforcing steel and one long core was taken slightly above first.

† SS-1 and -2 were earlier hand samples.

Procedure

67. The 22 concrete cores were examined visually and logged. Those cores that were intact and long enough for physical testing were set aside. The fragments of cores after this testing were examined to detect evidence of possible deleterious chemical reactions or other problems. A stereomicroscope and a polarizing microscope were used as needed for these and other examinations.

68. Petrographic examination of the concrete was made using guidance from Standard Recommended Practice for Petrographic Examination of Hardened Concrete (Method CRD-C 57-78)(U. S. Army Engineer Waterways Experiment Station 1949). This method is also ASTM C 856. Detailed examination was made of concrete from eight cores representing different concrete conditions and various locations within the structure. The fractured surfaces of broken cores were examined. Reaction products found on these surfaces were identified using X-ray diffraction and microscopy.

69. Pieces of intact cores were broken to allow examination of freshly fractured surfaces. One piece of core was sawed longitudinally, and the sawed surface was ground smooth before being examined.

70. The paste portions of several cores were concentrated by selective grinding and sieving. These paste concentrates were then examined by X-ray diffraction to determine phase compositions.

71. Ten soil samples were taken along the length of the SNORT track. Eight of these samples were examined by Xray diffraction to determine mineralogical composition.

72. All X-ray patterns were made with an X-ray diffractometer using nickel-filtered copper radiation.

Results

73. The concrete tended to be composed of 3/4- to 1-in. maximum size coarse aggregate. The coarse aggregate was generally fine-grained dark igneous rock particles. The fine aggregate was a natural siliceous sand. The particles for both the coarse and fine aggregates tended to have angular edges, but they were believed to be of natural gravel and sand.

74. The nonair-entrained concrete was well consolidated and generally homogeneous throughout the structure. Discontinuities and irregularities in the concrete are identified in Figures 20-23.

75. The concrete cores from the floor of the track ranged in quality

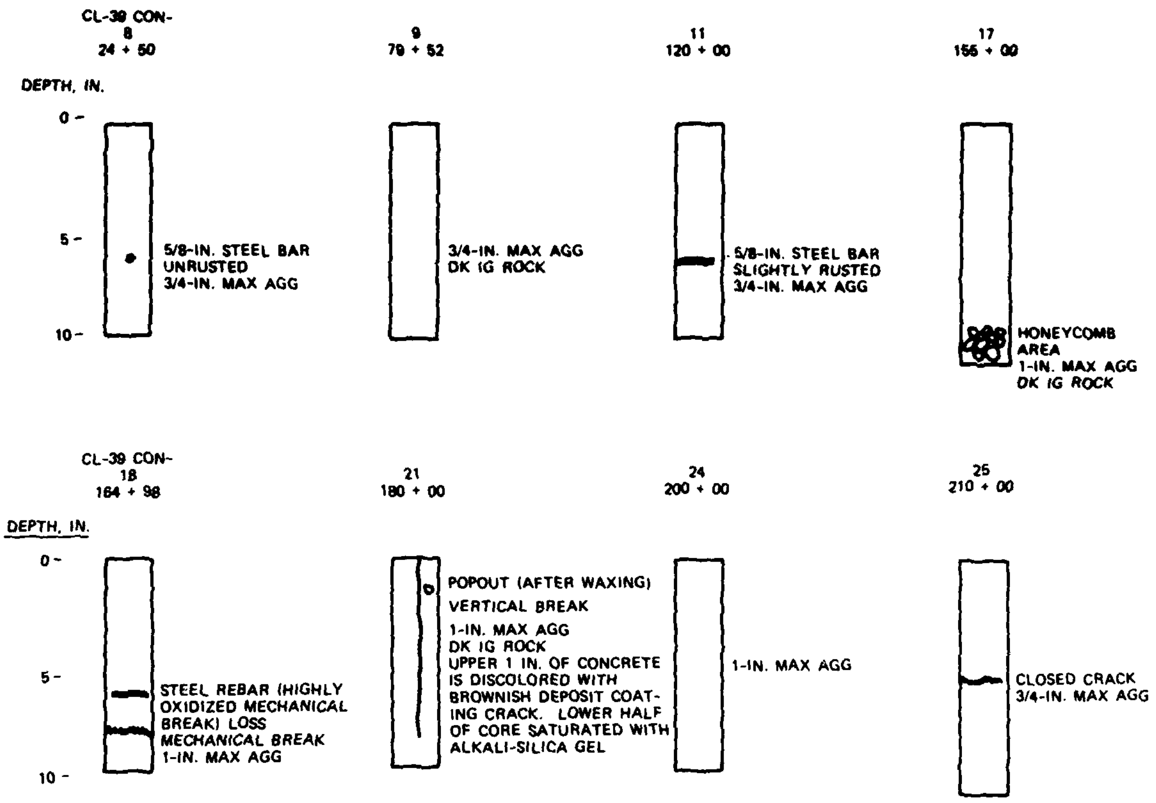


Figure 20. Logs of eight vertical SNORT cores from web (floor)

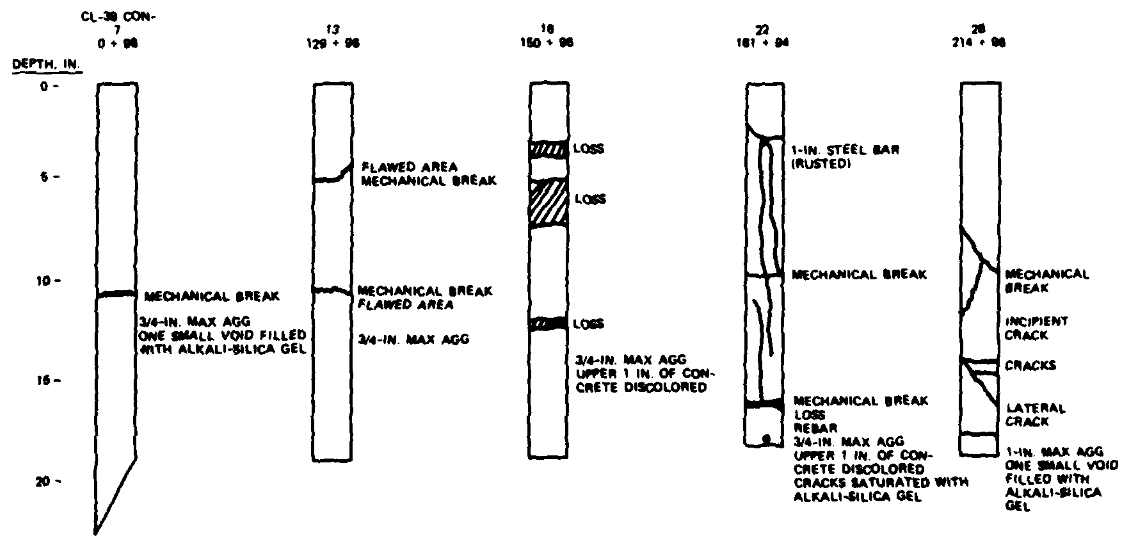


Figure 21. Logs of five horizontal SNORT cores from east rail support

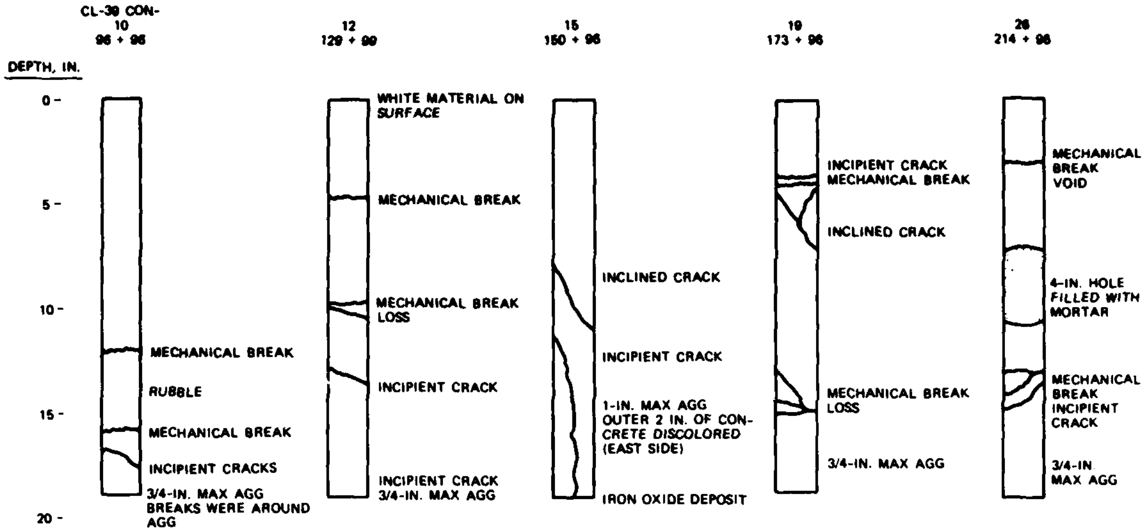


Figure 22. Logs of five horizontal SNORT cores from west rail support

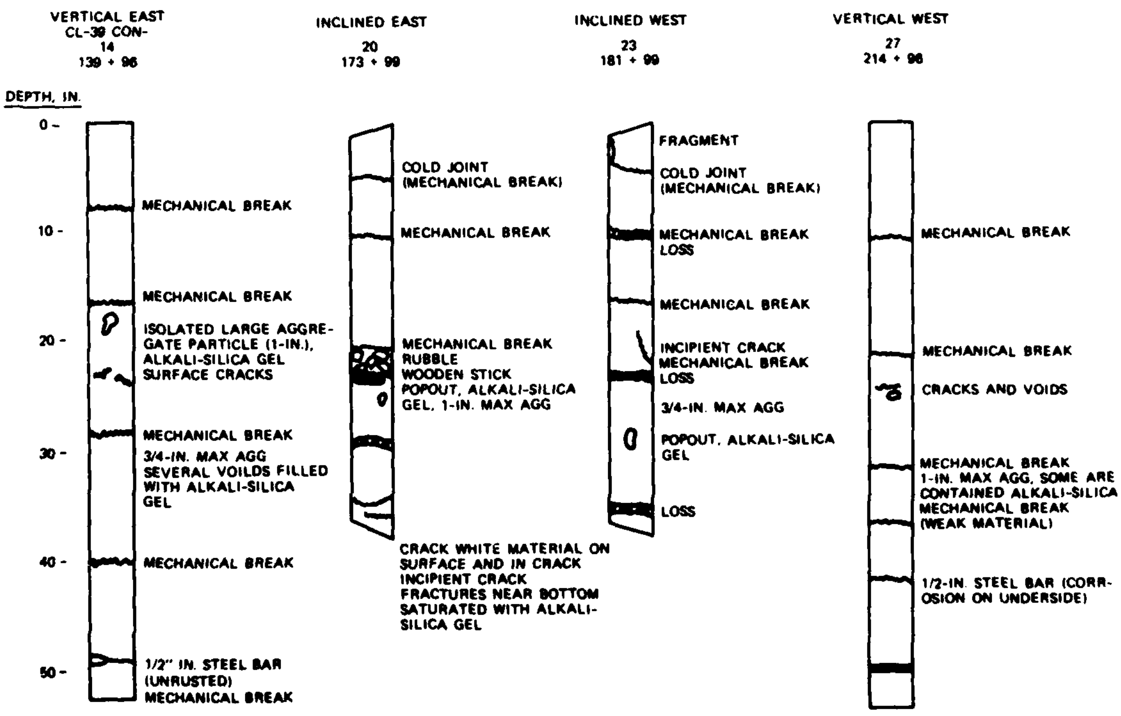


Figure 23. Logs of four inclined and vertical SNORT cores (into rail supports)

from good intact concrete core typified by sample CL-39 CON-8 nearer the upper end of the track (no rust on embedded steel), to core where embedded steel in the concrete was only slightly rusted (CL-39 CON-11), to highly rusted embedded steel in core CL-39 CON-18 toward the other end of the track (Figure 24a). Major cracks in the concrete had developed in core CL-39 CON-21. The cracked surfaces were coated with a brownish deposit. The lower portion of core CL-39 CON-18 was saturated with white alkali-silica gel that coated fractured surfaces and filled voids. Alkali-silica reaction was also the cause of popouts on the cored surface. The fine-grained dusky yellow (5Y 6/4) (Pollock, Kay, and Fookes 1981) aggregate particle causing one popout was composed of reactive ingredients including cristobalite, tridymite, and glass having an index of refraction lower than 1.544.* The associated alkali-silica gel had a clear vitreous appearance, and some central areas may be chalky white. Examination of immersion mounts with a polarizing microscope indicated an amorphous and a salt and pepper variety of alkali-silica gel.

76. The horizontal cores from the east and west support rails were in good condition from the beginning of the track to about sta 150+96, but were in worse condition thereafter. The two cores from sta 150+96 showed loss during drilling and numerous preexisting cracks propagating along the length of the core. Alkali-silica gel was identified on the crack surfaces of core CL-39 CON-22 from sta 181+94 and filling isolated voids in some of the horizontal cores throughout the length of the track.

77. The inner wall concrete from cores CL-39 CON-16 and CL-39 CON-15 was discolored to a brownish color. The color varied significantly from the usually light gray color of the cement paste. The normal gray paste was composed of ettringite, tetracalcium aluminate dichloride-10-hydrate (chloroaluminate), calcium hydroxide calcite, and residual aluminoferrite from the cement. The brownish paste contained no calcium hydroxide, no ettringite, no chloroaluminate, and was more carbonated than the normal gray paste. The presence of chloroaluminate is due to conversion of ettringite from salt in the area and was considered normal for this situation.

78. The condition of the vertical and inclined cores representing the concrete below grade of the east and west support rails is summarized in Figure 24. Alkali-silica gel was present in all four cores. The gel

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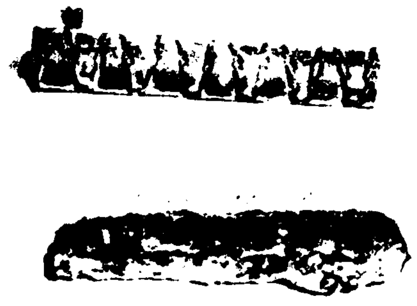
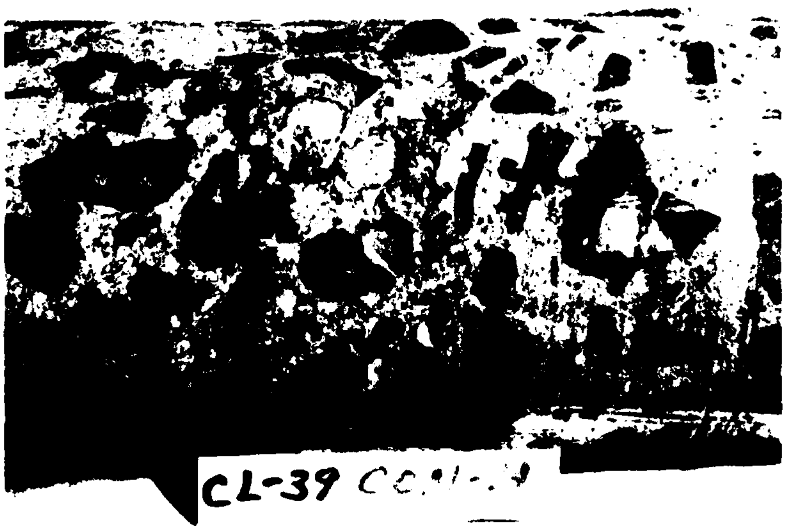
* Preliminary report, Van Dyke and Barnes, June 1975.



a. Reinforcing steel from core CL-39 CON-8 from sta 24+50 and core CL-39 CON-18 from sta 164-98. They compare the severe rusting of some steel to others that remain relatively unaffected. The 5/8-in.-diam steel bar in core CL-39 CON-18 was heavily rusted on one side and was only slightly affected on the reverse side



b. Expansion due to alkali-silica reaction has caused popouts of reactive aggregate particles after coring. The popouts occurred in less than 45 days from the time this core was drilled

Figure 24. Rusting of reinforcing steel and popouts caused by alkali-silica reaction

was generally found in isolated voids and associated with aggregate popouts on cored surfaces (Figure 24b). In core CL-39 CON-20, alkali-silica gel was found saturating the cracked area near the bottom of the core.

79. The soil samples commonly contained quartz, plagioclase feldspar, potassium feldspar, amphibole, calcite, clay-mica, smectite,* and kaolinite. Samples CL-39 SS-7, -8, -10, -11, and -12 contained more smectite than the other samples examined. No chloride-bearing minerals were detected by X-ray diffraction in any of the soils. This is somewhat surprising since, as mentioned earlier, chloride must be present to form chloroaluminate. The amounts may be below X-ray diffraction detection limits or chloride may be in the water.

Discussion

80. The concrete did not display uniform deterioration. The intact cores or cores where the breaks were caused mechanically tended to be in good physical condition. However, some cores showed signs of deterioration that were generally due to rusting of steel and alkali-silica reaction. The concrete near sta 180+00 showed both rusting of reinforcing steel and alkali-silica reaction.

81. As mentioned earlier, the chloroaluminate found in the cement paste indicates that chloride ions were and probably still are available for corrosion of the steel embedded in the concrete.

82. Alkali-silica reaction did not appear to be a primary cause of the deterioration but has contributed significantly to the degradation of the concrete in some instances. The presence of silica gel throughout the structure and observation of alkali-silica-caused popouts on cored surfaces suggest that the reaction may play an even more important role in the future degradation of the concrete.

83. Smectite, an expansive clay, was detected as a constituent in the soil in small quantities.

Conclusions

84. Concrete cores from the test track ranged from good to poor quality with better quality cores nearer the beginning of the track.

85. Deterioration was due to both rusting of embedded steel and to alkali-silica reaction. It was not possible to determine which factor started

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* Swelling clay; the montmorillonite-saponite group.

first or was most important. The source of the chloride that rusted the steel was not specifically identified.

86. Since coring, the development of popouts on concrete surfaces has occurred due to alkali-silica reaction. This shows that the reaction is not exhausted; all it needs is a favorable environment for more reaction to occur.

87. The soil at the test track contains some swelling clay.

88. If the concrete is replaced, precautions should be taken to avoid the use of reactive materials so that an alkali-silica reaction will not take place; it might be desirable to avoid the use of embedded steel since corrosion of it has been a problem. Finally, it would be desirable to stabilize the soil so that foundation movement would be minimal.

Chemical Analysis of Soils, Water, and Concrete Core from SNORT

89. Ten soil samples described earlier and two water samples were received by the Chemistry Unit, Materials and Concrete Analysis Group, on 2 June 1982. Below is the description of water samples.

Sample Description	WES Designated No.
Tap water	CL-39 W-2
Pond water	CL-39 W-1

90. The ten soil samples were analyzed for chlorides, sulfates, pH, and resistivity. All soils were prepared by air drying for 3 days, then grinding the samples to pass a 300-μm (No. 50) sieve. These parameters were chosen to determine if the soil would be corrosive to the concrete or reinforcement steel in the concrete. The results are shown in Table 10.

91. The chloride contents of the soils were determined by boiling 5 g of the soil in 100 ml of distilled water for 10 min, filtering to remove the soil particles, and determining the chlorides in the filtrate by potentiometric titration. The sulfates were determined by shaking 4 g of the soil in 100 ml of distilled water for 1 hr, filtering to remove the soil particles, and determining the sulfates in the filtrate by a turbimetric method. Resistivity was determined by a method found in Black (1965). The resistivity of extracts from a soil-to-water ratio of 1:2 were measured. The soils and water were shaken for 1 hr, filtered to remove soil particles, and the resistivity

of the extract was measured using a conductivity meter. The pH was determined by a method found in Black (1965).

92. The two water samples were analyzed for chlorides, sulfates, pH, resistivity, total solids, hardness, alkalinity, magnesium, sodium, potassium, and calcium. The results are shown in Table 11.

93. A concrete core designated as core CON-18 164+99 was analyzed for chloride content. Five sections of the core were analyzed for chloride content. The core was broken at a reinforcing bar located approximately 2 in. from the bottom side. The 2-in. section below the reinforcing bar was broken into two parts and the section above the reinforcing bar, approximately 6 in. high, was intact except for a corner off the top which was missing. Below is a description of the sections tested and the weight of each section.

Section	Description	Weight, g
1	Top of core approximately 1 in. thick	249
2	Area just below section 1 approximately 1 in. thick	229
3	Section next to and above reinforcing bar approximately 1/2 in. thick	176
4	Section next to and below reinforcing bar approximately 1 in. thick	428
5	Bottom of core approximately 1-1/4 in. thick	568

The chloride content of each section is shown in Table 12.

94. The soil test results indicate that the soil could be corrosive to steel. The resistivity of the soil-to-water extracts 1:2 was low, with a range from 94 to 2180 ohms/cm. The average resistivity of the ten soils was 860 ohms/cm, indicating a high amount of soluble salts. The concentration of water-soluble sulfates found in the soils was not excessively high. The water-soluble sulfates ranged from a low of <50 μg/g to a high of 1830 μg/g (<0.005 to 0.183 percent). ACI Manual of Concrete Practice (1980), Part I, states that water-soluble sulfates in soils with a range of 0.10 to 0.20 would be a moderate exposure to concrete and recommends a Type II, IP(MS), or IS(MS) cement be used for sulfate resistance. The water-soluble chlorides in the soils ranged from a low of 38 μg/g to a high of 1530 μg/g, and the average chloride content for the ten soils was 518 μg/g.

95. The water analysis test results indicate that the two waters should not be corrosive to steel or concrete. The chloride contents for CL-39 W-1

and CL-39 W-2 were low, 101 mg/l and 34.1 mg/l, respectively. The sulfate contents were also low, 68.5 mg/l and 44.8 mg/l.

96. The chloride content of the concrete core was found to be high. The bottom portions of core sections 4 and 5 were found to contain the greatest amount of chlorides, 0.251 and 0.243 percent chloride, respectively. This suggests that the soil may be contributing to the chloride content of the concrete. More concrete core analysis would be needed to confirm this theory. The average chloride content of the five sections analyzed was 0.177 percent chloride. Based on 4000 lb/cu yd, the concrete would contain 7.08 lb of chloride per cubic yard. Clear and Hay (1977) report that the chloride content corrosion threshold of concrete is approximately 1.3 lb of chloride per cubic yard. The amount found in the core greatly exceeds this value, which indicates that chlorides in the concrete are contributing to the corrosion of the reinforcement steel.

PART V: FIELD TEST RESULTS

In Situ Pressure Meter Tests

97. Because the foundation material at China Lake is sandy with inclusions of layers of caliche, WES personnel decided that in situ tests should be conducted to determine the modulus of subgrade reaction, modulus of elasticity, and shear modulus for the foundation.

98. The pressure meter method has been used and verified over the last 20 years, and it was used in testing and obtaining material properties of the foundation.

99. The geotechnical investigation reported herein was undertaken as part of the evaluation of the existing SNORT structure (Figure 25). The work consisted of performing pressure meter tests at various stations along the track in order to obtain the foundation properties as follows:

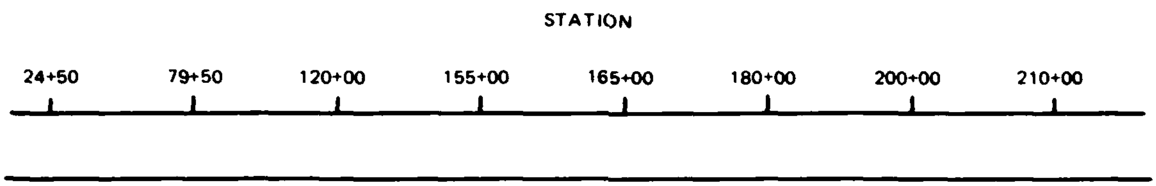
- a. A subgrade modulus for the foundation.
- b. The elastic properties: modulus of elasticity (E) and shear modulus (G).
- c. An estimate of Poisson's ratio.
- d. An estimate of ultimate bearing capacity and settlement for static loads for an average foundation condition.

100. The pressure meter tests were performed at 8 stations along the track; a total of 46 tests were performed between 20 May and 26 May 1982.

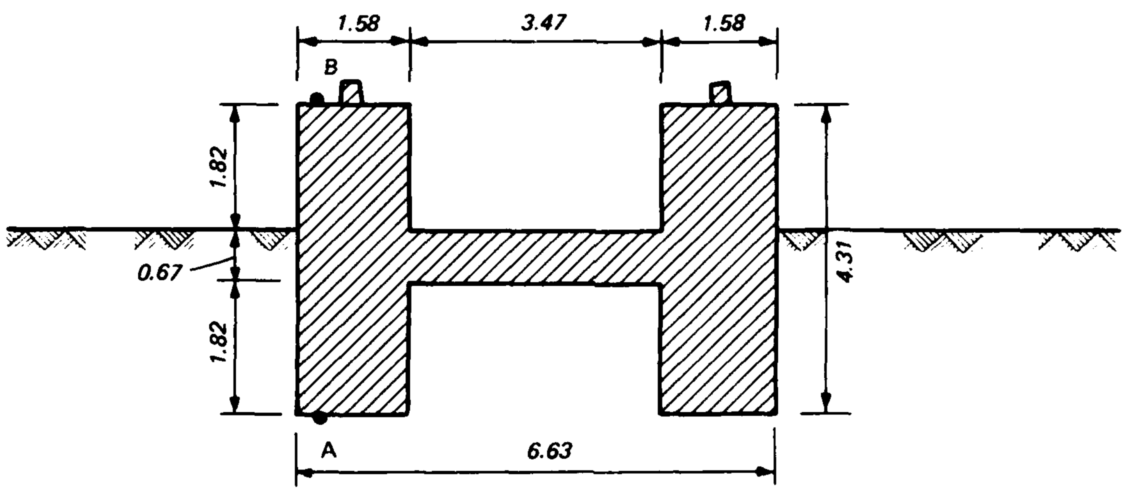
Pressure meter testing

101. Two pressure meters (PMT) were used at the site. With the pressure meter model B. S., 44 tests were performed; this pressure meter is a monocellular strain-controlled pressure meter, the probe is 60 mm in diameter and has an initial deflated volume of 1000 cm^3. With the pavement pressure meter, two tests were performed; this pressure meter is a monocellular strain-controlled pressure meter, the probe is 32 mm in diameter and has an initial deflated volume of 200 cm^3. Both PMT probes are inflated with water.

102. For 36 of the 46 tests, the borehole was prepared by augering in the dry with a 65-mm-diam hand auger; for the remaining 10 tests the soil was too hard to be drilled with the hand auger; these 10 tests were performed in holes prepared by rotary drilling with a 2.5-in. drill bit, a portable power auger, and a forklift for downward thrust. Results of pressure meter testing



PLAN VIEW



CROSS SECTION
DISTANCES IN FEET

Figure 25. Track plan view and cross section

are presented in Appendix A. The drilling procedure used for each test is indicated on each test curve presented in the appendix.

103. The raw data obtained in the field were reduced; corrections were applied for membrane resistance and volume losses in order to obtain the corrected curve. For each test, a raw curve, a volume loss curve, a membrane resistance curve, and a corrected curve are presented in Appendix A. A first loading modulus E_o , a reload modulus E_R , and a limit pressure P_L were also calculated. The first loading modulus was obtained from the straight part of the PMT curve on the first loading; the reload modulus was obtained from the slope of the unload-reload cycle; the limit pressure was estimated mostly by manual extension of the curve but sometimes by assuming $E_o/P_L = 10$. The detailed profiles of E_o , E_R , and P_L are given in Figures 26-28, respectively.

104. The average pressure meter parameters at each depth were obtained by averaging all values at that depth. This resulted in three average profiles: one for E_o , one for E_R , one for P_L . These averages are listed in Table 13.

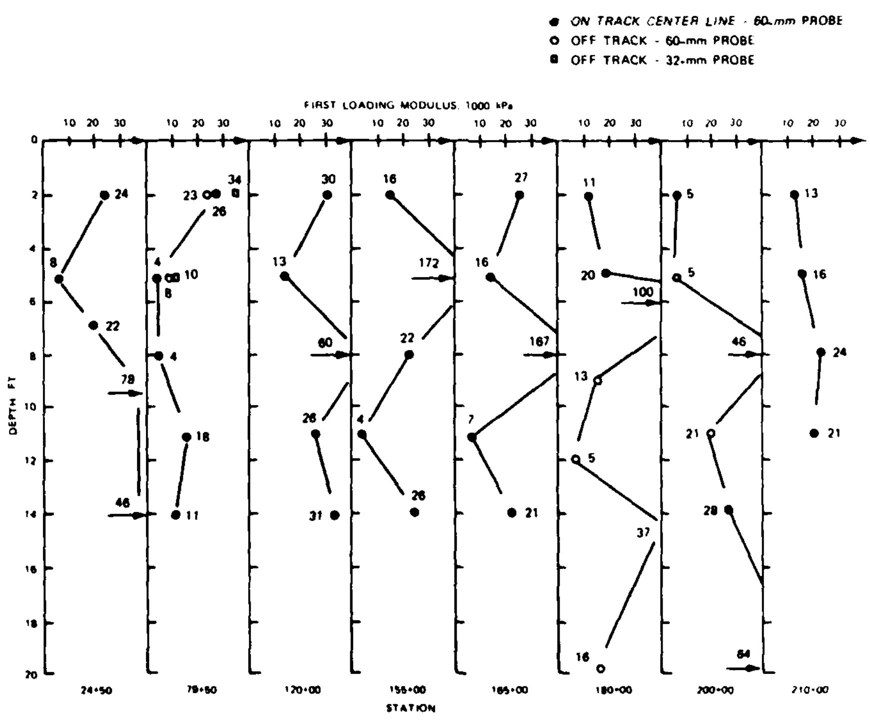


Figure 26. First loading modulus (1000 kPa)

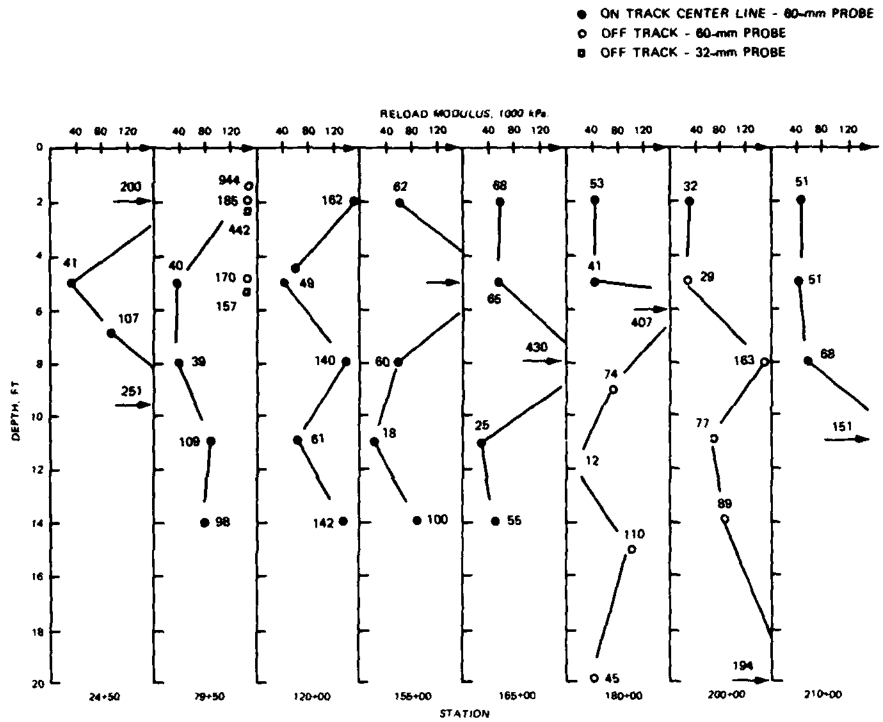


Figure 27. Reload modulus (1000 kPa)

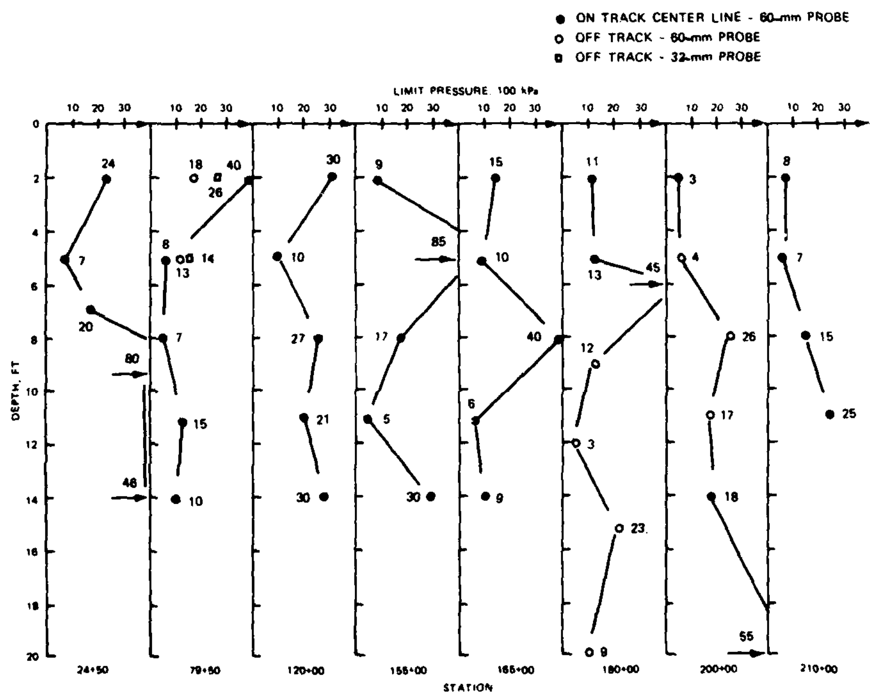


Figure 28. Limit pressure (100 kPa)

Foundation condition

105. On the basis of the pressure meter parameters and visual inspection, the soil can be classified as a medium to dense, fine clean sand. At almost all stations, a 2- to 3-ft-thick layer of cemented sand was encountered; it was most often found between the 5- and 10-ft depth.

106. The water table was not encountered within the first 20 ft. The moisture content of the sand is low; it is highest close to the surface under the track and decreases with depth.

Moduli of elasticity, Poisson's ratio

107. For each test a "Young's modulus" for the sand was obtained from the first loading modulus E_o as follows:

$$E_{Young's} = \frac{E_o}{\alpha} \tag{1}$$

where α is a rheological parameter recommended by Ménard (Baguelin, Jiziquel, and Shields 1978). For the sand of the SNORT track a value of 1/3 was selected; this made all $E_{Young's}$ three times larger than all $E_{o's}$. The values of $E_{Young's}$ are summarized in Table 14.

108. An average $E_{Young's}$ was calculated for each station; the averaging technique used was a harmonic average weighted on the basis of an assumed stress distribution with depth. The average $E_{Young's}$ for each station is presented in Table 14.

109. Poisson's ratio is not measured during a pressure meter test. Also, Poisson's ratio varies with strain and will typically have low values at very small strains and values often larger than 0.5 at or after failure. For this medium-to-dense sand, a value of 0.35 to 0.4 appears reasonable for small strains.

110. The average shear moduli G was obtained from the average $E_{Young's}$ at each station as follows:

$$G = \frac{E_{Young's}}{2(1 + \nu)} \tag{2}$$

where $\nu = 0.35$. The values of G are presented in Table 14.

Bearing capacity analysis

111. The ultimate bearing capacity (P_{ult}) can be evaluated from the pressure meter limit pressure profile. The station which has the smallest

limit pressures close to the surface is sta 200+00 where the limit pressure within the zone of interest averages 350 kPa. For sta 200+00 the ultimate bearing pressure that can be resisted by the soil under the track is calculated to be 360 kPa, or 7200 lb/ft^2.

112. The stations which have the highest limit pressures close to the surface are sta 79+50, 120+00, and 155+00. For these stations the limit pressure averages 2,000 kPa; this leads to an ultimate bearing pressure of 2,010 kPa, or 40,200 lb/ft^2.

113. The factor of safety against failure of the soil under the track for the usual loads applied to the track can be evaluated in two ways:

a. The beam-on-elastic foundation analysis gives the maximum pressure (P_{max}) on the soil under various loads. The ratio P_{ult}/P_{max} gives the factor of safety for each case (Table 15).

b. The ultimate bearing capacity can be multiplied by the appropriate contact area A under the track in order to obtain the ultimate load Q_u that the track can carry.

$$A = B \times L \qquad (3)$$

where B = track width

L = transfer length

The variation of Q_u versus L is plotted in Figure 29.

Settlement analysis

114. The settlement of the track under load can be estimated by the pressure meter method or by the beam-on-elastic foundation analysis. This section deals with the pressure meter method only. Settlement calculations were performed for an 80,000-lb load uniformly distributed over the area equal to the width of the track times the transfer length (L).

$$q = \frac{80,000}{6.64 \times L} \qquad (4)$$

The choice of transfer length will therefore influence the results; the settlement predictions are presented as a function of the transfer length for the worst condition (Figure 30) and for the best condition (Figure 31). The results have been extended to a 160,000-lb load.

115. Under the 80,000-lb load, for the worst condition (sta 200+00) and

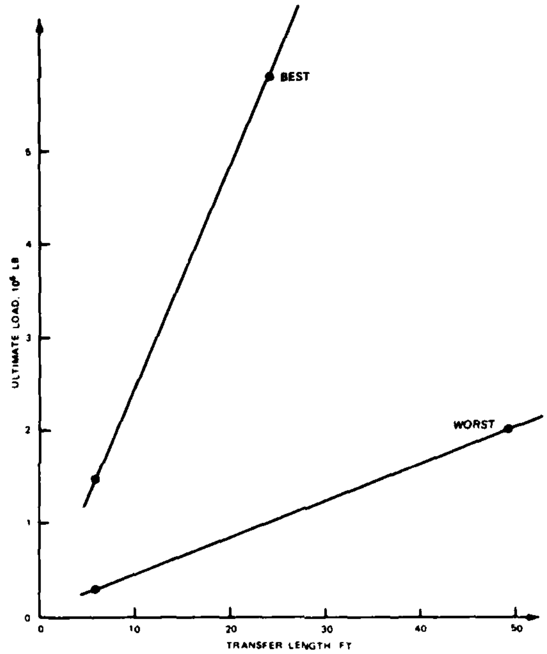


Figure 29. Result of bearing capacity analysis

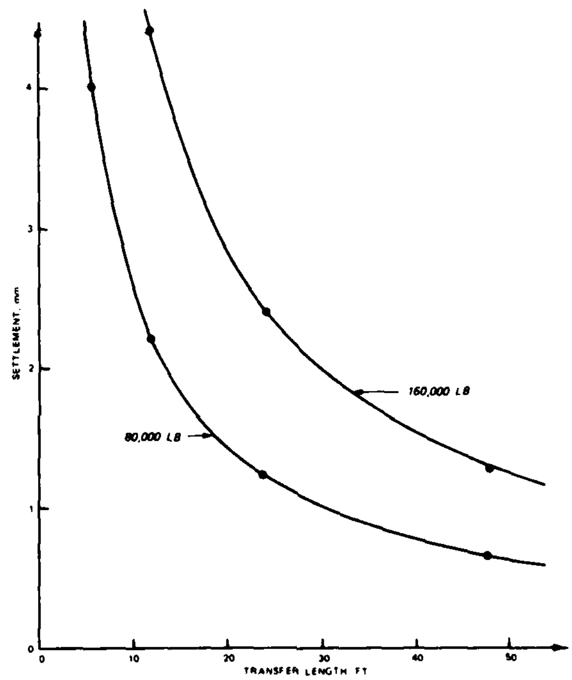


Figure 30. Result of settlement analysis for worst condition: static analysis

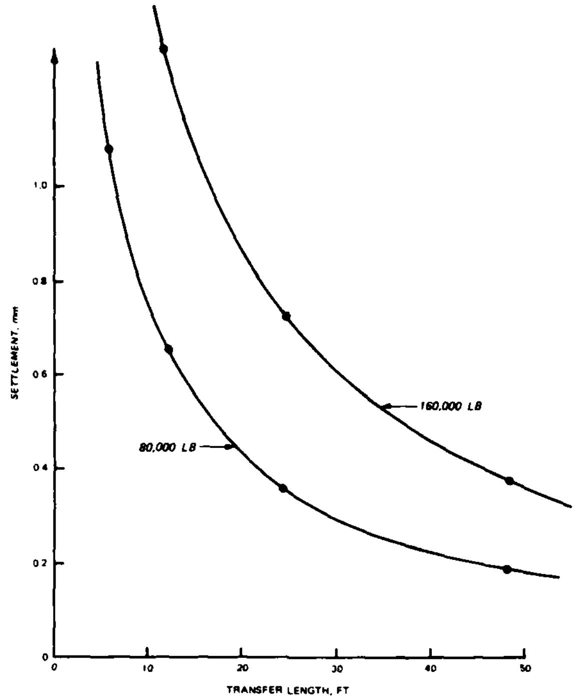


Figure 31. Result of settlement analysis for best condition: static analysis

for a reasonable transfer length of 30 ft, the calculated settlement is 1 mm or 39/1000 in. Under the 80,000-lb load, for the best condition (sta 120+00) and for a transfer length of 30 ft, the calculated settlement is 0.3 mm or 12/1000 in.

116. All previous analyses were performed for a static load which would remain on the track for a very long period of time. Instead, the track will be loaded dynamically by a rocket; this event will create a rapid load-unload cycle on the soil. It may then be more appropriate to calculate the settlement under this dynamic condition by using the pressure meter modulus E_R obtained from the unload-reload cycle of the test. This was done for an average soil E_R profile, and another settlement versus transfer length plot was obtained (Figure 32). According to these calculations, the settlement under a fast-traveling 80,000-lb point load, for an average soil condition, and for a 30-ft transfer length is 0.075 mm or 3/1000 in.

117. Load tests were performed on the track and the observed settlement under an 80,000-lb point static load varied between 5/1000 in. and 20/1000 in., depending on the station.

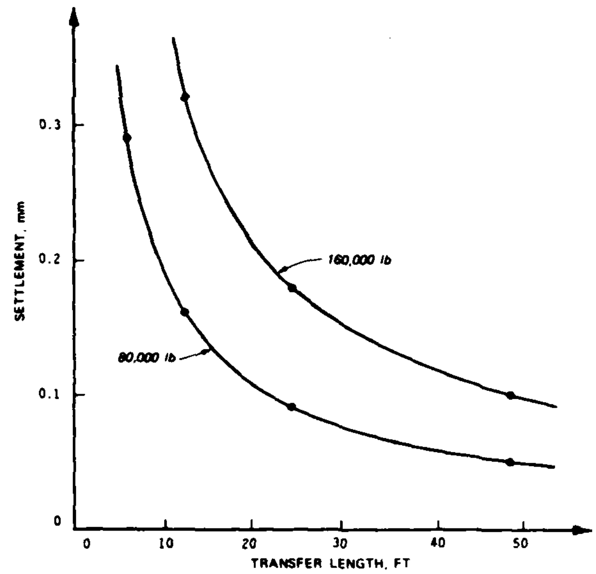


Figure 32. Result of settlement analysis for average condition: pseudo-dynamic analysis

<u>Modulus of subgrade reaction</u>

118. The modulus of subgrade reaction K is defined as:

$$K = \frac{q}{s} \tag{5}$$

where

q = pressure applied by the foundation

s = settlement

The value of K depends on many factors and is not a constant for a given soil. It has been calculated here on the basis of the settlement calculated for a corresponding bearing pressure obtained from Equation 4. Values of K as a function of the bearing pressure are presented in Figure 33 for the worst and best soil conditions. Values of K are also presented for each station for a bearing pressure of 28 kPa in Table 16.

Beam-on-elastic *foundation analysis*

119. The track was modeled using a beam-on-elastic foundation program. The assumptions made are listed in Table 17. A total of 11 different cases were modeled (Table 18). First, it was found that a minimum track length of

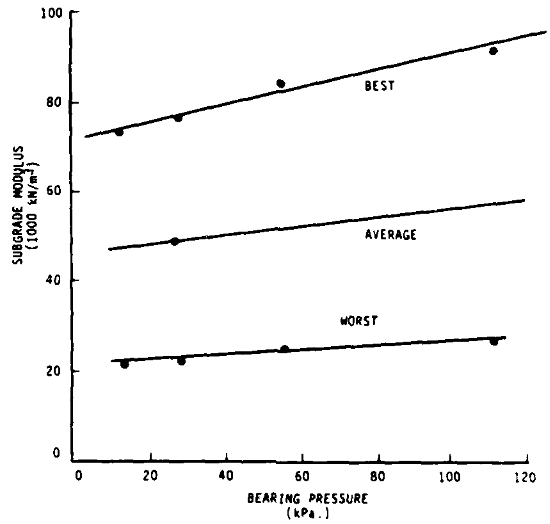


Figure 33. Modulus of subgrade reaction as a function of bearing pressure

100 ft is necessary to properly model the problem; shorter lengths will lead to higher deflections. Second, it was found that the track should be divided in elements which have a maximum length of 1 ft; longer elements will lead to larger deflections.

120. Under the 80,000-lb single load, the maximum deflection was 2.23×10^{-3} in. for the worst soil condition (Figure 34) and 0.89×10^{-3} in. for the strongest soil condition (Table 19).

121. Under the two 68,000-lb loads, applied 16 ft apart, the maximum settlement was 1.84×10^{-3} in. for the worst soil condition (Figure 35) and 0.73×10^{-3} in. for the strongest soil condition (Table 19). The maximum deflection occurred under the 80,000-lb load (Figure 34) and was smaller under the two 68,000-lb loads than under the single 80,000-lb load. This tends to indicate that the distance of 16 ft between the two 68,000-lb loads reduces the interaction between the two loads down to a negligible level.

122. The settlements obtained with the beam-on-elastic foundation simulation are much smaller than the observed settlements in the field. This may be due to a number of reasons; one reason could be as follows.

123. The predicted deflection is the one that will occur immediately under the track (Point A in Figure 25) while the observed deflection is

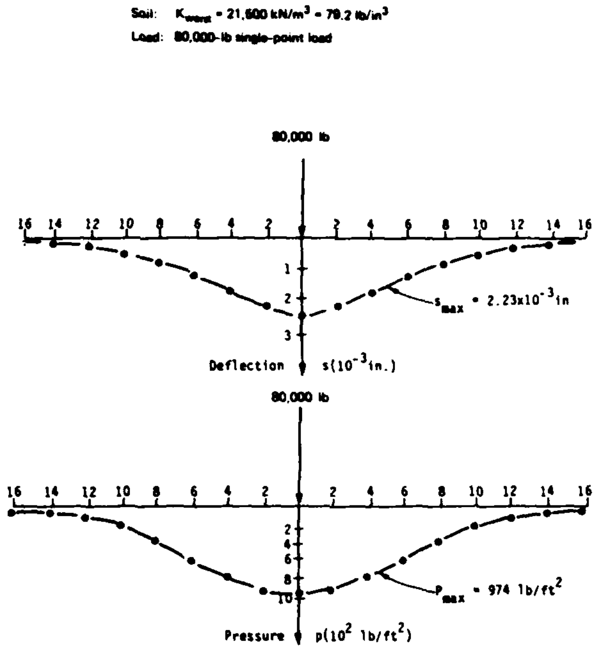


Figure 34. Computed deflections with 80,000-lb single-point load

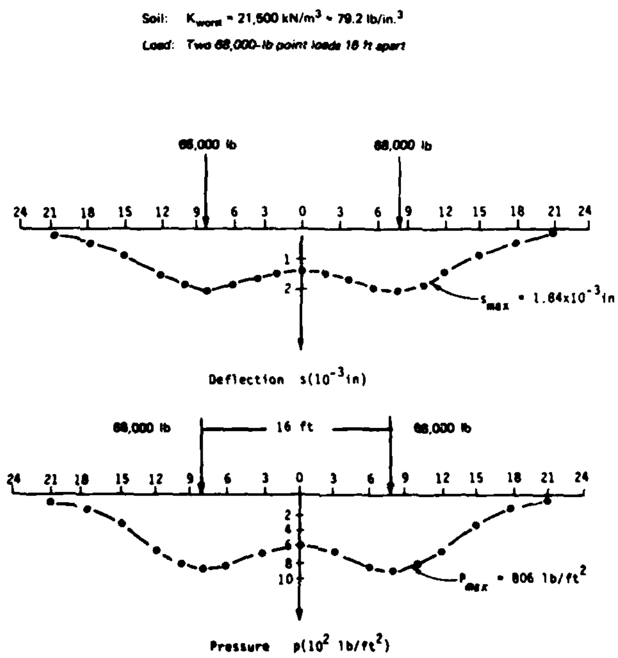


Figure 35. Computed deflections with two 68,000-lb point loads 16 ft apart

measured on top of the track (Point B in Figure 25); the compression of the track between A and B may not be negligible since longitudinal cracks exist and will close first before transmitting the load to the soil. Overall, however, the deflections (whether measured or calculated by the pressure meter method or the beam-on-elastic foundation method) are always smaller than 40×10^{-3} in.

Structural Load Tests

124. The concrete in the test track at China Lake is extensively deteriorated and will deteriorate more rapidly in the future.

125. It was not known how much the deterioration of the track may have affected its load-carrying capacity. The concrete track was overdesigned, and for the deterioration it has experienced up to this point it is possible that the track is capable of carrying design loads. To determine what the condition of the track is in relation to load, it was necessary to perform field-load tests.

126. Field-load tests were performed using downward and upward direction loads. The downward load was 80,000 lb on four shoes, two on each track spaced 8 ft 4 in. apart. The up load was approximately 30,000 lb on two shoes, one on each track. The up load was applied at the rail supports.

127. Using the properties of the track and foundation materials in a beam-on-elastic foundation analysis, one can determine what the deflection of the track should be assuming the track is not cracked and the surface concrete and reinforcing steel are not deteriorated. The deflections of the track under field-load tests can be compared with the deflections of the track from analytical results under the same loading condition, and conclusions can then be drawn as to how badly the track has been affected by the deterioration. The up loads were placed on the track at 66 locations. These loadings helped to determine the carrying capacity of the anchor bolts which hold the crane rail in place and gave some idea of the deflection of the concrete track and rail in an upward direction.

128. The down-load tests were performed by placing weights on a platform mounted on shoes which were supported on the track. Two 40,000-lb blocks were used as weights. A transit was used to take elevation readings on the concrete track and at the center of the platform location after the platform

was positioned. Elevation readings were then taken at the same position (the transit rod was never moved) after the load was applied and after the load was removed. The same procedure of taking readings was performed for the up loads.

129. The test results for the structural load testing are presented in Tables 20 and 21, respectively, for the down loads and up loads. The average down load deflections for the east leg and the west leg were 0.0084 in. and 0.0078 in., respectively. The average up-load deflections for the east leg and west leg were 0.0042 in. and 0.0041 in., respectively.

PART VI: STRUCTURAL ANALYSIS OF EXISTING TEST TRACK

Introduction

130. The existing SNORT structure at China Lake is cracked excessively, and the concrete is showing signs of extensive deterioration. From laboratory testing and analysis, it was found that some reinforcing steel is badly corroded, and there is potential for extensive corrosion. The concrete is experiencing alkali-silica reaction and under favorable moisture conditions, rapid deterioration could result. Under these deteriorating conditions and due to the fact that the concrete track cannot be rehabilitated to eliminate the active deterioration, the track is not dependable for long-term future use.

131. The structural analysis of the existing track consisted of:

a. Using design loads to determine stresses in the crane rail, tie down bolts, and concrete track for limiting and average soil conditions.

b. For design loads, deflections were determined in the concrete track for limiting and average soil conditions.

c. For loads imposed during field testing, deflections were determined in the concrete track for limiting and average soil conditions.

d. Deflections of the concrete track, as measured under field load tests, were presented and compared with the deflections obtained from analytical results. The analytical results were obtained using actual material properties of the track and foundation material without considering cracking or surface concrete deterioration. This comparison gave some indication of how the track has been affected by concrete cracking and steel and concrete deterioration.

Analysis of Existing Track Under Design Loads

Design loads

132. The design loads are presented in Table 22. These are the maximum static down loads and inertial up and side loads which will be supported by 12 shoes (6 on each rail) for both rail loads, and 6 shoes for one rail load. These loads are the maximum loads that have ever been supported by 12 shoes (6 on each rail) for both rail loads and 6 shoes for one rail load and are

the maximum loads that have been used on the SNORT track. These loads are reasonable design loads for future testing. The shoes are approximately 8 ft 4 in. apart, and the spacing of the crane rail supports are 4 ft 2 in. apart. Therefore a minimum length over which the load is transferred to the track will occur when the shoes are directly above every other crane rail support. This procedure gave a greater concentration of load at any loading position and was used to determine the stresses in the crane rail, anchor bolts, and concrete track.

133. The stresses due to the static and inertial loadings were determined first; then, by applying dynamic load factors and crane rail roughness factors, the maximum stresses for the dynamic conditions were inferred.

Design methods

134. The beam-on-elastic foundation method was used for analysis of the existing track. From preliminary analysis using beam-on-elastic foundation analysis and finite-element analysis, it was found that the stresses and stress concentrations in the track are low. Because the normal operating stresses in the track are low, the beam-on-elastic foundation analysis is adequate without the detail analysis by finite elements.

135. The theory of beam-on-elastic foundation analysis is presented in many textbooks.

136. It can be considered that the test track at China Lake rests on a continuous elastic foundation. Superposition may be used to combine the effect of various combinations of loads.

137. The properties of the foundation along the length of the existing test track vary to some degree; therefore, the analysis will be performed using limiting and average foundation properties.

138. Since the problem is statically indeterminate, the equilibrium equations

$$\Sigma F = 0 \tag{6}$$

$$\Sigma M = 0 \tag{7}$$

cannot be used to obtain a solution to the static case loadings. The equation of the elastic curve assumed by the beam

$$EI\left(\frac{d^2y}{dx^2}\right) = -M \tag{8}$$

was used and the solution to the problem was obtained by using Equations 6, 7, and 8. The deflection of the beam was assumed to be proportional to the pressure q under the beam. By differentiating both sides of Equation 6, we obtain

$$EI\left(\frac{d^4y}{dx^4}\right) = -\frac{d^2M}{dx^2} \tag{9}$$

but

$$\frac{d^2M}{dx^2} = q \tag{10}$$

Assume the positive sense of x is to the right and positive y is upwards; then

$$EI\left(\frac{d^4y}{dx^4}\right) = +q \tag{11}$$

The pressure per unit length of beam q is

$$q = wk_o y \tag{12}$$

where w is the width of the bottom of the beam, k_o is the force exerted by the elastic support per unit deflection of the support, and y is the beam deflection. When Equation 12 is inserted into Equation 11, we have the deformation equation

$$EI\left(\frac{d^4y}{dx^4}\right) = wk_o y \tag{13}$$

which was used with the equilibrium Equations 6 and 7 to obtain shears, moments, and deflections in the test track at China Lake.

139. A computer program was used to obtain the analytical results and these results were plotted to give a clear picture of the deflections, shears, and moments in the test track.

Length of supersonic track to consider in analysis

140. The test track is approximately 4.1 miles in length; therefore, for any sled position the track will not be affected significantly along its entire length. The question, then, is what length of track is significantly affected by any sled position.

141. The beam-on-elastic foundation analysis was used and results were obtained for different lengths of track (40, 50, 60, 70, 80, 90, 100, and 200 ft). From these results, the minimum length of track was determined such that the shears, moments, and deflections will not be significantly affected even if a longer length of track is analyzed.

142. It was found that the results were accurate if 100-ft lengths of track were used. Since it cost very little more, a 200-ft length of track was analyzed by the beam-on-elastic foundation analysis. In the design of the new track, a 100-ft length of track will be used in the finite-element analysis because the cost is much greater as the size of the three-dimensional finite-element problem is increased.

143. For the beam-on-elastic foundation analysis, different spring spacings were used to make sure the analytical model was accurate for the continuously supported track.

Design load stresses in crane rail, anchor bolts, and concrete track

144. Down loads on both rails of 136,000 lb and a maximum side load of 50,000 lb at 8 ft above the rail were considered. The 136,000-lb and the 50,000-lb loads act on 12 shoes, 6 on each track, with an 8-ft-4-in. spacing of shoes. The side load will result in horizontal loads through the centroid of the track plus a torque on the track. The shear stresses, due to the torque, cannot be obtained by the beam-on-elastic foundation analysis code which presently exists. These stresses will be calculated analytically and the results added to the effects caused by the vertical and side loads.

145. Results from the down load of 136,000 lb for limiting and average soil conditions (Table 23) are presented in Appendix B (Figures B1-B9). The deflection due to the weight of the structure was assumed to have occurred uniformly along the length of the track and does not affect the stresses in the structure. Therefore, it is not presented in the results from the beam-on-elastic foundation analysis.

146. The moment of inertia of the total track section was used in the beam-on-elastic foundation analysis. That is, the moment of inertia of the cracked section as used in the working-stress theory of reinforced concrete design was not used. Using the moment of inertia of the total track section makes the structure stiffer and is a conservative analysis because less load is transferred along the structure length to the foundation which causes the moments in the structure to be larger. If the concrete section is considered cracked and the tensile concrete area is neglected in the analysis, the maximum moments in the track are approximately one-half of those which are obtained when the total structure is considered effective.

147. The results of the beam-on-elastic foundation analysis for the 50,000-lb side load through the centroid of the section are presented in Figures B7-B9.

148. The results of the beam-on-elastic foundation analysis for the field-test load supported on four shoes (two on each crane rail) are presented in Figures B4-B6.

149. The maximum moments, shears, and deflections for the design down load of 136,000 lb and the field test down load of 80,000 lb are presented, respectively, in Tables 24 and 25. The deflections, moments, and shears due to the 50,000-lb side load acting through the centroid of the track section are presented in Table 26.

150. The section of the existing track and the axes are presented in Figure 36. The moments of inertia about the X-X and Y-Y axes are calculated below assuming compression in the top of the test track. Since the steel crane rails are not continuous and are not composite with the concrete H-sections, they are neglected in the computations. This will produce a conservative result because the crane rails are staggered and even at the weakest section (where two crane rails meet), the crane rail on the opposite side is not separated and has rigidity. If the stresses in the existing test are low, then the track is safe for future use.

151. The moments of inertia are calculated below.

152. Assume compression in the top of the track and calculate the moment of inertia about the X-X axis. Calculate kd .

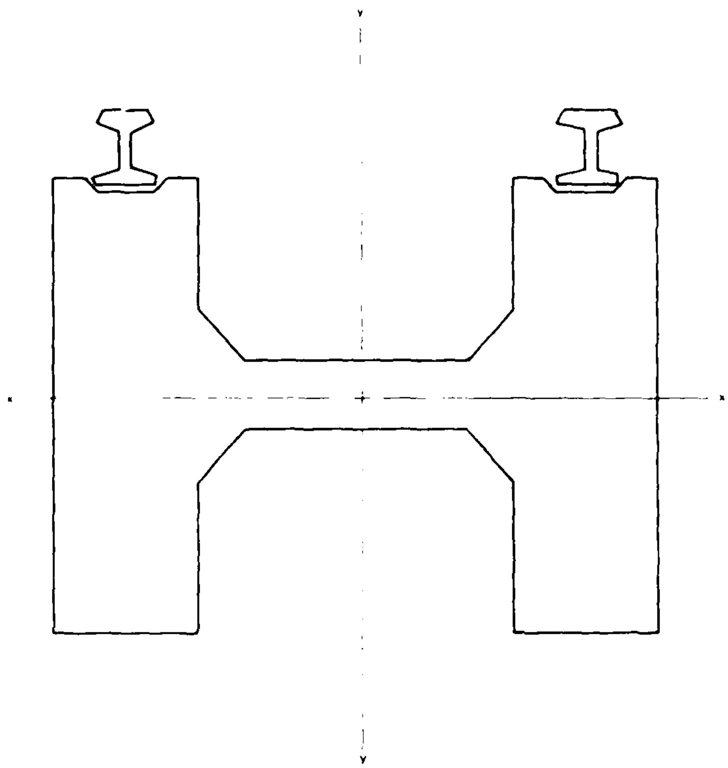


Figure 36. Section ot track showing axes orientation

$$(13.41)(kd - 0.81) + (2.64)(kd - 1.08) + (19kd - 30.88)$$

$$\times \left(\frac{kd - 1.625}{2}\right) + \left[2\left(\frac{30}{3.66}\right) - 1\right][3.12(kd - 6.95)] = (0.93)\ \frac{30}{3.66}\ (25.25 - kd)$$

$$+ (2)\left(\frac{30}{3.66}\right)(49.69 - kd)\ 9.5kd^2 + 57.2kd - 1329.41 = 0$$

$$kd = \frac{-57.2 \pm (57.2)^2 - (4)(9.5)(-1329.41)}{2(9.5)} = \frac{-57.2 \pm 231.93}{19}$$

$$= 9.2 \text{ in.}$$

Calculate I_{X-X} .

$$(4)\left[(4.125)\left(\frac{1.625}{3}\right)^3 + (4.125)(1.625)(9.2 - 1.625)^2\right] = 24 + 385 = \quad 409$$

$$+ 4\left[\frac{(1.625)(1.625)^3}{36} + \frac{(1.625)^2}{2}(8.12)^2\right] = 0.77 + 348 \qquad = \quad 349$$

$$+ (2)\frac{(19)(7.575)^3}{3} \qquad = \quad 5{,}506$$

$$\left[2\left(\frac{30}{3.66}\right) - 1\right](2)(3.12)(2.25)^2 \qquad = \quad 486$$

$$+ (2)(0.93)\left(\frac{30}{3.66}\right)(25.25 - 9.2)^2 \qquad = \quad 3{,}928$$

$$+ (2)(2)\left(\frac{30}{3.66}\right)(49.69 - 9.2)^2 \qquad = \quad \underline{53{,}752}$$

$$I_{X-X} = 64{,}430$$

Calculate the moment of inertia about the Y-Y axis. Calculate kd .

$$(51.62)(kd)\left(\frac{kd}{2}\right) + (1.56 + 0.31 + 1)(kd - 3)\left[2\left(\frac{30}{3.66}\right) - 1\right] = \left(\frac{30}{3.66}\right)$$

$$\times [(1.56 + 0.31 + 1)(16 - kd) + 0.31(32 - kd) + 0.31(47.62 - kd)$$

$$- (1.56 + 0.31 + 1)(63.62 - kd) + (1.56 + 0.31 + 1)76.62 - kd$$

$$25.81(kd)^2 + 2.87(kd - 3)(15.39) = (8.2)[2.87(16 - kd) + 0.31(32 - kd)$$

$$+ 0.31(47.62 - kd) + (2.87)(63.62 - kd)$$

$$+ 2.87(76.62 - kd)]$$

$$25.81(kd)^2 + 44.18(kd) - 132.54 = 8.2[45.42 - 2.87(kd) + 9.92 - 0.31(kd)$$

$$+ 14.76 - 0.31(kd) + 182.59 - 2.87(kd)$$

$$+ 219.90 - 2.87(kd)]$$

$$25.81(kd)^2 + 44.18(kd) - 132.54 = 8.2[4.73.09 - 9.23(kd)]$$

$$25.81(kd)^2 + 44.18(kd) - 132.54 = 3877.79 - 75.66(kd)$$

$$25.81(kd)^2 + 119.84(kd) - 4010.33 = 0$$

$$kd = \frac{-119.84 + \sqrt{(119.84)^2 + 4(25.81)(4010.33)}}{2(25.81)}$$

$$kd = \frac{-119.84 + 654.51}{51.62}$$

$$kd = 10.36 \text{ in.}$$

Calculate I_{Y-Y} .

$$\frac{(51.62)(10.36)^3}{3} = 19{,}133$$

$$\left[2\left(\frac{30}{3.66}\right) - 1\right](2.87)(10.36 - 3)^2 = 2{,}393$$

$$\left(\frac{30}{3.66}\right)(2.87)(16 - 10.36)^2 = 748$$

$$\left(\frac{30}{3.66}\right)(0.31)(32 - 10.36)^2 = 1{,}190$$

$$\left(\frac{30}{3.66}\right)(0.31)(47.62 - 10.36)^2 = 3{,}528$$

$$\left(\frac{30}{3.66}\right)(2.87)(63.62 - 10.36)^2 = 66{,}730$$

$$\left(\frac{30}{3.66}\right)(2.87)(76.62 - 10.36)^2 = \underline{103{,}282}$$

$$I_{Y-Y} = 197{,}004 \text{ in.}^4$$

153. Assume tension in the top of the track and calculate the moment of inertia about the X-X axis.

$$(19kd)\left(\frac{kd}{2}\right) + \left[2\left(\frac{30}{3.66}\right) - 1\right][2(kd - 3.56)] = \left(\frac{30}{3.66}\right)[3.12(46.3 - kd) + 0.93(28 - kd)$$

$$9.5(kd)^2 + 30.79(kd) - 54.80 = 1397.51 - 33.2(kd)$$

$$9.5(kd)^2 + 63.99(kd) - 1452.31 = 0$$

$$kd = \frac{-63.99 + (63.99)^2 + 4(9.5)(1452.31)}{2(9.5)}$$

$$kd = \frac{-63.99 + 243.38}{19}$$

$$kd = 9.45 \text{ in.}$$

154. Calculate I_{X-X} when tension is in the top of the track.

$$2\left(\frac{19(9.45)^3}{3}\right) = 10{,}690$$

$$2(3.12)\left(\frac{30}{3.66}\right)(46.3 - 9.45)^2 = 69{,}568$$

$$2(0.93)\left(\frac{30}{3.66}\right)(28 - 9.45)^2 = 5{,}246$$

$$2(2)\left[2\left(\frac{30}{3.66}\right) - 1\right](9.45 - 3.56)^2 = \underline{2{,}136}$$

$$I_{X-X} = 87{,}640 \text{ in.}^4$$

155. The compressive stress in the concrete can now be calculated for each of the foundation modulus constants. For $k = 79.2 \text{ lb/in.}^3$

$$f_{compressive} = \frac{(1.21 \times 10^6)(9.2)}{64{,}430} + \frac{(9.6 \times 10^5)(10.36)}{197{,}004}$$

$$= 173 + 50 = 223 \text{ psi}$$

For $k = 175 \text{ lb/in.}^3$

$$f_{compressive} = \frac{(7.3 \times 10^5)(9.2)}{64{,}430} + \frac{(5.8 \times 10^5)(10.36)}{197{,}004}$$

$$= 104 + 31$$

$$= 135 \text{ psi}$$

For $k = 271.1 \text{ lb/in.}^3$

$$f_{compressive} = \frac{(5.8 \times 10^5)(9.2)}{64{,}430} + \frac{(4.3 \times 10^5)(10.36)}{197{,}004}$$

$$= 83 + 23$$

$$= 106 \text{ psi}$$

156. Calculate the tensile stress in the reinforcing steel $k = 79.2\ lb/in.^3$

$$f_{steel} = \left[\frac{(1.21 \times 10^6)(40.49)}{64,430} + \frac{(9.6 \times 10^5)(66.27)}{197,004}\right] \frac{30}{3.66}$$

$$= (760 + 323)\ \frac{30}{3.66} = 8880\ psi$$

For $k = 175\ lb/in.^3$

$$f_{steel} = \left[\frac{(7.3 \times 10^5)(40.49)}{64,430} + \frac{(5.8 \times 10^5)(66.27)}{197,004}\right] \frac{30}{3.66}$$

$$= (459 + 195)\ \frac{30}{3.66} \approx 5360\ psi$$

For $k = 271.1\ lb/in.^3$

$$f_{steel} = \left[\frac{(5.8 \times 10^5)(40.49)}{64,430} + \frac{(4.3 \times 10^5)(66.27)}{197,004}\right] \frac{30}{3.66}$$

$$= (364 + 145)\ \frac{30}{3.66} = 4172\ psi$$

157. The maximum shear stress will occur when the track is subjected to the 136,000-lb down load or when it is subjected to half the down load with the inertia loads causing a torque.

$$\tau_{136,000\ lb} = \frac{18,480}{2,066} = 8.9\ psi \qquad \text{O.K.}$$

$$\tau_{\frac{136,000}{2}\ lb} + \tau_{50,000\ lb} + \text{torque shear} = \frac{18,480}{(2)(2,066)} + \frac{8835}{2399}$$

$$+ \frac{(6.4 \times 10^6)\sqrt{(39.81)^2 + (26.71)^2}}{6(463,624 + 1,966,817)} = 4.5 + 3.7 + 21 = 29.2\ psi \qquad \text{O.K.}$$

158. The stress is very low in the concrete and the reinforcing steel when subjected to static down and inertia side loads. The maximum compressive concrete stress is 223 psi and the maximum tensile steel stress is 8880 psi.

159. The shear stress is approximately 29 psi, which is low. The torque load is applied along the track at the six shoe locations, and the shear is computed as 1/6 the total torque stress because the foundation will react and reduce the shear from shoe location to shoe location.

160. If a dynamic load factor of 2 is used, it can be seen that the

compressive concrete, tensile reinforcing, and shear stresses are still below the allowables. The allowable compressive concrete stress is assumed to be 5,670/2 = 2,835 psi; the tensile steel stress, 20,000 psi; and the shear stress, 316 psi.

161. If a severe loading is considered where a dynamic load factor of 2 and a rail roughness coefficient of 6 (using only 1/2 the static loading) are applied at the same time, the stresses will be increased by approximately 6 times. The compressive and shear concrete stresses will be below the allowable level. The tensile stress in the reinforcing steel would be 53,280 psi, which appears to be above the allowable and above the ultimate of the reinforcing steel (40,000 psi). Since this is such an extreme loading and the stresses due to the dynamic loading will dissipate rather rapidly with depth, these maximum tensile stresses will never be mobilized.

162. To be sure the steel stress is not excessive, ultimate strength design will be used to calculate the ultimate moment capacity of the concrete section based on the lower four No. 9 bars and the six No. 5 bars being tensile reinforcement. The center of gravity of the tensile steel is

$$\bar{y} = \frac{(6)(0.31)(28 + (4)(1)(3.56)}{(6)(0.31) + (4)(1)} = 11.32 \text{ in.}$$

$$d = 53.25 \text{ in.} - 1.63 \text{ in.} - 11.32 \text{ in.} = 40.30 \text{ in.}$$

$$d' = 53.25 \text{ in.} - 1.63 \text{ in.} - 46.30 \text{ in.} = 5.32 \text{ in.}$$

$$A_s = 6(0.31) + (4)(1) = 5.86 \text{ in.}^2$$

$$A_s' = 4(1.56) = 6.24 \text{ in.}^2$$

163. Since the area of the compressive steel is greater than the area of the tensile steel, the ultimate moment will be based on the area of tensile steel.

$$M_u = \phi A_s f_y (d - d')$$

$$M_u = (0.9)(5.86)(40{,}000)(40.31 - 5.32)$$

$$= 7{,}381{,}490 \text{ in.-lb}$$

164. From Table 24, the maximum moment due to the 136,000-lb down load is 1.21×10^6 in.-lb. A factor of 6 applied to this moment gives 7.26×10^6 in.-lb, which is less than the 7.38×10^6-in.-lb capacity of the section. This gives a safety factor of approximately 1, and for this extreme loading and these conservative assumptions the reinforcing steel in the section is considered adequate.

165. The stress in the crane rail is adequate since the crane rail will only be required to carry about

$$\frac{(EI)_{\text{crane rail}}}{(EI)_{\text{crane rail}} + (EI)_{\text{concrete tract}}}$$

$$= \frac{(74)(30 \times 10^6)}{(74)(30 \times 10^6) + (3.66 \times 10^6)(4.6 \times 10^5)}$$

$$= \frac{2.2 \times 10^9}{1.7 \times 10^{12}} \approx 0.1 \text{ percent of the induced moment.}$$

This would cause a maximum stress in the crane rail of

$$\frac{(0.001)(7.26 \times 10^6)(3)}{74} = 294 \text{ psi} .$$

166. The up loads on the track are secondary in relation to the weight of the track itself. Up loading may result in overstress in the anchors and this would be the only cause for concern. The stresses in the anchors are calculated below.

<u>Stress in anchors</u>

$$\text{1-in.-diameter area} = \frac{(3.14)(1)^2}{4} = 0.785 \text{ in.}$$

$$\text{Stress in bar due to design load} = \frac{11{,}333 \text{ lb}}{(2)(0.785)} = 7219 \text{ psi}$$

$$\text{For field load tests} = \frac{15{,}000 \text{ lb}}{(2)(0.785)} = 9554 \text{ psi}$$

167. The anchor stress under design load is 7219 psi. With a dynamic load factor of 2, the stress would be a little over 14,000 psi, which is below

the allowable of 20,000 psi for the anchor rods.

168. For the extreme loading of 6 times the static loading, the stress in the anchors would be excessive. For the loads which are commonly applied to the SNORT structure, the anchor stresses are adequate.

169. The deflections from the field load test are presented in Table 20. The average deflection of the west wall is 0.0078 in. and for the east wall is 0.0084 in.

170. The analytical results were obtained (Table 25) assuming the track is uncracked and the surface concrete and reinforcing steel are nondeteriorated.

171. By comparing the results of the deflections obtained in the load testing with the analytical results, it is seen that they compare well. Since the deflections by analytical computations are a little higher than those which were obtained in the field, it appears that the deterioration of the test track has not progressed to the point that the load-carrying capacity of the track has been reduced. Therefore, the existing track can be used without problems while the new track is being built.

PART VII: DESIGN OF NEW SUPERSONIC TEST TRACK

Introduction

172. Since the existing test track is extensively cracked, deteriorated, and cannot be rehabilitated to eliminate the deteriorating agents which may cause rapid concrete deterioration, it is suggested that a new test track be constructed. The existing test track can be used to conduct field tests while the new track is being built.

Geometric Configuration and Reinforcement

173. The first considerations in the design of a new supersonic test track at China Lake are the geometrical configuration and the steel reinforcement for the concrete track. The general geometric configuration and steel reinforcement are presented in Figure 37.

174. The thicknesses of concrete sections and steel reinforcement were selected as minima, which would be prudent for a supersonic test track which will be subjected to extensive dynamic testing. The stresses under short-term static and dynamic tests may be lower than allowables, but this will add to long-term durability and testing potential.

175. It is important to have substantial reinforcing in a track subjected to dynamic loading. The reinforcing steel will help keep down cracking

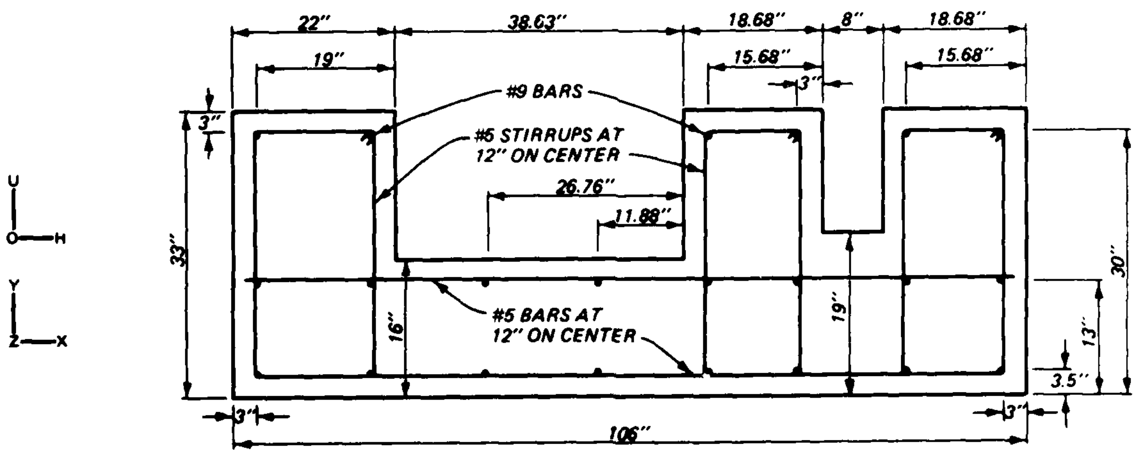


Figure 37. Configuration and reinforcement of proposed test track

due to vibrations, stress concentrations, fatigue loading, expansion and contraction, or any other effects which will tend to crack the concrete by tension stresses.

176. There are three track gages. The gage between the outer two rails is 84 in. or 7 ft. The intermediate gage is 56.5 in. and the narrow gage is 27.5 in. The rails with gage 56.5 in. will extend for the entire length of supersonic test track which is 8 miles. The 56.5-in. gage is that of the existing SNORT track and most other existing supersonic test tracks. The gage of the outer rails (84 in. or 7 ft) is the gage of the Holloman test track. The 84-in. gage track will extend for only 6 miles of the 8-mile track. The narrowest gage (27.5 in.) can be used for what were previously monorail tests. This gage, even though it is narrow, will give stability to the sled and test vehicle and can use braking capability with water in the narrow trough.

Material Properties

177. The assumed concrete properties are presented in Table 27. The same foundation properties as determined at the existing test track will be used for the design of the new test track. The same crane rail will be adequate, but larger tie-down anchors will be suggested.

Design Procedure

178. The design of the new track consisted of assuming a geometrical configuration of track and determining specific steel reinforcement that is not overstressed when subjected to design loads. The design loads were those that were used in the analysis of the existing track. Various combinations of the loadings were used, and a dynamic load factor of 2.0 and a rail roughness coefficient of 6 were applied to 1/2 the dead load to account for dynamic amplifications.

179. Two independent methods of analysis were used in evaluating the proposed test track. The beam-on-elastic foundation method was used to obtain a conventional sectional analysis of the track. The beam-on-elastic foundation analysis does not allow a consideration of stress concentrations or allow for the effect of positioning loads at various locations on the track cross section. A 200-ft length of track was used in the beam-on-elastic foundation

analysis and the results from various loads will be superpositioned to obtain stresses for specific case loadings.

180. The finite-element analysis was used to obtain stress concentrations in the concrete section of the proposed track for 16 load cases. A 100-ft length of track was used in the finite-element analysis. The load cases are presented in Appendix C (Figures C1-C7). The finite-element analysis will allow the effects of torsion, side loads, and vertical loads as well as the properties of the foundation to be taken into account simultaneously.

181. The results of the beam-on-elastic foundation analysis are also presented in Appendix C (Figures C18-C48). The maximum and minimum values of deflection, bending moment, and shear are presented in Table 28. The maximum concrete compressive stresses are presented in Table 29. These stresses were calculated using the same concept as that used in the calculations for the existing track. The tension area of concrete in the track section was used in the beam-on-elastic foundation analysis but was neglected when performing stress computations.

182. Since it is planned to have the crane rails continuous on the new track, the crane rails will add some resistance to deflection of the proposed track. Since the crane rails will not be tied composite to the concrete track, the amount of moment or load which will be taken individually by the concrete track or the crane rails will be proportional to the products of their moment of inertia and modulus of elasticity, respectively. The products of moment of inertia and modulus of elasticity for the track and rails are given in Table 30.

183. It can be seen from the relative ratios that most of the load will be taken by the concrete track. In fact, the amount taken by the rails is so small that it is not considered in computing maximum concrete stresses.

184. The maximum concrete stresses are due to a combination of the vertical and side loads. They are very small in relation to a 4000-psi maximum compressive stress; therefore, the track is satisfactory in relation to these stresses. When a total dynamic amplification factor of 6 is applied to the maximum stress, it is close to the 4000-psi ultimate strength of the concrete ($6 \times 634 = 3804$ psi). For such extreme case loadings, this is adequate.

185. The maximum reinforcing steel stress is 12,400 psi, which is not excessive. The dynamic amplification factor of 6 causes the stress in the steel to be above the ultimate of 40,000 psi. A maximum moment obtained by

ultimate strength design is a better way to judge the adequacy of the steel reinforcement. The ultimate strength moment is 13,340,000 in.-lb. This maximum moment capacity is much larger than any of the moments presented in Table 28; therefore, the proposed track section is considered adequate in relation to the beam-on-elastic foundation analysis results.

186. The maximum shear stress is difficult to obtain from the beam-on-elastic foundation analysis. It is difficult to determine how the shear from torsion is distributed because part of it will be taken by the interaction of the track with the foundation. The shear stress from finite-element analysis will be used to judge the adequacy of the beam in shear. These values of shear are presented in Table 31. The maximum shear value of 228 psi is less than the allowable of 316 psi for 4000-psi concrete that is reinforced with stirrups and main steel.

187. The deflections, moments, and shears for designing the transverse steel in the proposed test track were determined by beam-on-elastic foundation analysis. The deflections, moments, and shears are presented in Figures 38-40 for a 1-ft-wide transverse section. Considering the worst soil condition, the maximum moment is 22,700 in.-lb for static load and 136,200 in.-lb for the dynamic case. The ultimate moment of the 16-in. section with No. 5 bars is

$$M_u = (0.9)(0.62)(40,000)(12.7 - 3.3)$$
$$= 209,808 \text{ in.-lb}$$

The shear stress is 1224 lb/11.7 × 12 = 8.7 psi for the static load or 52.2 psi for the dynamic case. No. 5 bars on 12-in. centers are suggested as transverse steel for the proposed test track.

188. The anchor bolts for the proposed test track are determined as follows. Assume an up load at one shoe of 11,333 lb and a dynamic amplification factor of 6 which makes the maximum design load = 11,333 × 6 ≈ 68,000 per two anchor rods. Assume an allowable stress for this extreme condition as the yield strength of the anchor bar (40,000 psi).

$$40,000 = \frac{68,000}{(2)\ \text{Area}_{\text{one anchor bar}}}$$

$$\text{Area}_{\text{one anchor bar}} = \frac{68,000}{(2)(40,000)} = 0.85 \text{ in.}$$

Use 1-1/4-in. anchor bars.

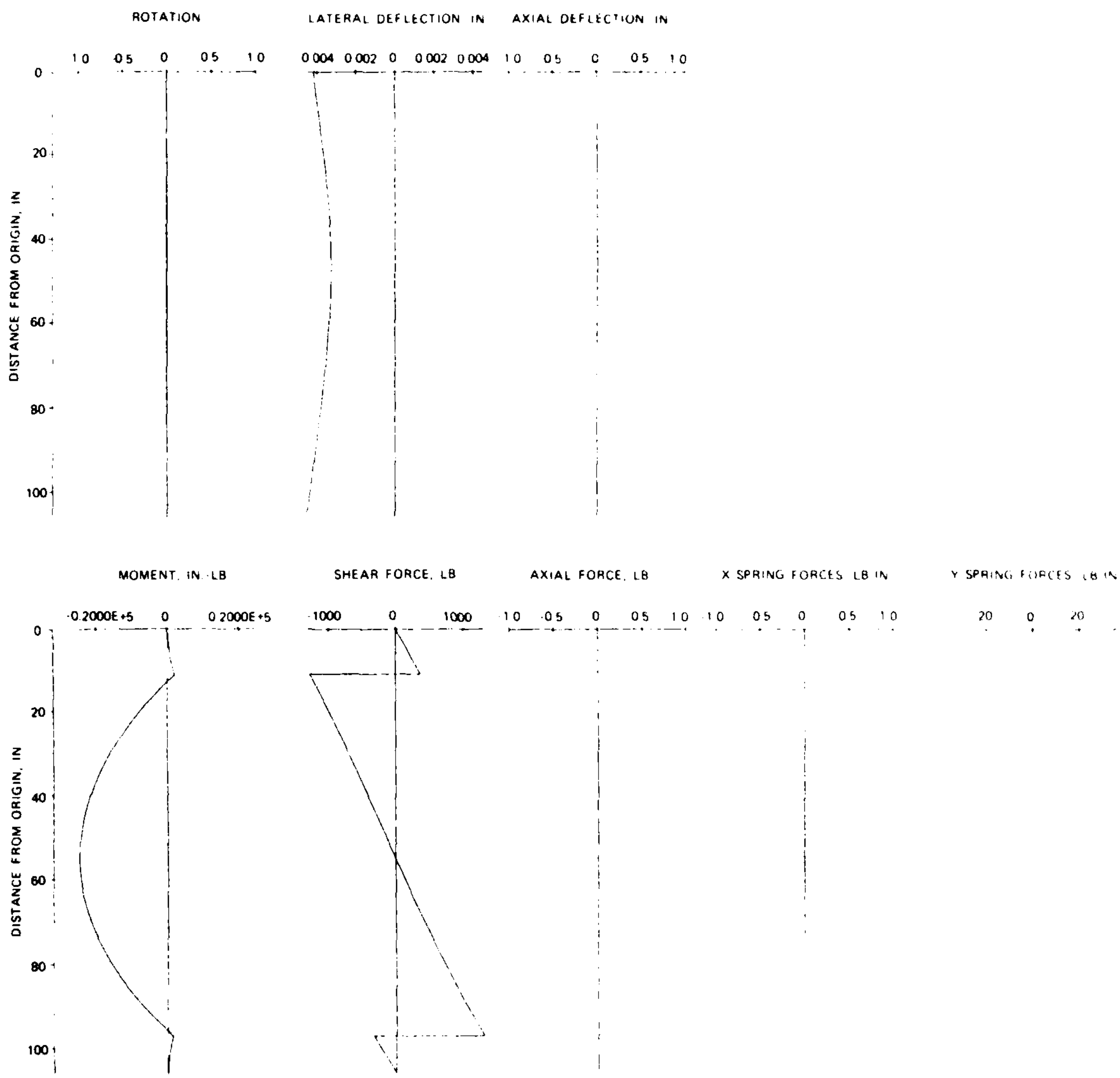


Figure 38. Beam-on-elastic foundation analysis, transverse section, 136,000-lb loading, K = 79.2 lb/in.^{3}

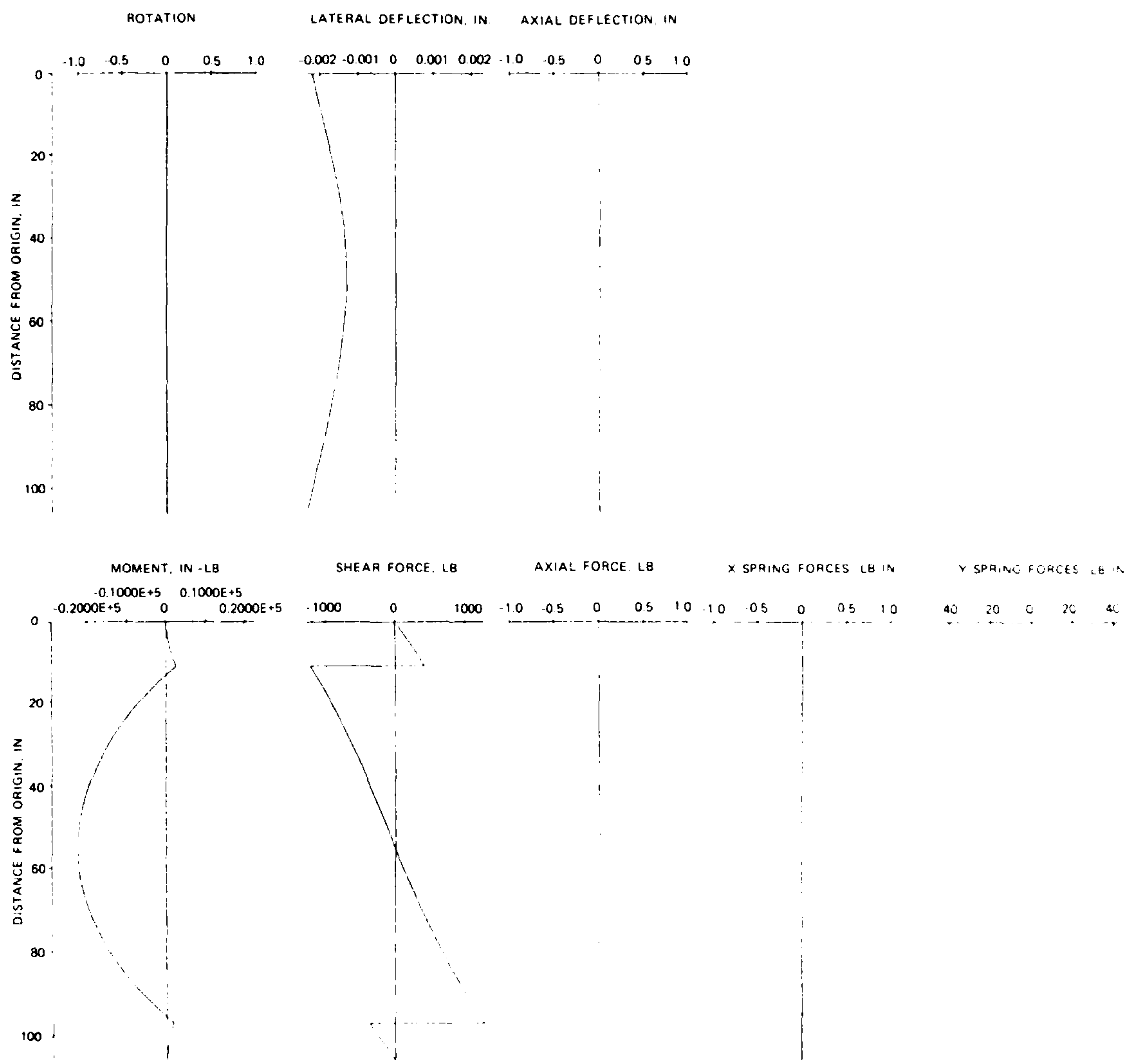


Figure 39. Beam-on-elastic foundation analysis, transverse section, 136,000-lb loading, K = 17.5 lb/in.^{3}

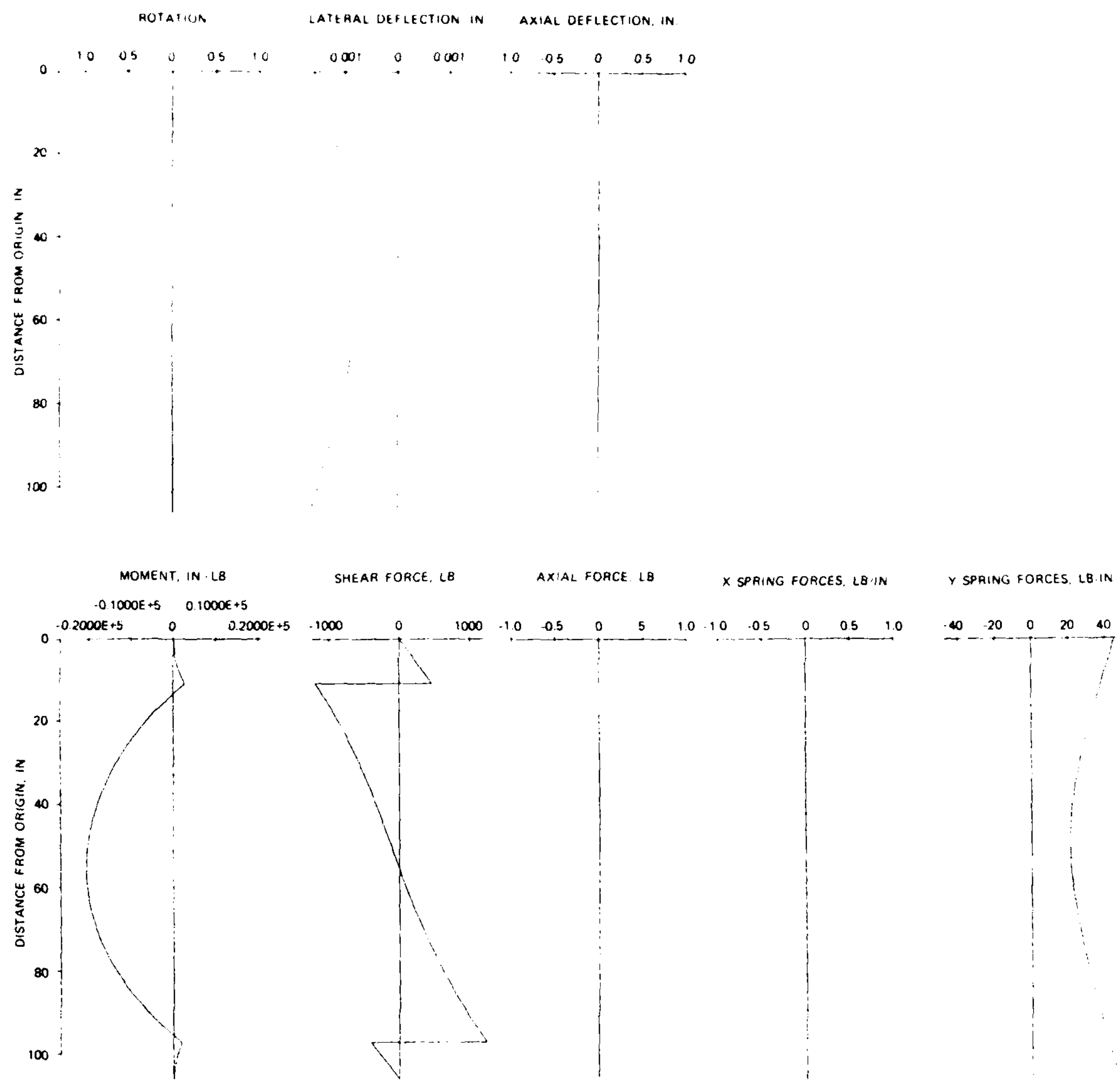


Figure 40. Beam-on-elastic foundation analysis, transverse section, 136,000-lb loading, $K = 271.1\ lb/in.^3$

189. The results of the finite-element analysis will be presented next and a discussion of the results of the beam-on-elastic foundation and finite-element analysis given later.

Finite-Element Analysis

Background

190. A finite-element analysis of the proposed SNORT track was made using a structural analysis computer program called SAP V. The variable-node (brick) element of the program was used to model the concrete structure, and the boundary (spring) element of the program was used to model the soil resistance. A 100-ft length of track was selected for the analysis; however, only half the length (50 ft) was required as input to the program due to symmetry created by placing the center of gravity of the loads at the midpoint of the 100-ft length.

Input

191. The 50-ft length of structure was input as 12 planes of variable-node (brick) elements for a total of 384 elements. Figure 41 shows the positions of the elements in the first plane. Element numbers for the same position in each succeeding plane are increased by 1. The first plane of elements is adjacent to the midpoint of the full 100-ft section. All elements are 50 in. in length and have the material properties of the concrete for the proposed track (Table 27).

192. The soil resistance was modeled using 13 planes of boundary (spring) elements with 36 elements per plane for a total of 468 boundary

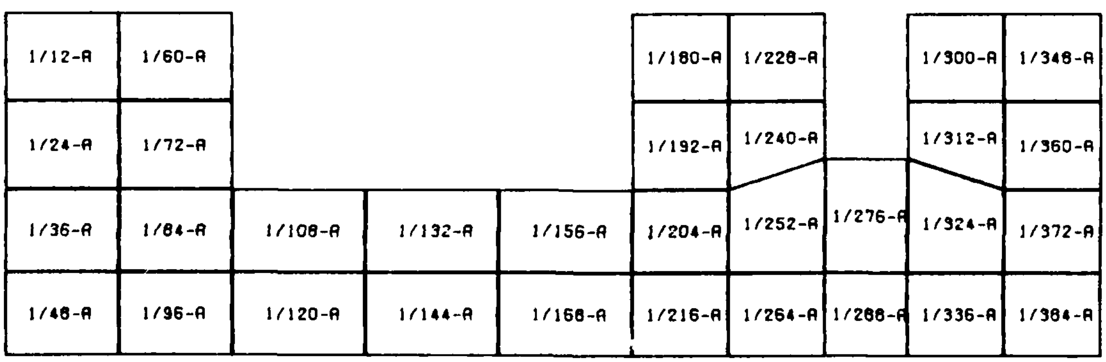


Figure 41. Finite-element grid

elements. The strut resistance that aids in resisting lateral displacement of the structure was modeled using 39 boundary elements normal to the vertical face opposing the applied lateral loads. The spring constant assigned to these elements was linearly varied between k = 0 $lb/in.^3$ at the soil surface (assumed to be 16 in. above the base of the structure) and 175 $lb/in.^3$ at the base of the structure. Skin friction along the vertical faces was considered negligible, and therefore, was not included in the analysis. The bearing resistance of the soil along the base of the structure was modeled using 143 boundary elements normal to the plane of the base. The spring constant assigned these elements was 175 $lb/in.^3$. The shear resistance was modeled using 286 elements (143 in the lateral and 143 in the longitudinal directions) within the plane of the base of the structure. The spring constant assigned these elements was 75 $lb/in.^3$.

193. There were 17 load cases included in the analysis. Load cases 1 and 5 represented the normal static loads applied to the outermost rails. Load cases 9 and 13 represented the normal static loads applied to the nearest two rails. Load cases 1 and 9 are the maximum downward static loads, while load cases 5 and 13 are the maximum upward static loads. Load cases that included the effects of inertia loads were input for each static load case. Load cases that simulated the dynamic loadings were input for each static and inertia load case. A dynamic factor of 2 and/or a rail roughness coefficient of 6 applied to one-half the dead load was used for each of the dynamic load cases. Load case 17 included the weight of the structure only. All other load cases also included the weight of the structure. A summary of the applied loads is presented in Table 32. Again, the applied loads are depicted by load case in Appendix C (Figures C1-C7).

Output

194. Output indicated that the most severe load condition was that represented by load case 12. This load case included inertia loads with a dynamic load factor of 2 and/or a rail roughness coefficient of 6 applied to one-half the dead load. The loads were applied to the nearest two rails. This resulted in maximum normal compressive stress of 357 psi, normal tensile stress of 363 psi, and shear stress of 228 psi.

195. A summary of the resulting minimum and maximum stresses for all load cases is presented in Table 31. Details of the finite-element analysis showing undeformed and deformed grids and normal and shear stresses for each

load case are presented in Appendix D (Figures D1-D17). All stresses were computed at the centroid of the elements.

196. Since there is some twist in the track in the finite-element analysis because the vertical and lateral loads are applied simultaneously, a better comparison of the deflections and stresses for the beam-on-elastic foundation analysis and the finite-element analysis results is obtained by using finite-element analysis results for elements near the center of the track section. Table 33 gives the comparison of deflections from beam-on-elastic foundation and the finite-element analysis results. These comparisons are excellent.

197. The comparison of stresses in the concrete for beam-on-elastic foundation analysis and finite-element analysis must also be considered carefully. The stresses in the finite-element analysis are at the center of the approximate 8-in. by 8-in. by 50-in. elements and not at the outer concrete surface as figured by the beam-on-elastic foundation analysis. It is considered best to be conservative and use the compressive concrete stresses as obtained by the beam-on-elastic foundation analysis for the preliminary design of the proposed test track.

198. The track section in Figure C1 is considered adequate but not too conservative since the dimensions are about minimum for a dynamic test track and some stress magnitudes seem to be as large as desirable in relation to maximum allowable values.

Preliminary Cost Estimate of New Track

199. A preliminary cost projection was made for the major items needed for the new track facility. The new track parallels the existing track so that some facilities can be shared. These costs are based on a preliminary estimate done by Naval Weapons Center personnel in 1977. All costs were indexed to 1982 prices. A contingency of 15 percent is included in the preliminary cost figures.

Preliminary Cost Estimate

Civil	
Earthwork	$ 1,830K
Construction Survey	550K
Drainage	847K

(Continued)

Civil (Continued)

Water Brake System	2,222K
Access Roads	10,005K
Gates	44K
Subtotal	$15,498K

Electrical and Mechanical

Electrical	$ 573K
Distribution	3,638K
Camera and Signal Cable	3,509K
Electrical Warning System	165K
Track Grounding	165K
Track Magnetic Coils	2,198K
Subtotal	$10,248K

Architectural and Structural

Concrete (24,000 cu yd @ $164/cu yd)	$ 3,936K
Reinforcing steel (4,300,000 lb @ $1.00/lb)	4,300K
Rails 171 lb B.S. (6,620,000 lb @ $1.90/lb) (includes tie downs and alignment)	12,578K
Forms (650,000 SF @ $10.00 SF)	6,500K
Underpass (1 ea)	
Concrete	109K
Reinforcing steel	78K
Forms	156K
Access Tunnel	1,092K
Loader Barricade Building	70K
Tie Down Grid	117K
Large Camera Stations	234K
Small Camera Stations	390K
Concrete P. C. Vault	62K
Droop Snoot Pad	55K
T. M. Van Barricades	180K
Breech Barricades	468K
Subtotal	$30,325K

Other

Relocate SAM-D Towers	90K
Laser Alignment System	100K
Total	$56,261K
Say	$56M

PART VIII: CONCLUSIONS AND RECOMMENDATIONS

200. The field inspection and overall analysis of the SNORT structure reveals extensive cracking of concrete. The concrete is cracked both longitudinally and vertically, and mechanical impedance tests as well as coring show that, in general, the cracks extend through the sections of the structure. The longitudinal cracks follow the reinforcing on both legs, which indicates corrosion and expansion of the steel which produce cracks in the concrete.

201. Cracks in the concrete will allow the penetration of water and chlorides which will accelerate corrosion of the reinforcing steel and cracking of the concrete. Rusting of the reinforcing steel was severe at some locations and nonexistent at others, but due to the entry of water through cracks and wicking along the steel, the steel corrosion will become more widespread and extensive in the future. Some reinforcing steel is badly corroded and because chemical analysis shows that the concrete has a high chloride content, future corrosion of the reinforcing steel can be expected.

202. The concrete is showing signs of extensive deterioration. Some sections of the surface concrete sound hollow when tapped with a hammer. Continued tapping will cause about a 1-in. depth of surface to fall from the tapped area.

203. The concrete is experiencing alkali-silica reaction and under favorable moisture conditions, rapid deterioration can result.

204. Because of the deteriorating conditions and the fact that the concrete track cannot be rehabilitated to eliminate active deterioration, the track is not dependable for long-term future use. Since a policy decision has been made by the Department of the Navy that the SNORT structure is a necessary facility and should be rehabilitated or replaced, it then follows that a replacement is essential.

205. At present, the interior concrete has competent engineering properties and from field-load tests it was found that the SNORT structure has adequate capability for field tests during the time in which a new track is being constructed. This assumes that the initiation of the new track construction will start immediately, and the planning and construction will be completed in 5 years.

206. In situ testing demonstrated that the foundation at the SNORT site

is structurally adequate for the loads imposed by a test track.

207. The proposed test track will extend the testing capabilities and hence the progressive development of our military capabilities. It is recommended that the new test track proposed in this study be constructed.

208. All components of the concrete to be used in the new test track and the concrete mixture itself should be thoroughly studied and developed such that a durable and nondeteriorating product is produced. The reinforcing steel should be coated such that it will not deteriorate even if, for some reason, deteriorating agents reach the steel.

209. It is suggested that the crane rail be made continuous so as to decrease rail roughness.

210. Consideration of a system to slipform the concrete is suggested to cut down on costs and construction time.

211. If a new track is not constructed, long-term supersonic testing will be impaired. The new supersonic test track will eliminate future problems (which are now apparent from the use of the existing SNORT structure) and will be progressive in supersonic testing and the development of military capabilities.

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Table 1

Loads Possible on SNORT

Type of Load	Nominal Load, lb	
	One Rail	Both Rails
Down load	68,000	136,000
Up load	37,500	75,000
Side load		
At 6-1/2 ft above rails and 2100-fps velocity	--	38,000
At 8 ft above rails and 1500-fps velocity	--	50,000

Table 2

Typical SNORT Performance Values

Weight of Payload + Carriage lb (mass)	Acceleration g's	Maximum Velocity fps	Duration of Maximum Velocity sec	Deceleration g's	Deceleration Distance ft
200	100+	3500+	4.1	30	6300
5,000	20	2500	7.2	15	4100
10,000	15	1500	10.4	10	3500
20,000	10	1000	16.9	5	3100

Table 3

Analysis of Well Water

Analysis	Station 146	Station 196
Principal constituents, mg/L		
Cations		
Calcium	6.7	133.0
Magnesium	1.2	6.8
Sodium	83.0	860.0
Anions		
Bicarbonate	140.0	53.0
Sulfate	46.0	1554.0
Chloride	10.0	436.0
Nitrate	2.1	49.0
Other constituents, mg/L		
Boron	0.94	7.3
Silica	8.7	4.4
Iron	2.0	0.01
Manganese	0.02	0.02
Orthophosphate	2.0	0.37
Nitrate	0.47	11.0
Total alkalinity $CaCO^3$	115	44
Total hardness $CaCO^3$	22	360
Dissolved solids	284	3136
pH	7.99	7.43
Conductivity, micromhos/cm @ 25°C	380	4480

Table 4

Evaluation of Longitudinal Cracking

Begin Station	End Station	Evaluation No. West Wall West Face	Evaluation No. West Wall East Face	Evaluation No. East Wall West Face	Evaluation No. East Wall East Face	West Wall Average	East Wall Average	Structure Average
0.50	0.55	6	9	10	4	7.5	7	7.25
0.55	0.75	2	3	5	4	2.5	4.5	3.5
0.75	1.00	2	8	5	4	5	4.5	4.75
1.00	1.10	2	8	9	4	5	6.5	5.75
1.10	2.00	3	8	9	4	5.5	6.5	6
2.00	3.05	3	8	7	4	5.5	5.5	5.5
3.05	3.25	3	6	5	4	4.5	4.5	4.5
3.25	4.25	2	6	5	4	4	4.5	4.25
4.25	4.83	2	6	4	4	4	4	4
4.83	5.04	1	0	1	0	0.5	0.5	0.5
5.04	5.55	1	6	4	3	3.5	3.5	3.5
5.55	7.10	1	4	1	3	2.5	2	2.25
7.10	10.40	1	1	1	3	1	2	1.5
10.40	10.75	2	1	1	3	1.5	2	1.75
10.75	11.00	3	1	1	3	2	2	2
11.00	22.40	1	1	1	3	1	2	1.5
22.40	22.90	2	1	1	3	1.5	2	1.75
22.90	22.60	1	1	1	3	1	2	1.5
28.60	33.55	3	1	1	3	2	2	2
33.55	48.70	2	1	1	3	1.5	2	1.75
48.70	96.35	3	1	1	3	2	2	2
96.35	96.58	4	1	1	3	2.5	2	2.25
96.52	96.75	4	1	1	4	2.5	2.5	2.5
96.75	96.95	10	6	1	4	8	2.5	5.25
96.95	97.05	10	6	6	4	8	5	6.5
97.05	100.20	1	1	1	4	1	2.5	1.75
100.20	105.85	1	1	1	3	1	2	1.5
105.25	106.50	4	1	1	3	2.5	2	2.25
106.50	109.00	1	1	1	3	1	2	1.5
109.00	109.92	1	1	2	3	1	2.5	1.75
109.92	110.28	1	1	1	4	1	2.5	1.75
110.28	110.49	7	6	1	4	6.5	2.5	4.5
110.49	110.80	7	6	1	3	6.5	2	4.25
110.80	115.90	1	1	1	3	1	2	1.5
115.90	116.03	5	1	1	3	3	2	2.5
116.03	117.01	5	1	5	3	3	4	3.5
117.01	117.25	5	1	7	3	3	5	4
117.25	117.68	5	1	6	3	3	4.5	3.75
117.62	118.00	5	2	5	3	3.5	4	3.75
118.00	118.70	5	4	5	3	4.5	4	4.25
118.70	119.40	5	4	4	3	4.5	3.5	4
119.40	119.60	5	4	3	3	4.5	3	3.75
119.60	119.90	1	4	3	3	2.5	3	2.75
119.90	120.34	1	4	6	3	2.5	4.5	3.5
120.34	120.82	1	4	6	4	2.5	5	3.75
120.82	121.00	1	4	6	3	2.5	4.5	3.5
121.00	121.35	1	4	2	3	2.5	2.5	2.5
121.35	122.17	1	2	2	3	1.5	2.5	2
122.17	122.65	6	2	2	3	4	2.5	3.25
122.65	123.00	1	2	2	3	1.5	2.5	2
123.00	123.15	1	2	5	6	1.5	5.5	3.5
123.15	123.48	1	1	5	6	1	5.5	3.25
123.48	124.00	5	1	5	6	3	5.5	4.25
124.00	124.62	5	6	7	6	5.5	6.5	6
124.62	125.25	5	6	5	4	5.5	4.5	5
125.25	125.60	5	7	5	4	6	4.5	5.25
125.60	125.85	5	4	5	4	4.5	4.5	4.5
125.85	126.00	7	4	5	4	5.5	4.5	5
126.00	126.20	7	1	5	4	4	4.5	4.25
126.20	127.05	7	1	4	4	4	4	4

(Continued)

Table 4 (Continued)

Begin Station	End Station	Evaluation No. West Wall West Face	Evaluation No. West Wall East Face	Evaluation No. East Wall West Face	Evaluation No. East Wall East Face	West Wall Average	East Wall Average	Structure Average
127.05	128.05	7	4	2	3	5.5	2.5	4
128.05	129.10	9	4	2	3	6.5	2.5	4.5
129.10	129.25	9	3	6	4	6	5	5.5
129.25	129.58	2	3	6	4	2.5	5	3.75
129.58	130.18	9	7	6	4	8	5	6.5
130.18	130.30	9	7	6	7	8	6.5	7.25
130.30	130.60	9	7	4	7	8	5.5	6.75
130.60	131.08	9	7	7	7	8	7	7.5
131.08	131.25	9	7	2	7	8	4.5	6.25
131.25	131.56	9	5	2	7	7	4.5	5.75
131.56	132.02	9	5	3	7	7	5	6
132.02	132.55	9	4	4	7	6.5	5.5	6
132.55	132.96	6	4	4	7	5	5.5	5.25
132.96	133.30	6	6	6	7	6	6.5	6.25
133.30	133.50	6	6	5	7	6	6	6
133.50	133.80	9	6	5	7	7.5	6	6.75
133.80	135.35	9	6	6	7	7.5	6.5	7
135.35	136.95	9	6	5	7	7.5	6	6.75
136.95	137.53	9	6	4	4	7.5	4	5.75
137.53	137.75	2	1	1	3	1.5	2	1.75
137.75	138.15	8	1	1	3	4.5	2	3.25
138.15	139.10	2	1	1	3	1.5	2	1.75
139.10	139.60	6	1	1	3	3.5	2	2.75
139.60	140.40	2	1	1	3	1.5	2	1.75
140.40	140.85	5	1	1	3	3	2	2.5
140.85	142.10	4	1	1	3	2.5	2	2.25
142.10	144.52	3	1	1	3	2	2	2
144.52	145.13	3	1	9	7	2	8	5
145.13	145.54	9	6	9	3	7.5	6	6.75
145.54	146.00	2	1	1	3	1.5	2	1.75
146.00	146.80	6	1	1	3	3.5	2	2.75
146.80	147.52	2	1	1	3	1.5	2	1.75
147.52	148.80	4	1	1	3	2.5	2	2.25
148.80	149.71	3	1	1	3	2	2	2
149.71	150.28	10	6	9	7	8	8	8
150.28	150.69	10	1	1	3	5.5	2	3.75
150.69	151.27	10	6	8	7	8	7.5	7.75
151.27	151.42	4	6	8	7	5	7.5	6.25
151.42	151.74	4	1	8	7	2.5	7.5	5
151.74	152.75	10	7	1	3	8.5	2	5.25
152.75	152.85	2	7	8	7	4.5	7.5	6
152.85	153.28	2	2	8	7	2	7.5	4.75
153.28	153.55	10	6	8	7	8	7.5	7.75
153.55	154.00	2	2	2	3	2	2.5	2.25
154.00	154.56	8	6	2	3	7	2.5	4.75
154.56	155.08	8	6	7	3	7	5	6
155.08	155.40	4	2	3	3	3	3	3
155.40	155.66	7	2	3	3	4.5	3	3.75
155.60	155.98	7	6	3	3	6.5	3	4.75
155.98	156.29	0	0	0	0	0	0	0
156.29	156.60	9	1	4	6	5	5	5
156.60	156.72	9	4	4	6	6.5	5	5.75
156.72	157.25	5	1	1	3	3	2	2.5
157.25	157.46	5	4	1	3	4.5	2	3.25
157.46	157.72	5	4	9	6	4.5	7.5	6
157.72	158.10	5	1	5	6	3	5.5	4.25
158.10	158.40	5	1	3	6	3	4.5	3.75
158.40	158.55	5	7	3	6	6	4.5	5.25
158.55	159.10	5	2	3	6	3.5	4.5	4
159.10	159.65	5	2	8	6	3.5	7	5.25
159.65	160.06	7	5	3	6	6	4.5	5.25
160.06	160.30	7	5	8	6	6	7	6.5
160.30	160.65	7	5	8	4	6	6	6
160.65	161.55	7	2	1	4	4.5	2.5	3.5
161.55	162.65	7	5	6	4	6	5	5.5

(Continued)

Table 4 (Continued)

Begin Station	End Station	Evaluation No. West Wall West Face	Evaluation No. West Wall East Face	Evaluation No. East Wall West Face	Evaluation No. East Wall East Face	West Wall Average	East Wall Average	Structure Average
162.65	163.15	7	2	1	4	4.5	2.5	3.5
163.15	163.55	7	6	5	4	6.5	4.5	5.5
163.55	163.85	7	2	3	4	4.5	3.5	4
163.85	164.40	9	4	3	4	6.5	3.5	5
164.40	164.90	9	4	3	6	6.5	4.5	5.5
164.90	165.15	9	2	3	6	5.5	4.5	5
165.15	165.63	9	2	3	4	5.5	3.5	4.5
165.63	166.09	2	2	1	7	2	4	3
166.07	166.62	9	4	4	7	6.5	5.5	6
166.62	166.90	9	1	6	7	5	6.5	5.75
166.70	162.24	9	1	5	7	5	6	5.5
162.24	168.75	9	6	2	4	7.5	3	5.25
162.75	169.00	9	1	2	4	5	3	4
169.00	169.65	9	1	5	4	5	4.5	4.75
169.65	170.55	9	1	6	4	5	5	5
170.55	171.15	9	1	1	3	5	2	3.5
171.15	171.60	9	4	8	7	6.5	7.5	7
171.60	171.85	9	1	8	7	5	7.5	6.25
171.85	172.15	9	1	4	7	5	5.5	5.25
172.15	172.55	9	1	4	2	5	3	4
172.55	173.03	9	4	4	4	6.5	4	5.25
173.03	173.20	9	2	4	4	5.5	4	4.75
173.20	173.35	9	2	2	4	5.5	3	4.25
173.35	173.50	9	2	2	7	5.5	4.5	5
173.50	174.00	9	7	8	7	8	7.5	7.75
174.00	174.25	9	7	6	7	8	6.5	7.25
174.25	174.48	9	7	6	5	8	5.5	6.75
174.48	174.75	5	7	4	5	6	4.5	5.25
174.75	175.15	5	7	6	5	6	5.5	5.75
175.15	175.29	5	7	6	7	6	6.5	6.25
175.29	175.65	9	4	6	7	6.5	6.5	6.5
175.65	176.95	9	4	8	7	6.5	7.5	7
176.95	177.15	9	4	6	7	6.5	6.5	6.5
177.15	177.55	9	4	6	6	6.5	6	6.25
177.55	178.30	7	1	1	6	4	3.5	3.75
178.30	178.50	2	1	1	5	1.5	3	2.25
178.50	178.92	6	1	1	5	3.5	3	3.25
178.92	179.08	6	1	1	8	3.5	4.5	4
179.08	179.50	6	1	6	8	3.5	7	5.5
179.50	180.14	10	1	6	8	5.5	7	6.25
180.14	180.51	0	0	0	0	0	0	0
180.51	180.58	9	1	7	8	5	7.5	6.25
180.58	181.50	9	4	7	8	6.5	7.5	7
181.50	182.35	9	8	7	8	8.5	7.5	8
182.35	183.50	9	8	5	8	8.5	6.5	7.5
182.50	183.49	9	5	5	7	7	6	6.5
183.49	184.02	4	5	3	7	4.5	5	4.75
184.02	184.30	4	5	7	7	4.5	7	5.75
184.30	184.75	4	3	6	7	3.5	6.5	5
184.75	184.90	7	3	6	7	5	6.5	5.75
184.90	185.44	7	3	5	7	5	6	5.5
185.44	186.02	9	7	5	7	8	6	7
186.02	186.25	9	7	2	7	8	4.5	6.25
186.25	187.03	9	7	6	7	8	6.5	7.25
187.03	187.20	9	3	6	8	6	7	6.5
187.20	187.50	8	3	6	8	5.5	7	6.25
187.50	188.05	8	6	6	8	7	7	7
188.05	189.06	8	6	3	7	7	5	6
189.06	189.46	3	6	1	7	4.5	4	4.25
189.46	190.00	6	6	1	7	6	4	5
190.00	190.33	1	6	1	7	3.5	4	3.75
190.33	190.85	7	6	1	7	6.5	4	5.25
190.85	191.06	7	6	1	6	6.5	3.5	[illegible]
191.06	191.35	7	5	1	6	6	3.5	4.75
191.35	192.52	7	5	1	5	6	3	4.5

(Continued)

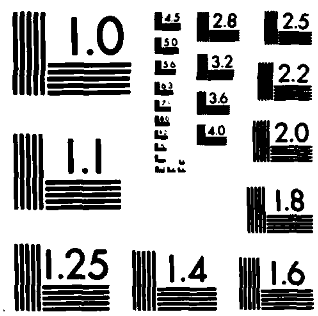
Table 4 (Concluded)

Begin Station	End Station	Evaluation No. West Wall West Face	Evaluation No. West Wall East Face	Evaluation No. East Wall West Face	Evaluation No. East Wall East Face	West Wall Average	East Wall Average	Structure Average
192.52	193.05	7	7	6	6	7	6	6.5
193.05	193.25	8	5	3	6	6.5	4.5	5.5
193.25	194.00	8	5	3	3	6.5	3	4.75
194.00	194.10	8	5	6	5	6.5	5.5	6
194.10	194.56	8	5	6	7	6.5	6.5	6.5
194.56	194.67	8	5	4	4	6.5	4	5.25
194.67	195.00	8	1	4	4	4.5	4	4.25
195.00	195.70	8	1	6	4	4.5	5	4.75
195.70	196.00	2	1	4	4	1.5	4	2.75
196.00	196.15	2	1	6	7	1.5	6.5	4
196.15	196.52	2	1	6	5	1.5	5.5	3.5
196.52	197.06	2	1	3	5	1.5	4	2.75
197.06	197.16	2	1	6	5	1.5	5.5	3.5
197.16	197.40	8	1	3	5	4.5	4	4.25
197.40	197.80	8	1	3	3	4.5	3	3.75
197.80	198.08	8	1	2	3	4.5	2.5	3.5
198.08	198.55	2	1	2	3	1.5	2.5	2
198.55	199.68	8	1	4	3	4.5	3.5	4
199.68	199.84	8	1	2	3	4.5	2.5	3.5
199.84	200.10	5	1	2	3	3	2.5	2.75
200.10	200.23	5	1	6	3	3	4.5	3.75
200.23	200.87	5	1	1	3	3	2	2.5
200.87	201.28	7	3	1	3	5	2	3.5
201.28	201.48	2		1	3	2	2	2
201.48	201.92	6	4	6	3	5	4.5	4.75
201.92	202.05	6	2	6	3	4	4.5	4.25
202.05	202.18	0	0	0	0	0	0	0
202.18	202.55	7	1	6	3	4	4.5	4.25
202.55	203.06	1	1	1	3	1	2	1.5
203.06	204.02	1	1	5	3	1	4	2.5
204.02	204.70	1	1	1	3	1	2	1.5
204.70	205.04	1	1	4	3	1	3.5	2.25
205.04	206.00	2	1	1	3	1.5	2	1.75
206.00	206.20	2	1	4	3	1.5	3.5	2.5
206.20	207.77	2	1	1	3	1.5	2	1.75
207.77	208.06	4	1	1	6	2.5	3.5	3
208.06	208.25	4	1	4	3	2.5	3.5	3
208.25	208.56	4	1	2	3	2.5	2.5	2.5
208.56	209.35	2	4	2	3	3	2.5	2.75
209.35	209.80	2	1	2	3	1.5	2.5	2
209.80	210.86	2	1	4	3	1.5	3.5	2.5
210.86	211.18	3	1	3	3	2	3	2.5
211.18	211.54	3	3	3	3	3	3	3
211.54	211.87	8	3	3	3	5.5	3	4.25
211.87	212.08	0	0	0	0	0	0	0
212.08	212.44	8	5	3	3	6.5	3	4.75
212.44	212.75	3	5	3	3	4	3	3.5
212.75	212.90	3	1	3	3	2	3	2.5
212.90	213.25	3	4	3	3	3.5	3	3.25
213.25	213.70	3	1	3	3	2	3	2.5
213.70	214.21	7	1	3	3	4	3	3.5
214.21	214.53	2	4	3	3	3	3	3
214.53	215.00	8	1	2	3	4.5	2.5	3.5
215.00	215.53	8	1	2	5	4.5	3.5	4
215.53	215.92	10	1	2	6	5.5	4	4.75
215.92	216.02	2	1	2	6	1.5	4	2.75

AD-A140 036 CONDITION EVALUATION OF SUPERSONIC NAVAL ORDNANCE RESEARCH TRACK (SNORT)(U) ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG MS STRUC..

2/3

UNCLASSIFIED B R SULLIVAN ET AL. FEB 84 WES/MP/SL-84-1 F/G 13/13 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Table 5

Location of Areas of Significant Spalling

Station No.	Wall West	Wall East	Face West	Face East
10.52	X		X	
10.53		X		X
10.66	X		X	
31.92		X		X
96.12		X	X	
99.96		X		X
99.98	X		X	
140.75	X		X	
145.44	X		X	
155.98		X		X
156.00	X		X	
170.94	X		X	
170.94		X		X
171.07	X		X	
173.12	X		X	
181.02		X	X	
199.08		X	X	
199.10		X		X
204.62	X			X
204.62		X		X

Table 6

Detailed Core Data and Core Locations

Core Identification	SL No.	Station	Section	Plane	Starting Location	Distance from Starting Location, in.
Unconfined Compression Tests						
	CL-39					
HC 96*	CON-7	0+96	East leg	Horizontal	East face	5
VC 7952W	CON-9	79+52	Floor	Vertical	Top face	4
HC 9696	CON-10	96+96	West leg	Horizontal	West face	6
VC 12000W*	CON-11	120+00	Floor	Vertical	Top face	4
VC 13496	CON-14	139+96	East leg	Vertical	Top face	12
VC 13996*	CON-14	139+96	East leg	Vertical	Top face	34
HC 15096**	CON-16	150+96	West leg	Horizontal	West face	3.5
VC 15500	CON-17	155+00	Floor	Vertical	Top face	4
SC 17399	CON-20	173+99	East leg	Slanted	West face	15
VC 21496	CON-27	214+96	West leg	Vertical	Top face	5
VC 21496*	CON-27	214+96	West leg	Vertical	Top face	15
Tensile Splitting Tests						
HC 96	CON-7	0+96	East leg	Horizontal	East face	15
VC 2450W†	CON-9	24+50	Floor	Vertical	Top face	4
HC 12996	CON-13	129+96	East leg	Horizontal	West face	15
VC 13976	CON-14	139+96	East leg	Vertical	Top face	43
HC 12199**	CON-23	181+99	West leg	Slanted	East face	7
VC 20000W	CON-24	200+00	Floor	Vertical	Top face	4
VC 21496	CON-27	214+96	West leg	Vertical	Top face	27
HC 21496**	CON-28	214+96	East leg	Horizontal	West face	3.5

* Strain gaged.
** Short core.
† Steel bar in specimen.

Table 7

Properties from Strain-Gaged Specimens

Property	Cylinder Identification and Location			
	HC 96 Sta 0+96 East wall	VC 12000 Sta 120+00 Floor	VC 13996 Sta 139+96 East wall	VC 21496 Sta 214+96 West wall
σ_{ult} , psi	5290	6240	5000	6530
S_2 (at 40% σ_{ult}), millionths	2120	2500	2000	2610
ε_2 (strain at S_2), millionths	630	575	680	675
S_1 (σ at strain of 50 μin./in.), millionths	140	170	1190	170
ε_{t1} (transverse strain at S_1), millionths	10	5	10	10
εt2 (transverse strain at S_2), millionths	120	110	140	145
E , millions of psi	3.41	4.44	2.87	3.90
μ	0.19	0.20	0.21	0.22

Average $E = 3.66 \times 10^6$ psi

Average $\mu = 0.205$

$G = 1.52 \times 10^6$ psi

Table 8

Concrete Core Test Results

Station	Ultimate Tensile-Splitting Strength psi	Ultimate Compressive Strength psi	Modulus of Elasticity 10^6 psi	Poisson's Ratio	Shear Modulus 10^6 psi
0+96	460	5290	3.41	0.19	1.43
24+50	570	--	--	--	--
79+52	--	6280	--	--	--
96+96	--	4450	--	--	--
120+00	--	6240	4.44	0.20	1.85
129+96	390	--	--	--	--
139+96	710	6190*	2.87	0.21	1.19
150+96	--	4080	--	--	--
155+00	--	7180	--	--	--
173+99	--	4440	--	--	--
181+99	410	--	--	--	--
200+00	640	--	--	--	--
214+96	440*	6020*	3.90	0.22	1.60

* Two-cylinder average.

Table 9

Results of Tests on Foundation Material

Depth ft	Water Content %	Density pcf	Soil Classification	Liquid Limit	Plastic Limit	Plasticity Index	Comments
				SNORT Sta 24+50			
3			SM			NP	Silty sands, sand-silt mixtures
Under footing	5.9		SM			NP	Silty sands, sand-silt mixtures
5	5.1		SM			NP	Silty sands, sand-silt mixtures
5.5	5.5	132	SM			NP	Silty sands, sand-silt mixtures
6	5.9		SM			NP	Silty sands, sand-silt mixtures
7	5.1		SM			NP	Silty sands, sand-silt mixtures
8	3.9		SW-SM			NP	Well-graded sands, gravelly sands little or no fines/silty sands sands, sand-silt mixtures some caliche
9	6.3		SM			NP	Silty sands, sand-silt mixtures
11	6.5		SW-SM			NP	Silty sands, sand-silt mixtures/ well-graded sands, gravelly sands, little or no fines, some caliche
14	6.4		SM			NP	Silty sand, sand-silt mixtures
				SNORT Sta 70+50			
3			SM			NP	Silty sands, sand-silt mixtures
Under footing			SM			NP	Silty sands, sand-silt mixtures
7	2.5	113	SW-SM				Well-graded sands, gravelly sands, little or no fines/silty sands, sand-silt mixtures
8	3.4		SW				Well-graded sands, gravelly sands, little or no fines
12.5	3.1		SW				Well-graded sands, gravelly sands, little or no fines
14	3.0		SW				Well-graded sands, gravelly sands, little or no fines
				SNORT Sta 120			
3			SM			NP	Silty sands, sand-silt mixtures
Under footing	3.8		SM			NP	Silty sands, sand-silt mixtures
7	7.7	115	SM-SC	26.9	20.3	6.6	Silty sands, sand-silt mixtures/ clayey sands, sand-clay mixtures
7.5	6.7		SM			NP	Silty sands, sand-silt mixtures
10	6.3		SM			NP	Silty sands, sand-silt mixtures
14	7.2		SM			NP	Silty sands, sand-silt mixtures
				SNORT Sta 155			
3			SM	24.0	21.5	2.5	Silty sands, sand-silt mixtures
Under footing	14.8		CL	29.6	19.9	9.7	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays
7	6.8	94.8	SM	42.8	37.0	5.8	Silty sands, sand-silt mixtures/ some caliche

(Continued)

Table 9 (Continued)

Depth ft	Water Content %	Density pcf	Soil Classi-fication	Liquid Limit	Plastic Limit	Plas-ticity Index	Comments
			SNORT Sta 155 (Continued)				
10	11.2		ML	39.0	26.6	12.4	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity, some caliche
14	13.7		ML	39.0	26.9	12.1	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity, some caliche
			SNORT Sta 165				
3			ML	30.0	20.2	10.7	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
Under footing	12.0		SM			NP	Silty sands, sand-silt mixtures
6	15.1	130	SM	29.3	20.4	8.9	Silty sands, sand-silt mixtures, some caliche
9	17.0		SM	31.2	24.0	7.2	Silty sands, sand-silt mixtures, some caliche
14	27.9		ML	50.0	36.7	13.3	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
			SNORT Sta 180				
3			SM	24.3	20.7	3.6	Silty sands, sand-silt mixtures
Under footing	16.7		SM			NP	Silty sands, sand-silt mixtures
6.5	7.2	116	SW-SM			NP	Well-graded sands, gravelly sands, little or no fines/silty sands, sand-silt mixtures
8.5	20.9		SM	31.8	28.8	3.0	Silty sands, sand-silt mixtures
9.5	23.8		SM	34.4	28.4	6.0	Silty sands, sand-silt mixtures
14	31.9		ML	38.0	30.5	7.5	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
			SNORT Sta 200				
3			SM	NP	NP	NP	Silty sands, sand-silt mixtures
Under footing	8.3		SM	NP	NP	NP	Silty sands, sand-silt mixtures
6	8.0	129	SM	NP	NP	NP	Silty sands, sand-silt mixtures, some caliche
7.5	27.9		MH	42.5	26.2	16.3	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic soils
10.5	26.5		ML	36.5	31.7	4.8	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
14	17.7		ML	31.2	28.1	3.1	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity

(Continued)

Table 9 (Concluded)

Depth ft	Water Content %	Density pcf	Soil Classification	Liquid Limit	Plastic Limit	Plasticity Index	Comments
				SNORT Sta 210			
3.5			SM	NP	NP	NP	Silty sands, sand-silt mixtures
Under footing	11.1		SM	NP	NP	NP	Silty sands, sand-silt mixtures
6	13.8	110	SM	23.4	21.2	2.2	Silty sands, sand-silt mixtures
7.5	13.8		SC	29.5	19.3	10.2	Clayey sands, sand-clay mixtures
10	5.3		SM	NP	NP	NP	Silty sands, sand-silt mixtures
11.5	4.5		SM	NP	NP	NP	Silty sands, sand-silt mixtures
14	4.0		SW-SM	NP	NP	NP	Well-graded sands, gravelly sands, little or no fines/silty sands, sand-silt mixtures

Table 10

Chemical Test Results for Soils (SNORT)

Sample	Chloride* µg/g	Sulfate* µg/g	Resistivity** ohm-cm	pH
SS-3	1030	950	109	8.0
SS-4	70	<50	1450	8.0
SS-5	83	<50	1890	8.0
SS-6	38	<50	2180	8.8
SS-7	43	<50	1170	8.6
SS-8	1530	1730	709	8.3
SS-9	916	1830	94	8.1
SS-10	135	150	585	8.8
SS-11	793	330	156	8.2
SS-12	542	180	258	8.6

* Chlorides and sulfates are water-soluble extracts.
** Soil-to-water extract 1:2.

Table 11

Analysis for Water Samples (SNORT)

Parameter	Pond Sample CL-39 W-1	Tap Sample CL-39 W-2
Chlorides	101 mg/l	34.1 mg/l
Sulfates	68.5 mg/l	44.8 mg/l
pH	6.7	7.6
Resistivity	1295 ohms-cm	2490 ohms-cm
Total solids	464 mg/l	254 mg/l
Hardness	52.6 mg/l as $CaCO_3$	83.3 mg/l as $CaCO_3$
Alkalinity	129 mg/l as $CaCO_3$	101 mg/l as $CaCO_3$
Magnesium	5.5 mg/l	7.0 mg/l
Sodium	130.0 mg/l	42.3 mg/l
Potassium	9.0 mg/l	3.0 mg/l
Calcium	13.8 mg/l	25.2 mg/l

Table 12

Chloride Content of Concrete Core

Section of Core	Chloride,%
1	0.132
2	0.072
3	0.187
4	0.251
5	0.243

Table 13

Pressure Meter Average Results

Depth ft	E_o kPa	E_R kPa	P_L kPa	$\frac{E_R}{E_o}$	$\frac{E_o}{P_L}$
2	19,000	196,000	1750	10	11
5	32,000	45,000	1800	1.4	18
8	48,000	143,000	2400	3	20
11	20,000	88,000	2100	4.4	9.5
14	29,000	99,000	2400	3.4	12
20	40,000	120,000	3200	3	12.5

Table 14

Moduli of Elasticity, kPa

Depth ft	Station 24+50	79+50	120+00	155+00	165+00	180+00	200+00	210+00	Average of Stations
2	72,000	78,000	90,000	48,000	81,000	33,000	15,000	39,000	
3									
4									
5	24,000	12,000	39,000	516,000	48,000	60,000	15,000	48,000	
6						300,000			
7	66,000								
8		12,000	180,000	66,000	501,000		138,000	72,000	
9	234,000					39,000			
10									
11		54,000	78,000	120,000	21,000		63,000	63,000	
12						15,000			
14	138,00	33,000	93,000	78,000	63,000		84,000		
15						111,000			
20						48,000	192,000		
Average E (kPa)	51,400	22,300	67,100	56,800	56,000	45,800	24,800	51,200	46,900
Average G (kPa)	19,000	8,300	24,900	21,000	20,700	17,000	9,200	19,000	17,400

Table 15

Factors of Safety Against Bearing Capacity Failure

Condition	One 80,000-lb Single Load	Two 68,000-lb Point Loads 16 ft Apart
K_{worst} = 79.2 lb/in.^{3}	7.4	8.9
K_{best} = 271.1 lb/in.^{3}	30.8	37.5

Table 16

Modulus of Subgrade Reaction at Each Station

Transfer Length = 24 ft

Load = 80,000 lb

Average Pressure = 28 kPa

Station	E_d kPa	E_c kPa	s mm	K kN/m^3
24+50	17,100	24,000	0.50	56,000
79+50	7,400	26,000	1.00	28,000
120+00	22,400	30,000	0.38	73,700
155+00	18,900	26,000	0.45	62,200
165+00	18,700	27,000	0.45	62,200
180+00	15,300	11,000	0.66	42,400
200+00	8,300	5,000	1.30	21,500
210+00	17,100	13,000	0.58	48,300

K_{avg} = 49,300 kN/m^3

Table 17

Beam-on-Elastic Foundations

Assumption:	Track	I = 385,600 in.^{4}
		A = 2,274 in.^{2}
		$E_c = 4.5 \times 10^6$ psi
		c = 0.17
	Soil	1. K_{worst} = 21,500 kN/m^3 = 79.2 lb/in.^{3}
		2. K_{best} = 73,600 kN/m^3 = 271.1 lb/in.^{3}
		3. K = 27,100 kN/m^3 = 100 lb/in.^{3}
	Load	1. 80,000-lb single-point load
		2. Two 68,000-lb point loads 16 ft apart
		3. 136,000-lb single-point load

Table 18

Results of Beam-on-Elastic Foundation Analysis

Length of Track ft	Element Length in.	Load lb	K lb/in.^{3}	Maximum Deflection 10^{-3} in.	Maximum Bending Moment 10^6 × lb-in.	Maximum Pressure lb/ft^2
200	12	80,000	79.2	2.23	1.44	974
200	6	80,000	79.2	2.22	1.45	989
200	12	2 × 68,000 (16 ft apart)	79.2	1.84	1.11	806
200	12	80,000	271.1	0.89	1.05	1303
200	12	2 × 68,000 (16 ft apart)	271.1	0.73	0.88	1071
100	12	80,000	79.2	2.23	1.44	974
140	12	80,000	79.2	2.23	1.44	974
170	12	80,000	79.2	2.23	1.44	974
40	4.8	136,000	100	48.4	6.10	1606
40	4.8	136,000 + 1971 lb/in.	100	70.0	6.14	704
40	4.8	136,000 + 1971 lb/in.	100	80.0	6.26	731

Table 19

Computed Deflections, Strongest Soil Conditions

Soil: K_{best} = 73,600 kN/m^3 = 271.1 lb/in.^{3}

Load: 80,000-lb single-point load

$$S_{max} = 0.89 \times 10^{-3} \text{ in.}$$

$$P_{max} = 1303 \text{ lb/ft}^2$$

Soil: K_{best} = 73,600 kN/m^3 = 271.1 lb/in.^{3}

Load: Two 68,000-lb point loads 16 ft apart

$$S_{max} = 0.73 \times 10^{-3} \text{ in.}$$

$$P_{max} = 1071 \text{ lb/ft}^2$$

Table 20

Field Load Test Deflections Under 80,000-lb

Down Load

Station	Deflections, in. West Wall Leg	Deflections, in. East Wall Leg
1	0.020	
3	0.010	0.019
4	0.002	0.009
5	0.010	0.022
6	0.004	0.013
6	0.005	0.007
7.96	0.002	0.002
10	0.005	0.006
12	0.005	0.008
14	0.011	0.009
16	0.016	0.019
18	0.012	0.010
20	0.010	0.008
22	0.006	0.003
24	0.007	0.005
26	0.005	0.007
28	0.005	0.010
30	0.003	0.004
32	0.003	0.007
34	0.009	0.016
36	0.003	0.003
38	0.008	0.001
40	0.009	0.006
42	0.010	0.013
44	0.004	0.003
46	0.017	0.016
50	0.015	0.014
52	0.013	0.008
56	0.002	0.002
60	0.004	0.001
64	0.002	0.005
68	0.005	0.002
72	0.012	0.014
76	0.004	0.006
80	0.005	0.005
84	0.010	0.009
88	0.009	0.010
92	0.002	0.012
96	0.010	0.013
100.04	0.010	0.011
104	0.005	0.002
108	0.012	0.013
112	0.012	0.005
116	0.004	0.004
120.04	0.016	0.020
124.04	0.002	--
128.04	0.007	0.006
132.04	0.004	0.003
135.96	0.004	0.002
140.04	0.009	0.009
143.96	0.009	0.005
147.96	0.005	0.006
152.04	0.007	0.011
156.08	0.006	0.005
159.96	0.005	0.003
163.96	0.004	0.004
167.96	0.007	0.009
171.96	0.009	0.009
176.04	0.016	0.012
180.04	0.012	0.016
180.33	0.012	0.010
181.96	0.014	0.014
183.96	0.007	0.008
188.04	0.006	0.004
191.96	0.002	0.005
197.96	0.012	0.011
200.04	0.005	0.006
203.96	0.007	0.005
209.96	0.008	0.006
212.04	0.012	0.016
213.96	0.010	0.012
215.66	0.014	0.013
120.38	0.017	0.014
91.92	0.007	0.012
47.96	0.003	0.005
3.96	0.003	0.001
1.96	0.004	0.001
0.96	0.008	0.010
Average	0.0078	0.0084

Table 21

Field Load Test Deflections Under 26,000-lb Up Load

Station	Deflections, in. West Wall Leg	Deflections, in. East Wall Leg	Station	Deflections, in. West Wall Leg	Deflections, in. East Wall Leg
22-2	0.004	0.004	132-2	0.006	0.006
24-2	0.002	0.001	136-2	0.005	0.009
26-2	0.003	0.003	140-2	0.005	0.006
28-2	0.007	0.008	144-2	0.006	0.004
30-2	0.002	0.004	148-2	0.005	0.010
32-2	0.003	0.003	152-2	0.001	0.003
34-2	0.003	0.005	156-2	0.005	0.004
36-2	0.002	0.004	160-2	0.002	0.002
37-2	0.003	0.002	164-2	0.004	0.005
40-2	0	0.001	168-4	0.004	0.003
42-2	0.005	0.003	172-2	0.005	0.006
44-2	0.007	0.005	176-2	0.006	0.005
46-2	0.005	0.002	180+2	0.002	0.002
48-2	0.003	0.001	180+32	0.011	0.009
50-2	0.003	0.003	182-2	0.003	0.004
52-2	0.003	0.001	184-2	0.008	0.008
56-2	0.004	0.004	188-2	0.004	0.005
60-2	0.004	0.003	192-2	0.005	0.004
64-2	0.002	0.001	196-2	0.005	0.003
68-2	0.003	0.005	200-2	0.005	0.003
72-2	0.004	0.003	204-2	0.005	0.005
76-2	0.004	0.002	208-2	0.006	0.002
80-2	0.006	0.003	212-2	0.005	0.003
84-2	0.002	0.002	214-2	0.011	0.009
88-2	0.002	0.002	215+64	0.002	0.006
92-2	0.006	0.004	152-4	0.002	0.003
96-2	0.005	0.005	148-2	0.004	0.004
100+2	0.004	0.001	120+40	0.006	0.012
104-2	0.003	0.001	80-2	0.006	0.009
108-2	0.001	0.001	22-6	0.003	0.004
112-2	0.003	0.003	2-2	0.005	0.005
116-2	0.003	0.004	Average	0.0042	0.0041
120+2	0.003	0.005			
124-2	0.005	0.004			
128-2	0.005	0.003			

Table 22

Design Loads

Type of Load	Nominal Load, lb	
	One Rail	Both Rails
Down load	68,000	136,000
Up load	37,500	75,000
Side load		
At 6-1/2 ft above rails and 2100-fps velocity	--	38,000
At 8 ft above rails and 1500-fps velocity	--	50,000

Table 23

Limiting and Average Soil Conditions

Soil Condition	Modulus of Subgrade Reaction lb/in.^{3}
Worst	79.2
Average	175
Best	271.1

Table 24

Maximum Moments, Shears, and Deflections, Down Load of 136,000 lb

Parameter	136,000-lb Down Load, Both Rails, 12 Shoes		
	k = 79.2 lb/in.^{3}	k = 175 lb/in.^{3}	k = 271.1 lb/in.^{3}
Deflection (in.)	0.0013 -0.0355	0.0006 -0.0170	0.0004 -0.0114
Shear (lb)	18,480 -18,480	15,830 -15,830	14,730 -14,730
Bending moment (in.-lb)	1.21×10^6 -7.8×10^5	7.3×10^5 -5.3×10^5	5.8×10^5 -4.2×10^5

Table 25

Maximum Moments, Shears, and Deflections,

Down Load of 80,000 lb

	Down Load of 80,000 lb, Both Rails, 4 Shoes		
Parameter	k = 79.2 lb/in.^{3}	k = 175 lb/in.^{3}	k = 271.1 lb/in.^{3}
Deflection (in.)	0.0010 -0.0255	0.0005 -0.0130	0.0003 -0.0088
Shear (lb)	17,520 -17,520	15,120 -15,120	13,390 -13,930
Bending moment (in.-lb)	1.4×10^6 -6.3×10^5	9.1×10^5 -4.6×10^5	7.1×10^5 -3.8×10^5

Table 26

Maximum Deflections, Moments, and Shears

Side Load of 50,000 lb

	Side Load of 50,000 lb, Both Rails, 12 Shoes		
Parameter	k = 79.2 lb/in.^{3}	k = 175 lb/in.^{3}	k = 271.1 lb/in.^{3}
Deflection (in.)	0.0005 -0.0113	0.0002 -0.0057	0.00014 -0.0038
Shear (lb)	8835 -8835	7401 -7401	6734 -6734
Bending moment (in.-lb)	9.6×10^5 -4.9×10^5	5.8×10^5 -3.5×10^5	4.3×10^5 -2.8×10^5

Table 27

Material Properties Used for Proposed Track

Ultimate Compressive Strength, f'_c, psi	Modulus of Elasticity, E, psi	Poisson's Ratio v	Modulus of Rigidity, G, psi
4000	3,750,000	0.20	1,560,000

Table 28

Maximum Deflections, Momonts, and Shears from Beam-on-Elastic Foundation Analysis

Load Case	Soil Constant, K , lb/in.^{3}	Vertical Load, FZ: DZ Min in.	DZ Max in.	MXX Min in.-lb	MXX Max in.-lb	VXZ Min lb	VXZ Max lb	Traverse Load, FX: DX Min in.	DX Max in.	MZZ Min in.-lb	MZZ Max in.-lb	VXZ Min lb	VXZ Max lb
1	79.2	-0.0288	0.0009	-395,800	545,200	-14,440	14,440	-0.0083	0.0003	-479,300	941,600	-8,776	8,776
	[illegible]	-0.0130	0.0004	-266,200	419,000	-13,060	13,060	-0.0077	0.0003	-461,800	893,400	-8,605	8,605
		-0.0083	0.0003	-216,300	389,000	-12,710	12,710	-0 0072	0.0003	-448,300	851,700	-8,454	8,454
2		.1009	0.0030	-1,385,000	1,908,000	-50,550	50,550	-0.0083	0.0003	-479,300	941,600	-8,776	8,776
		0.0456	0.0015	-931,600	1,467,000	-45,720	45,720	-0.0077	0.0003	-461,800	893,400	-8,605	8,605
		-0.0292	0.0010	-756,900	1,362,000	-44,480	44,480	-0.0072	0.0003	-448,300	851,700	-8,454	8,454
3		-0.0576	0.0019	-791,600	1,090,000	-28,880	28,880	-0.0167	0.0007	-958,600	1,883,000	-17,550	17,550
	[illegible]	-0.0260	0.0009	-532,400	838,100	-26,130	26,130	-0.0155	0.0006	-923,700	1,787,000	-17,210	17,210
	271.1	-0.0167	0.0006	-432,500	778,000	-25,420	25,420	-0.0144	0.0006	-896,700	1,703,000	-16,910	16,910
4	79.2	-0.2018	0.0066	-2,771,000	3,816,000	-101,100	101,100	-0.0167	0.0007	-958,600	1,883,000	-17,550	17,550
	175.0	-0.0910	0.0030	-1,836,000	2,933,000	-91,450	91,450	-0.0155	0.0006	-923,700	1,787,000	-17,210	17,210
	271.1	-0.0584	0.0020	-1,439,000	2,723,000	-88,960	88,960	-0.0144	0.0006	-896,700	1,703,000	-16,910	16,910
5	79.2	-0.0310	0.0000	-300,700	218,200	-7,964	7,964	-0.0083	0.0003	-479,300	941,600	-8,776	8,776
	175.0	-0.0140	0.0000	-231,100	146,800	-7,205	7,205	-0.0077	0.0003	-461,800	893,400	-8,605	8,605
	271.1	-0.0090	0.0000	-214,500	119,300	-7,008	7,008	-0.0072	0.0003	-448,300	851,700	-8,454	8,454
6	79.2	-0.0320	0.0172	-901,900	654,800	-23,890	23,890	-0.0083	0.0003	-479,300	941,600	-8,776	8,776
	175.0	-0.0145	0.0078	-693,300	440,400	-21,610	21,610	-0.0077	0.0003	-461,800	893,400	-8,605	8,605
	271.1	-0.0093	0.0049	-643,600	357,800	-21,020	21,020	-0.0072	0.0003	-448,300	851,700	-8,454	8,454
7	79.2	-0.0315	0.0013	-601,300	436,500	-15,930	15,930	-0.0167	0.0007	-958,600	1,883,000	-17,550	17,550
	175.0	-0.0142	0.0006	-462,200	293,600	-14,410	14,410	-0.0155	0.0006	-923,700	1,787,000	-17,210	17,210
	271.0	-0.0091	0.0003	-429,000	238,500	-14,020	14,020	-0.0144	0.0006	-896,700	1,703,000	-16,910	16,910
8	79.2	-0.0336	0.0649	-1,804,000	1,310,000	-47,790	47,790	-0.0167	0.0007	-958,600	1,883,000	-17,550	17,550
	175.0	-0.0152	0.0293	-1,387,000	880,700	-43,230	43,230	-0.0155	0.0006	-923,700	1,787,000	-17,210	17,210
	271.1	-0.0098	0.0187	-1,287,000	715,500	-42,050	42,050	-0.0144	0.0006	-896,700	1,703,000	-16,910	16,910
17	79.2	-0.0304	0.0000	0	0	0	0	0.0	0.0	0	0	0	0
	175.0	-0.0138	0.0000	0	0	0	0	0.0	0.0	0	0	0	0
	271.1	-0.0089	0.0000	0	0	0	0	0.0	0.0	0	0	0	0

Table 29

Maximum Compressive Stresses in Concrete Track

Load Case	Soil Constant lb/in.^{3}	Maximum Compressive Stresses in Concrete Track
1	79.2	117
	175	95
	271.1	91
2	79.2	316
	175	250
	271.1	233
3	79.2	235
	175	194
	271.1	181
4	79.2	634
	175	501
	271.1	466
5	79.2	69
	175	57
	271.1	51
6	79.2	133
	175	100
	271.1	86
7	79.2	139
	175	114
	271.1	102
8	79.2	267
	175	200
	271.1	172

Table 30

Relative Stiffness About Y-Y and X-X Axes

Item	I_o	E	$I_o \times E$
	Y-Y Axis		
Concrete track	451,194	30×10^6	13.5×10^{12}
Crane rails	100	3.75×10^6	3.8×10^8
	X-X Axis		
Concrete track	50,810	30×10^6	1.5×10^{12}
Crane rails	297	3.75×10^6	1.1×10^9

Table 31

Minimum and Maximum Stress from Finite-Element Analysis Results

	Normal*						Shear					
	SX		SY		SZ		VXY		VYZ		VZY	
Load Case	Min psi	Max psi	Min psi	Max psi	Min psi	Max psi	Min psi	Max psi	Min psi	Max psi	Min psi	Max psi
1	-16	15	-20	19	-16	4	-8	4	-9	11	-4	5
2	-47	46	-53	49	-58	14	-13	6	-30	27	-16	14
3	-29	27	-41	39	-32	8	-16	8	-18	22	-7	11
4	-91	89	-106	98	-117	28	-26	11	-61	54	-32	27
5	-9	7	-17	17	-5	10	-10	6	-12	7	-2	4
6	-20	19	-24	25	-7	29	-13	12	-23	15	-5	9
7	-21	15	-33	35	-9	21	-20	12	-24	14	-5	8
8	-44	41	-48	51	-14	58	-25	23	-45	30	-11	19
9	-15	24	-32	58	-16	2	-27	23	-22	32	-5	8
10	-39	46	-182	186	-62	15	-79	98	-70	124	-18	18
11	-26	46	-65	117	-31	5	-54	46	-44	63	-9	16
12	-71	86	-357	363	-100	21	-145	176	-127	228	-33	44
13	-15	25	-36	34	-6	10	-12	8	-12	4	-3	9
14	-22	25	-44	101	-7	31	-34	17	-38	21	-5	15
15	-28	46	-72	69	-10	22	-24	15	-24	8	-6	18
16	-43	47	-88	202	-14	62	-69	35	-76	42	-10	30
17	-3	3	-1	1	-2	0	0	0	0	0	-1	1

* Note a negative (-) normal stress is a compressive stress.

Table 32

Applied Loads

Load Case	Number Shoes	Shoe Spacing in.	Total FX kips	Total FZ kips	Total MYY in.-kips	Per Shoe FX kips	Per Shoe FZ kips	Per Shoe MYY in.-kips
1	12	50	50	-136	5,100	4.2	-11.3	425
2	12	50	50	-476	5,100	4.2	-39.7	425
3	12	50	100	-272	10,200	8.3	-22.7	850
4	12	50	100	-952	10,200	8.2	-79.3	850
5	12	50	50	75	5,100	4.2	6.2	425
6	12	50	50	225	5,100	4.2	18.8	425
7	12	50	100	150	10,200	8.3	12.5	850
8	12	50	100	450	10,200	8.3	37.5	850
9	6	50	50	-68	5,100	8.3	-11.3	850
10	6	50	50	-408	5,100	8.3	-68.0	850
11	6	50	100	-136	10,200	16.7	-22.7	1700
12	6	50	100	-816	10,200	16.7	-136.0	1700
13	6	50	50	38	5,100	8.3	6.2	850
14	6	50	50	188	5,100	8.3	31.2	850
15	6	50	100	75	10,200	16.7	12.5	1700
16	6	50	100	375	10,200	16.7	62.5	1700
17*	0	50	0		0	0		0

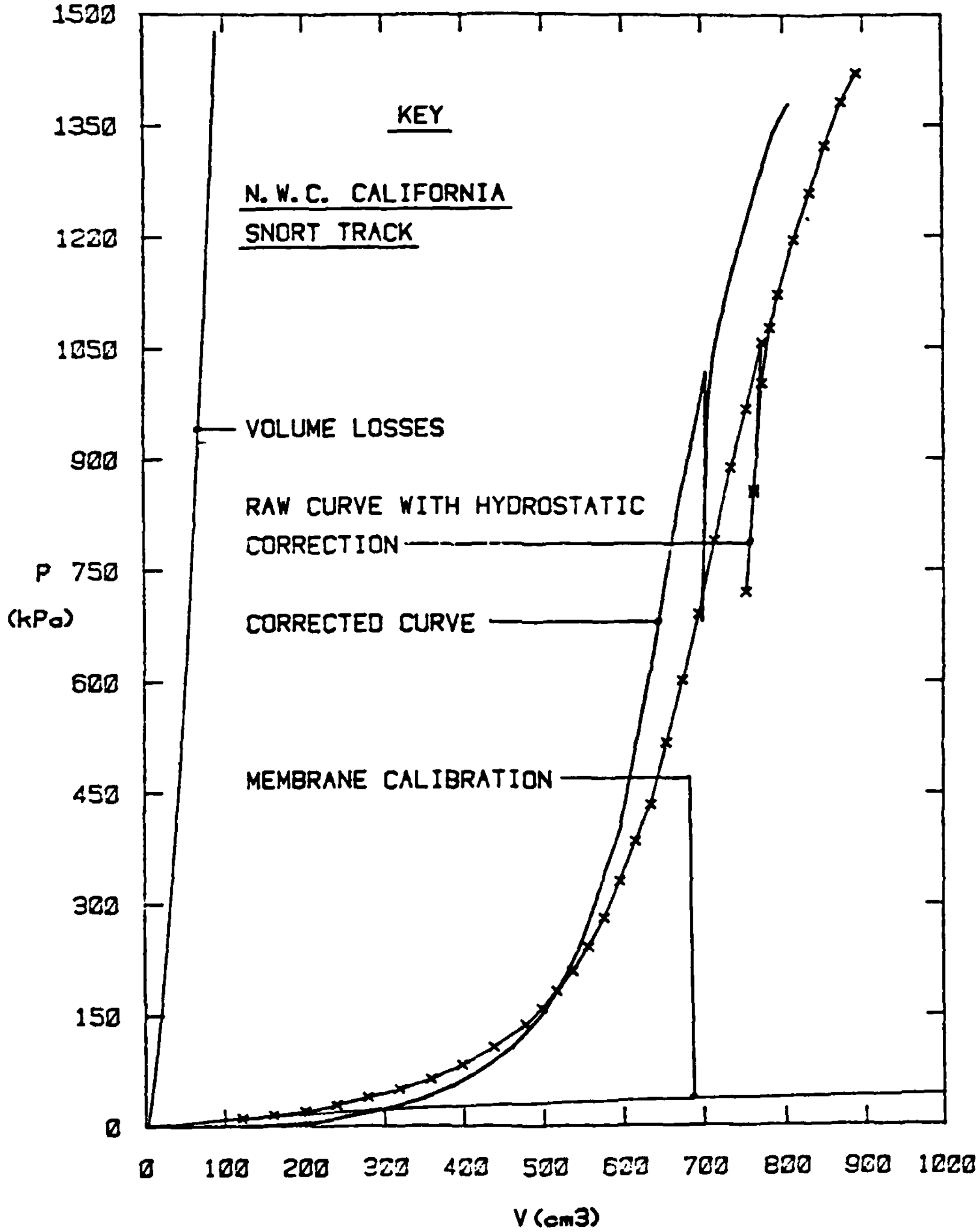
* Only weight of structure used in analysis.

Table 33

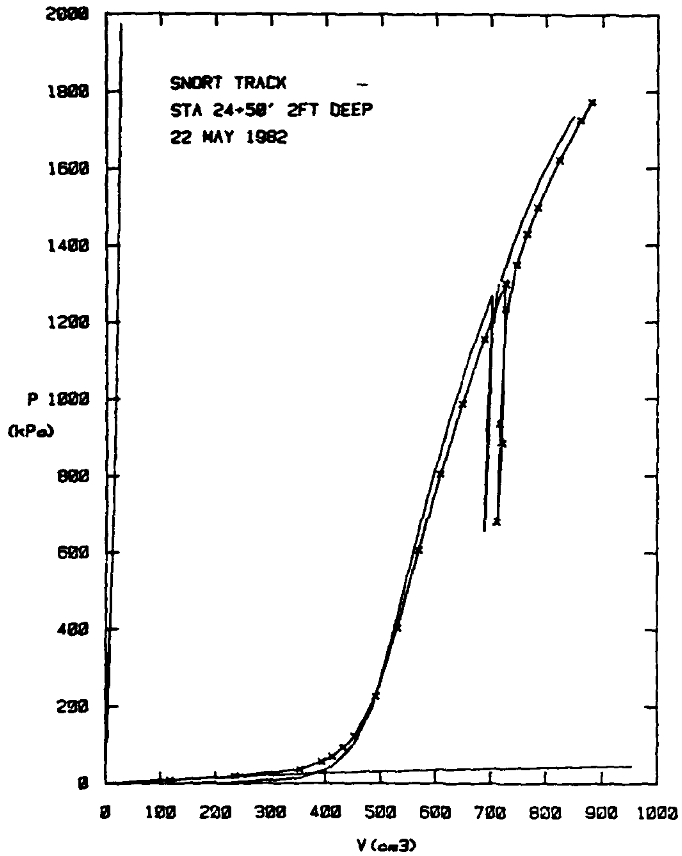
Deflections of Track at Center of Gravity of Sled Loads

Load Case	Finite-Element Analysis: Maximum Deflection Considering Twist in.	Finite-Element Analysis: Deflection at Center Line of Beam: Vertical in.	Transverse in.	Net in.	Beam on Elastic Foundation Analysis Deflection at Center Line of Beam: Vertical in.	Transverse in.	Net in.
1	-0.0342	-0.0249	0.0081	-0.0262	-0.0268	0.0077	-0.0279
2	-0.0624	-0.0572	0.0078	-0.0577	-0.0594	0.0077	-0.0599
3	-0.0551	-0.0372	0.0162	-0.0406	-0.0398	0.0155	-0.0427
4	-0.1110	-0.1018	0.0153	-0.1029	-0.1048	0.0155	-0.1059
5	-0.0188	-0.0049	0.0085	-0.0098	-0.0058	0.0077	-0.0096
6	0.0246	0.0093	0.0087	0.0127	0.0080	0.0077	0.0111
7	0.0309	0.0028	0.0168	0.0170	0.0010	0.0155	0.0155
8	0.0590	0.0313	0.0171	0.0357	0.0288	0.0155	0.0327
9	-0.0506	-0.0206	0.0117	-0.0237	--	--	--
10	-0.1650	-0.0664	0.0184	-0.0689	--	--	--
11	-0.0884	-0.0285	0.0233	-0.0368	--	--	--
12	-0.2870	-0.1091	0.0348	-0.1145	--	--	--
13	-0.0166	-0.0063	0.0097	-0.0116	--	--	--
14	0.0385	0.0139	0.0067	0.0154	--	--	--
15	-0.0251	-0.0001	0.0192	-0.0192	--	--	--
16	0.0906	0.0403	0.0133	0.0424	--	--	--
17	-0.0140	-0.0126	0.0002	-0.0126	-0.0138	0.000	-0.0138

APPENDIX A: PRESSURE METER TEST CURVES



KEY
N. W. C. CALIFORNIA
SNORT TRACK
VOLUME LOSSES
RAW CURVE WITH HYDROSTATIC
CORRECTION
CORRECTED CURVE
MEMBRANE CALIBRATION
P
(kPa)
V (cm3)
0
150
300
450
600
750
900
1050
1220
1350
1500
100
200
300
400
500
600
700
800
900
1000



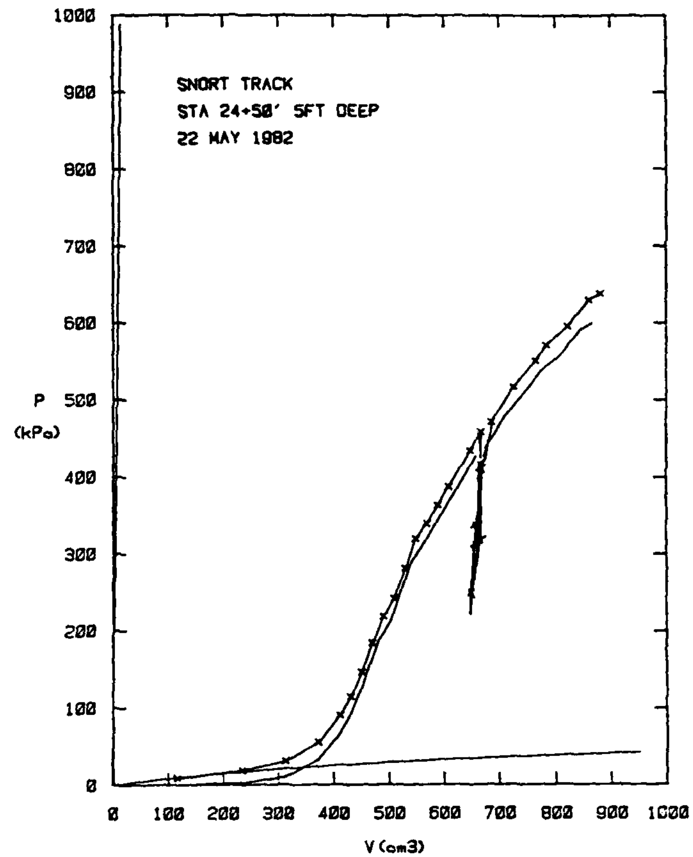
TEST NO. 1

HAND AUGERING ON TRACK CENTER LINE

E_o = 24100 kPa.

E_R = 201000 kPa.

P_L^* = 2400 kPa.



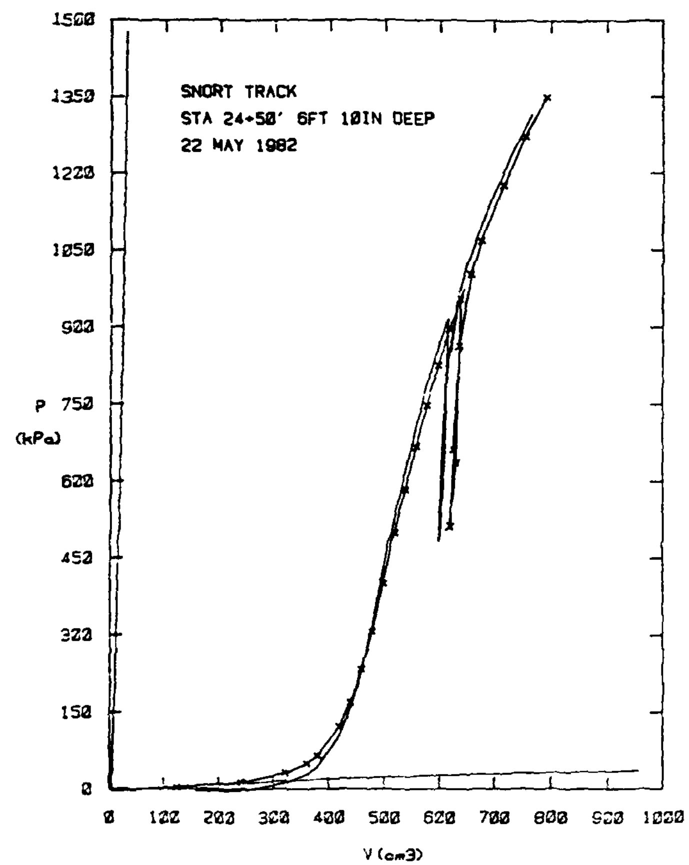
TEST NO. 2

HAND AUGERING ON TRACK CENTER LINE

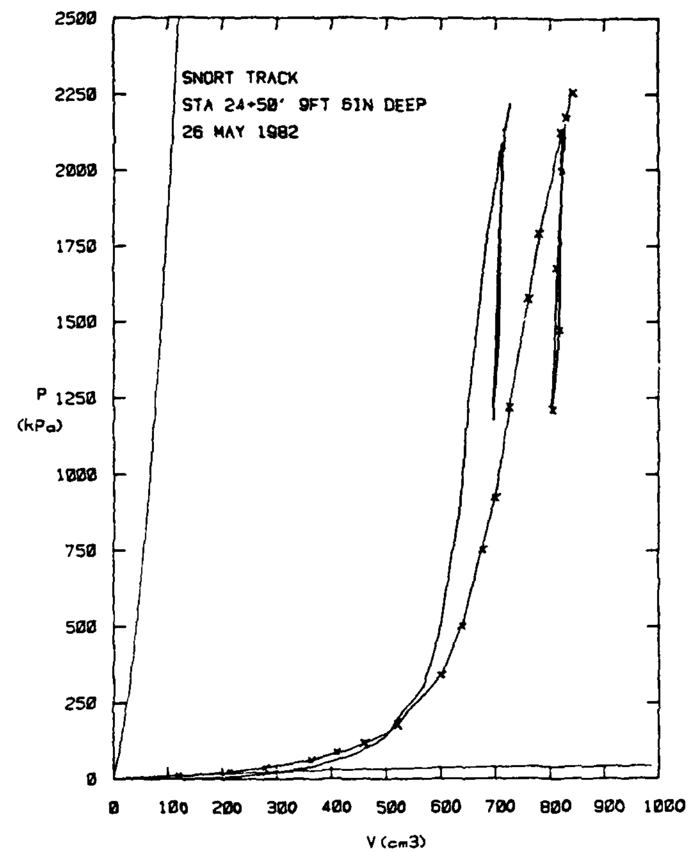
E_o = 7900 kPa.

E_R = 40500 kPa.

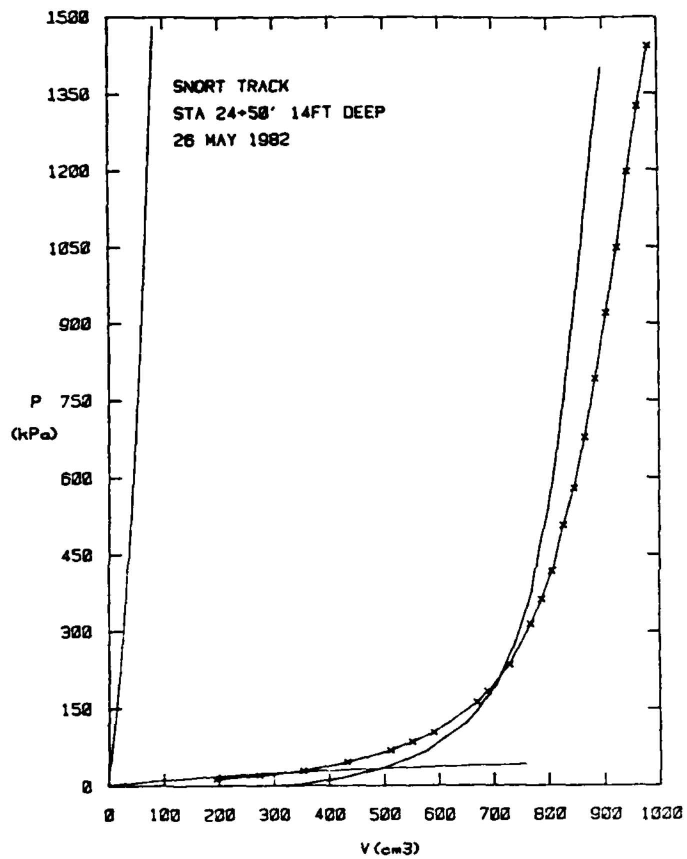
P_L^* = 700 kPa.



TEST NO. 3
HAND AUGERING ON TRACK CENTER LINE
E_o = 22200 kPa.
E_R = 107000 kPa.
P_L^* = 1950 kPa.



TEST NO. 4
HAND AUGERING ON TRACK CENTER LINE
E_o = 78400 kPa.
E_R = 251000 kPa.
P_L^* = 7840 kPa.



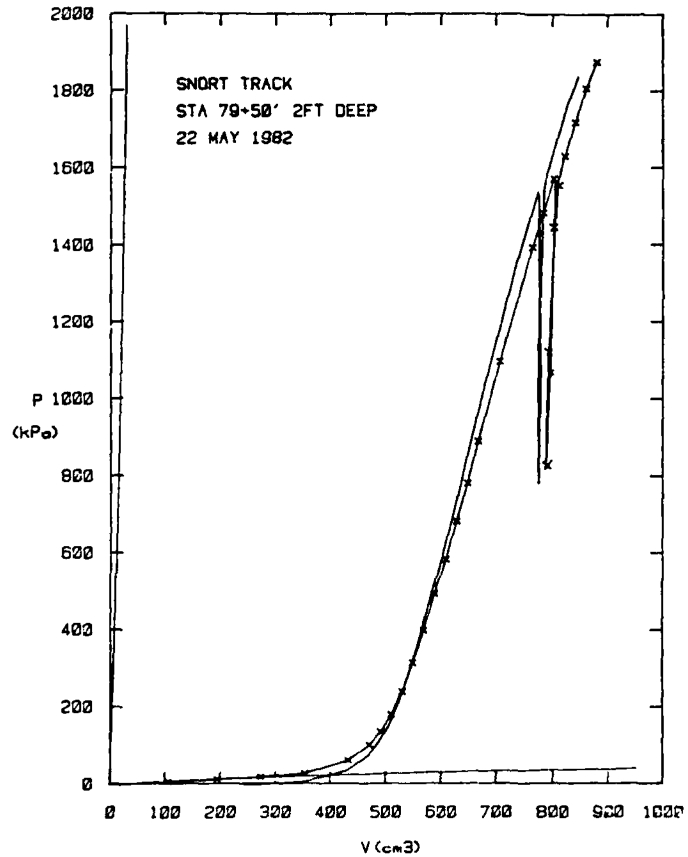
TEST NO. 5

HAND AUGERING ON TRACK CENTER LINE

E_o = 45600 kPa.

E_R = /

P_L^* = 4560 kPa.



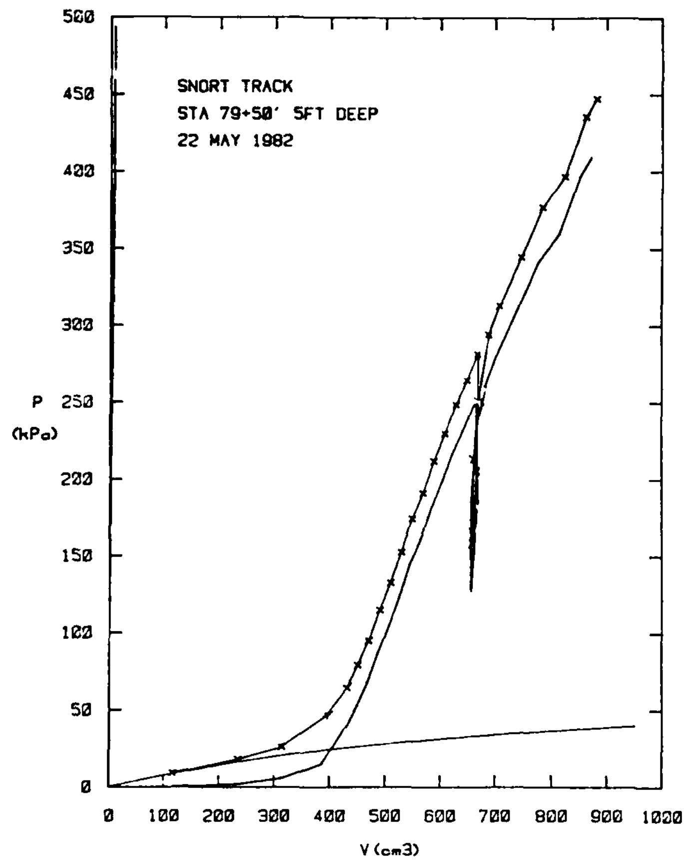
TEST NO. 6

HAND AUGERING ON TRACK CENTER LINE

E_o = 26100 kPa.

E_R = 944000 kPa.

P_L^* = 4000 kPa.



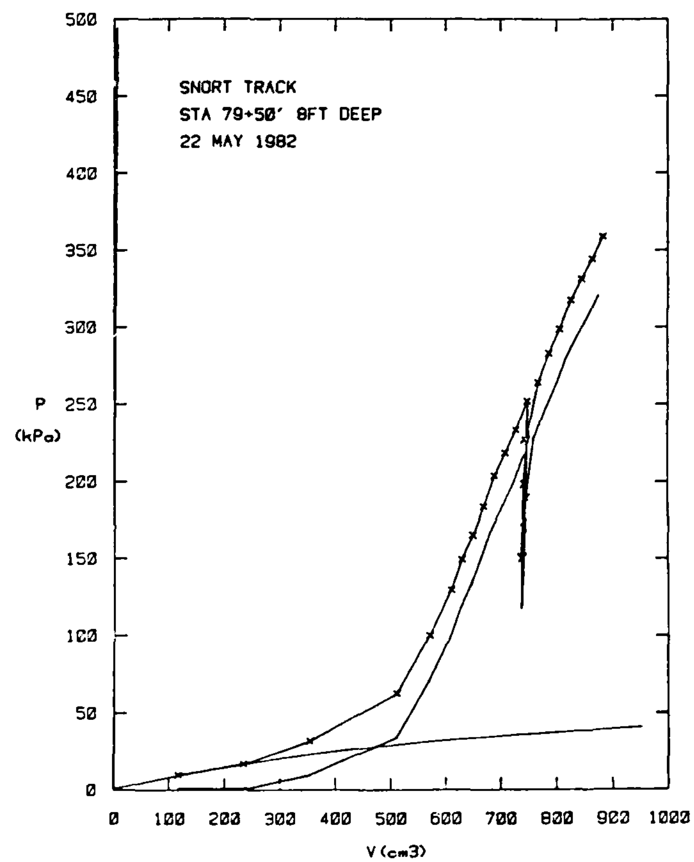
TEST NO. 7

HAND AUGERING ON TRACK CENTER LINE

E_o = 4300 kPa.

E_R = 40300 kPa.

P_L^* = 800 kPa.



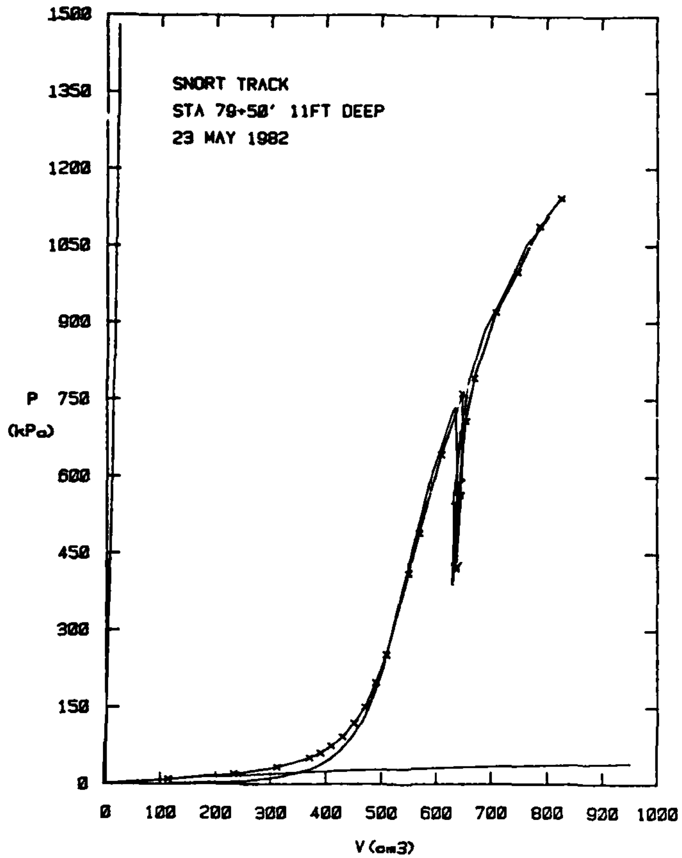
TEST NO. 8

HAND AUGERING, SLIGHT COLLAPSE OF HOLE, ON TRACK CENTER LINE

E_o = 4300 kPa.

E_R = 38800 kPa.

P_L^* = 680 kPa.



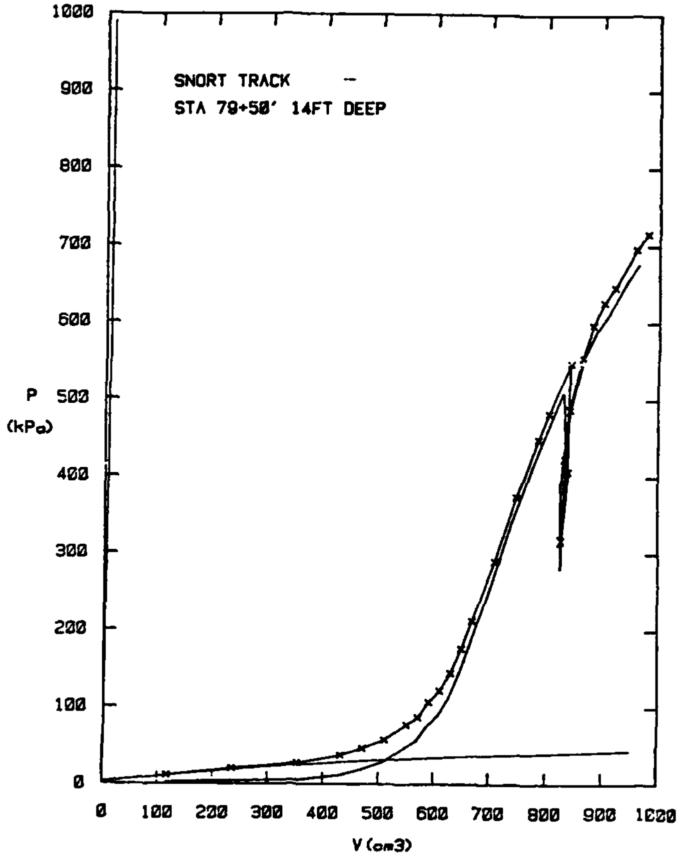
TEST NO. 9

HAND AUGERING, POSSIBLE SLIGHT COLLAPSE, ON TRACK CENTER LINE

E_o = 18500 kPa.

E_R = 109000 kPa.

P_L^* = 1500 kPa.



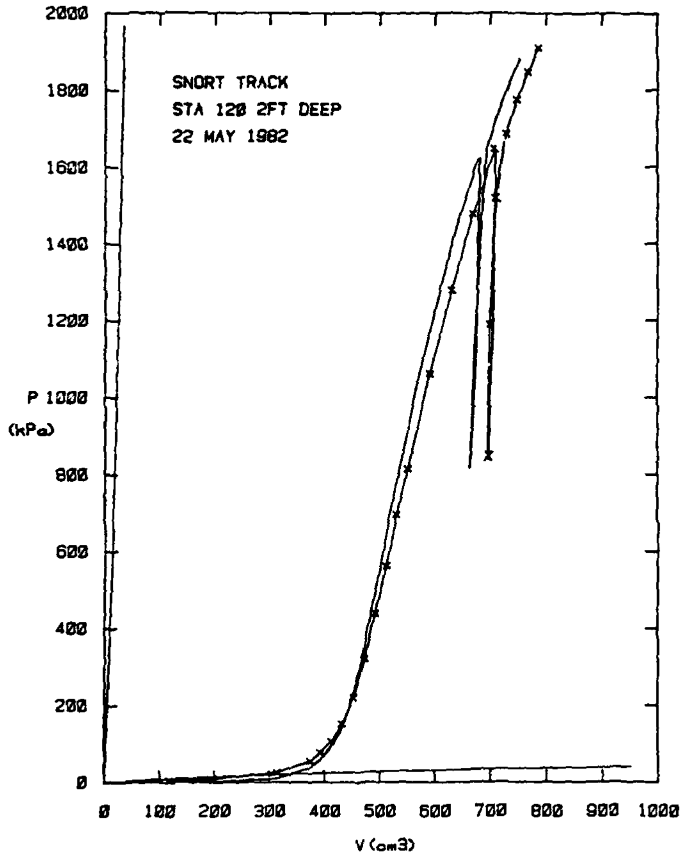
TEST NO. 10

HAND AUGERING ON TRACK CENTER LINE

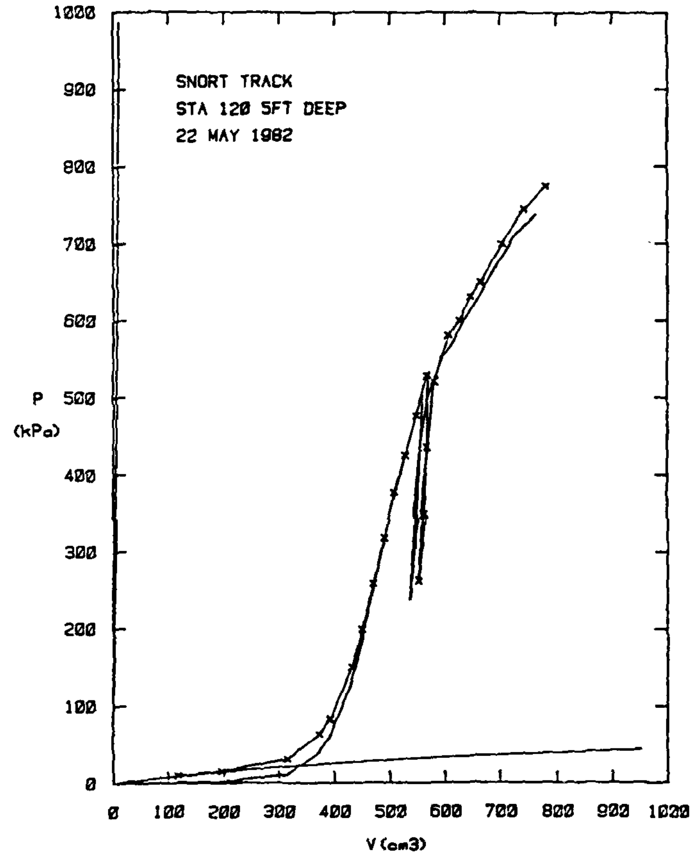
E_o = 10700 kPa.

E_R = 97600 kPa.

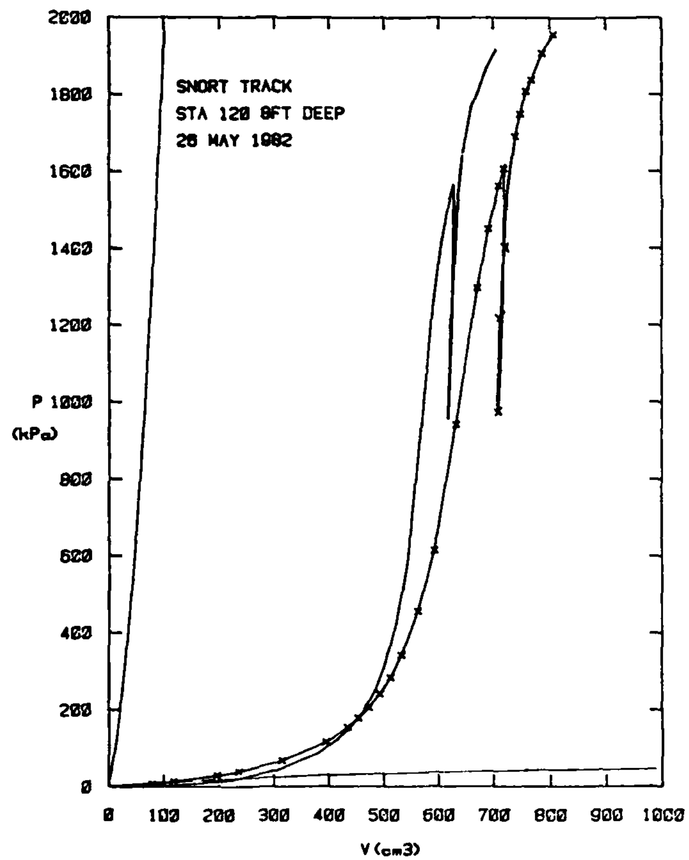
P_L^* = 1000 kPa.



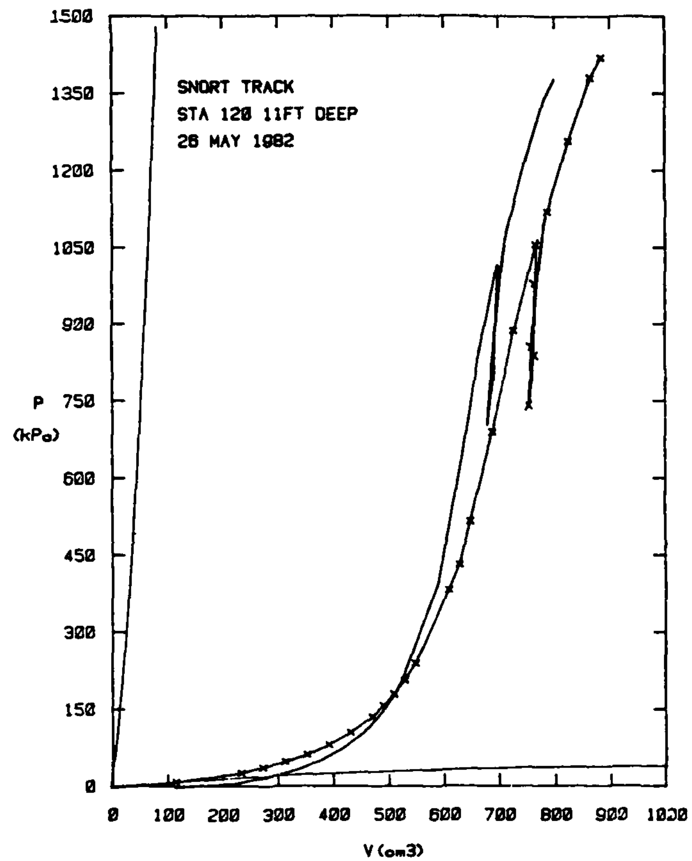
TEST NO. 11
HAND AUGERING ON TRACK CENTER LINE
E_o = 29500 kPa.
E_R = 162000 kPa.
P_L^* = 3000 kPa.



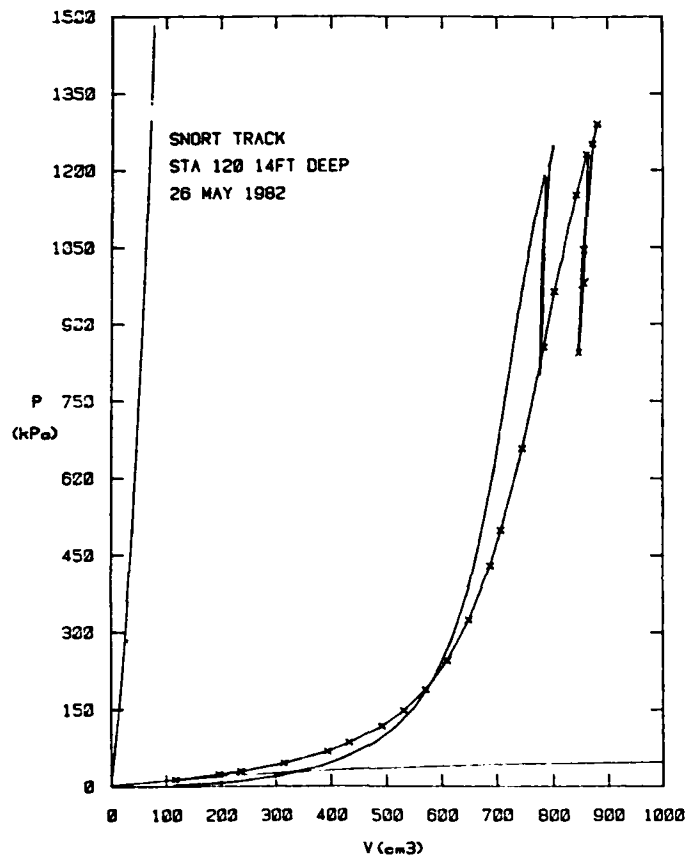
TEST NO. 12
HAND AUGERING ON TRACK CENTER LINE
E_o = 12800 kPa.
E_R = 48700 kPa.
P_L^* = 1000 kPa.



TEST NO. 13
SOME MACHINE AUGERING ON TRACK CENTER LINE
E_o = 59600 kPa.
E_R = 140000 kPa.
P_L^* = 2700 kPa.



TEST NO. 14
SOME MACHINE AUGERING ON TRACK CENTER LINE
E_o = 26300 kPa.
E_R = 60800 kPa.
P_L^* = 2100 kPa.



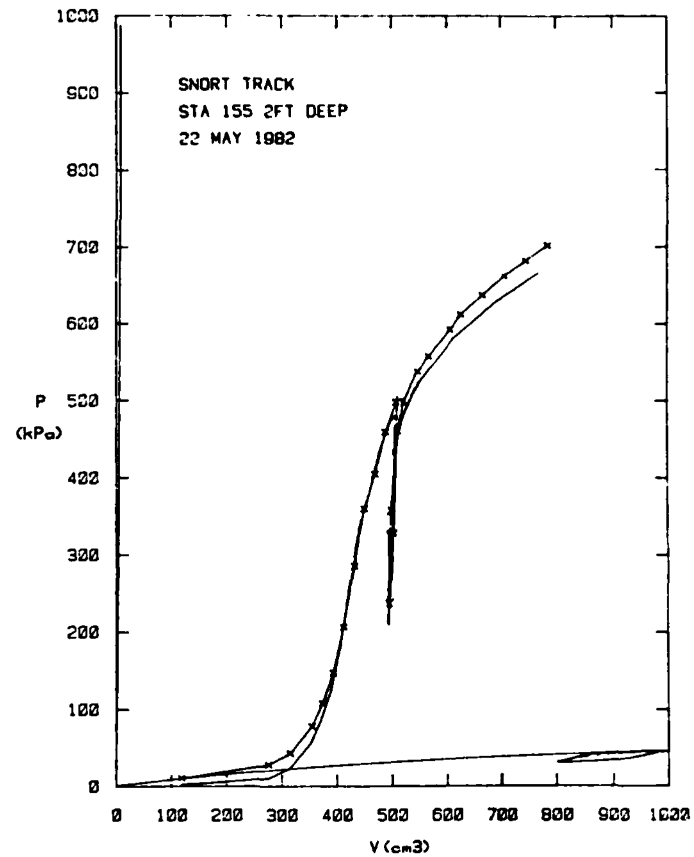
TEST NO. 15

SOME MACHINE AUGERING ON TRACK CENTER LINE

E_o = 31000 kPa.

E_R = 142000 kPa.

P_L^* = 3000 kPa.



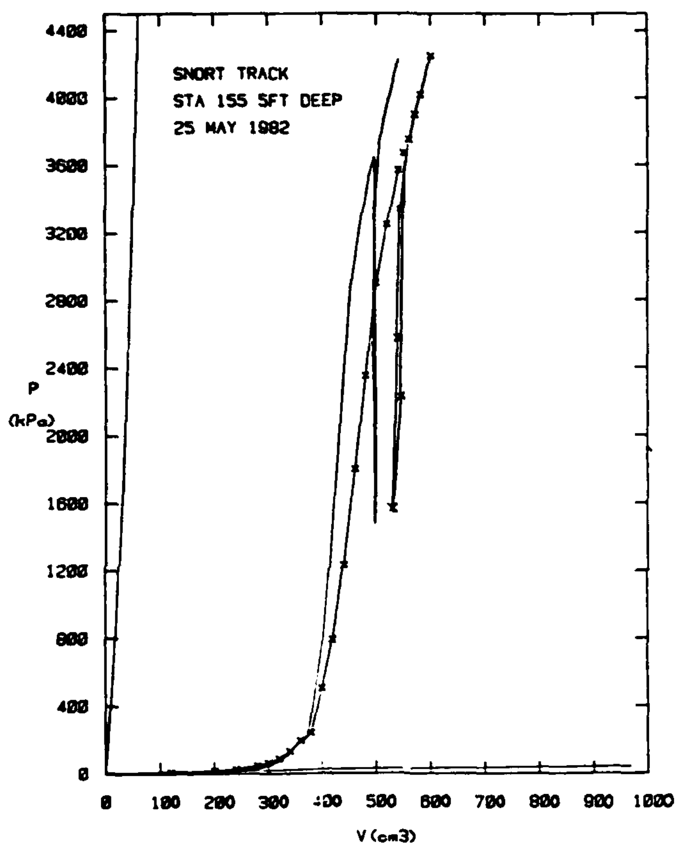
TEST NO. 16

HAND AUGERING ON TRACK CENTER LINE

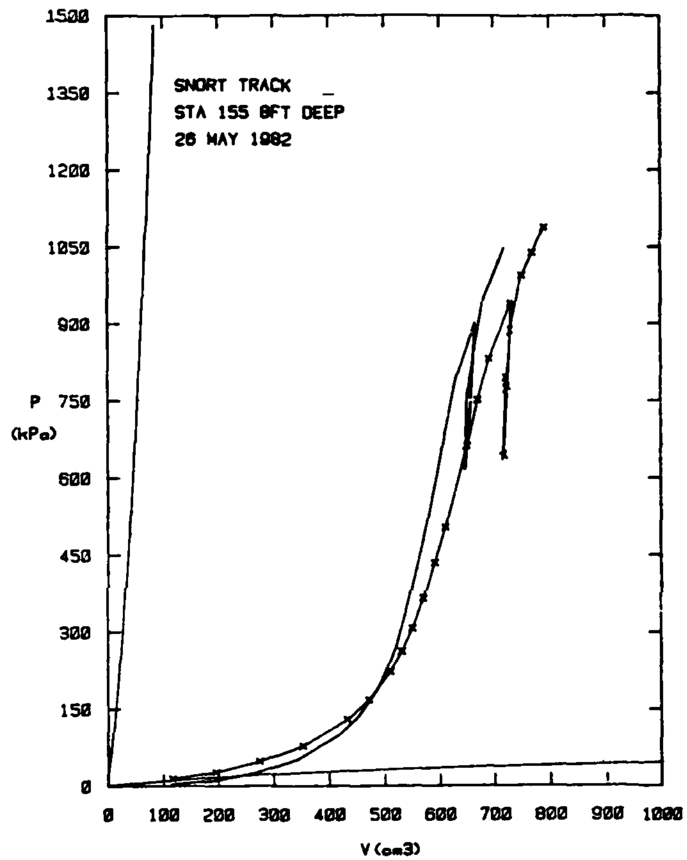
E_o = 16100 kPa.

E_R = 61900 kPa.

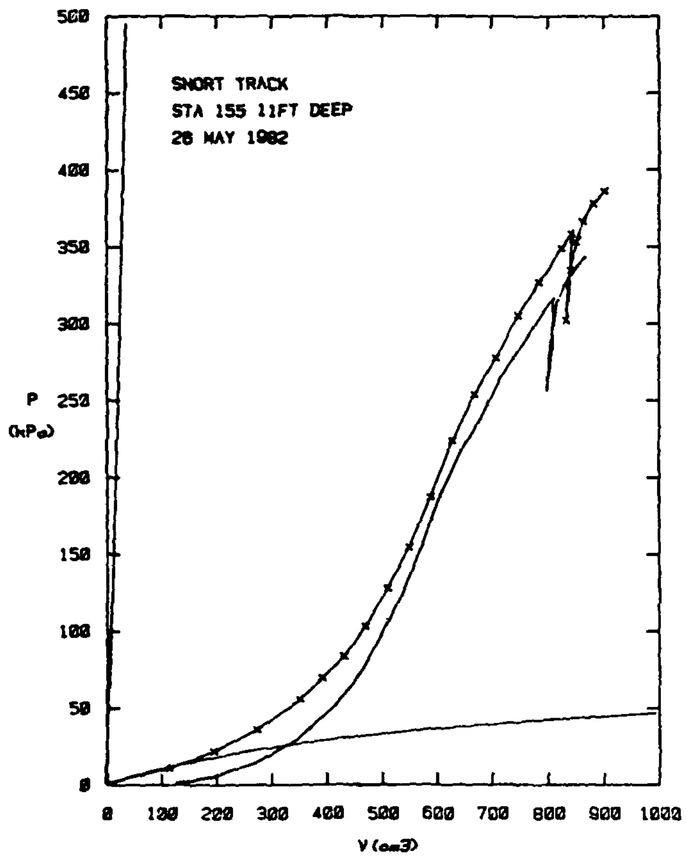
P_L^* = 850 kPa.



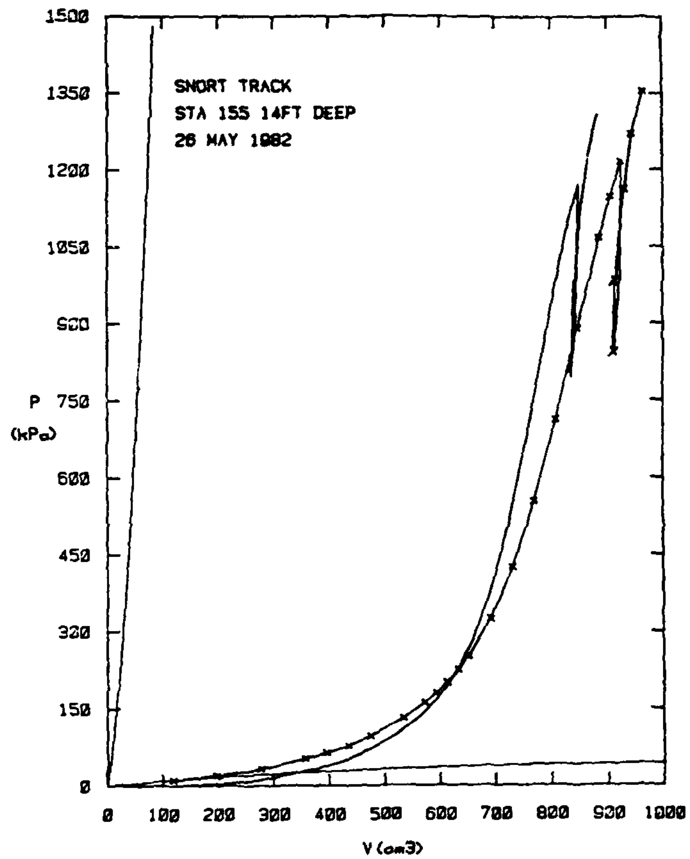
TEST NO. 17
HEAVY MACHINE AUGERING ON TRACK CENTER LINE
E_o = 172000 kPa.
E_R =
P_L^* = 8500 kPa.



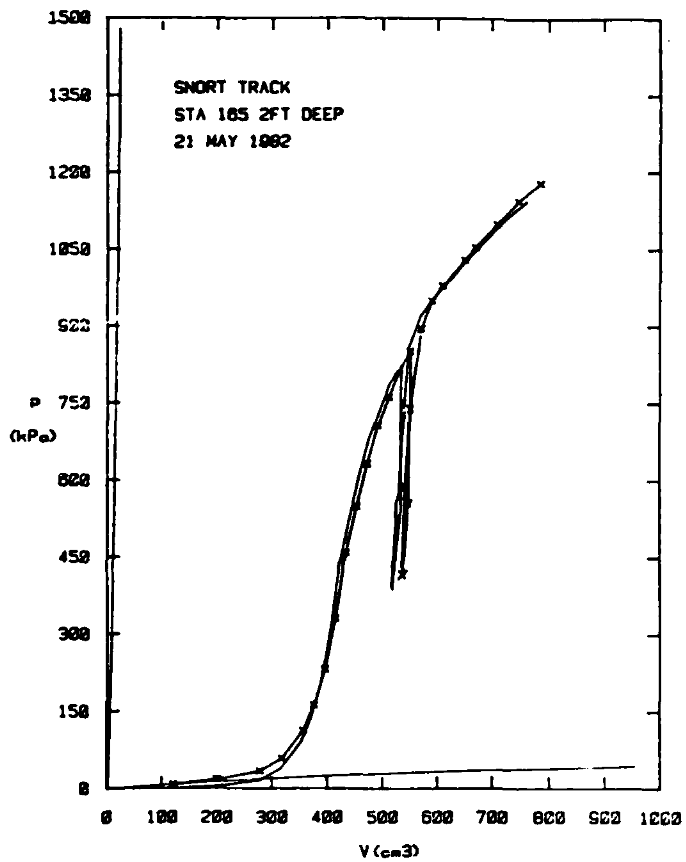
TEST NO. 18
HEAVY MACHINE AUGERING ON TRACK CENTER LINE. DISTURBANCE!
E_o = 22400 kPa.
E_R = 60000 kPa.
P_L^* = 1700 kPa.



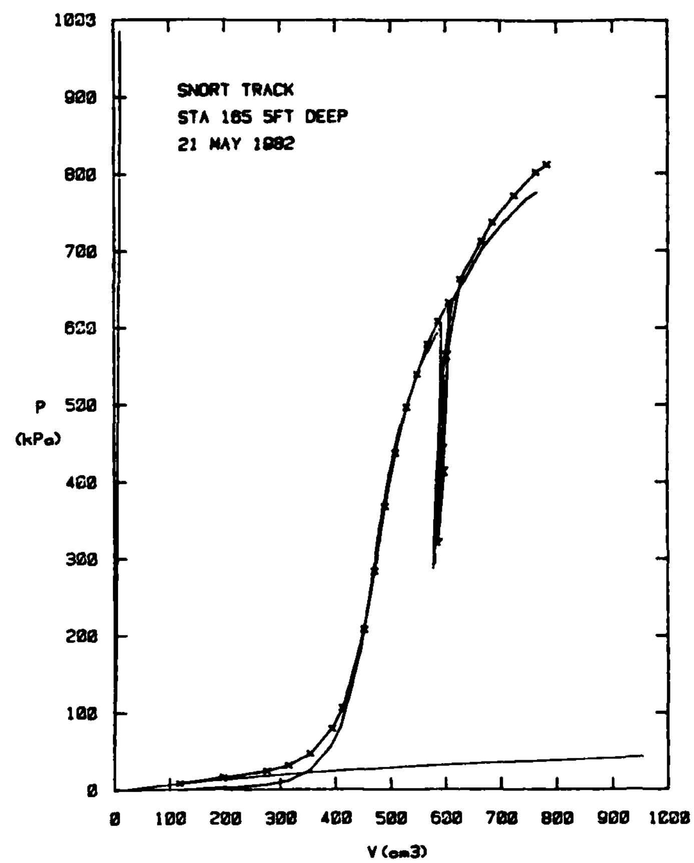
TEST NO. 19
HEAVY MACHINE AUGERING ON TRACK CENTER LINE. DISTURBANCE!
E_o = 4100 kPa.
E_R = 18400 kPa.
P^*_L = 500 kPa.



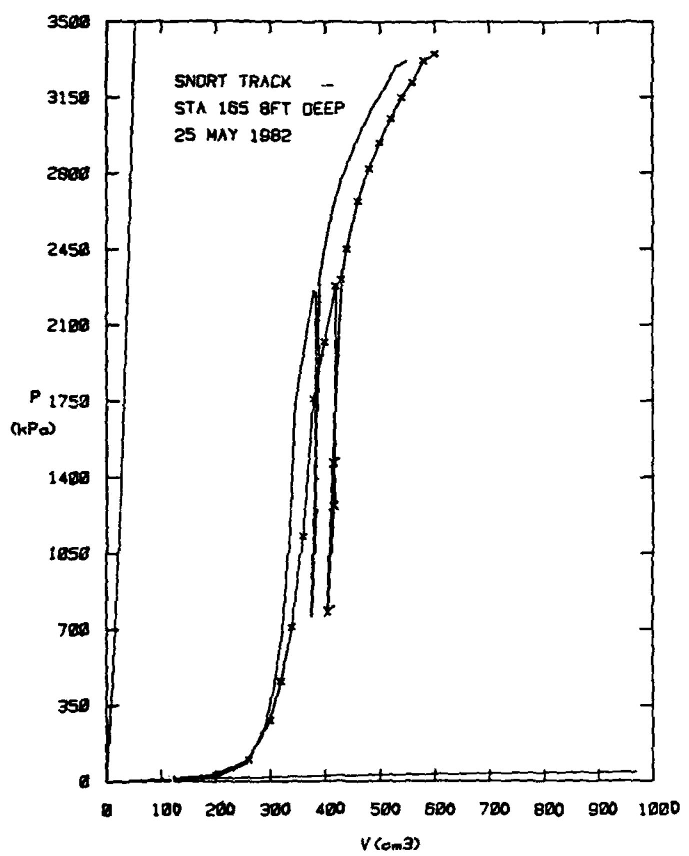
TEST NO. 20
HEAVY MACHINE AUGERING ON TRACK CENTER LINE. DISTURBANCE!
E_o = 26100 kPa.
E_R = 105000 kPa.
P^*_L = 3000 kPa.



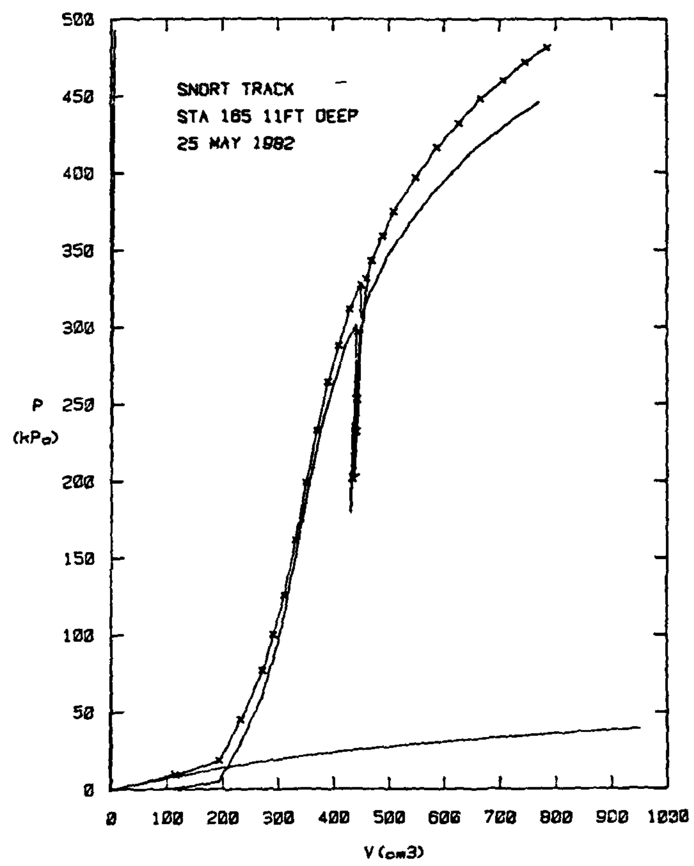
TEST NO. 21
HAND AUGERING ON TRACK CENTER LINE
E_o = 27200 kPa.
E_R = 68100 kPa.
P^*_L = 1500 kPa.



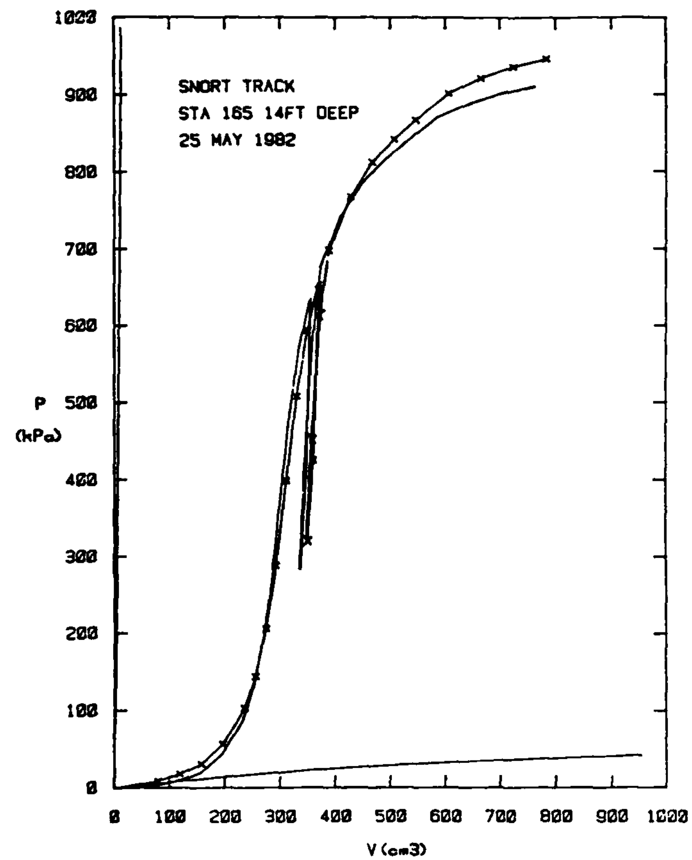
TEST NO. 22
HAND AUGERING ON TRACK CENTER LINE
E_o = 16200 kPa.
E_R = 65100 kPa.
P^*_L = 1000 kPa.



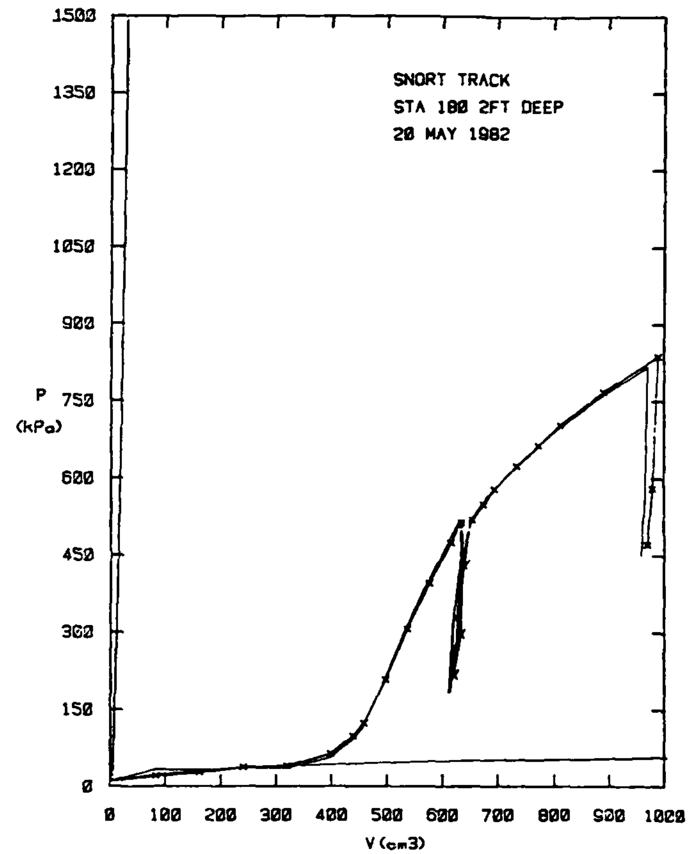
TEST NO. 23
HEAVY MACHINE AUGERING ON TRACK CENTER LINE.
HOLE SOAKED IN WATER OVERNIGHT.
E_o = 167000 kPa.
E_R = 430000 kPa.
P_L^* = 4000 kPa.



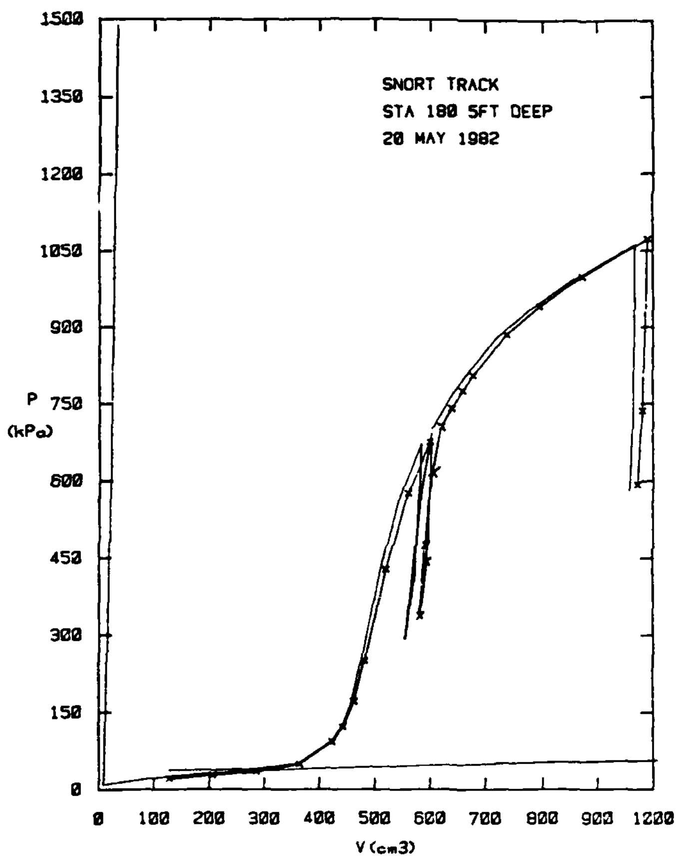
TEST NO. 24
LIGHT MACHINE AND HAND AUGERING ON TRACK CENTER LINE.
SOFT CLAY CUTTINGS.
E_o = 6800 kPa.
E_R = 25500 kPa.
P_L^* = 550 kPa.



TEST NO. 25
HAND AUGERING, STIFF CLAY CUTTINGS, ON TRACK CENTER LINE.
E_o = 21200 kPa.
E_R = 55300 kPa.
P_L^* = 900 kPa.



TEST NO. 26
HAND AUGERING ON TRACK CENTER LINE.
E_o = 11100 kPa.
E_R = 53000 kPa.
P_L^* = 1050 kPa.



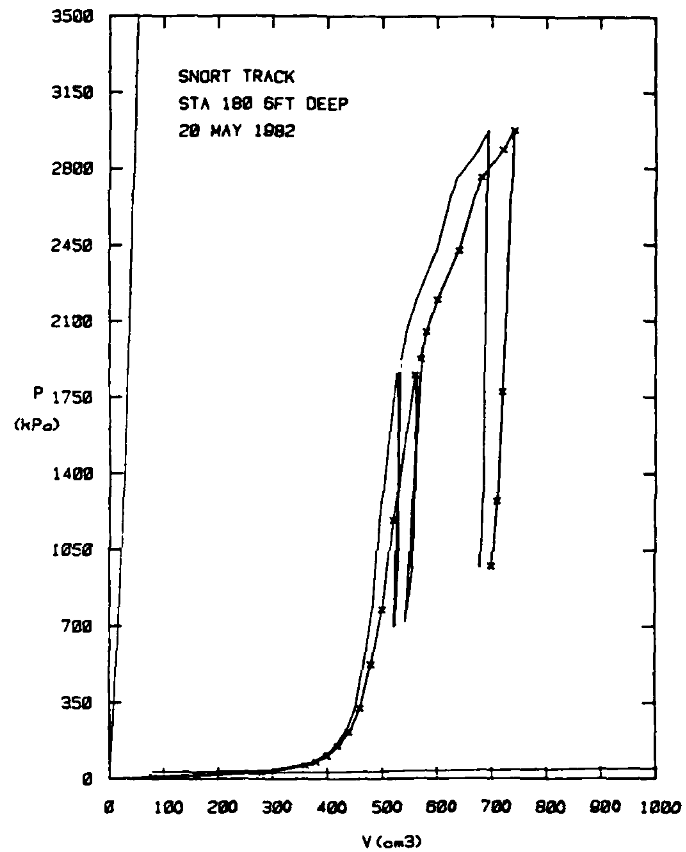
TEST NO. 27

HAND AUGERING ON TRACK CENTER LINE.

E_o = 20000 kPa.

E_R = 41300 kPa.

P_L^* = 1300 kPa.



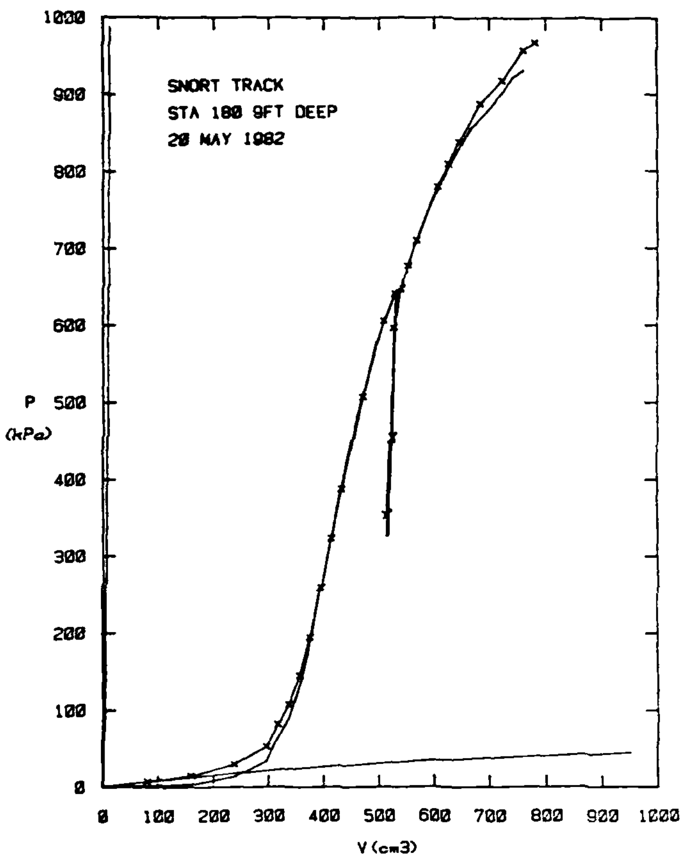
TEST NO. 28

HAND AUGERING OFF TRACK CENTER LINE.

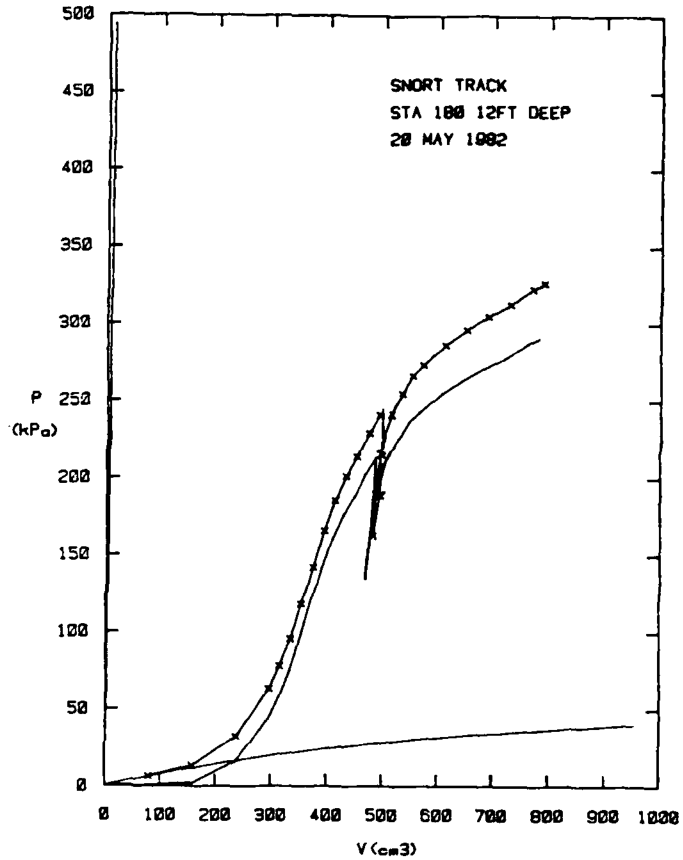
E_o = 101000 kPa.

E_R = 407000 kPa.

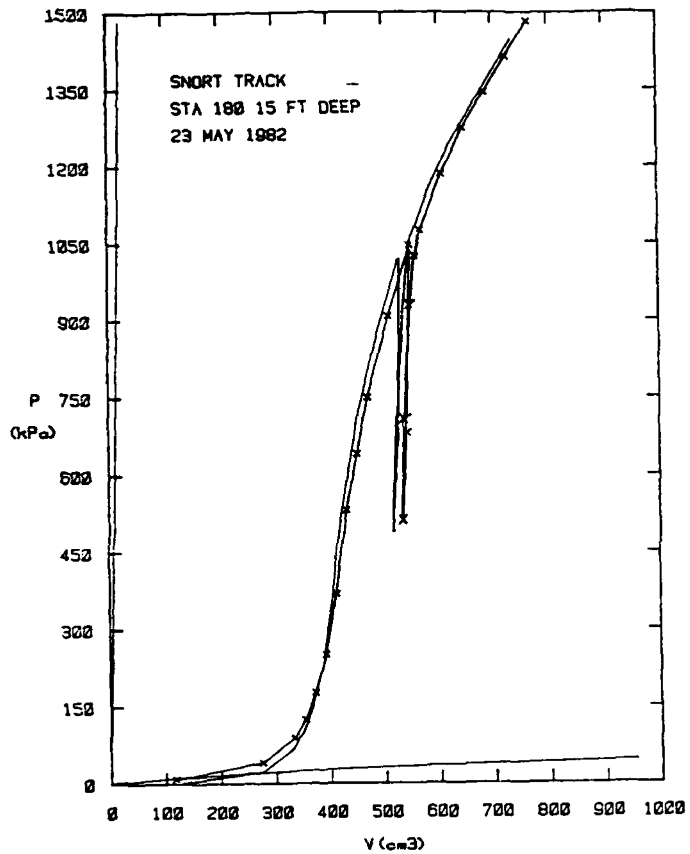
P_L^* = 4500 kPa.



TEST NO. 29
MAINLY HAND AUGERING OFF TRACK CENTER LINE.
SOME MACHINE AUGERING.
E_o = 13400 kPa.
E_R = 73700 kPa.
P_L^* = 1200 kPa.



TEST NO. 30
HAND AUGERING OFF TRACK CENTER LINE.
E_o = 4600 kPa.
E_R = 12100 kPa.
P_L^* = 320 kPa.



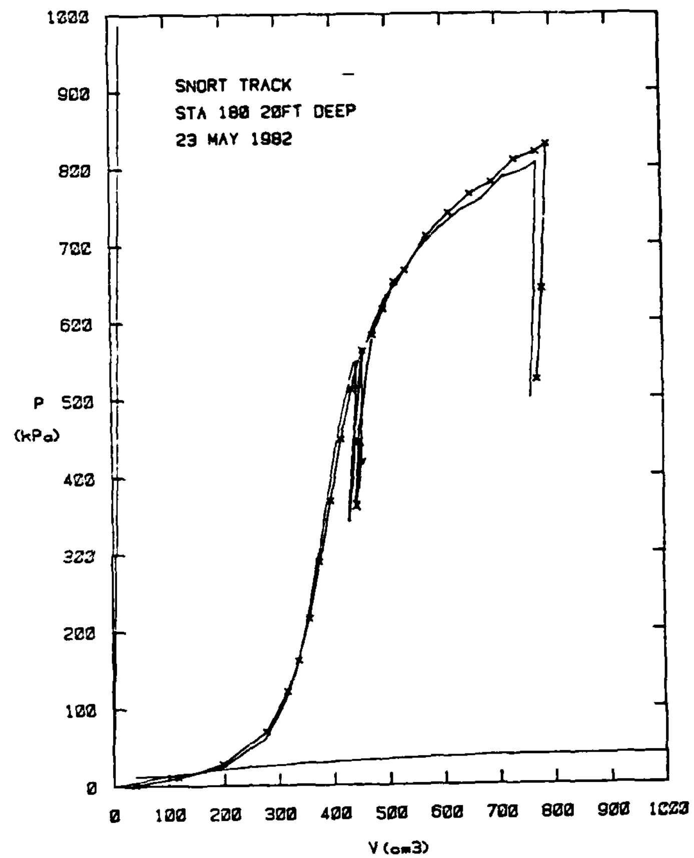
TEST NO. 31

HAND AUGERING OFF TRACK CENTER LINE.

E_o = 37100 kPa.

E_R = 110000 kPa.

P_L^* = 2300 kPa.



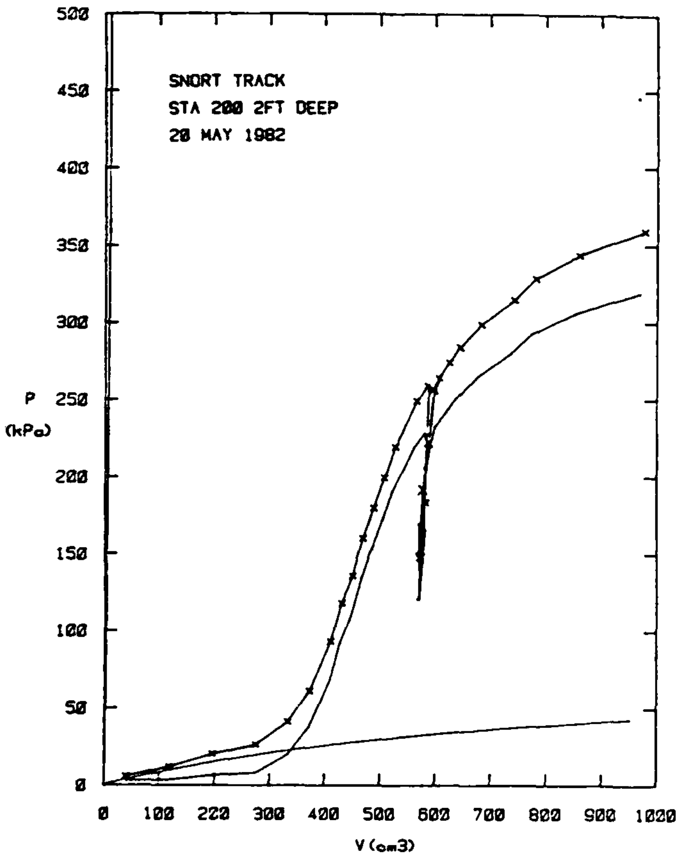
TEST NO. 32

HAND AUGERING, CLAY CUTTINGS, OFF TRACK CENTER LINE.

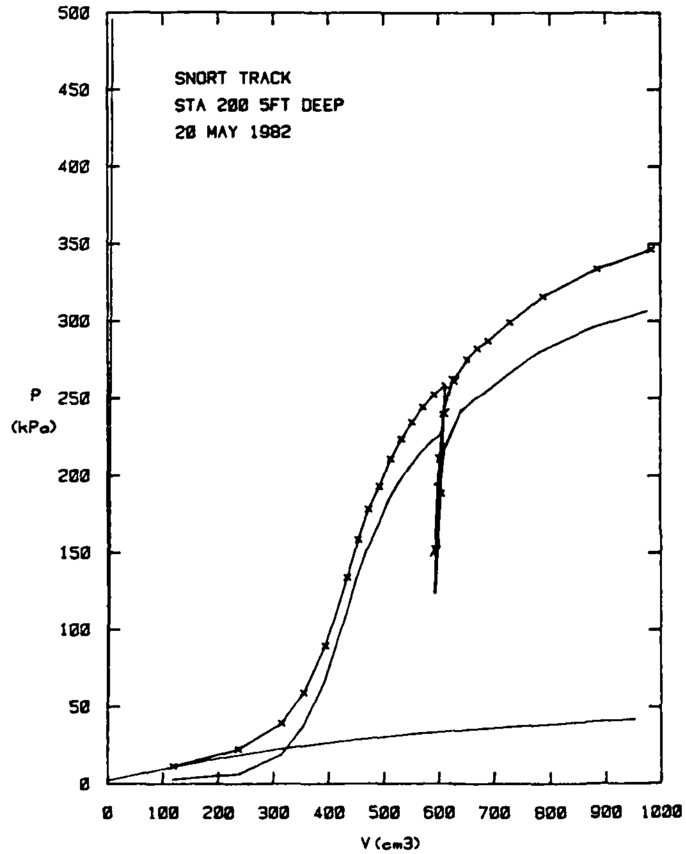
E_o = 16400 kPa.

E_R = 45200 kPa.

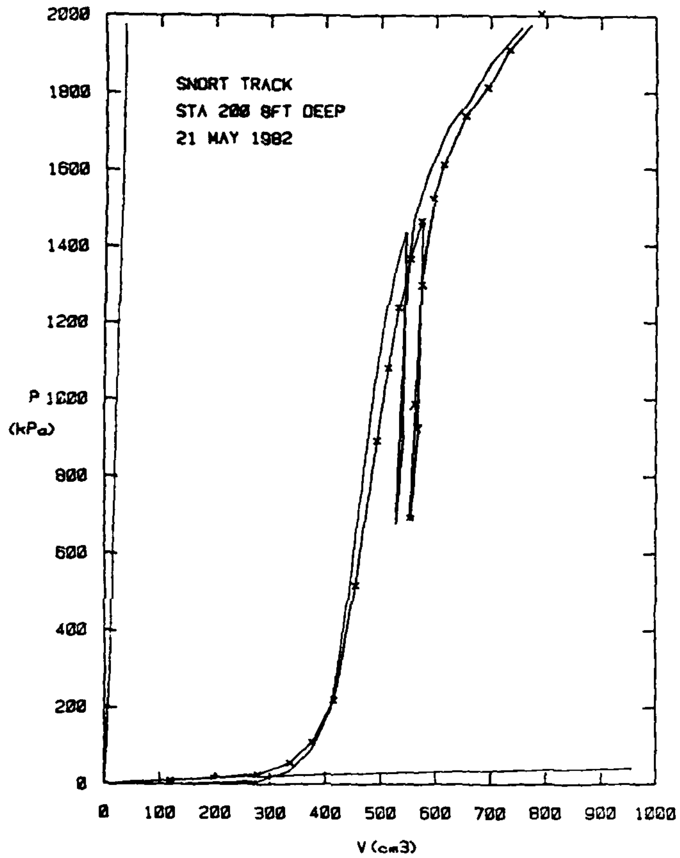
P_L^* = 850 kPa.



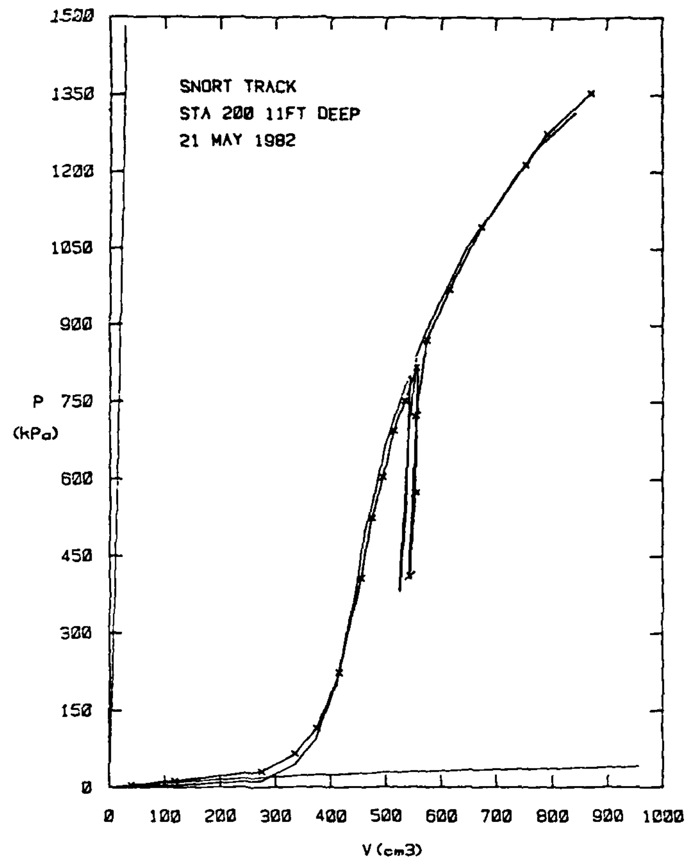
TEST NO. 33
HAND AUGERING ON TRACK CENTER LINE.
E_o = 4700 kPa.
E_R = 32500 kPa.
P_L^* = 330 kPa.



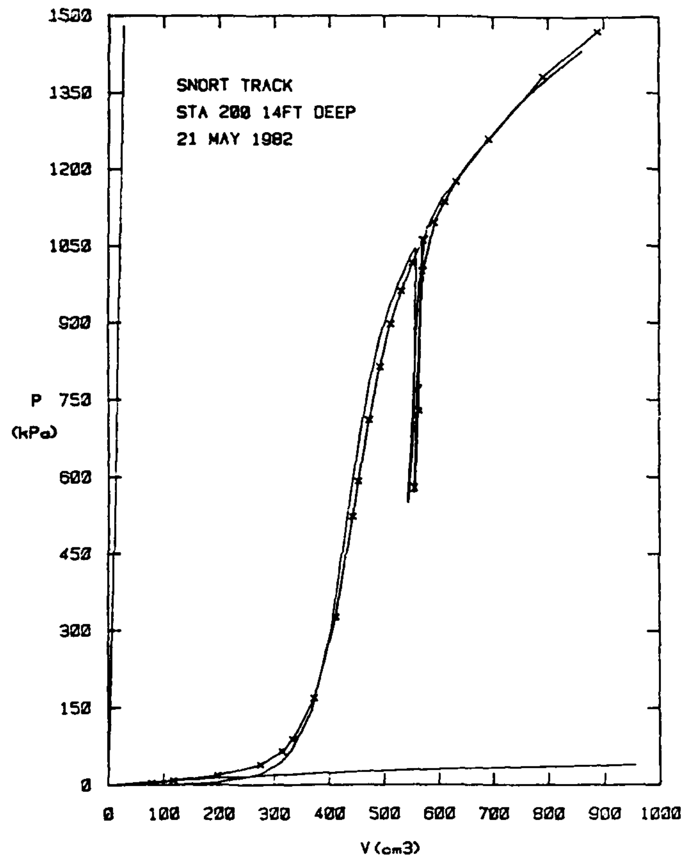
TEST NO. 34
HAND AUGERING OFF TRACK CENTER LINE.
E_o = 4800 kPa.
E_R = 28600 kPa.
P_L^* = 350 kPa.



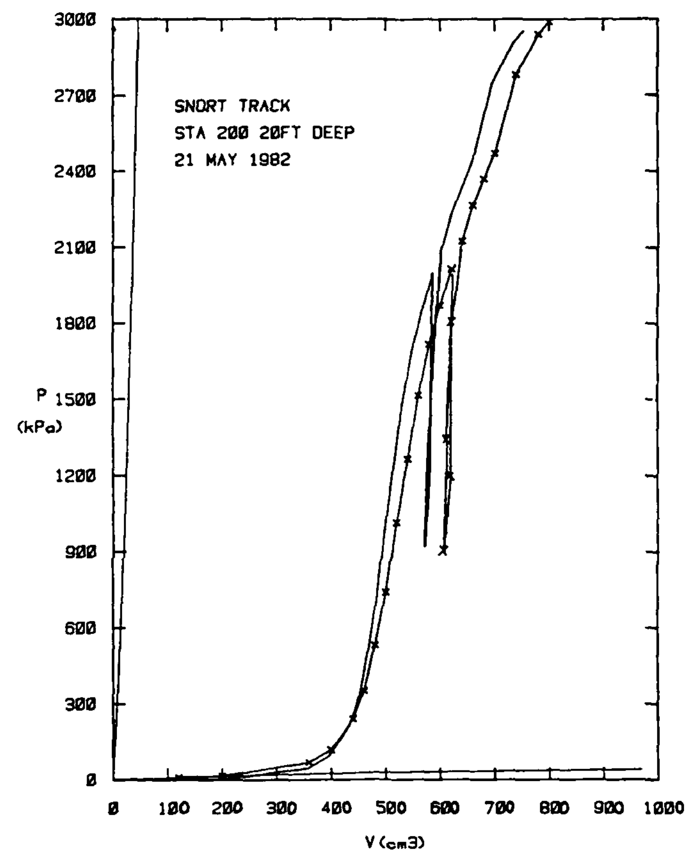
TEST NO. 35
HAND AUGERING OFF TRACK CENTER LINE.
E_o = 46500 kPa.
E_R = 163000 kPa.
P_L^* = 2600 kPa.



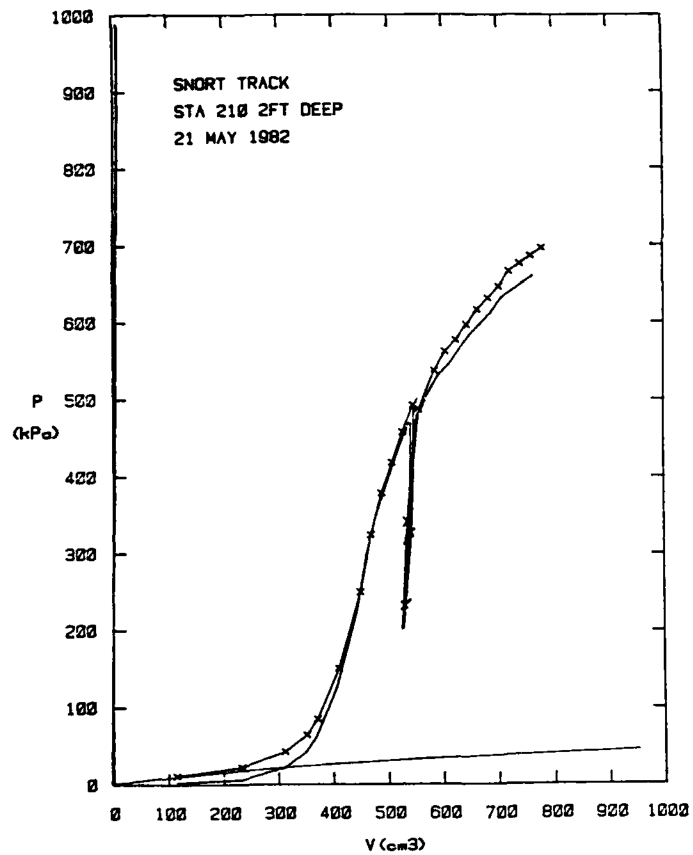
TEST NO. 36
HAND AUGERING OFF TRACK CENTER LINE.
E_o = 21400 kPa.
E_R = 76800 kPa.
P_L^* = 1700 kPa.



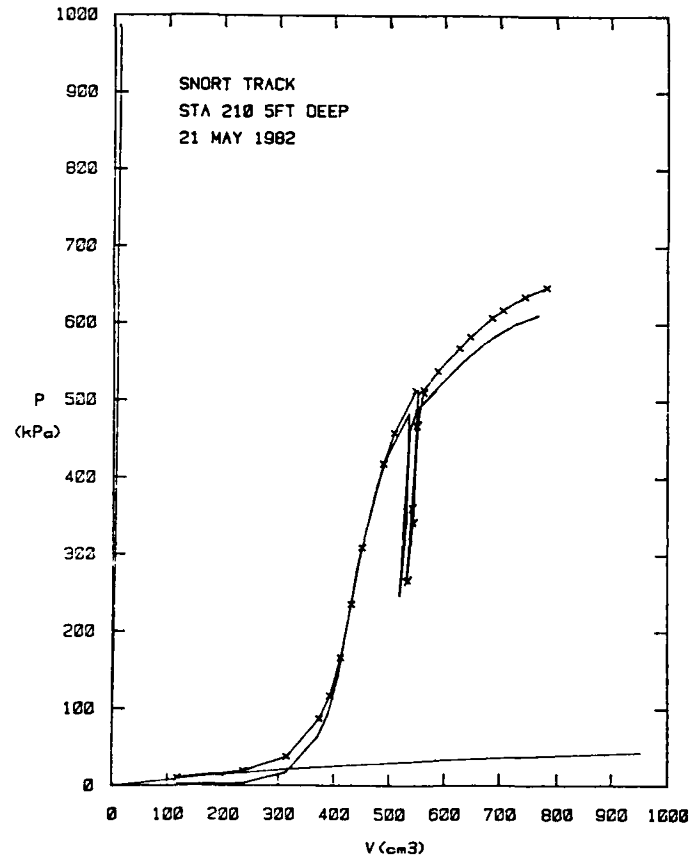
TEST NO. 37
HAND AUGERING OFF TRACK CENTER LINE.
E_o = 28400 kPa.
E_R = 88600 kPa.
P_L^* = 1800 kPa.



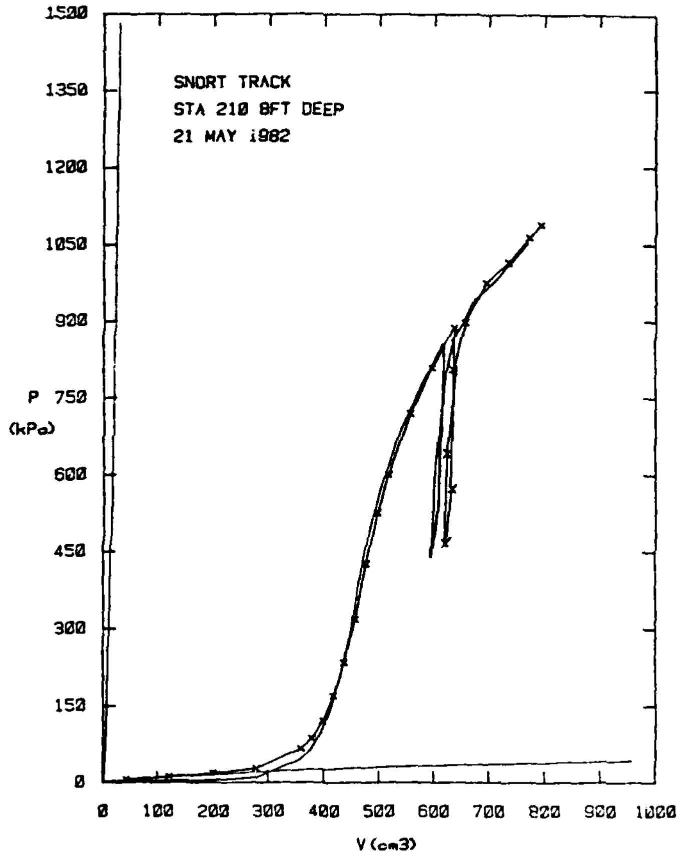
TEST NO. 38
HAND AUGERING OFF TRACK CENTER LINE.
E_o = 64300 kPa.
E_R = 194000 kPa.
P_L^* = 5500 kPa.



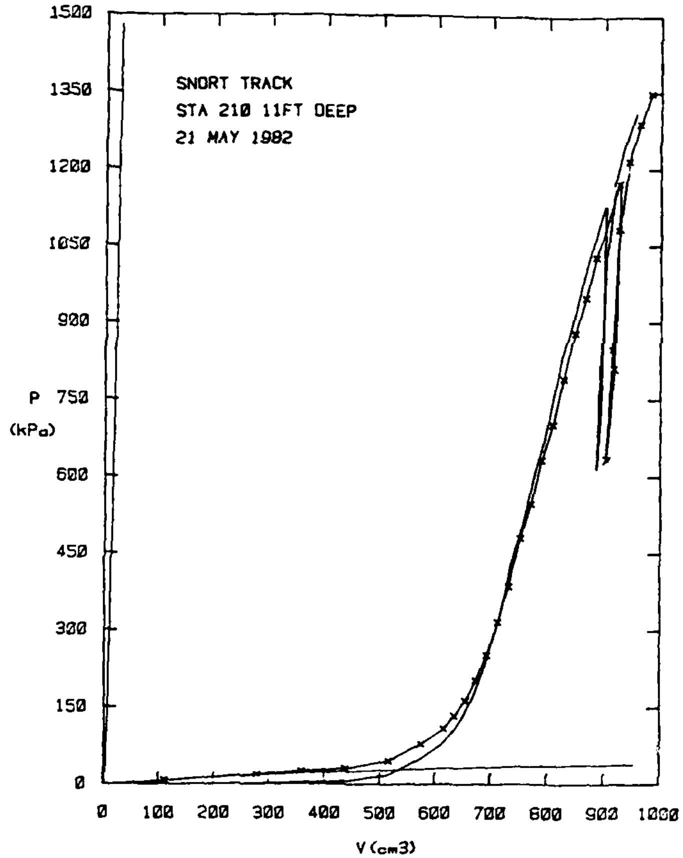
TEST NO. 39
HAND AUGERING ON TRACK CENTER LINE.
E_o = 13300 kPa.
E_R = 51500 kPa.
P^*_L = 750 kPa.



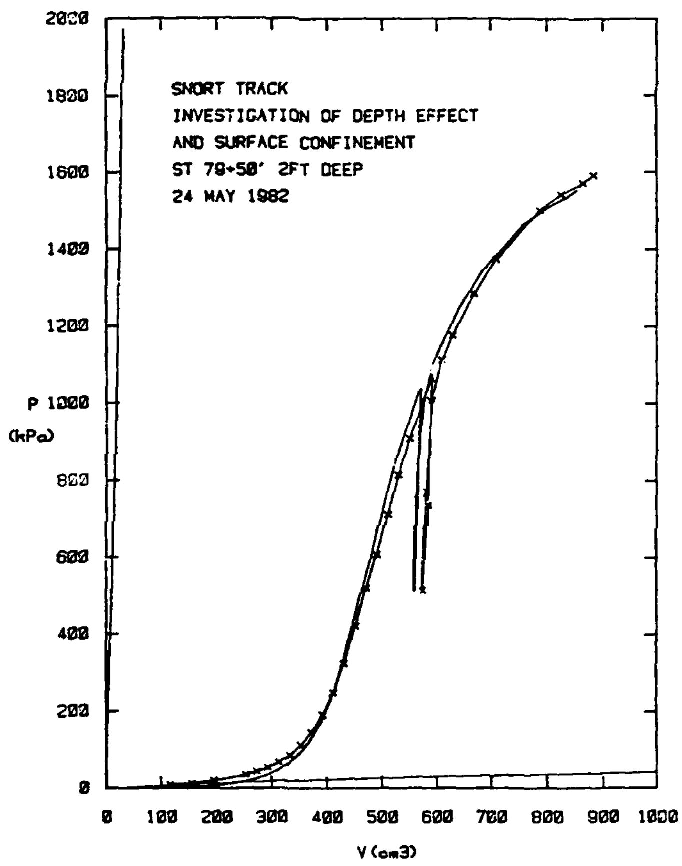
TEST NO. 40
HAND AUGERING ON TRACK CENTER LINE.
E_o = 15900 kPa.
E_R = 51200 kPa.
P^*_L = 670 kPa.



TEST NO. 41
HAND AUGERING ON TRACK CENTER LINE.
E_o = 23800 kPa.
E_R = 67600 kPa.
P^*_L = 1500 kPa.



TEST NO. 42
HAND AUGERING, HOLE COLLAPSING, ON TRACK CENTER LINE.
E_o = 21200 kPa.
E_R = 151200 kPa.
P^*_L = 2500 kPa.

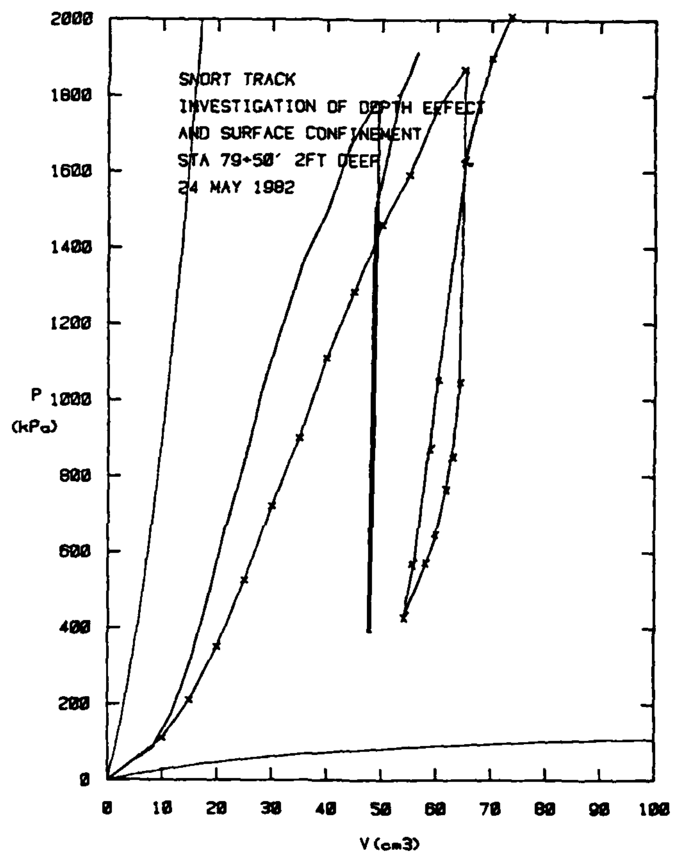


TEST NO. 43 HAND AUGERING OFF TRACK

E_o = 22600 kPa.

E_R = 185000 kPa.

P_L^* = 1750 kPa.



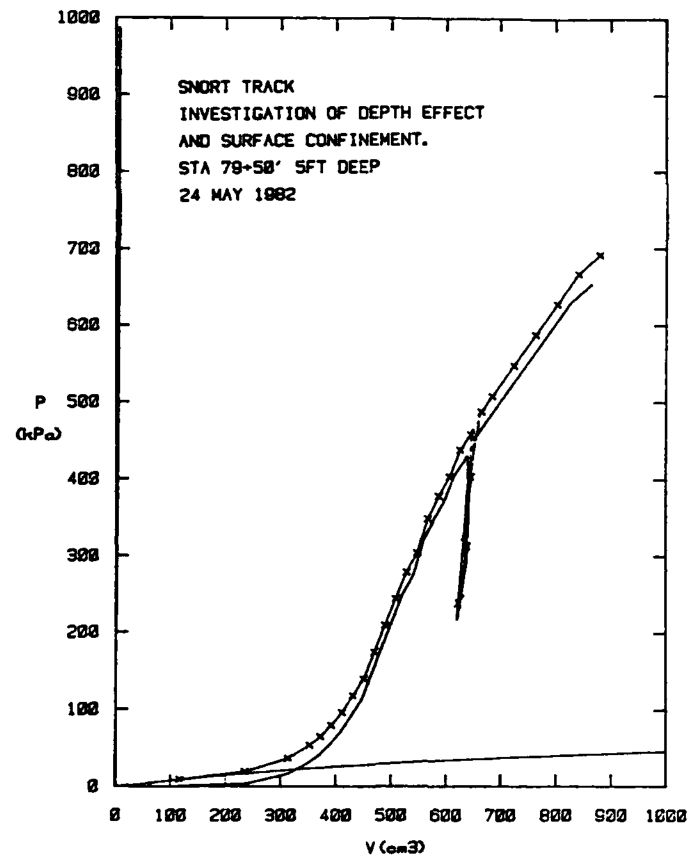
TEST NO. 44

HAND AUGERING OFF TRACK - 32 mm. PROBE.

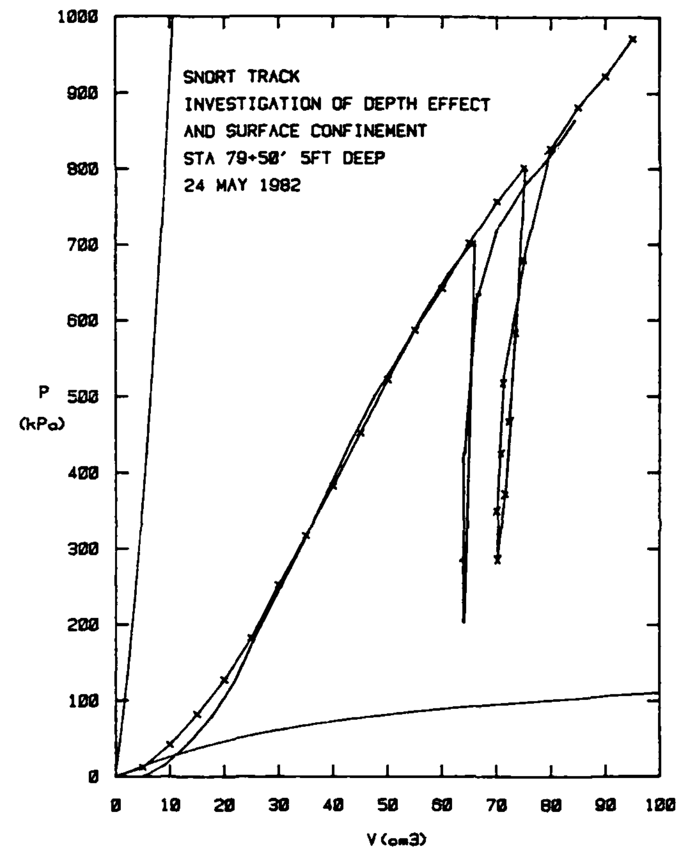
E_o = 33800 kPa.

E_R = 442000 kPa.

P_L^* = 2600 kPa.



TEST NO. 45
HAND AUGERING OFF TRACK
E_o = 8200 kPa.
E_R = 170000 kPa.
P^*_L = 1300 kPa.



TEST NO. 46
HAND AUGERING OFF TRACK - 32 mm. PROBE.
E_o = 9700 kPa.
E_R = 157000 kPa.
P^*_L = 1400 kPa.

APPENDIX B: ANALYSIS OF EXISTING TRACK UNDER DESIGN LOADS

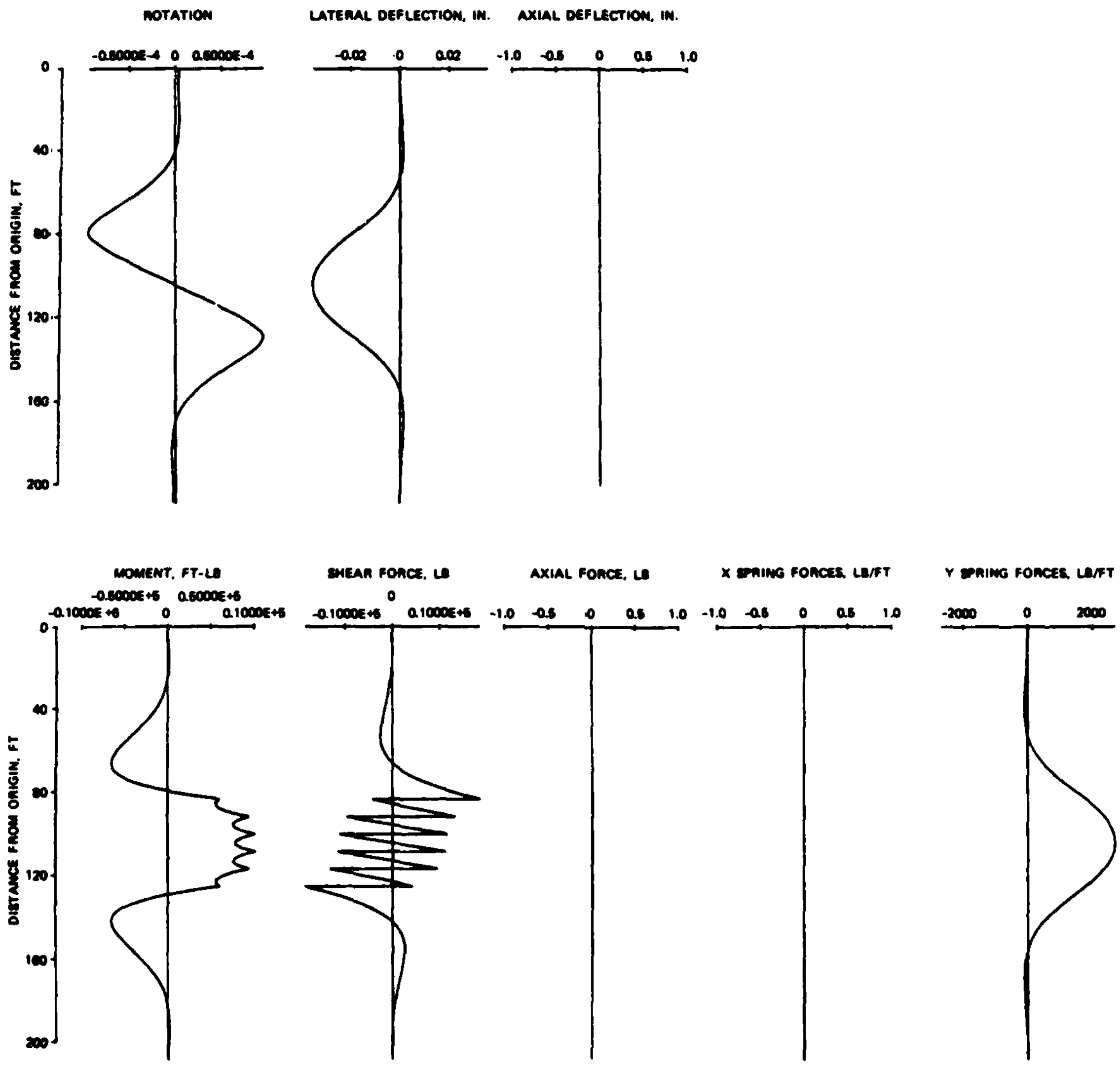


Figure B1. Axial deflection, lateral deflection, and rotation; K = 79.2 lb/in.^{3}

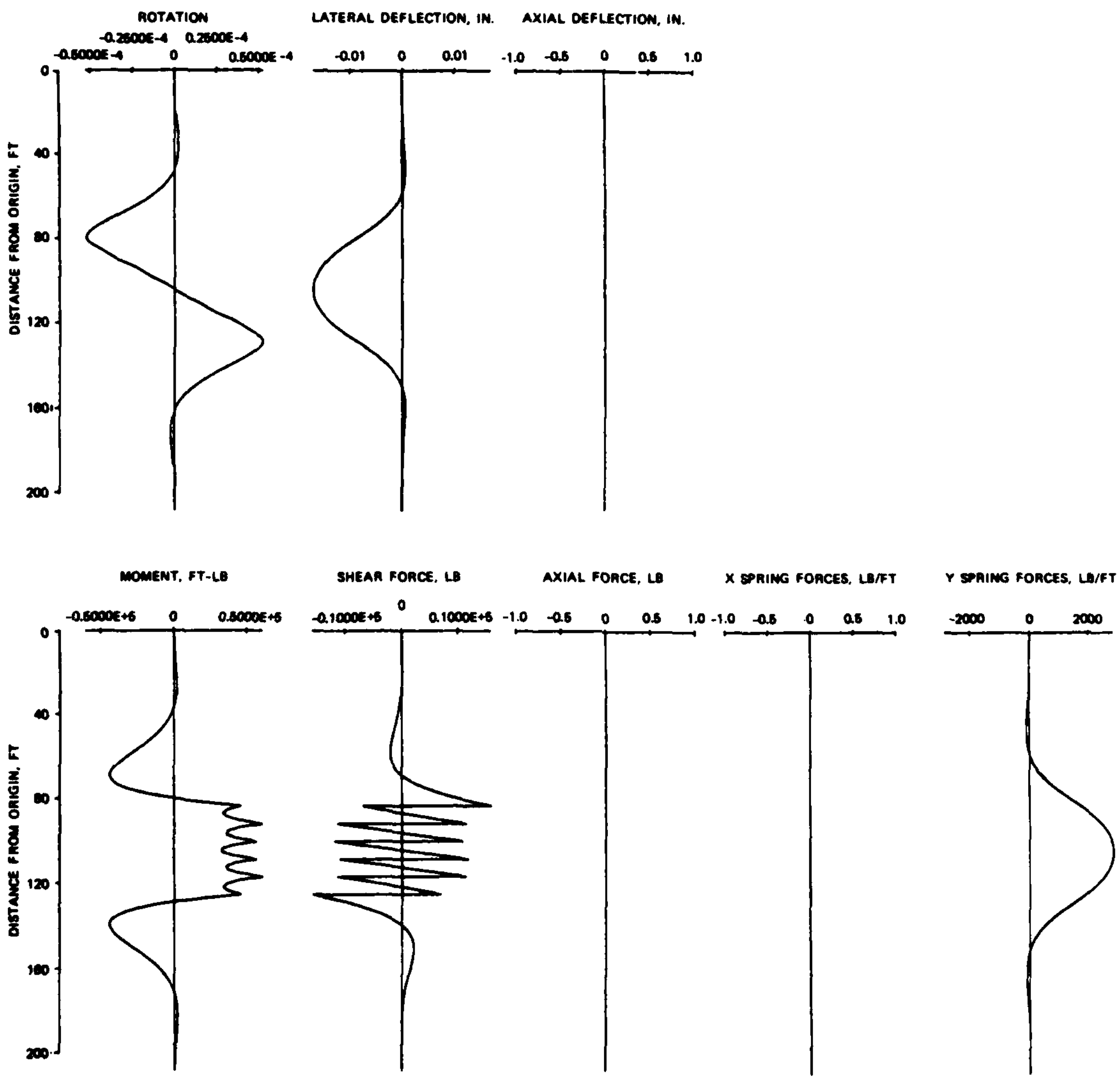


Figure B2. Axial deflection, lateral deflection, and rotation; K = 175 lb/in.^{3}

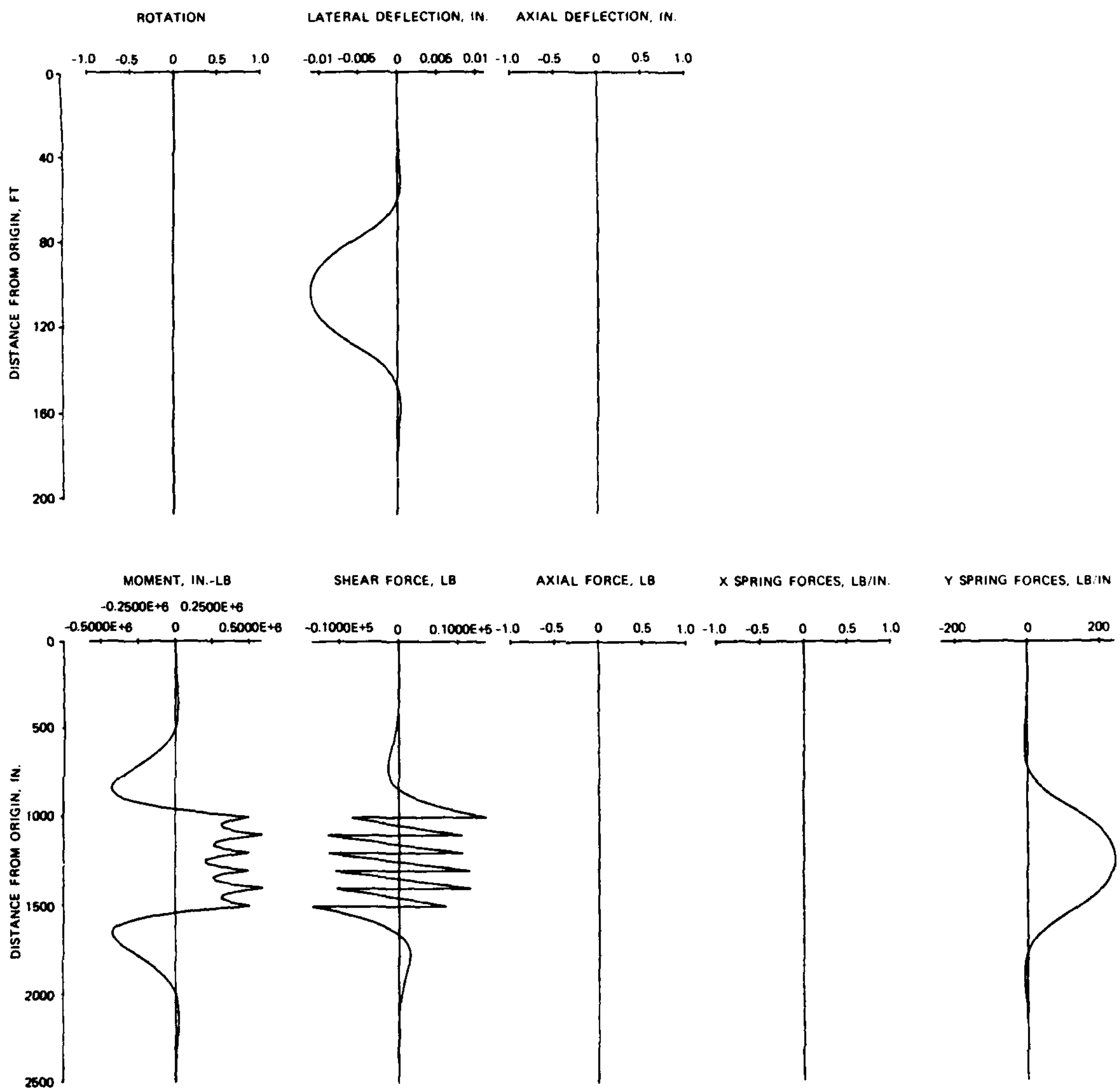


Figure B3. Axial deflection, lateral deflection, and rotation; $K = 271.1\ lb/in.^3$

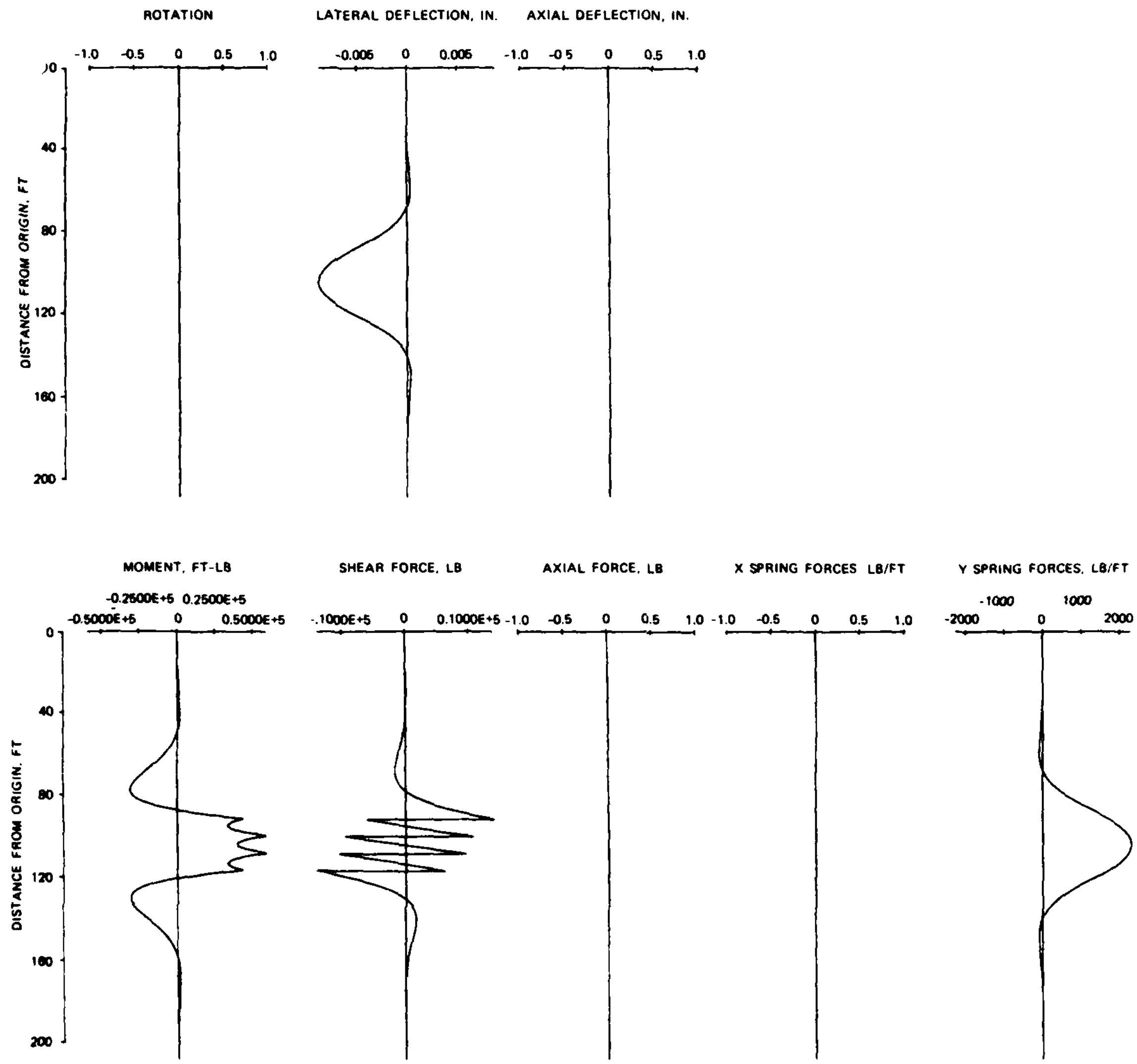


Figure B4. Results for 80,000-lb down load; field load test, on 4 shoes, 2 on each track; K = 79.1 $lb/in.^3$

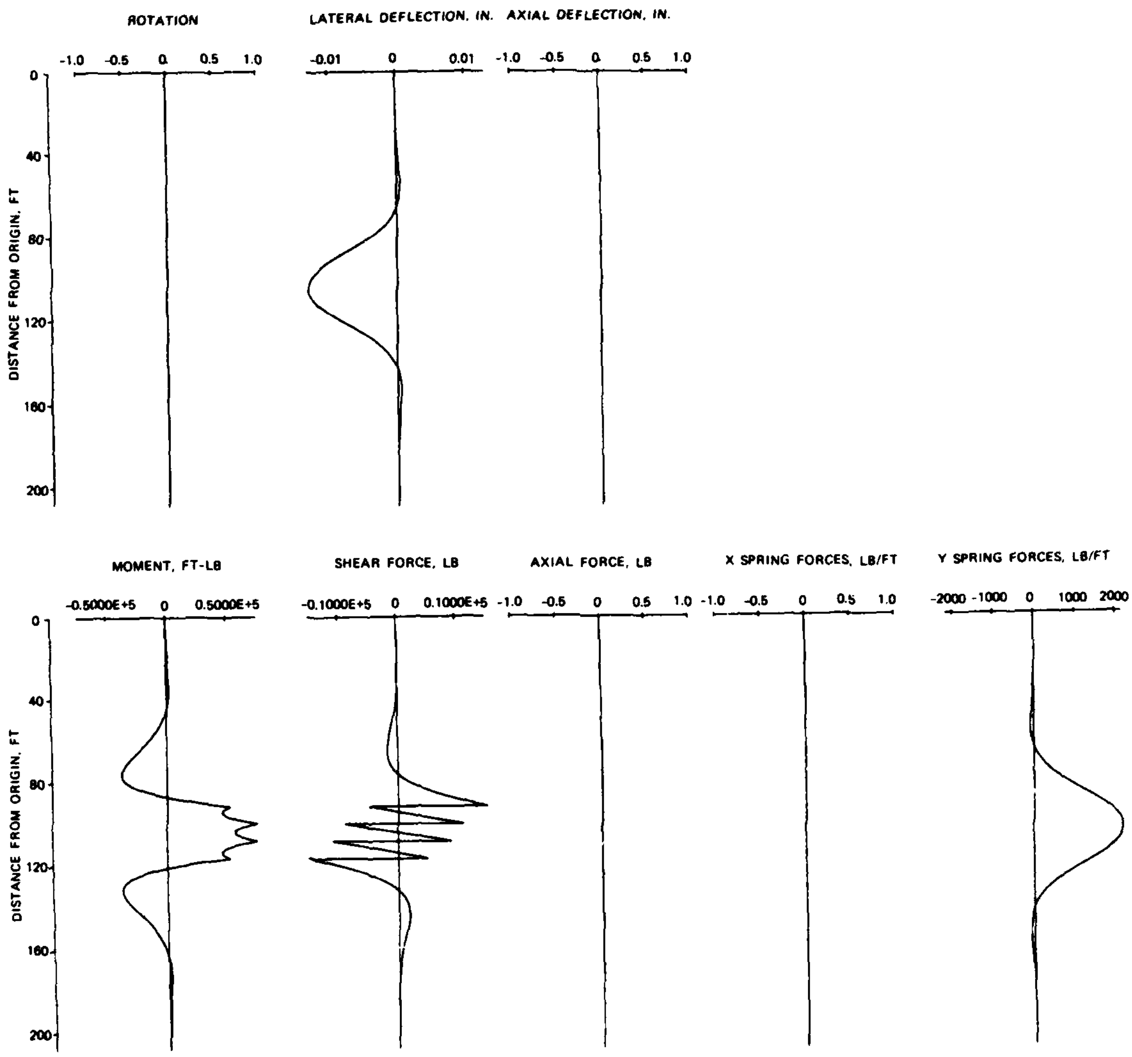


Figure B5. Results for 80,000-lb down load; field load test, on 4 shoes, 2 on each track; $K = 175\ lb/in.^3$

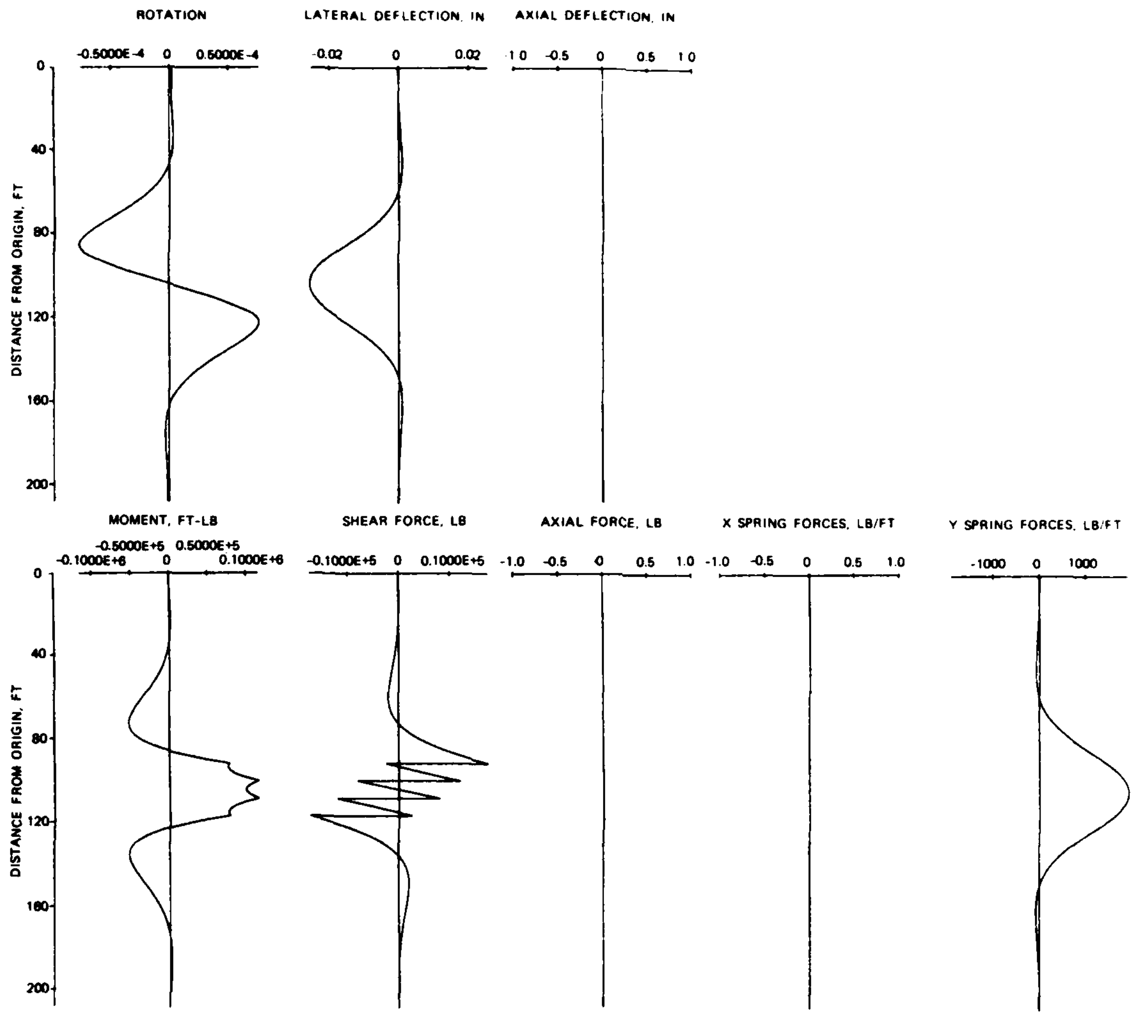


Figure B6. Results for 80,000-lb down load; field load test, on 4 shoes, 2 on each track; $K = 271.1\ lb/in.^3$

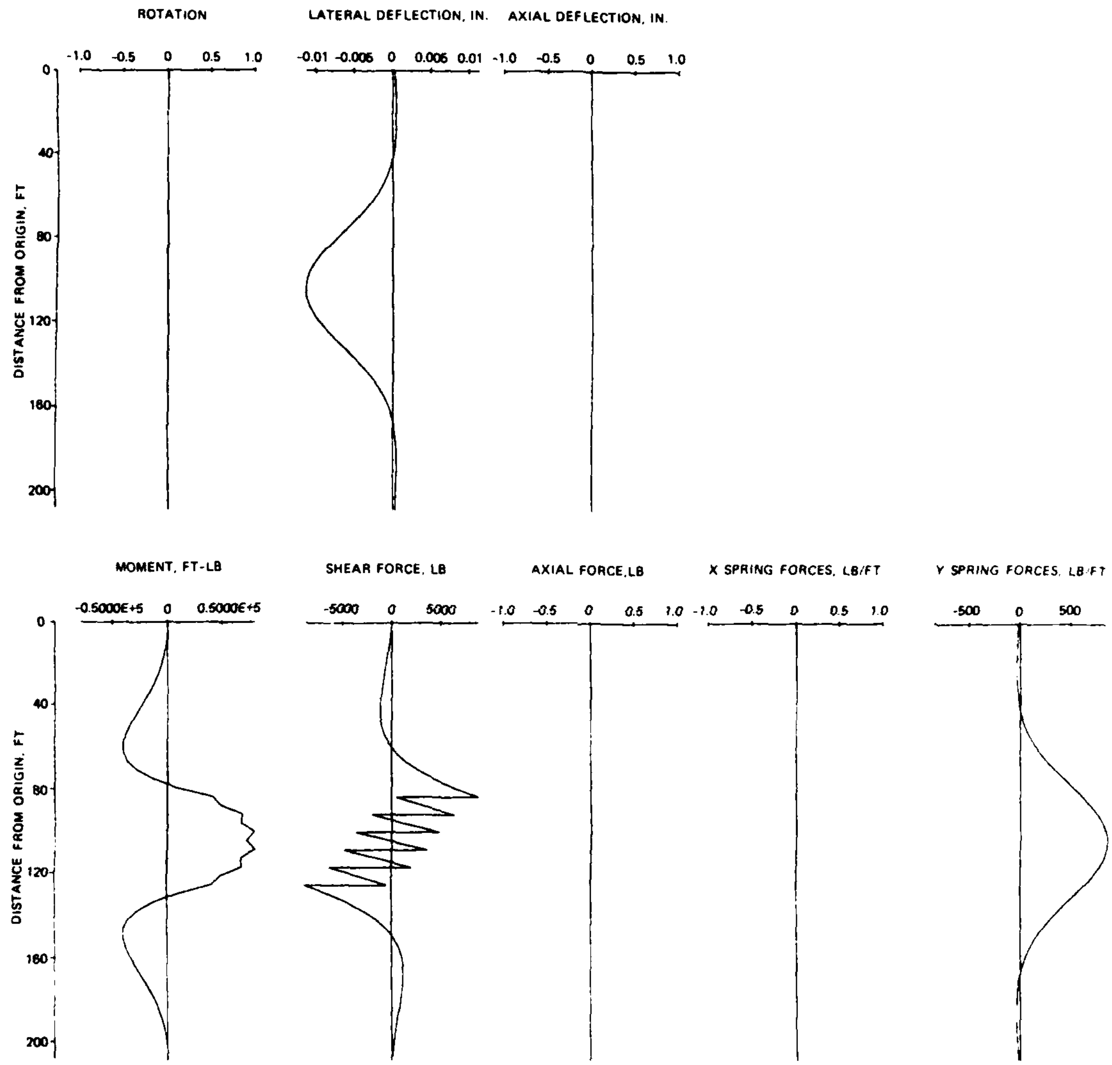


Figure B7. Results for 50,000-lb side load through centroid of track, on 12 shoes, 6 on each track; K = 79.1 lb/in.^{3}

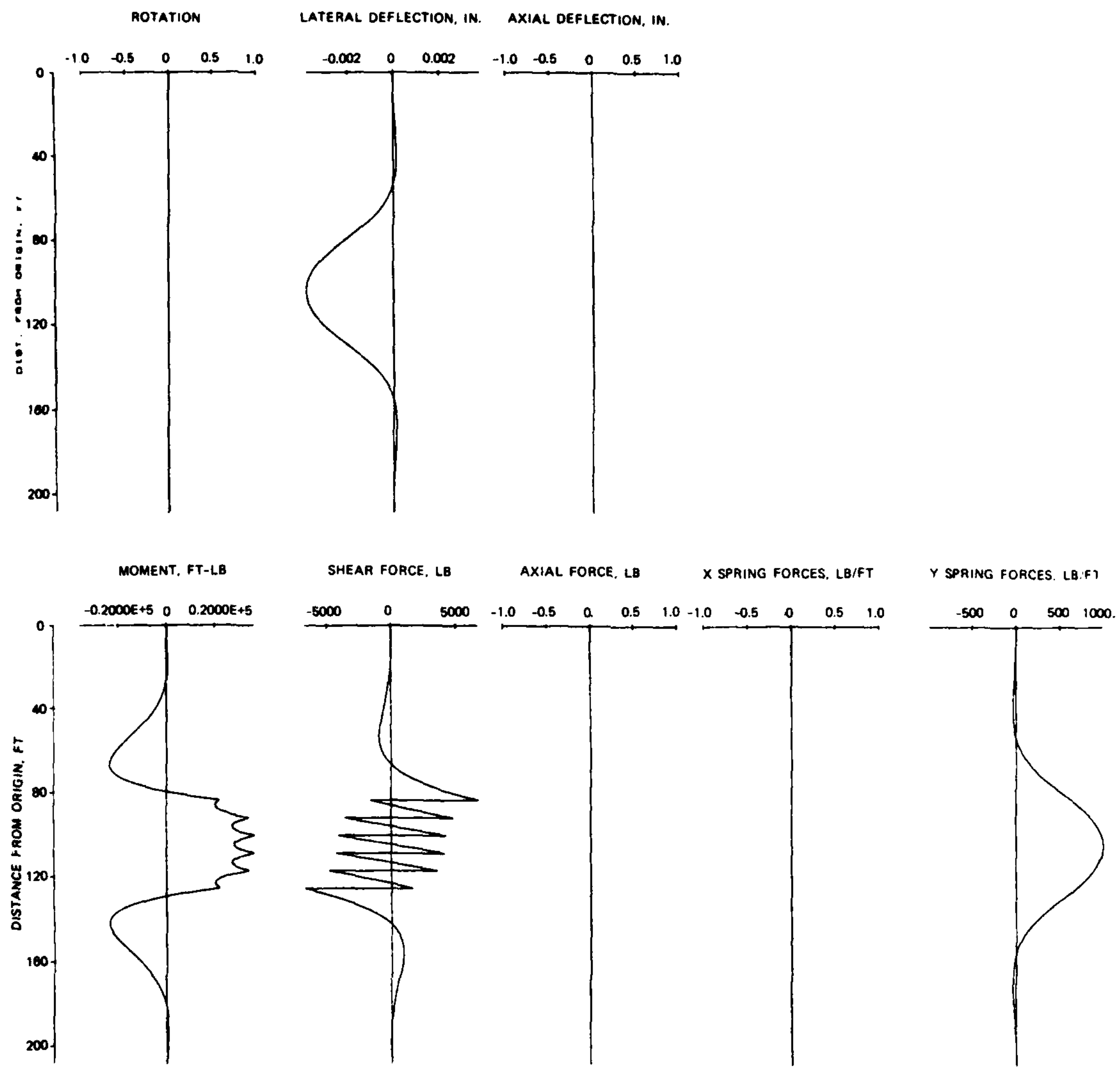


Figure B8. Results for 50,000-lb side load through centroid of track, on 12 shoes, 6 on each track; K = 175 lb/in.^{3}

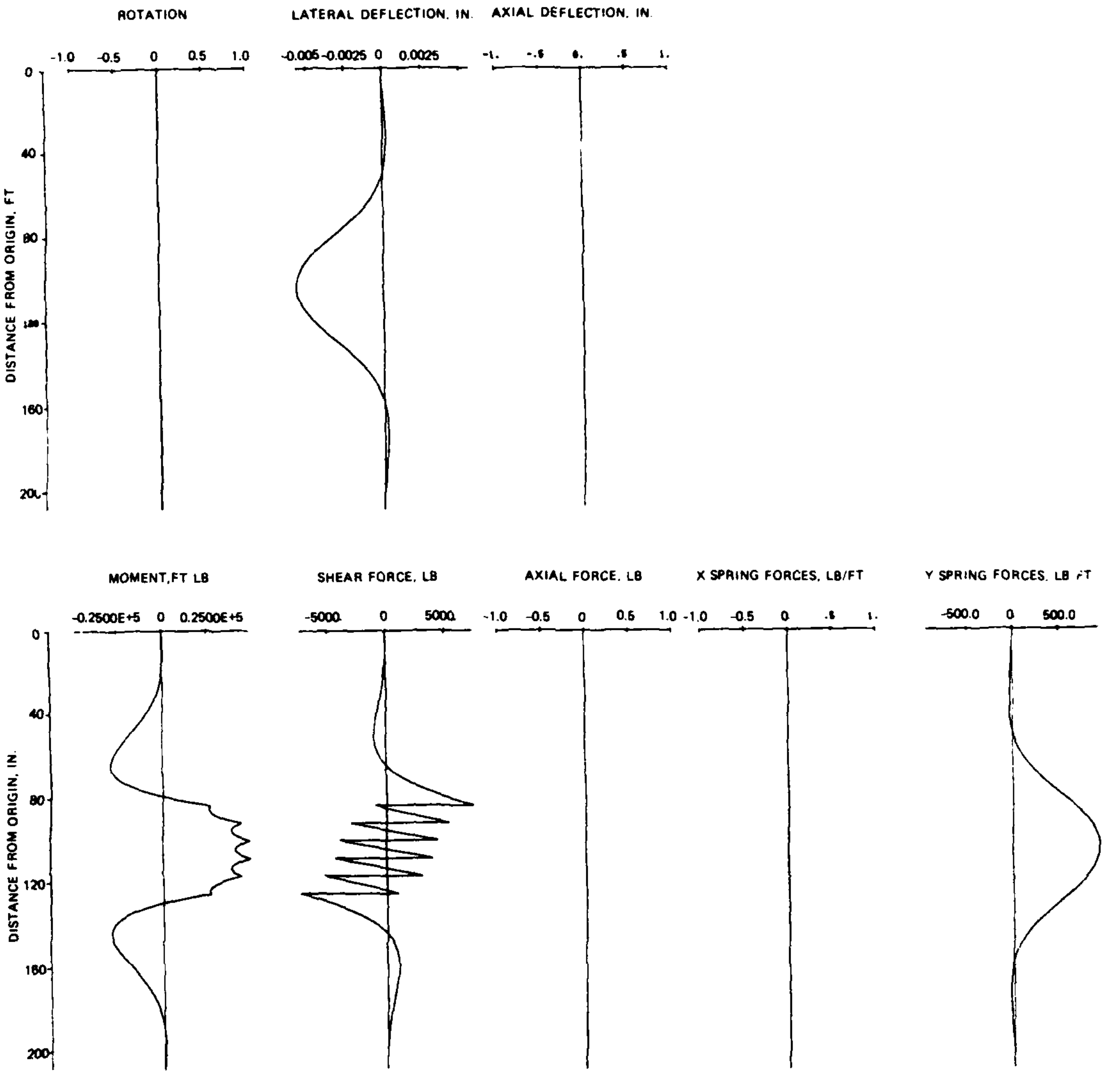


Figure B9. Results for 50,000-lb side load through centroid of track, on 12 shoes, 6 on each track; K = 271.1 lb/in.^{3}

APPENDIX C: STRESS EVALUATION OF PROPOSED SNORT TEST TRACK

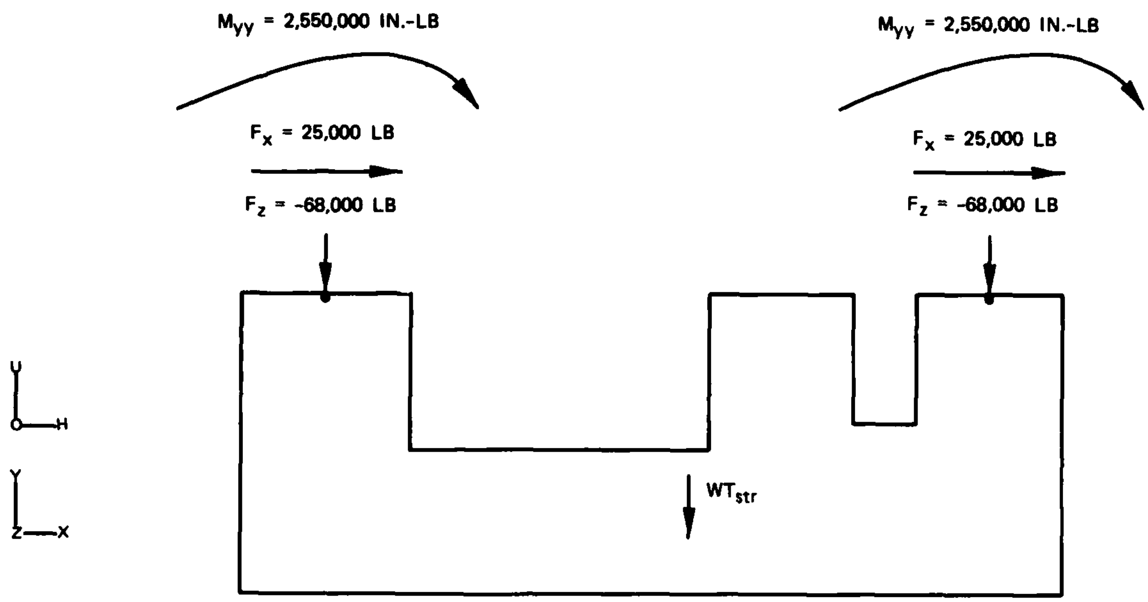


Figure C1. Applied loads, load case 1

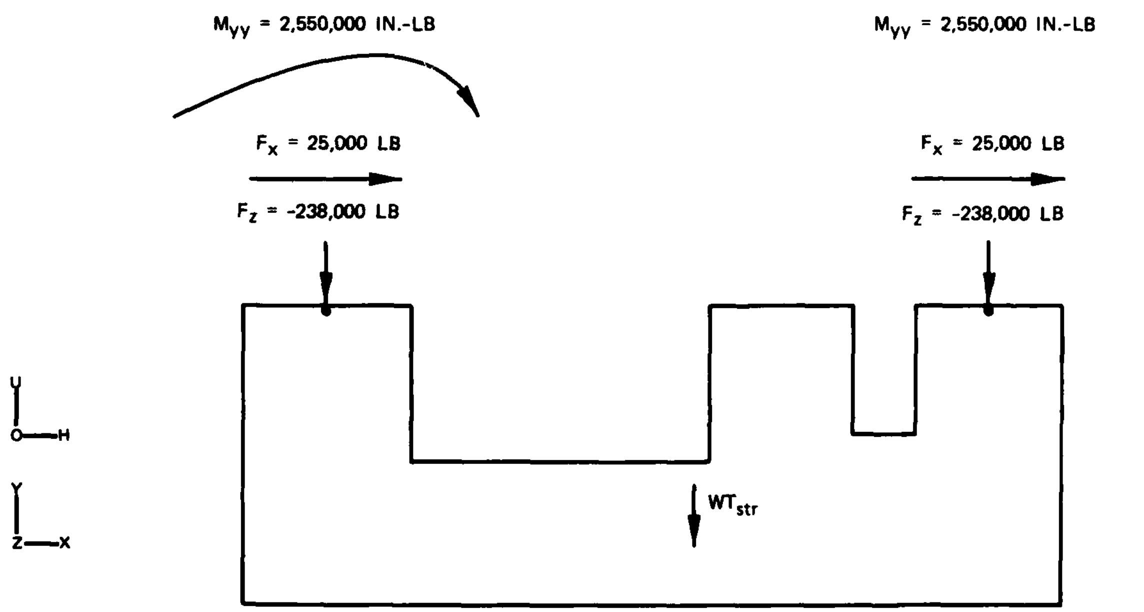


Figure C2. Applied loads, load case 2 (inertia loads for load case 1)

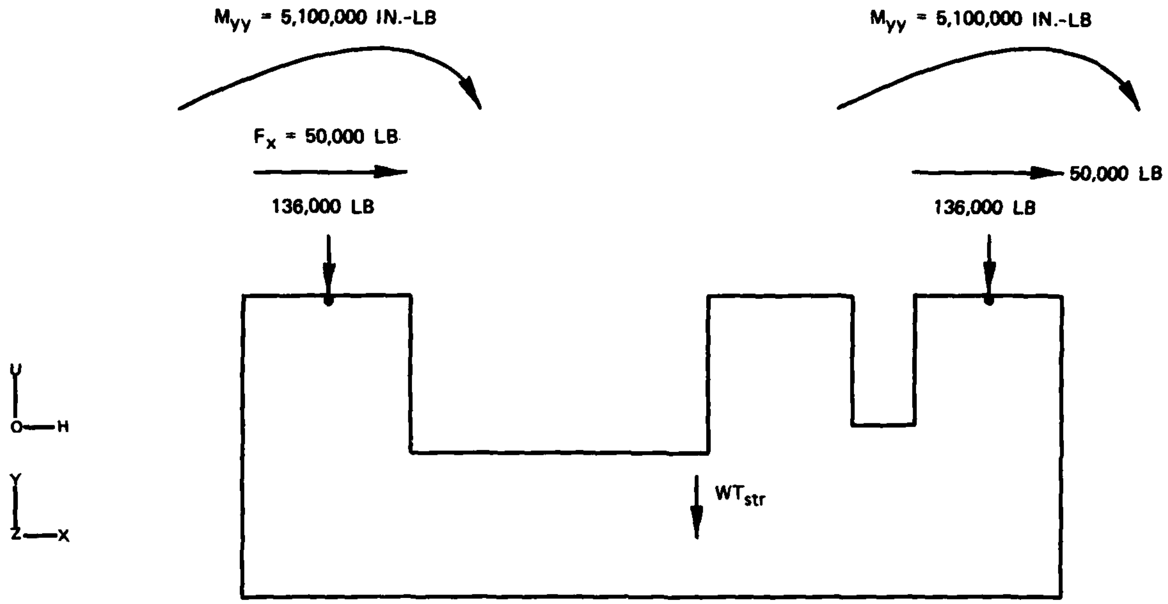


Figure C3. Applied loads, load case 3 (dynamic load factor of 2 applied to load case 1)

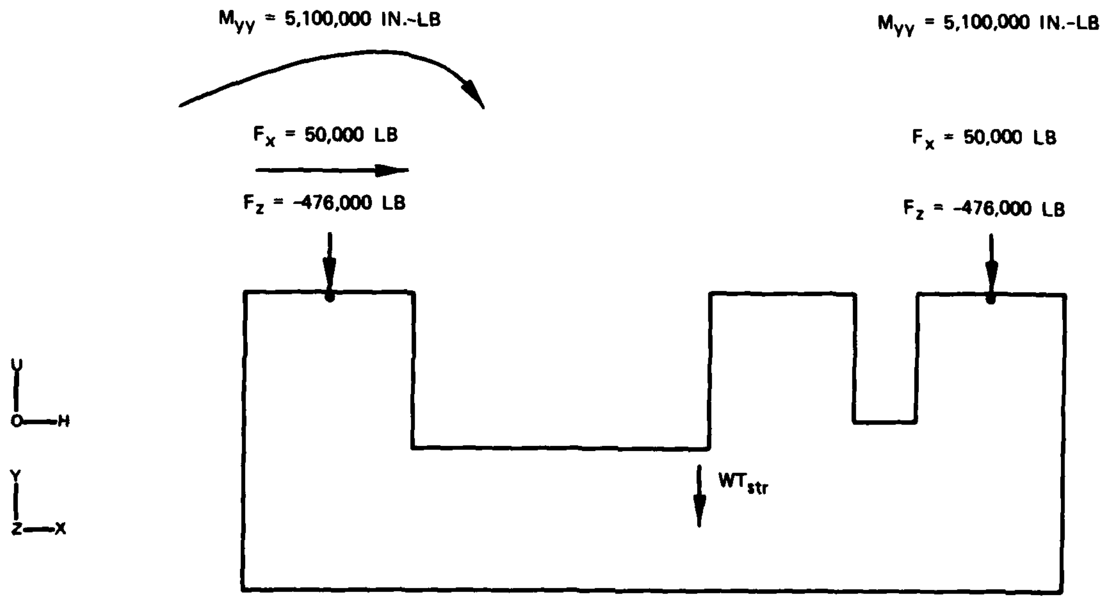


Figure C4. Applied loads, load case 4 (dynamic load factor of 2 applied to load case 2)

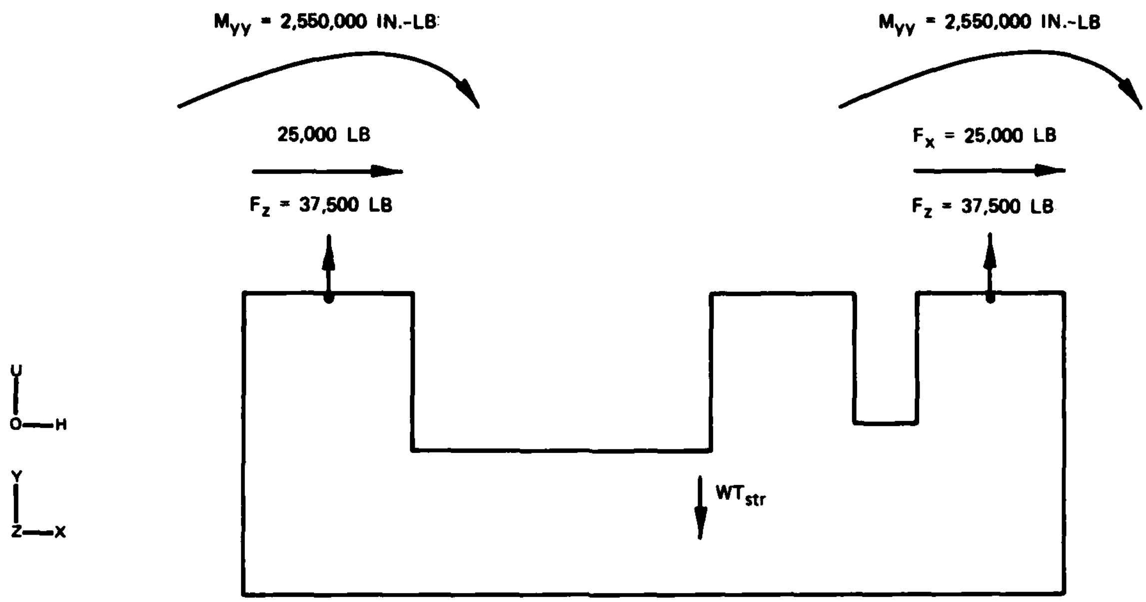


Figure C5. Applied loads, load case 5

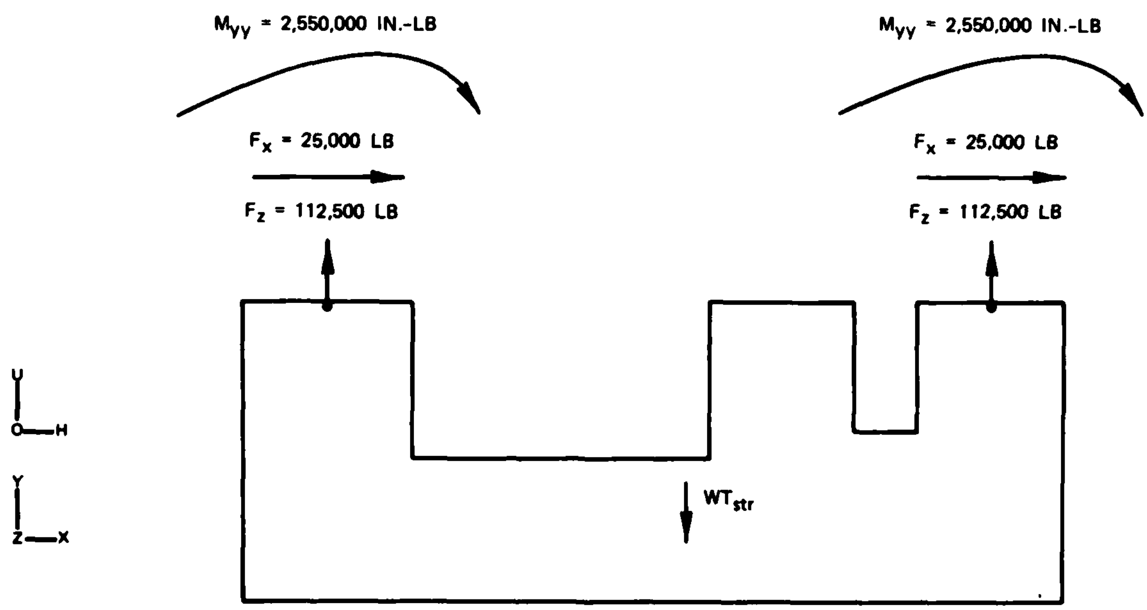


Figure C6. Applied loads, load case 6 (inertia loads for load case 5)

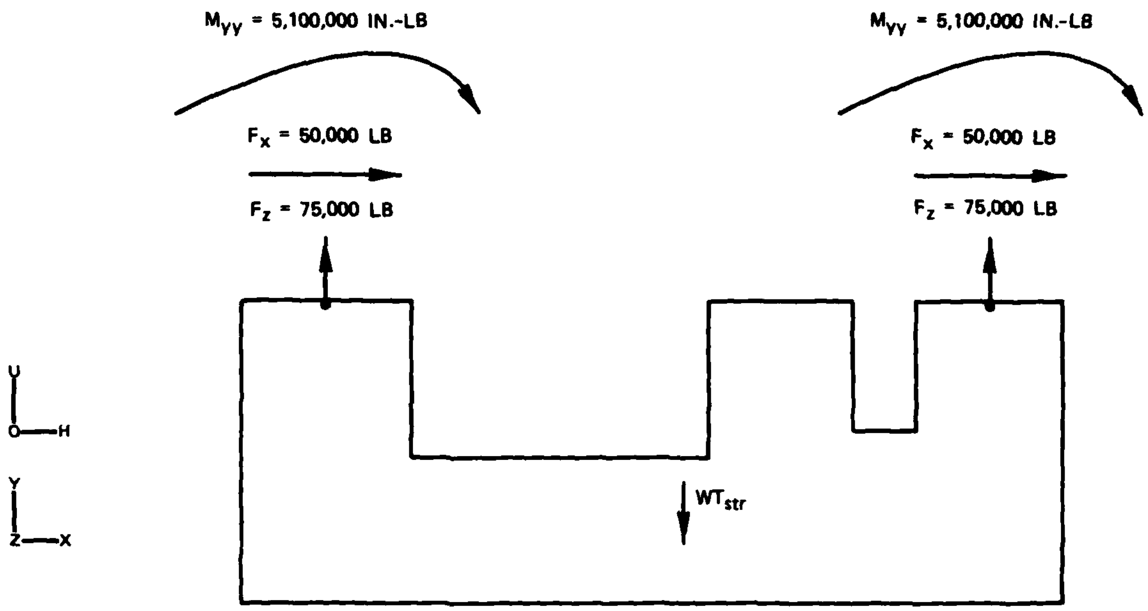


Figure C7. Applied loads, load case 7 (dynamic load factor of 2 applied to load case 5)

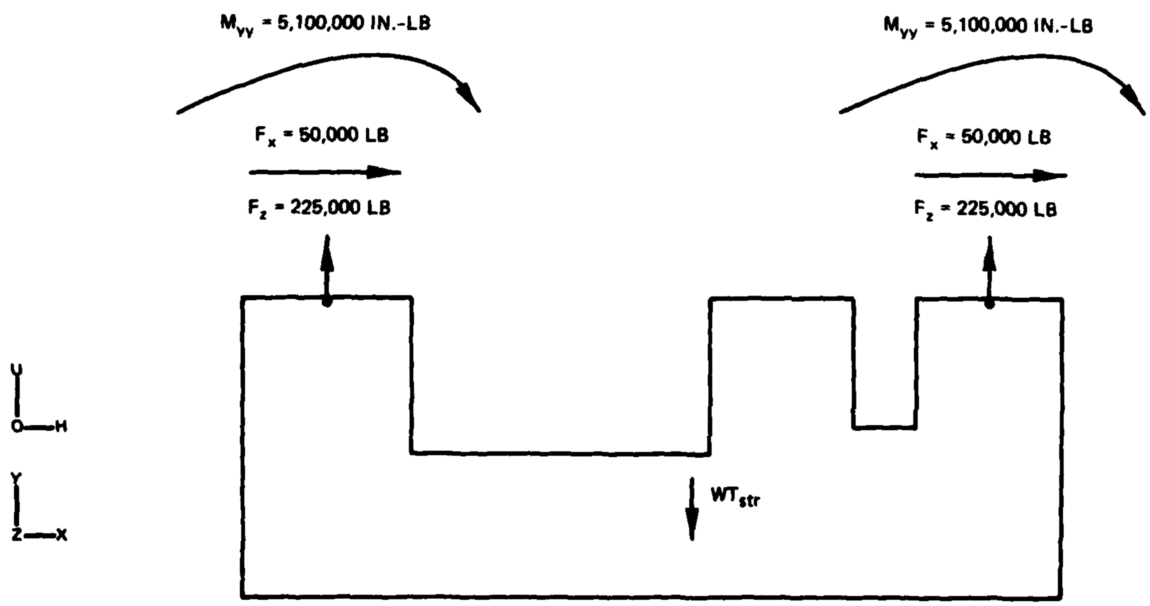


Figure C8. Applied loads, load case 8 (dynamic load factor of 2 applied to load case 6)

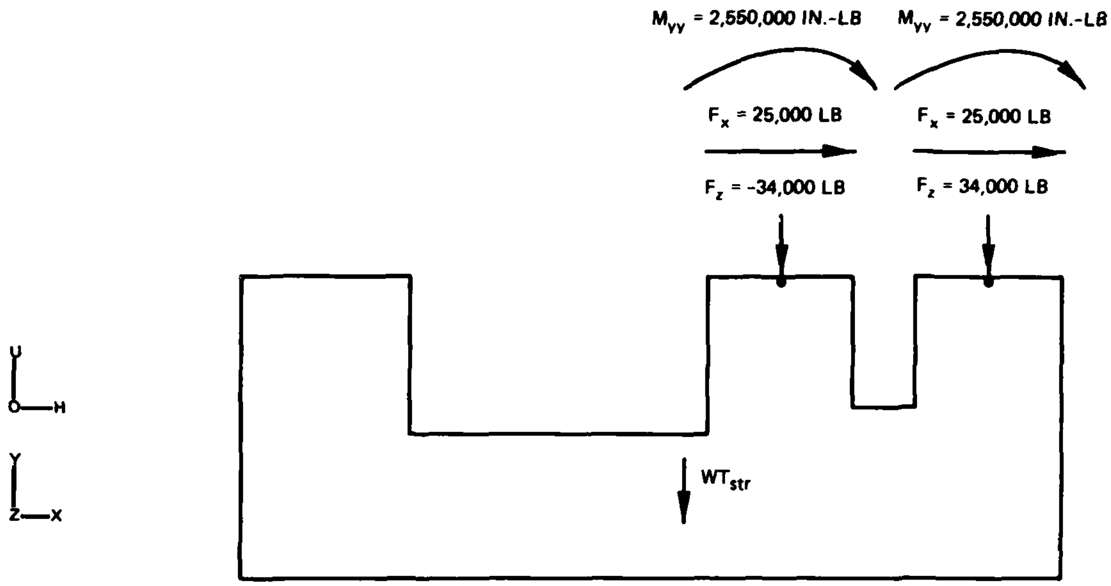


Figure C9. Applied loads, load case 9

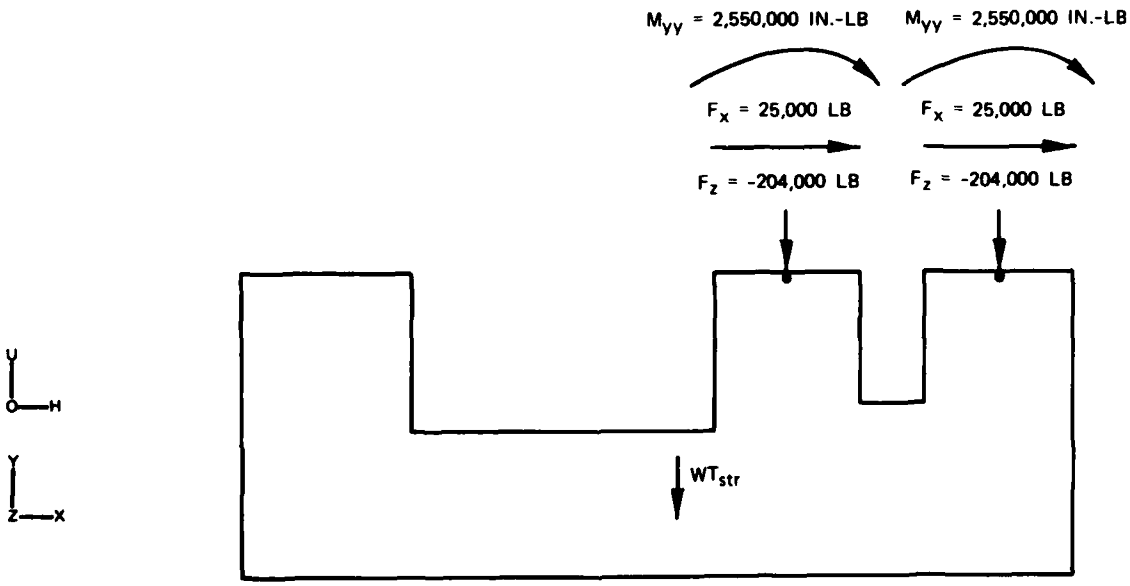


Figure C10. Applied loads, load case 10 (inertia loads for load case 9)

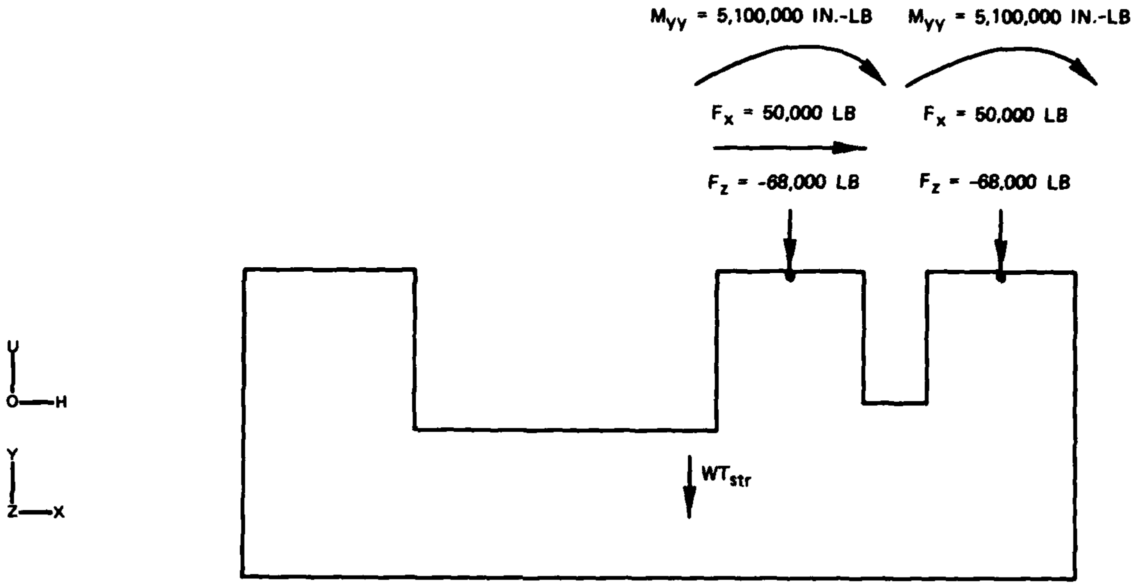


Figure C11. Applied loads, load case 11 (dynamic load factor of 2 applied to load case 9)

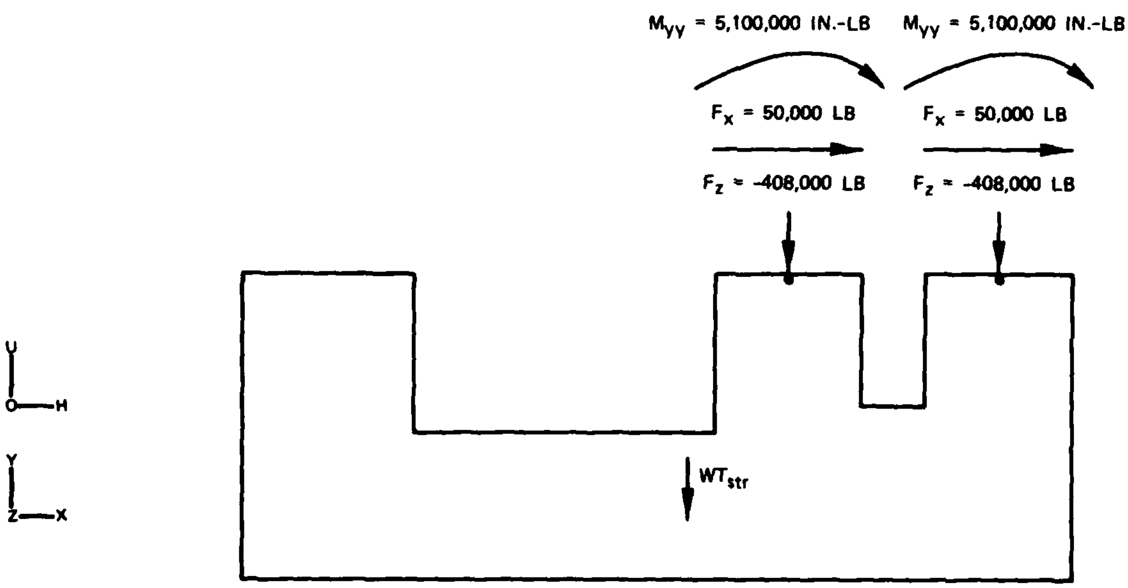


Figure C12. Applied loads, load case 12 (dynamic load factor of 2 applied to load case 1)

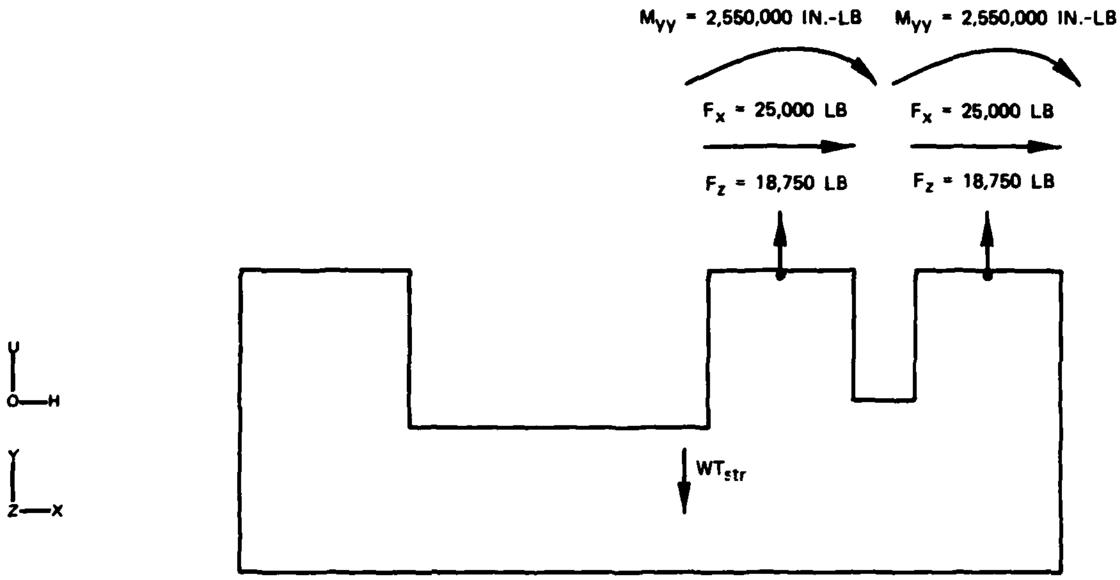


Figure C13. Applied loads, load case 13

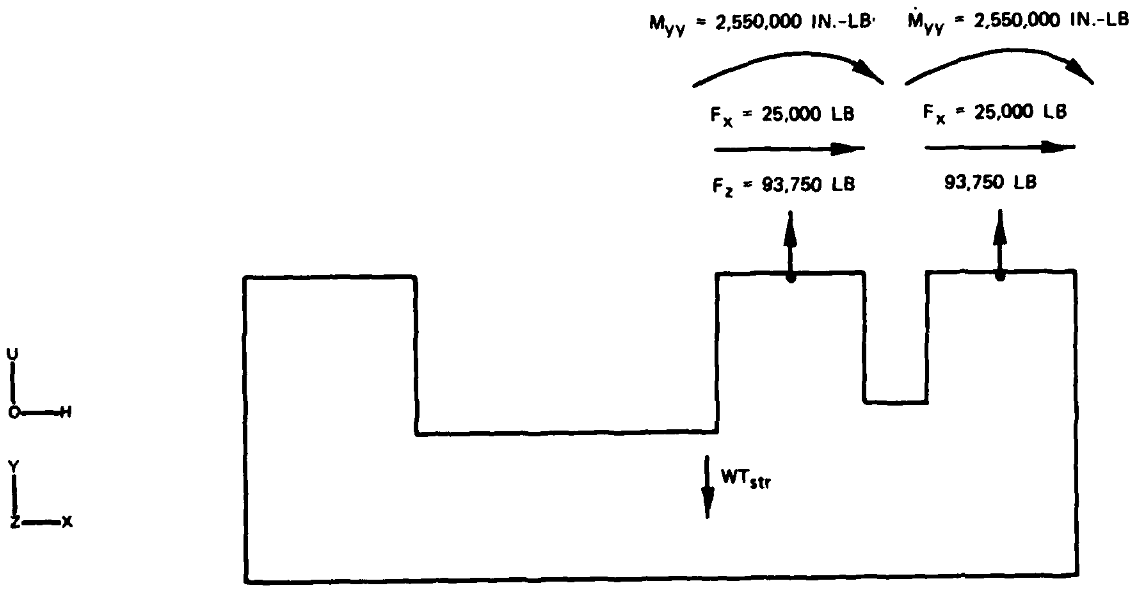


Figure C14. Applied loads, load case 14 (inertia loads for load case 13)

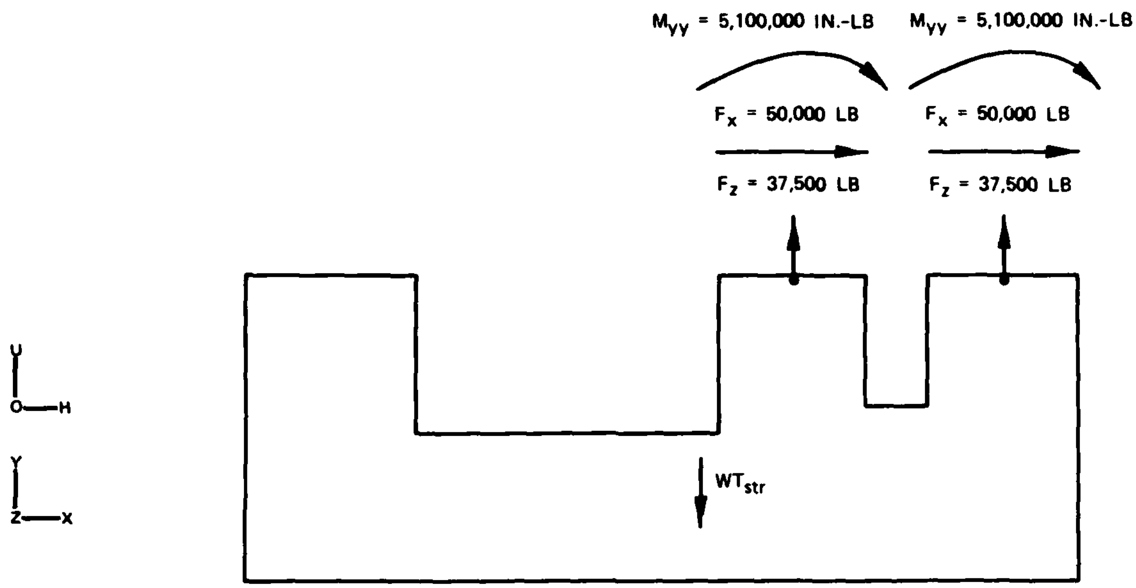


Figure C15. Applied loads, load case 15 (dynamic load factor of 2 applied to load case 13)

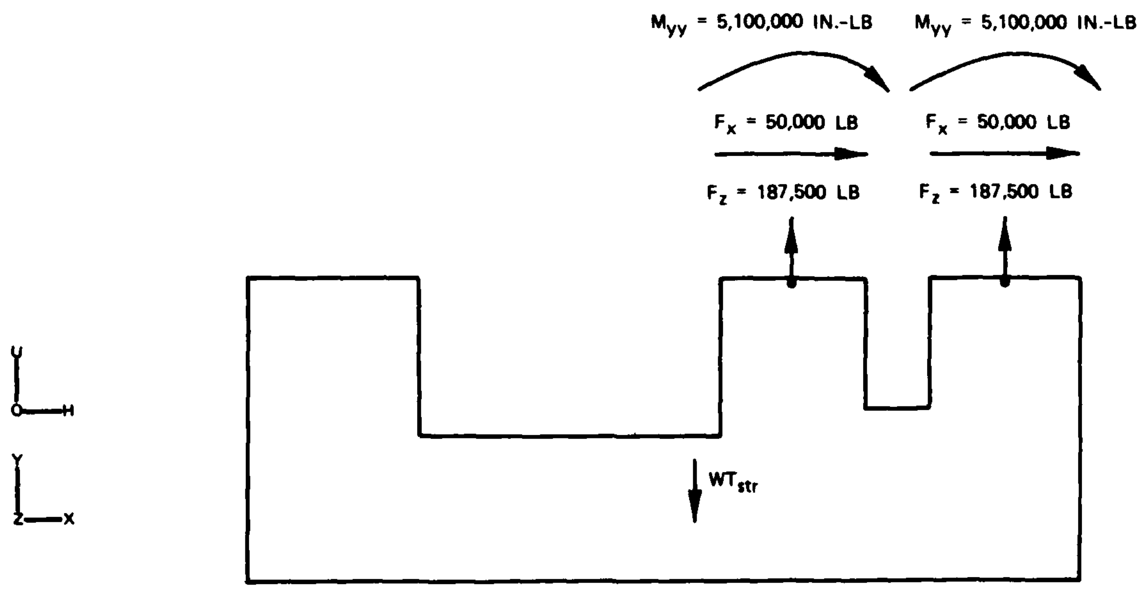


Figure C16. Applied loads, load case 16 (dynamic load factor of 2 applied to load case 14)

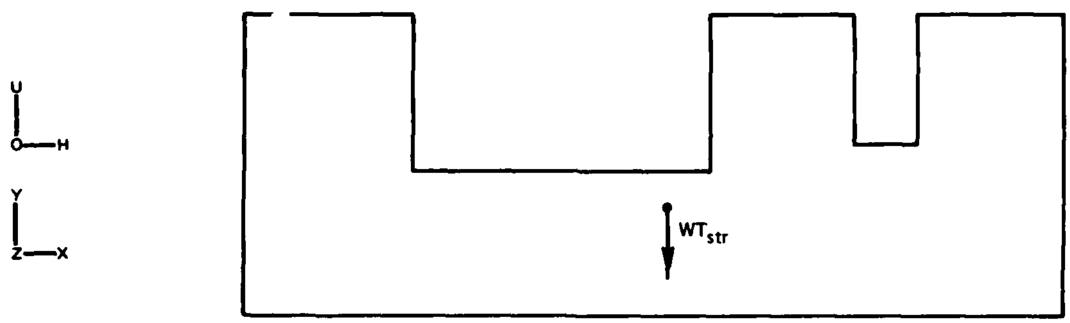


Figure C17. Applied load, load case 17 (weight of structure only)

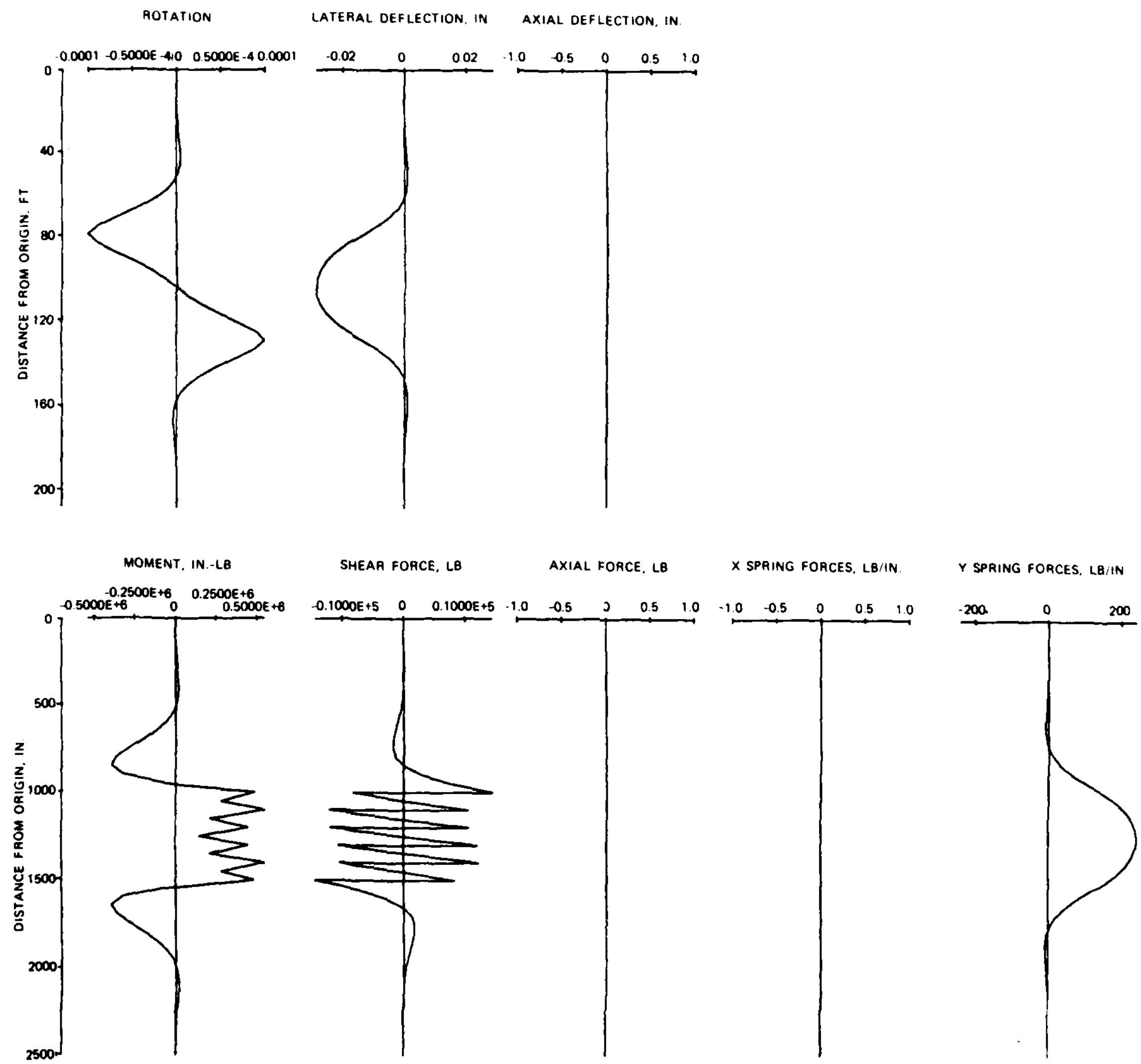


Figure C18. Beam-on-elastic foundation analysis for vertical loading of load case 1 with K = 79.2 $lb/in.^3$

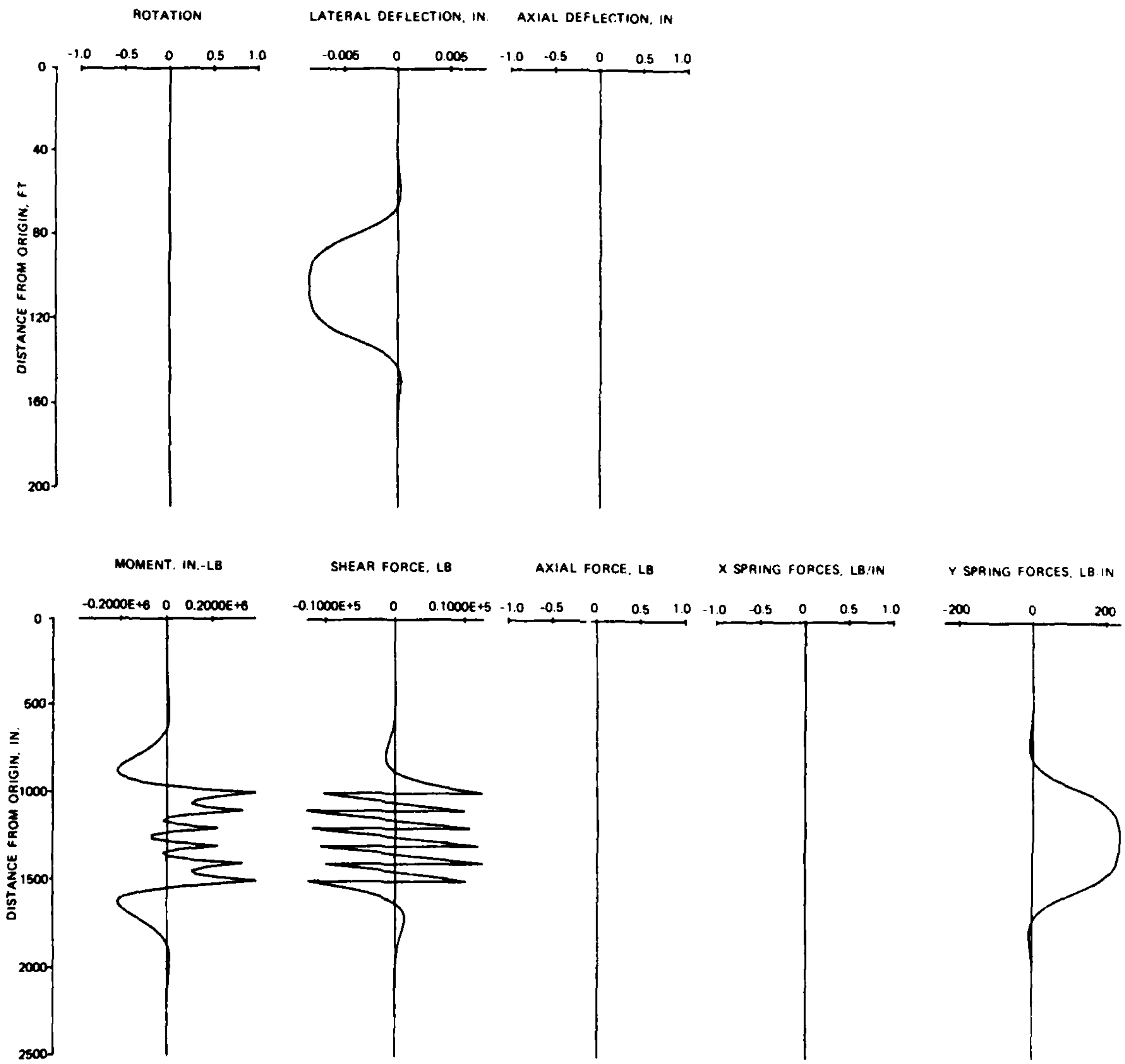


Figure C19. Beam-on-elastic foundation analysis for vertical loading of load case 1 with K = 271.1 lb/in.^{3}

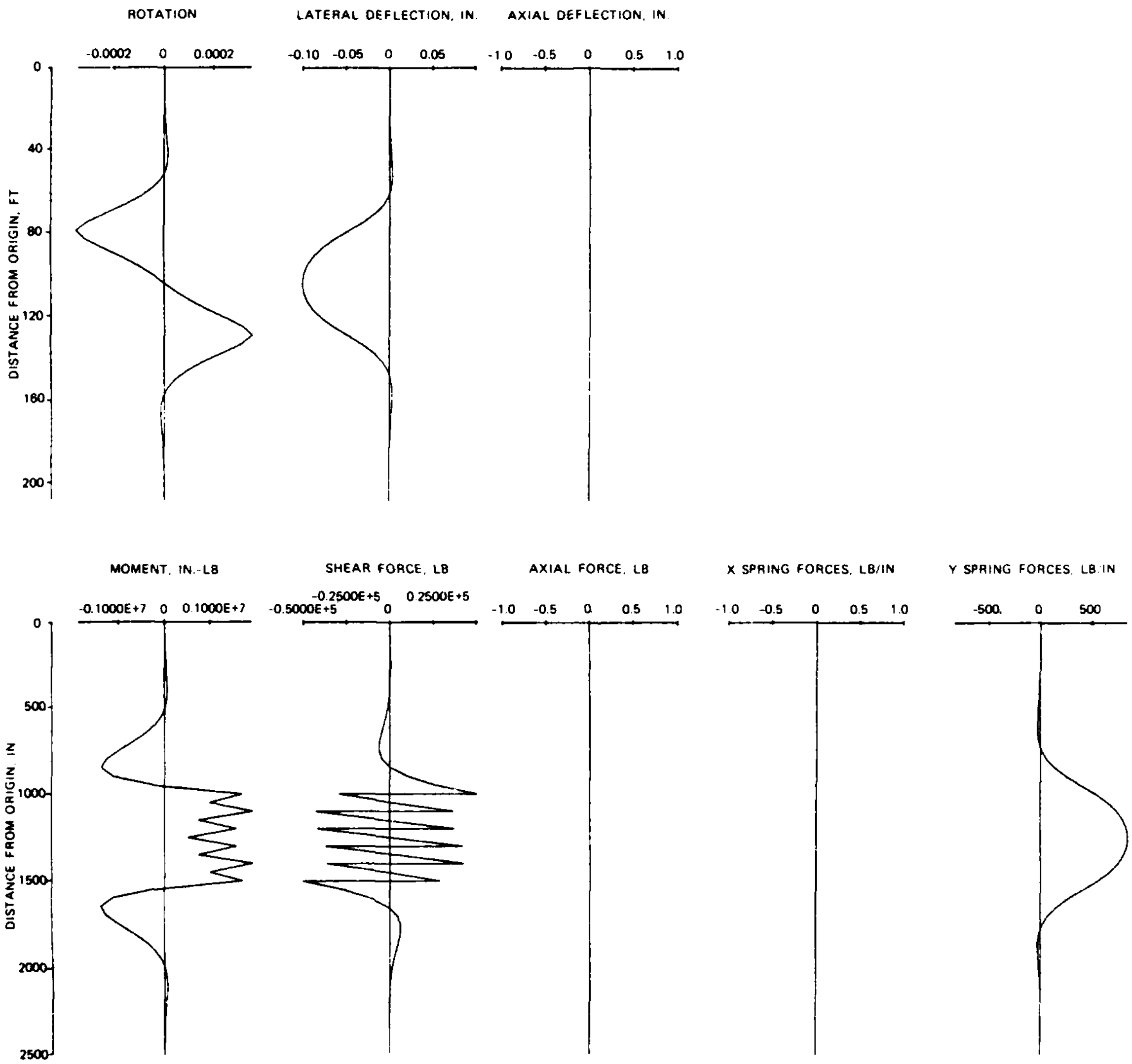


Figure C20. Beam-on-elastic foundation analysis for vertical loading of load case 2 with K = 79.2 lb/in.^{3}

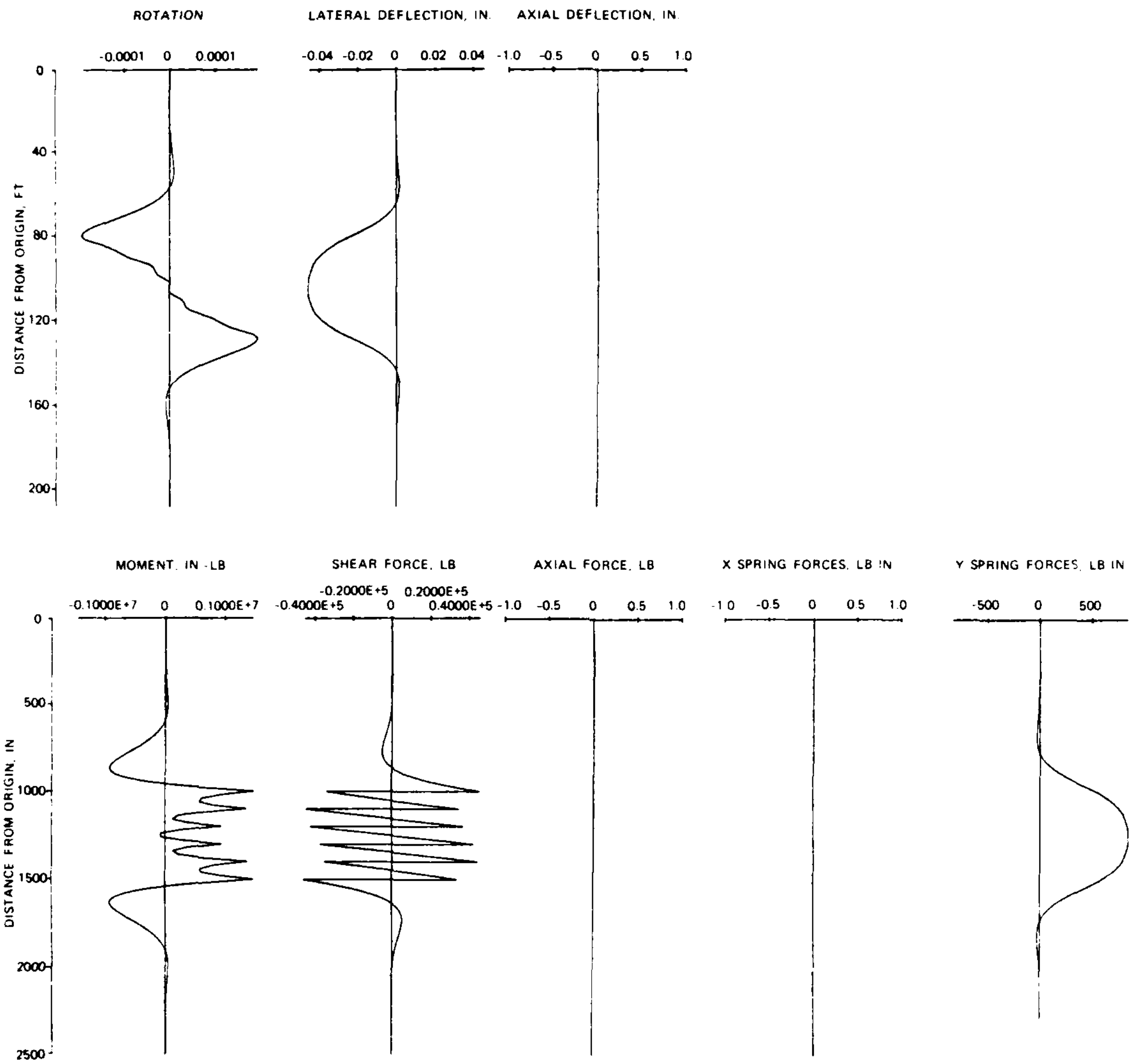


Figure C21. Beam-on-elastic foundation analysis for vertical loading of load case 2 with K = 175 lb/in.^{3}

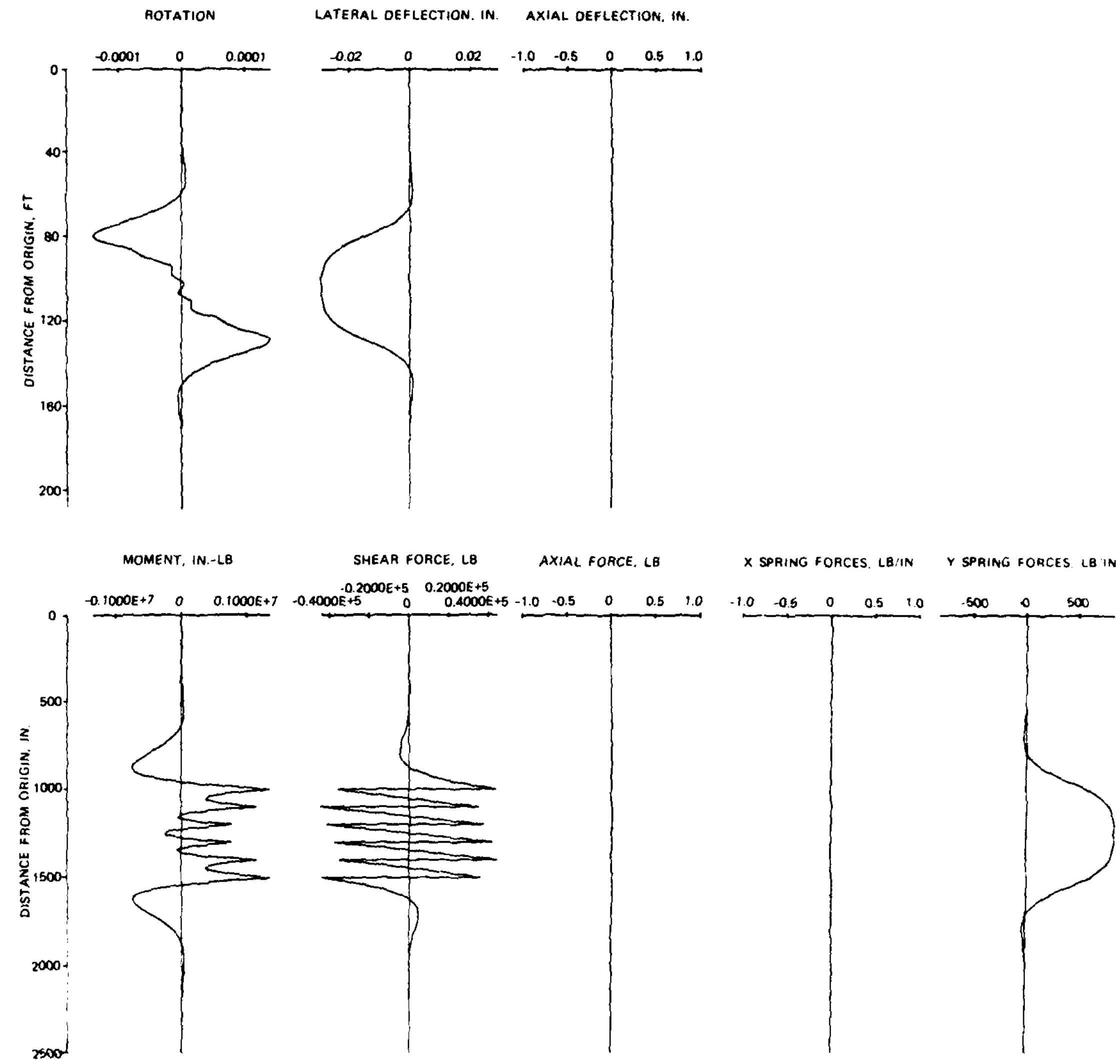


Figure C22. Beam-on-elastic foundation analysis for vertical loading of load case 2 with $K = 271.1$ lb/in.^{3}

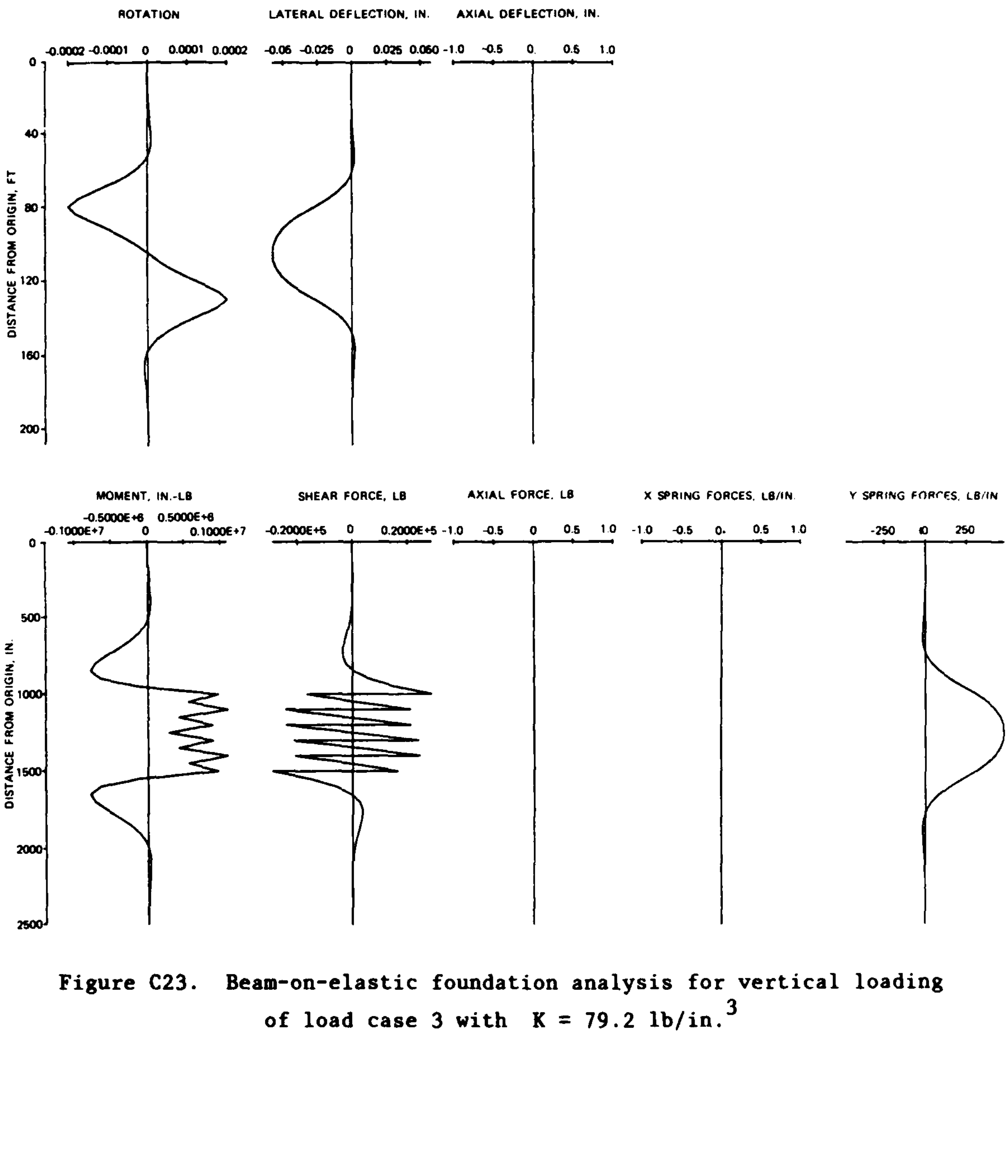


Figure C23. Beam-on-elastic foundation analysis for vertical loading of load case 3 with $K = 79.2\ lb/in.^3$

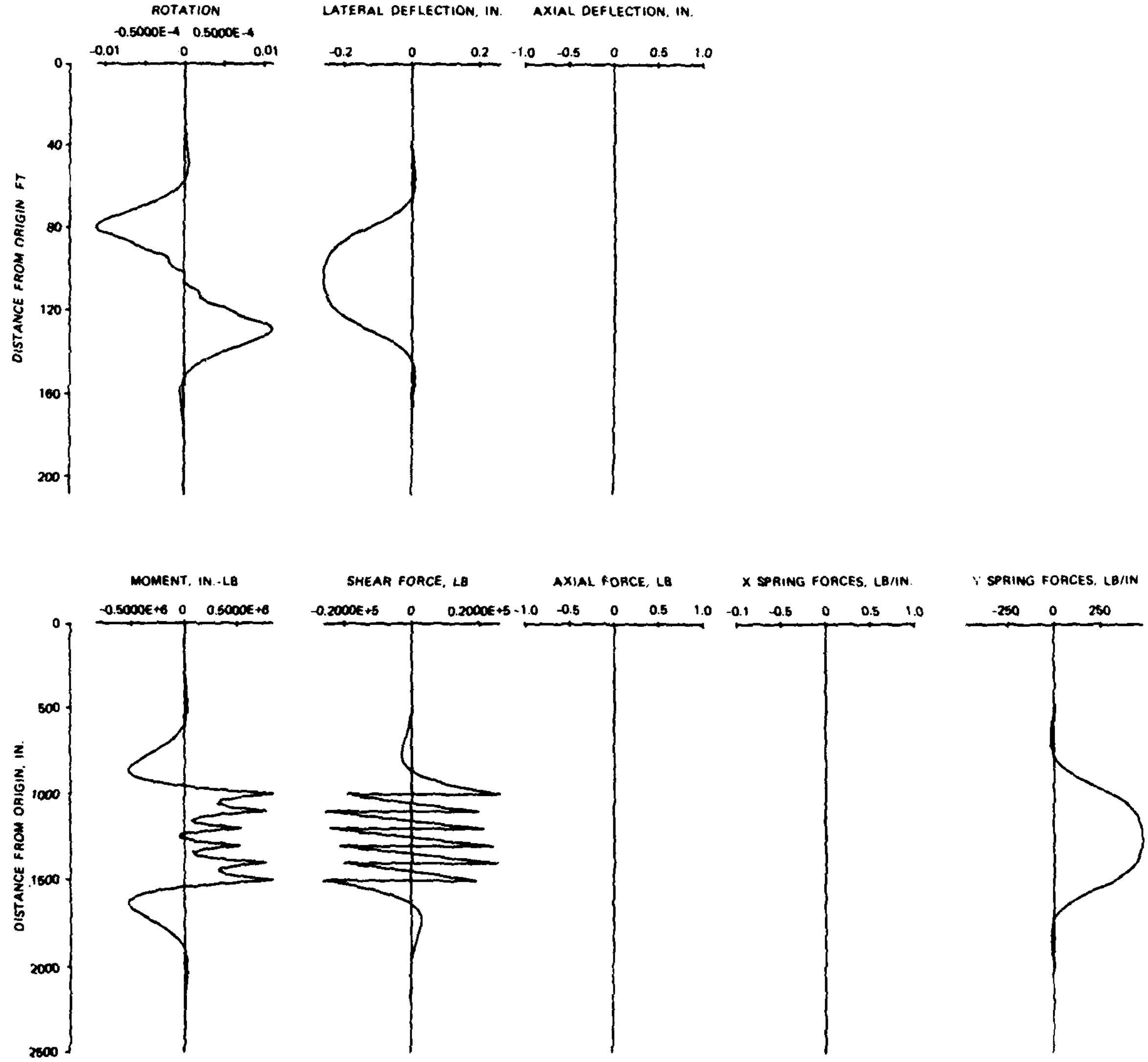


Figure C24. Beam-on-elastic foundation analysis for vertical loading of load case 3 with K = 175 lb/in.^{3}

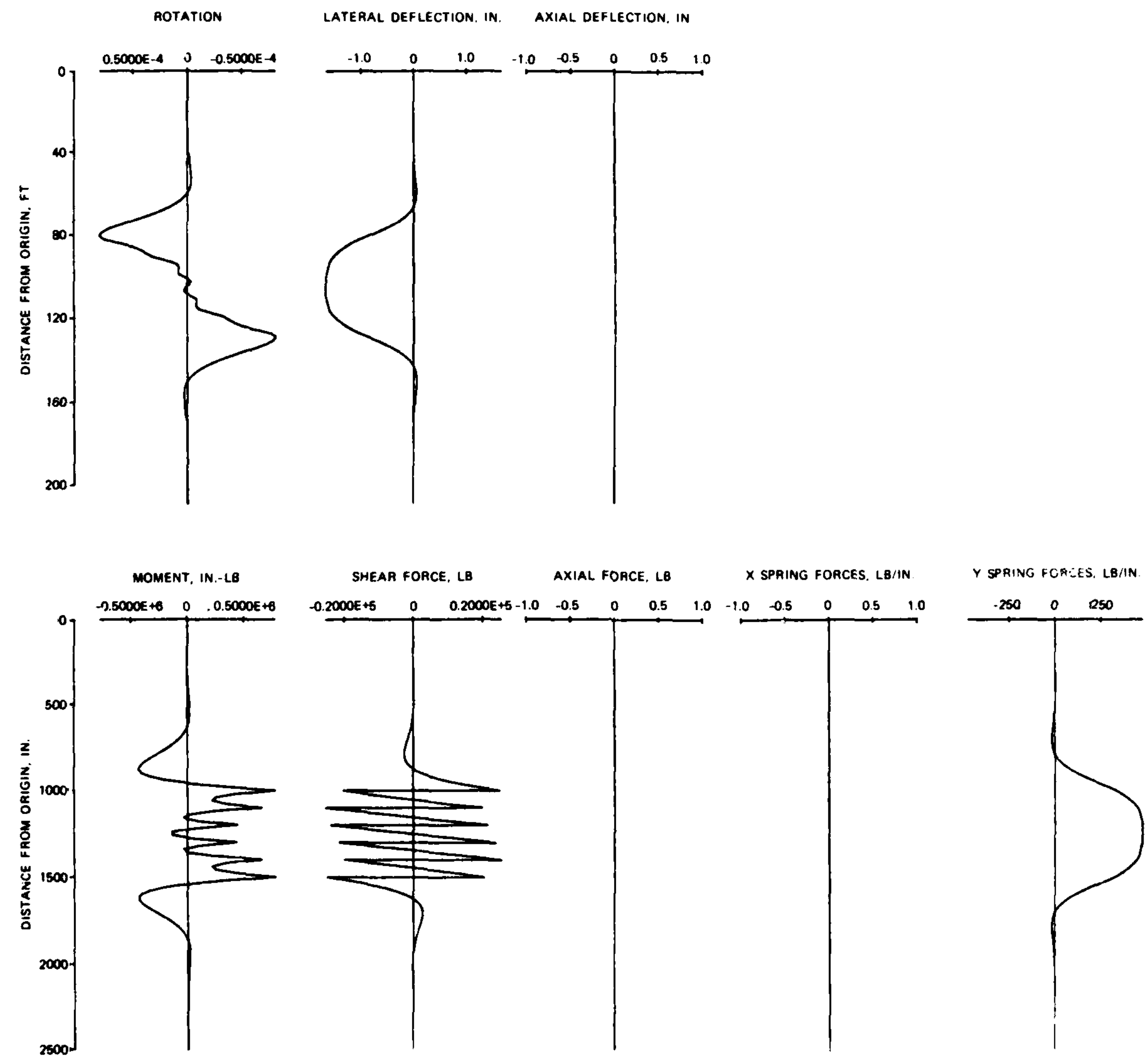


Figure C25. Beam-on-elastic foundation analysis for vertical loading of load case 3 with K· = 271.1 lb/in.^{3}

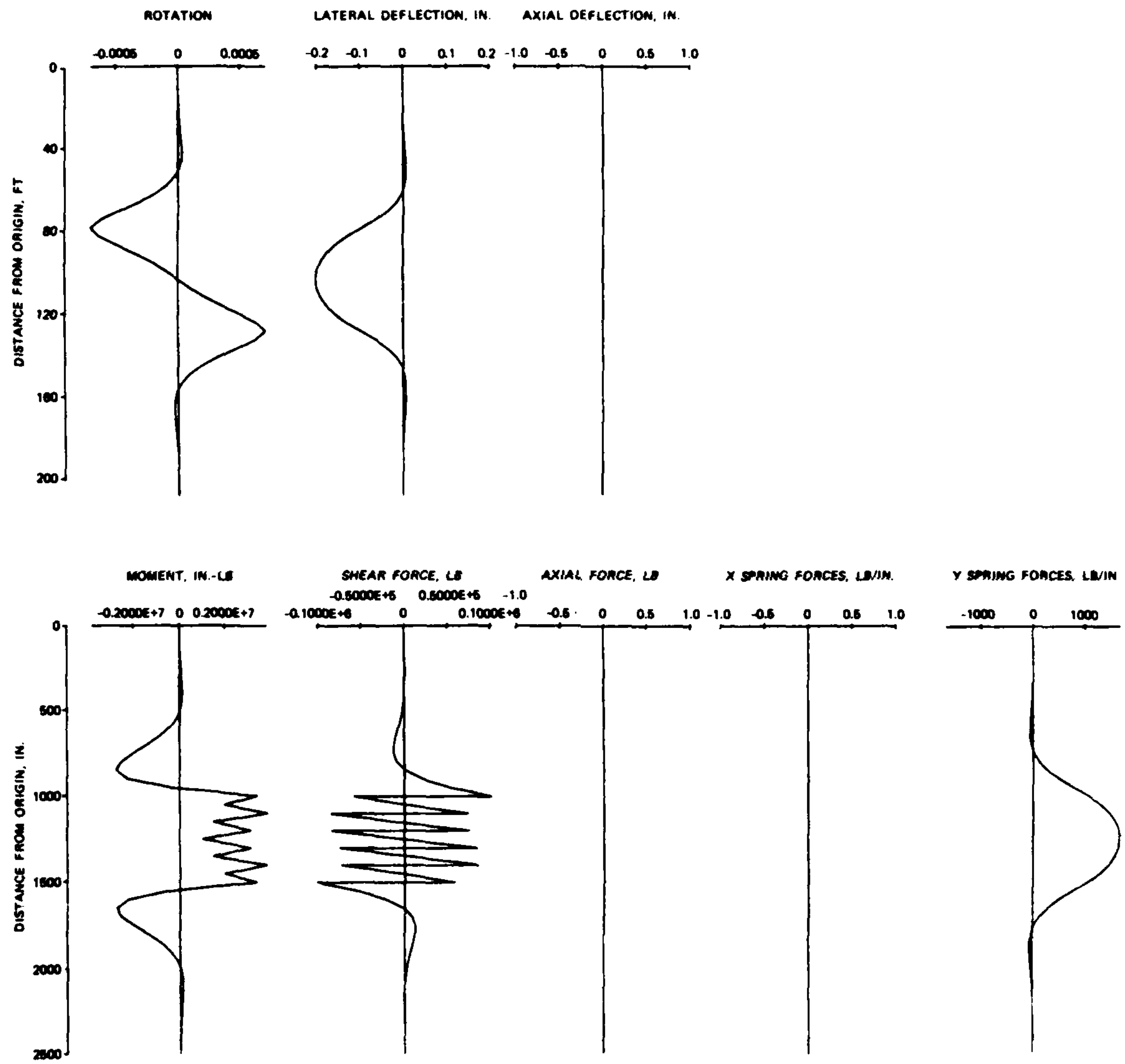


Figure C26. Beam-on-elastic foundation analysis for vertical loading of load case 4 with K = 79.2 lb/in.[3]

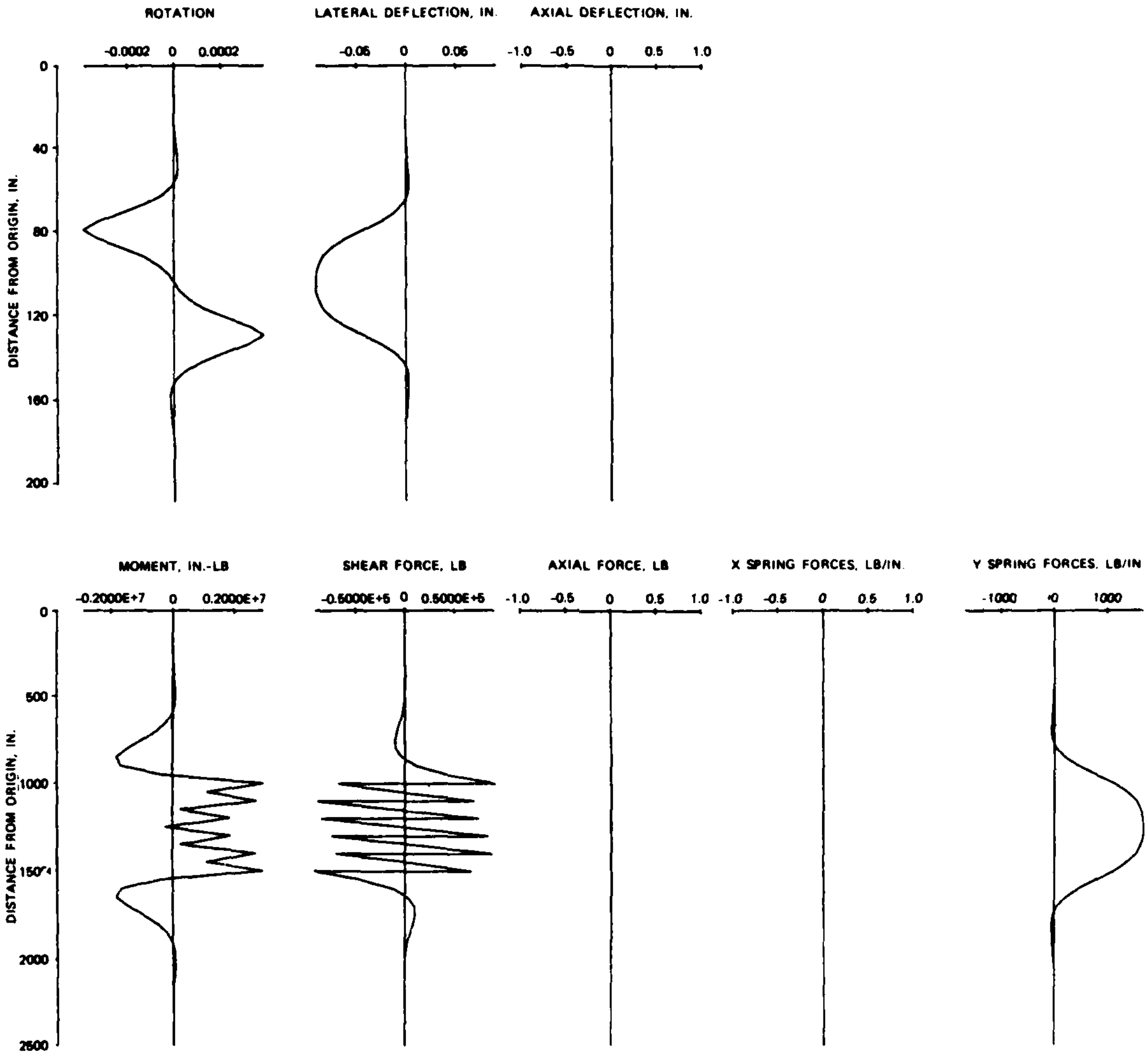


Figure C27. Beam-on-elastic foundation analysis for vertical loading of load case 4 with $K = 175\ lb/in.^3$

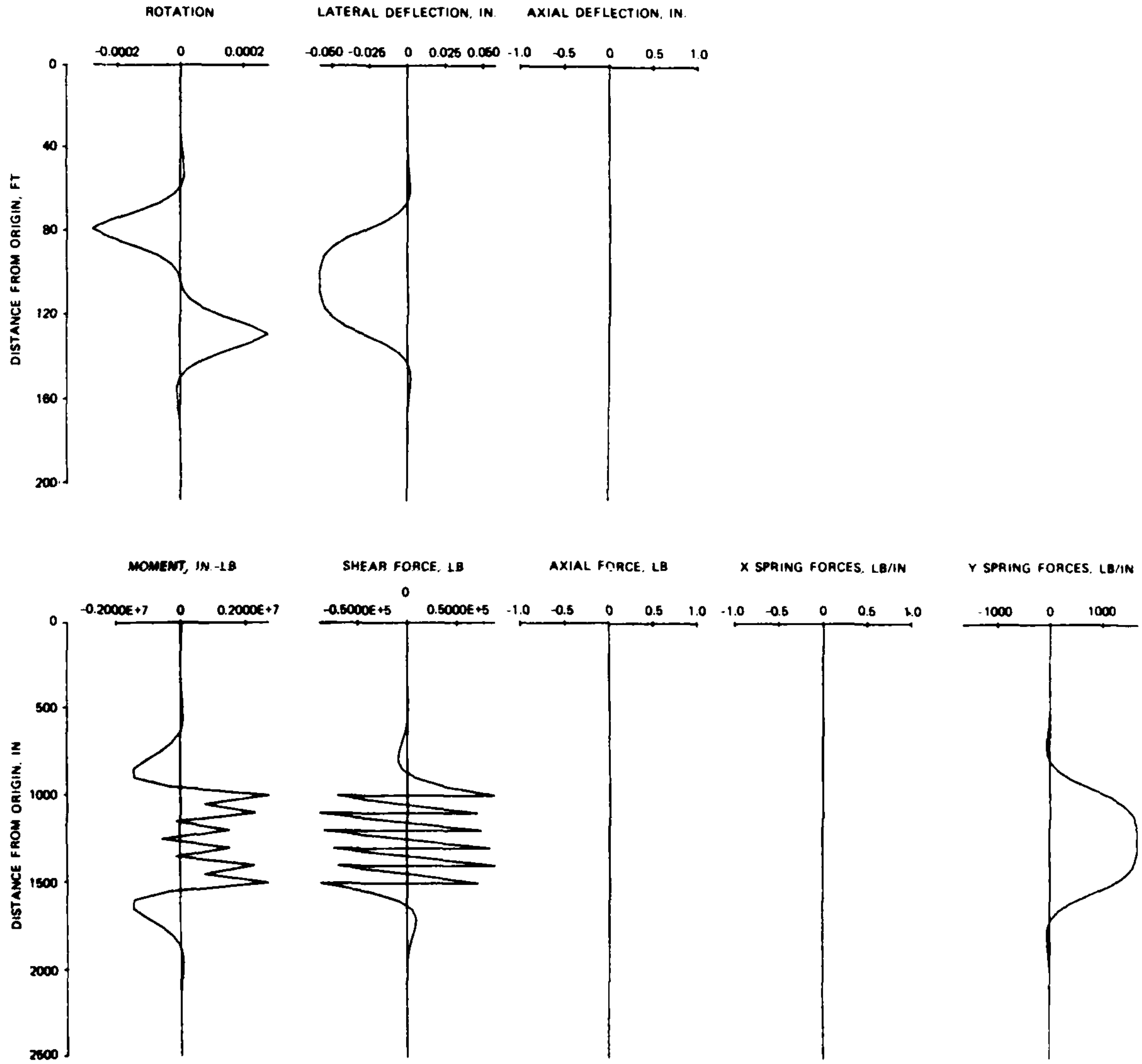


Figure C28. Beam-on-elastic foundation analysis for vertical loading of load case 4 with $K = 271.1$ lb/in.^{3}

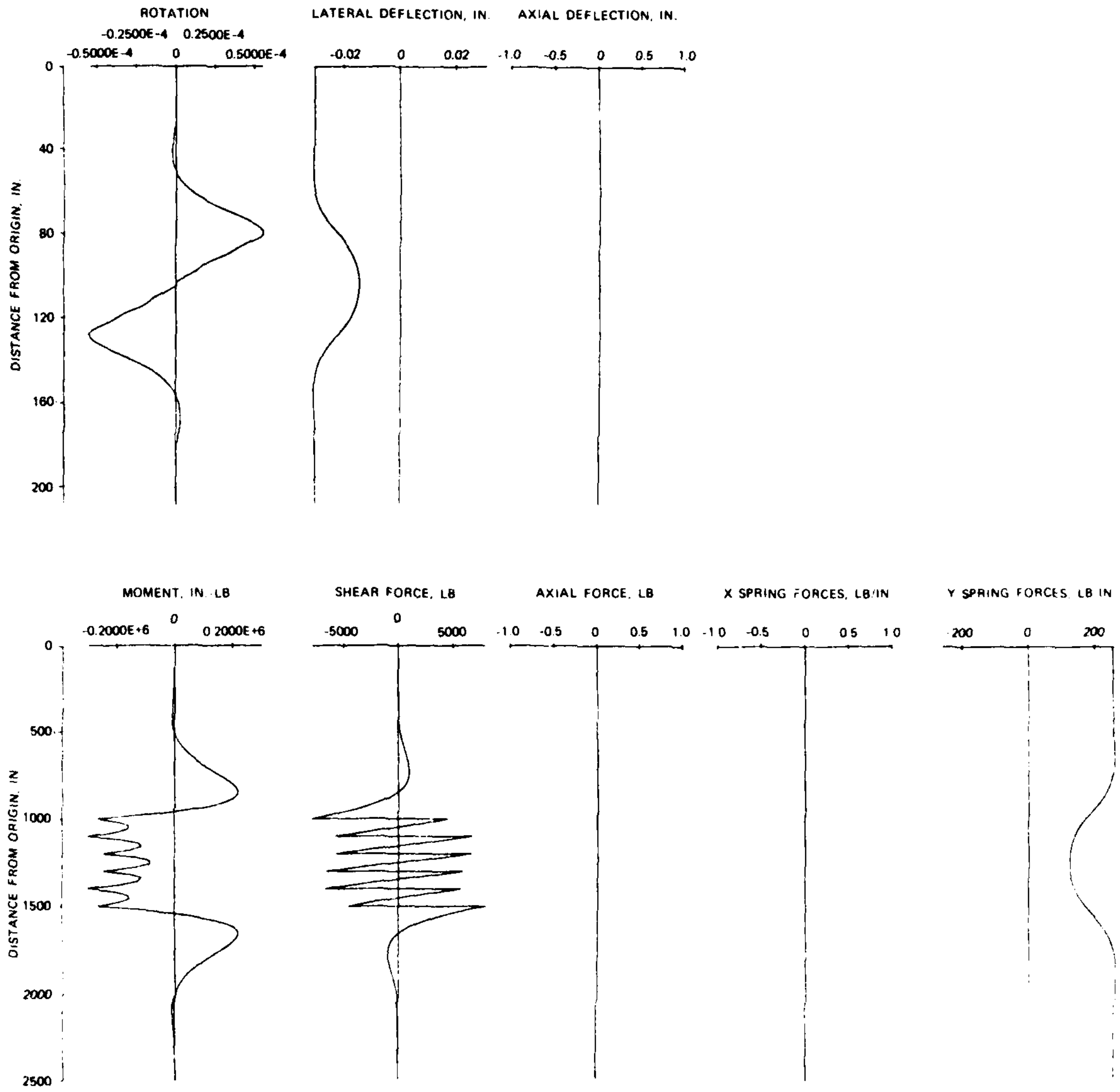


Figure C29. Beam-on-elastic foundation analysis for vertical loading of load case 5 with $K = 79.2\ \text{lb/in.}^3$

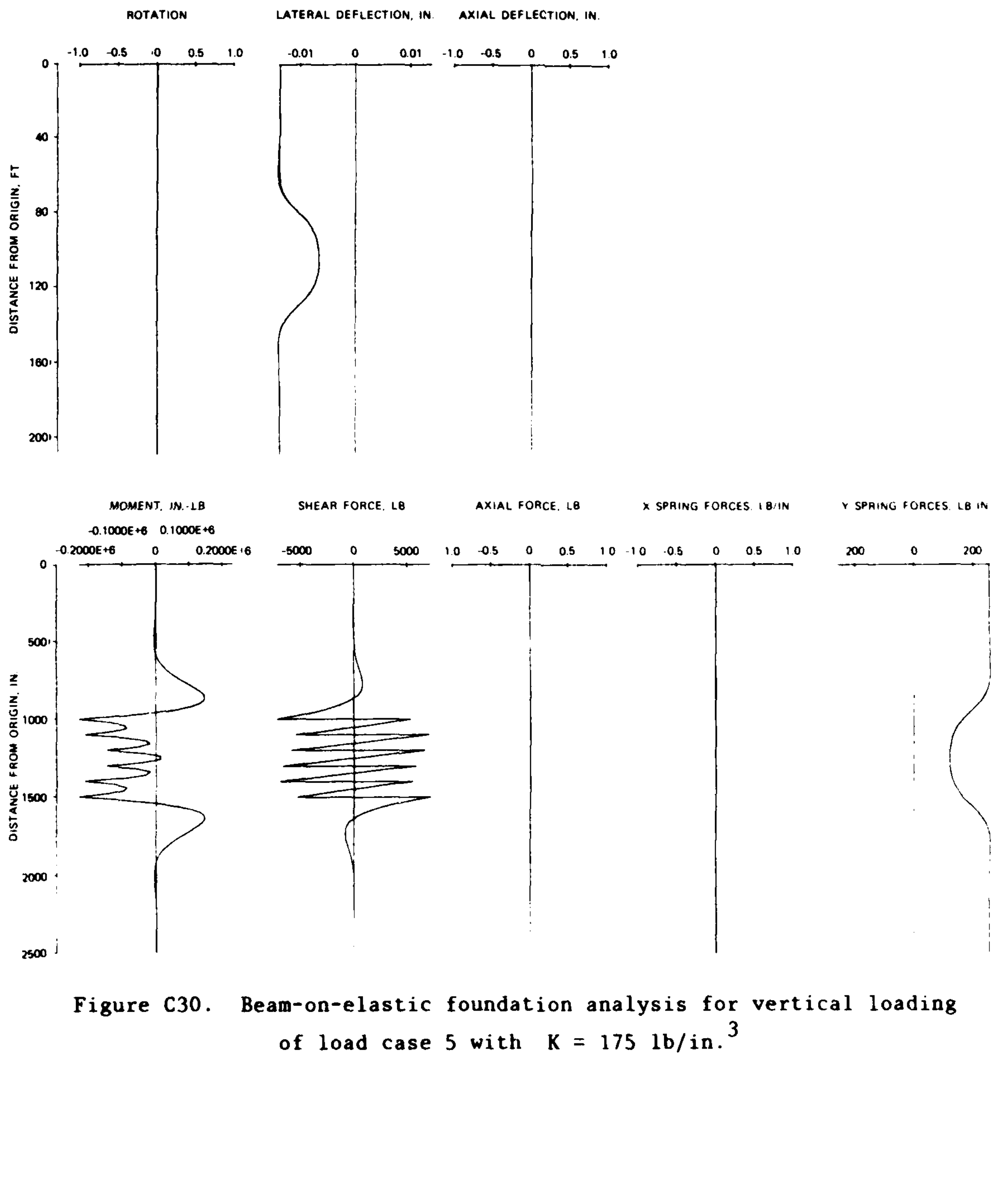


Figure C30. Beam-on-elastic foundation analysis for vertical loading of load case 5 with $K = 175\ lb/in.^3$

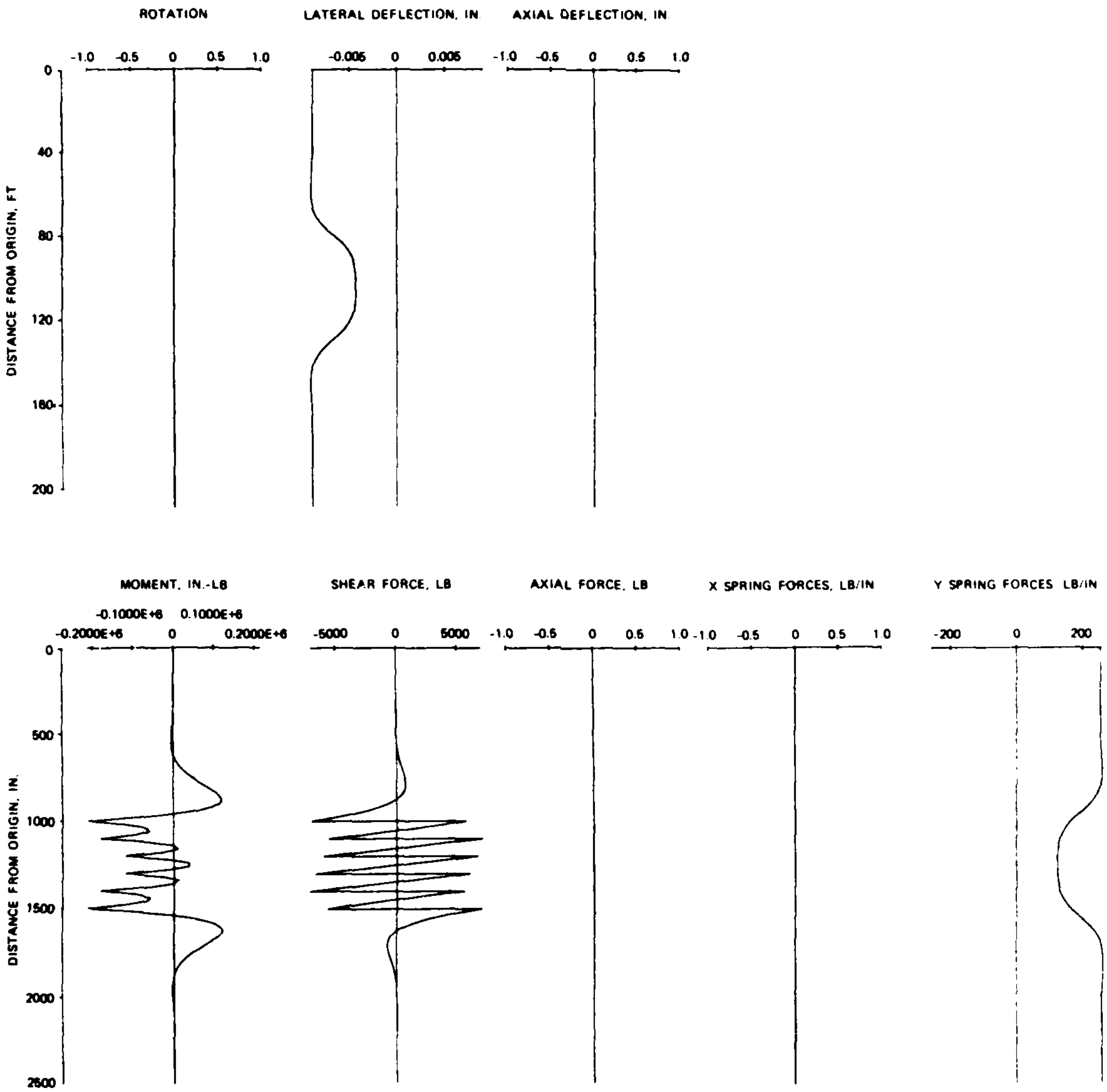


Figure C31. Beam-on-elastic foundation analysis for vertical loading of load case 5 with K = 271.1 lb/in.^{3}

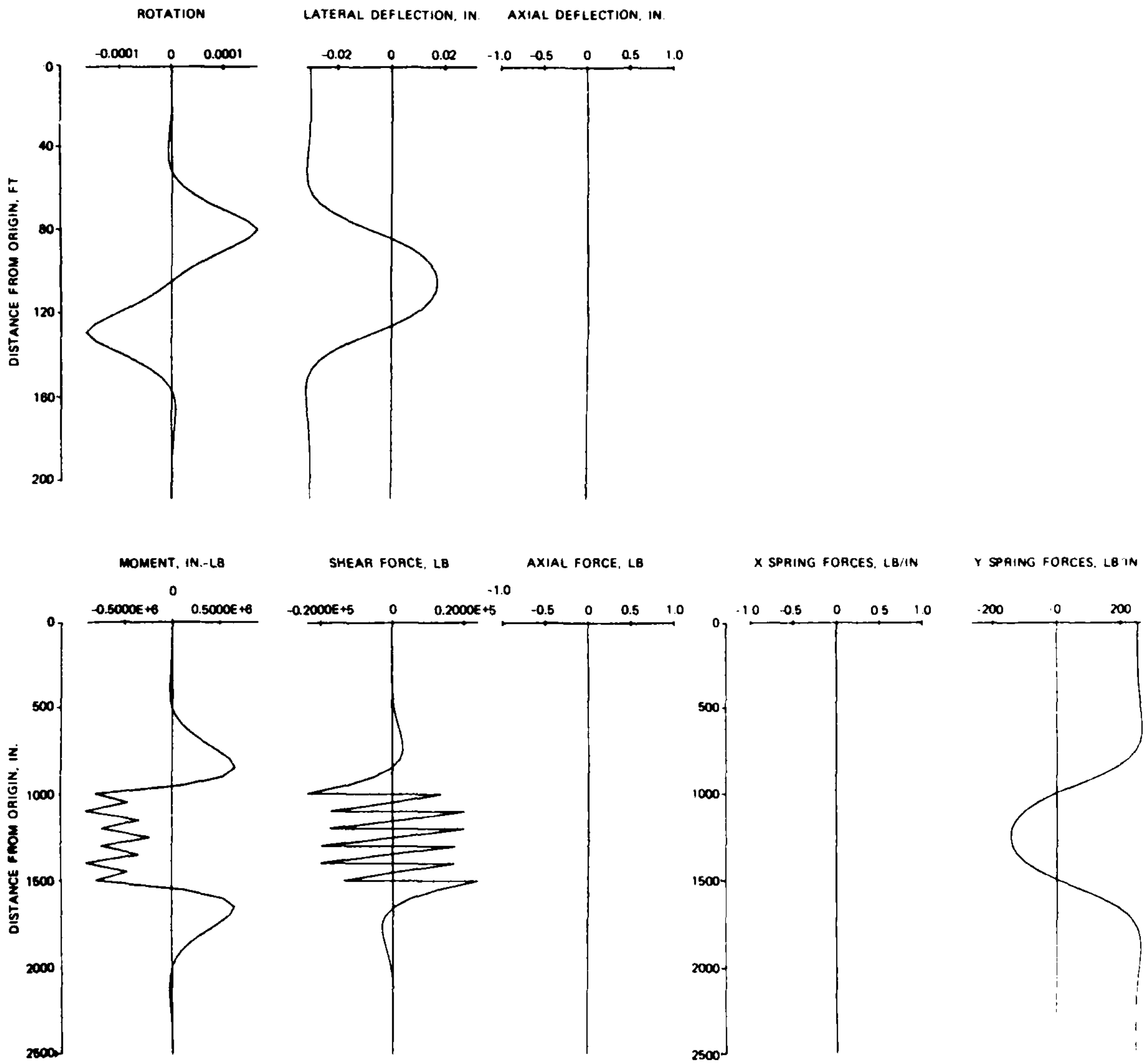


Figure C32. Beam-on-elastic foundation analysis for vertical loading of load case 6 with $K = 79.2\ \mathrm{lb/in.}^3$

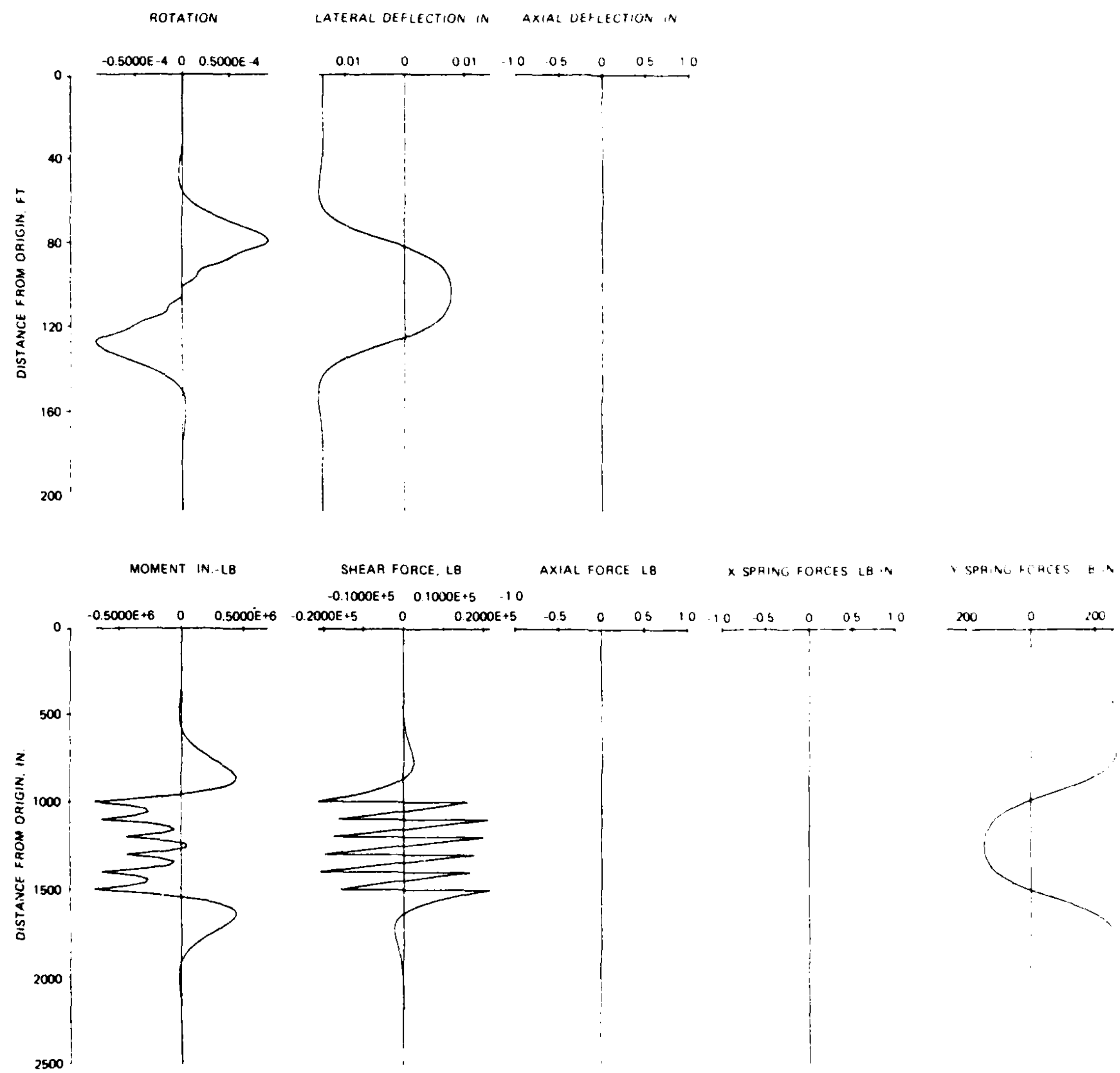


Figure C33. Beam-on-elastic foundation analysis for vertical loading of load case 6 with $K = 175\ lb/in.^3$

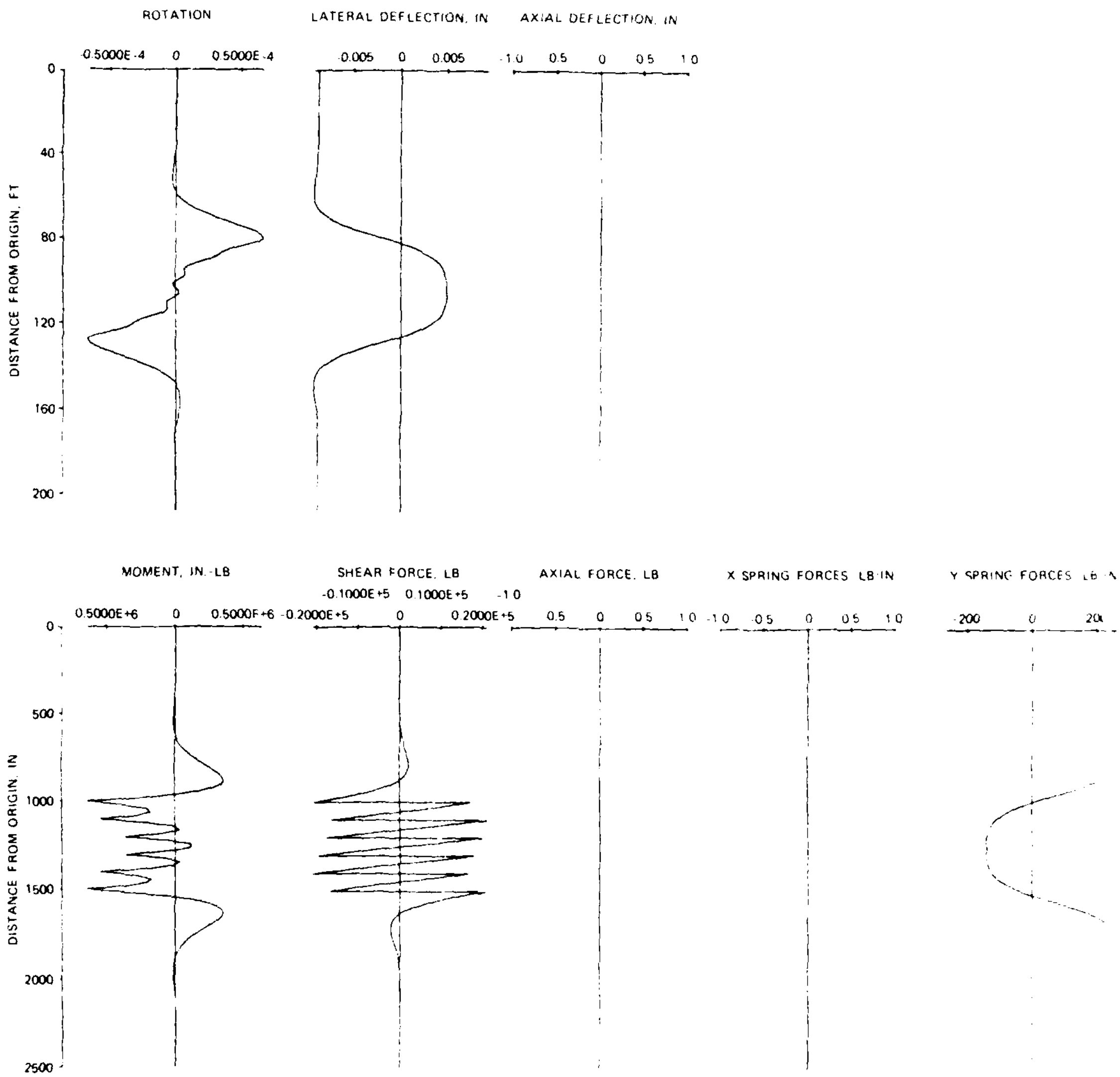


Figure C34. Beam-on-elastic foundation analysis for vertical loading of load case 6 with K = 271.1 lb/in.^{3}

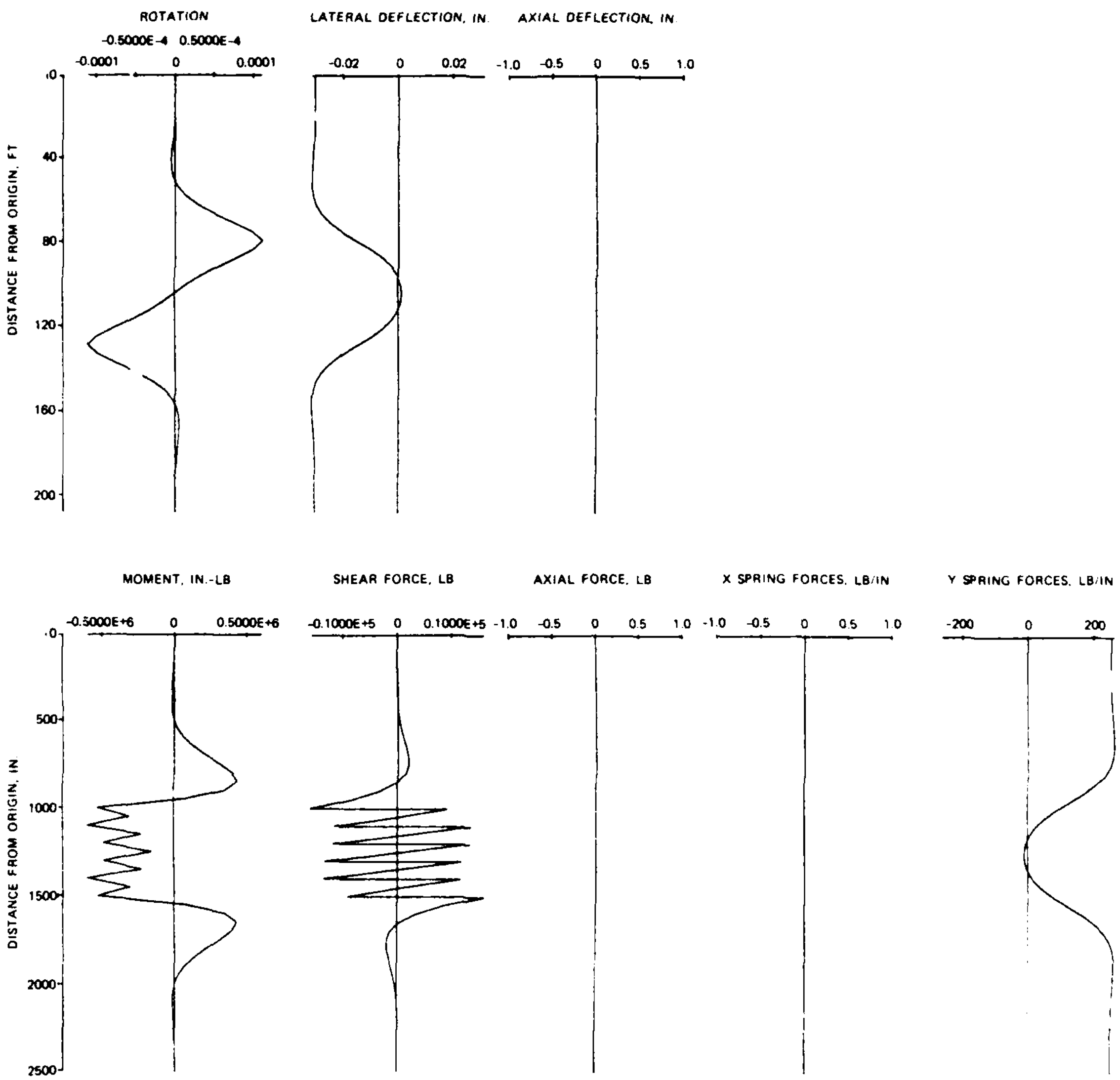


Figure C35. Beam-on-elastic foundation analysis for vertical loading of load case 7 with $K = 79.2\ \mathrm{lb/in.}^3$

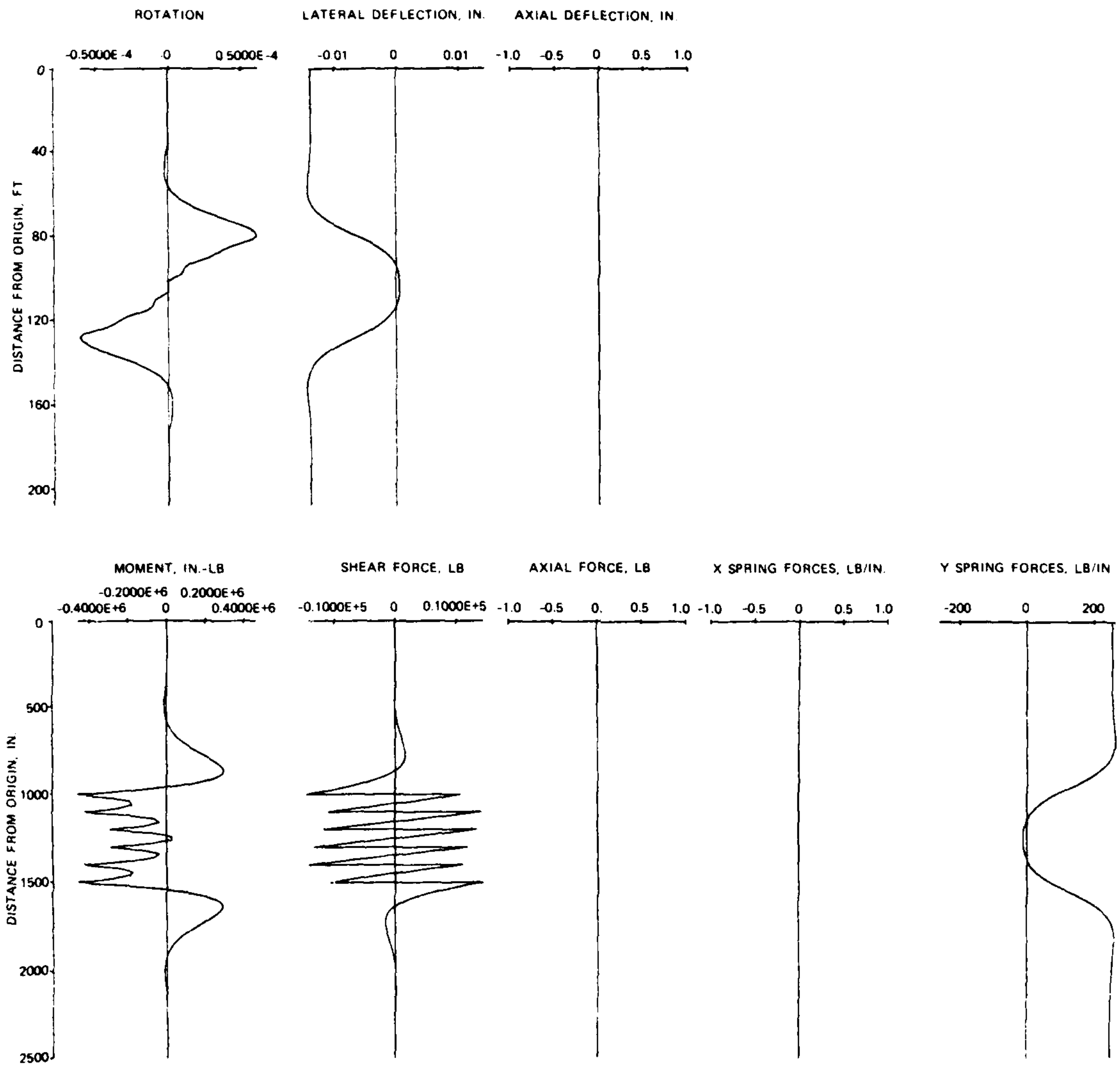


Figure C36. Beam-on-elastic foundation analysis for vertical loading of load case 7 with $K = 175$ lb/in.^{3}

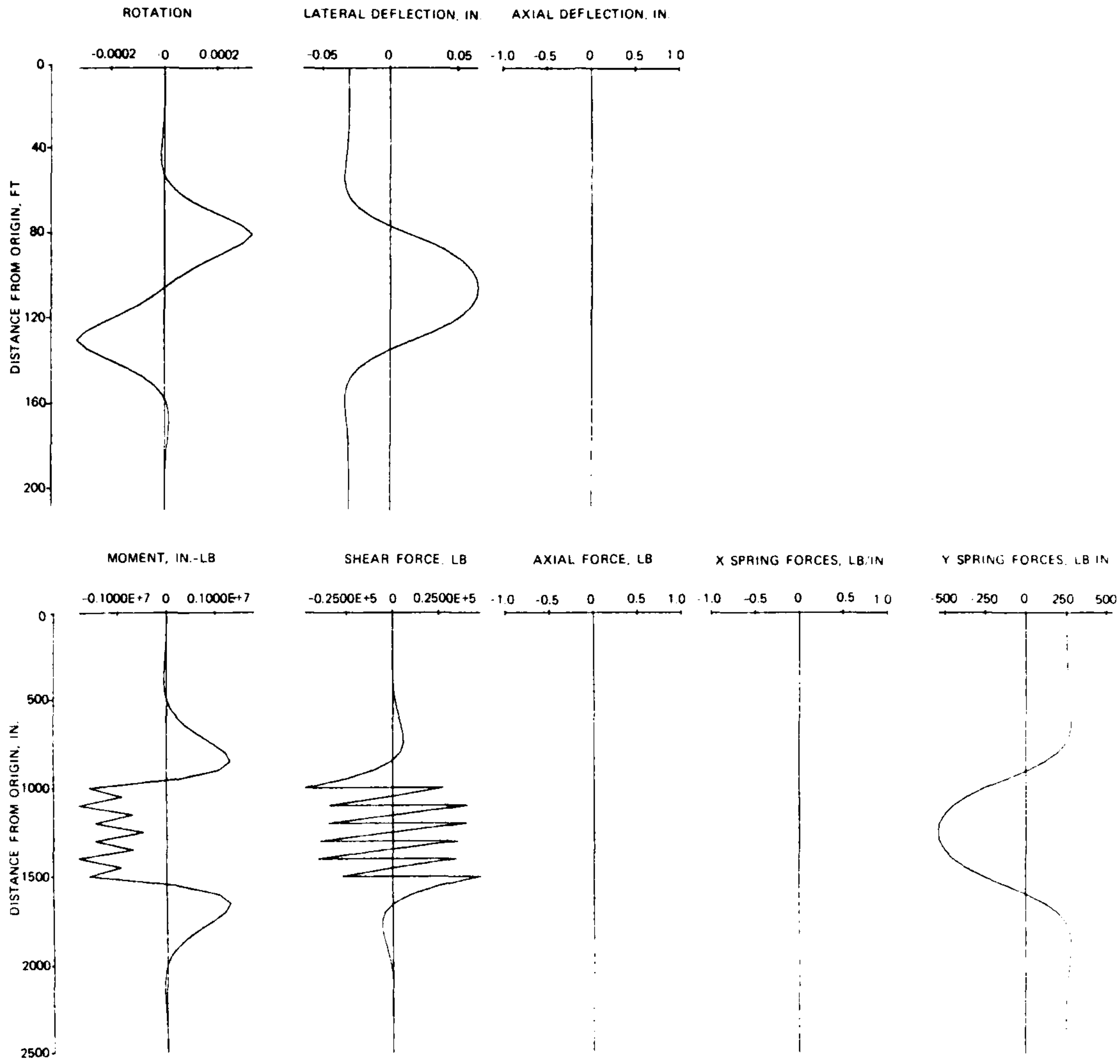


Figure C37. Beam-on-elastic foundation analysis for vertical loading of load case 8 with K = 79.2 lb/in.^{3}

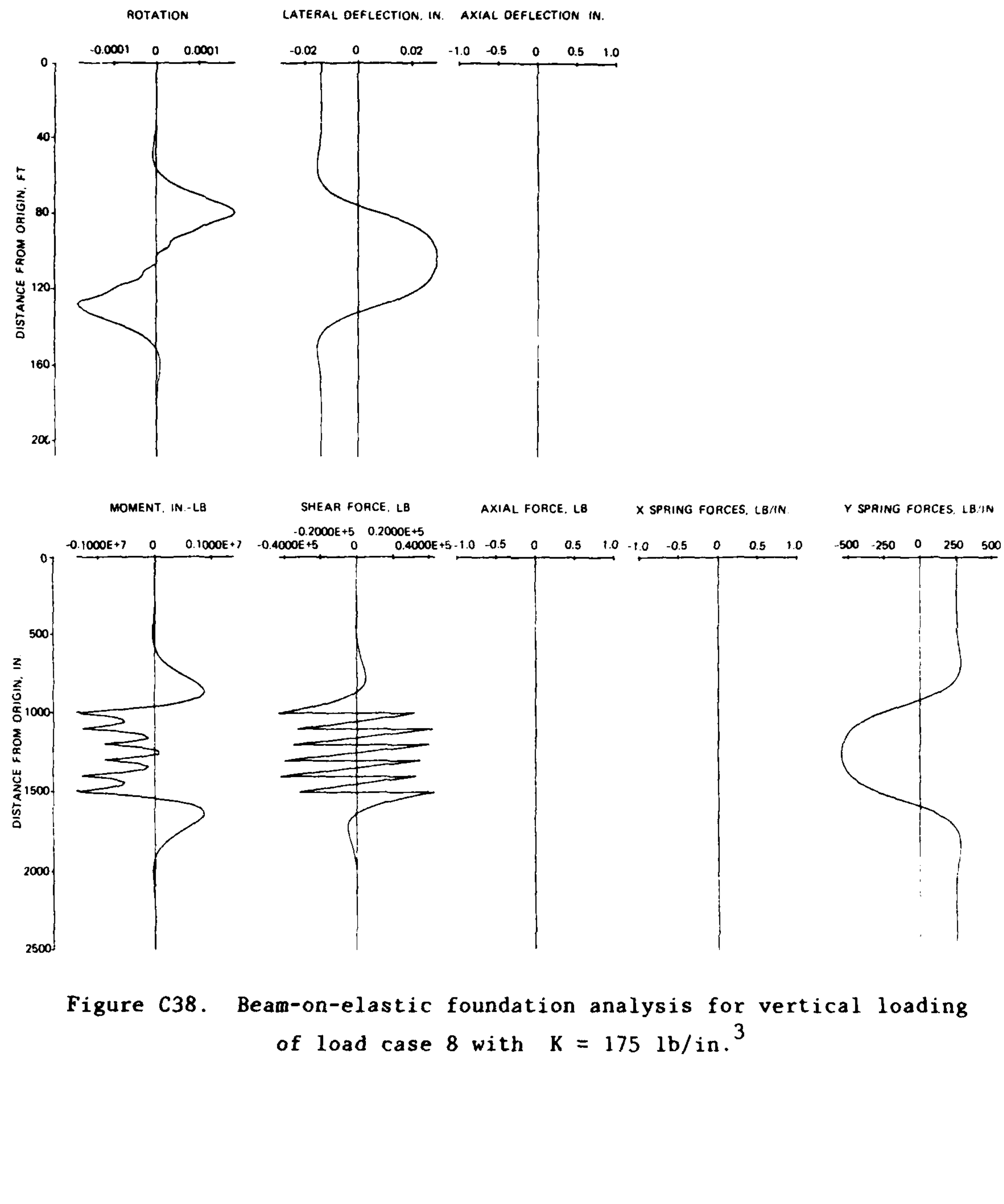


Figure C38. Beam-on-elastic foundation analysis for vertical loading of load case 8 with K = 175 lb/in.^{3}

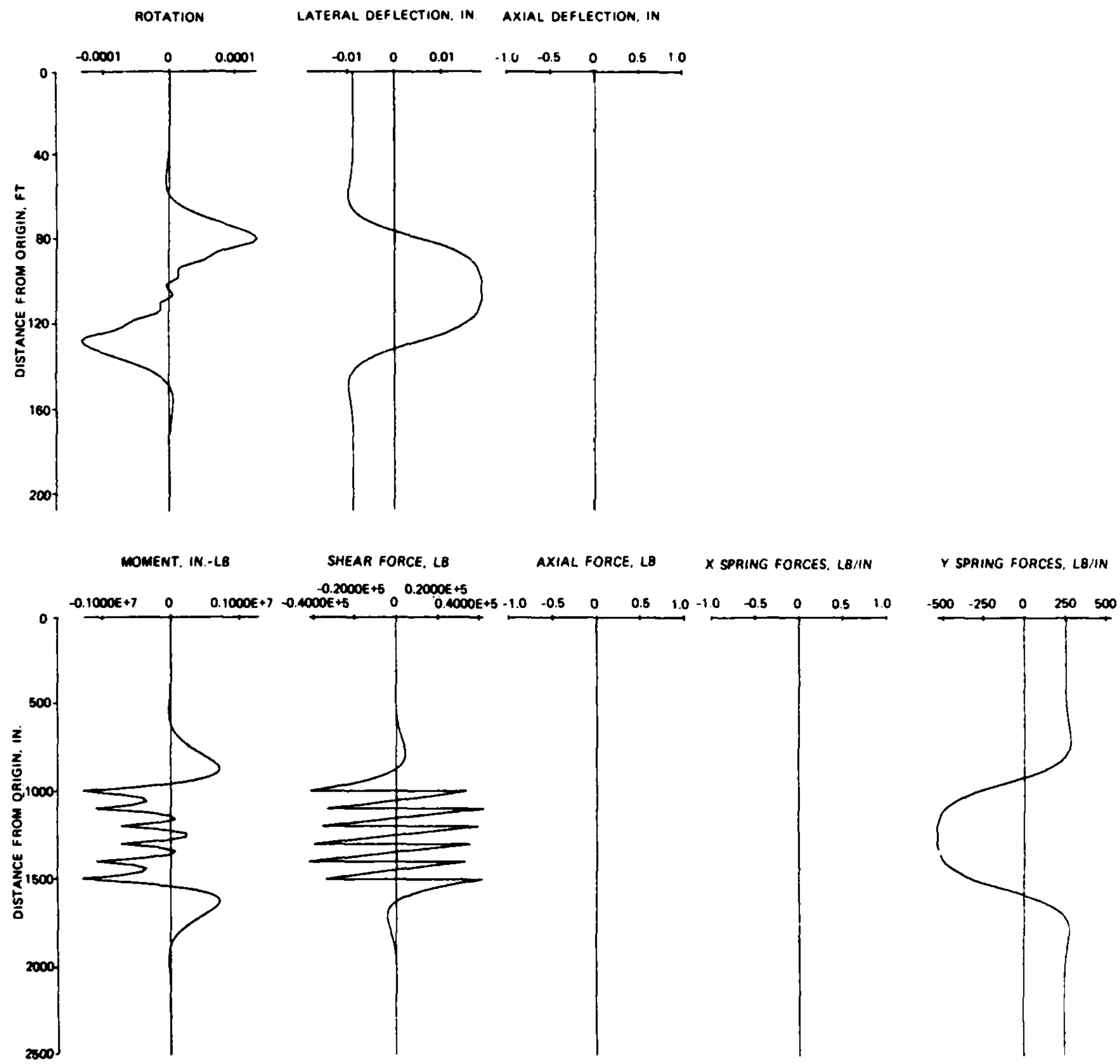


Figure C39. Beam-on-elastic foundation analysis for vertical loading of load case 8 with K = 271.1 lb/in.^{3}

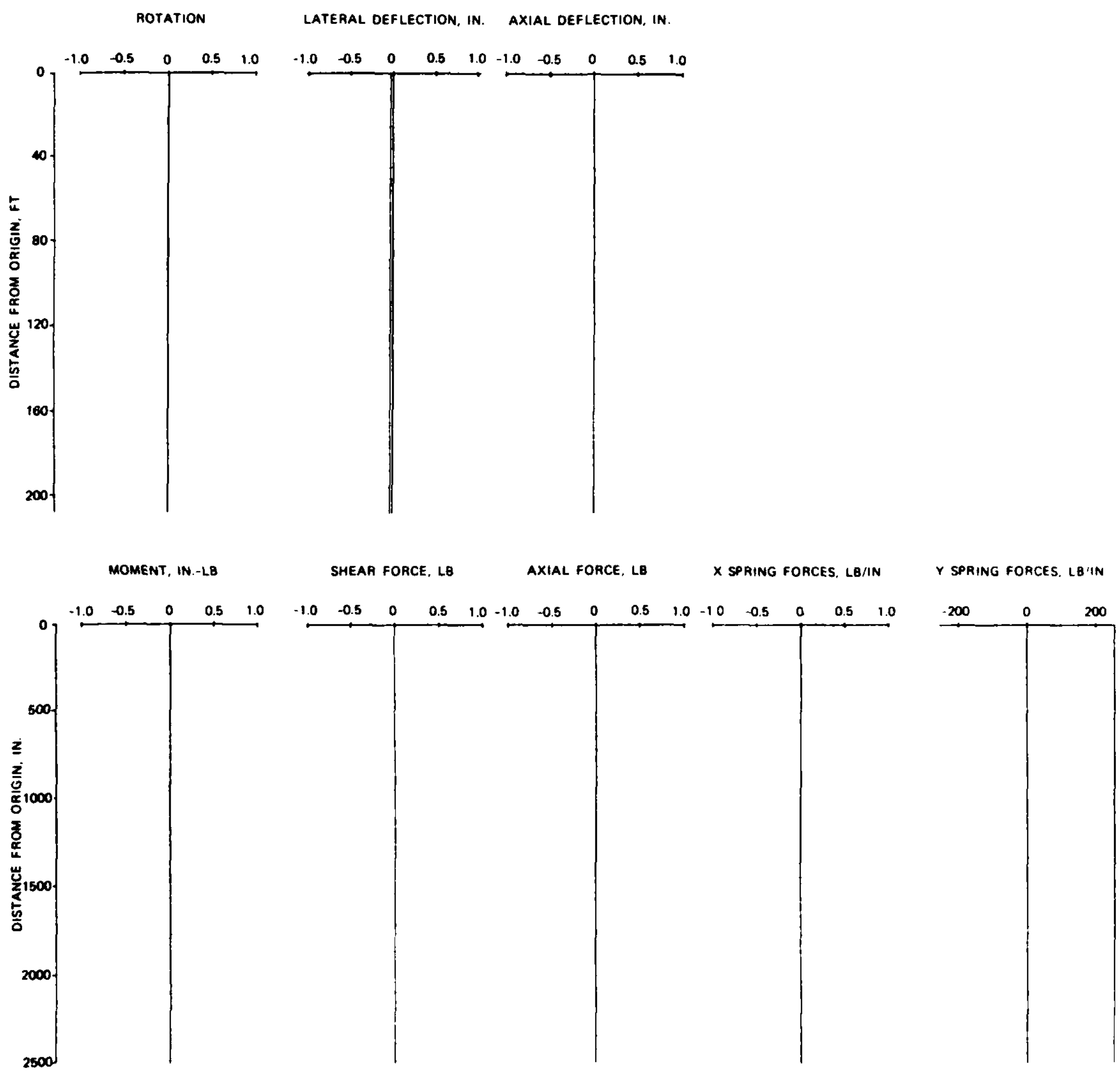


Figure C40. Beam-on-elastic foundation analysis for vertical loading of load case 17 with K = 79.2 lb/in.[3]

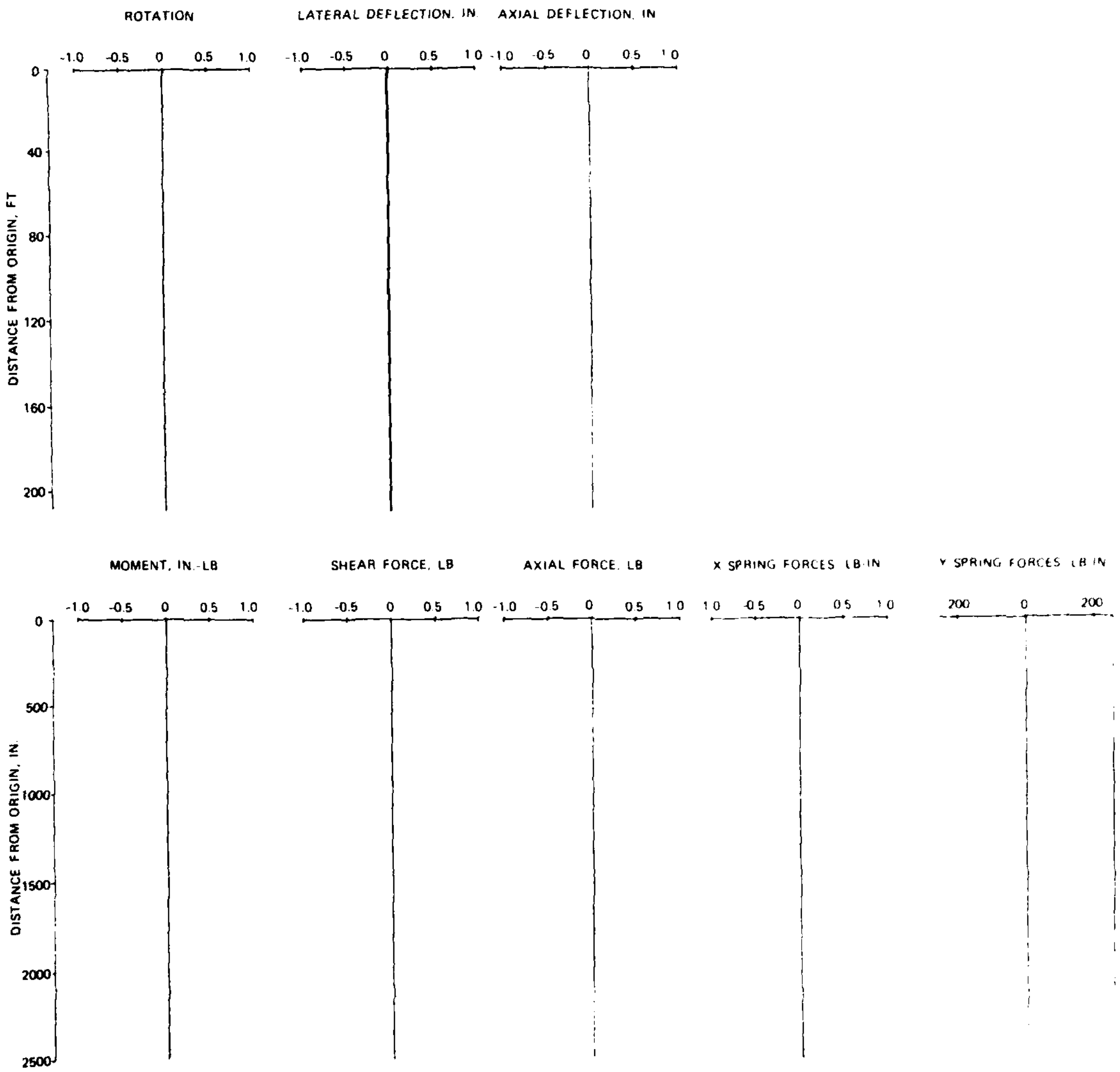


Figure C41. Beam-on-elastic foundation analysis for vertical loading of load case 17 with $K = 175$ lb/in.^{3}

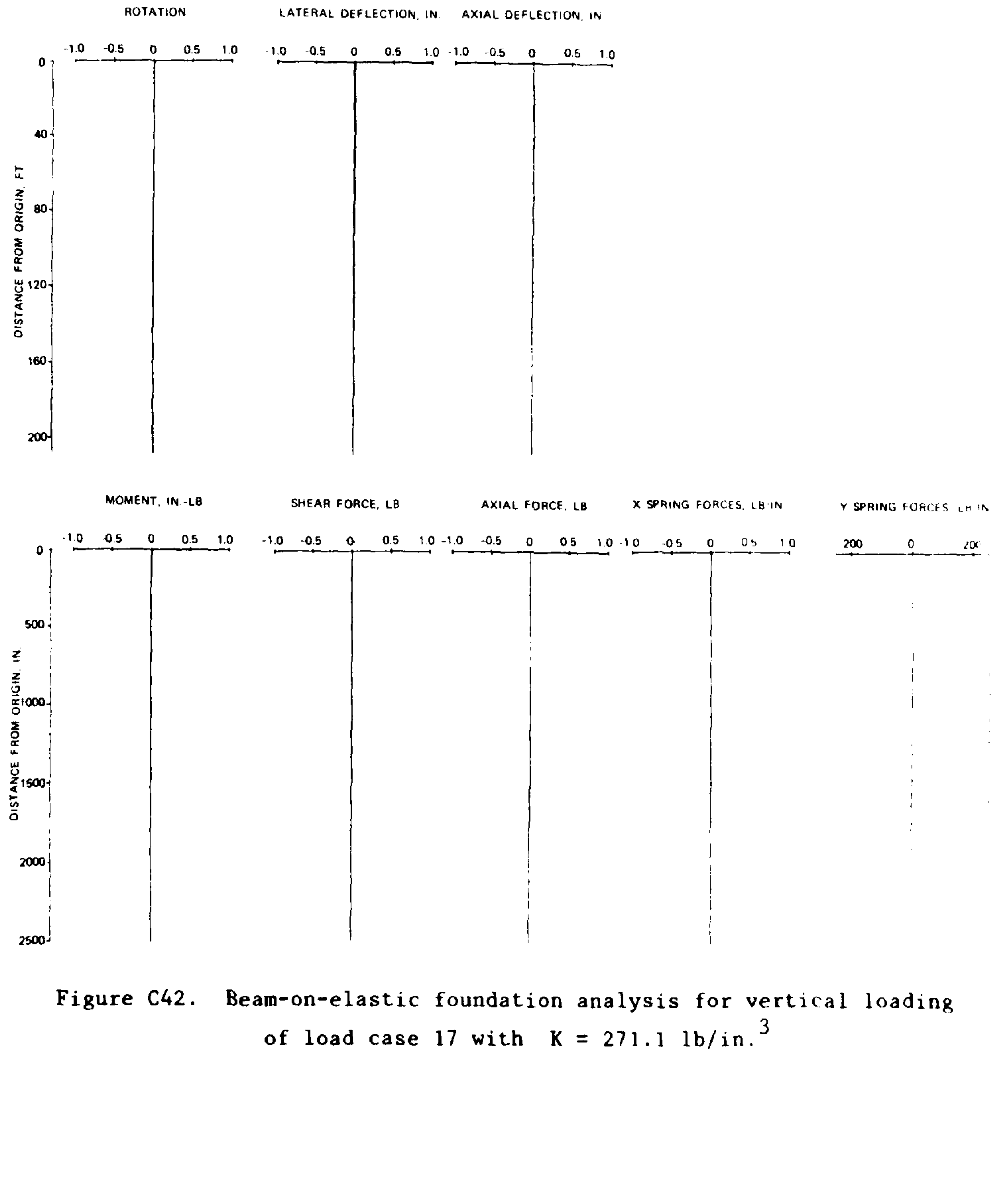


Figure C42. Beam-on-elastic foundation analysis for vertical loading of load case 17 with K = 271.1 $lb/in.^3$

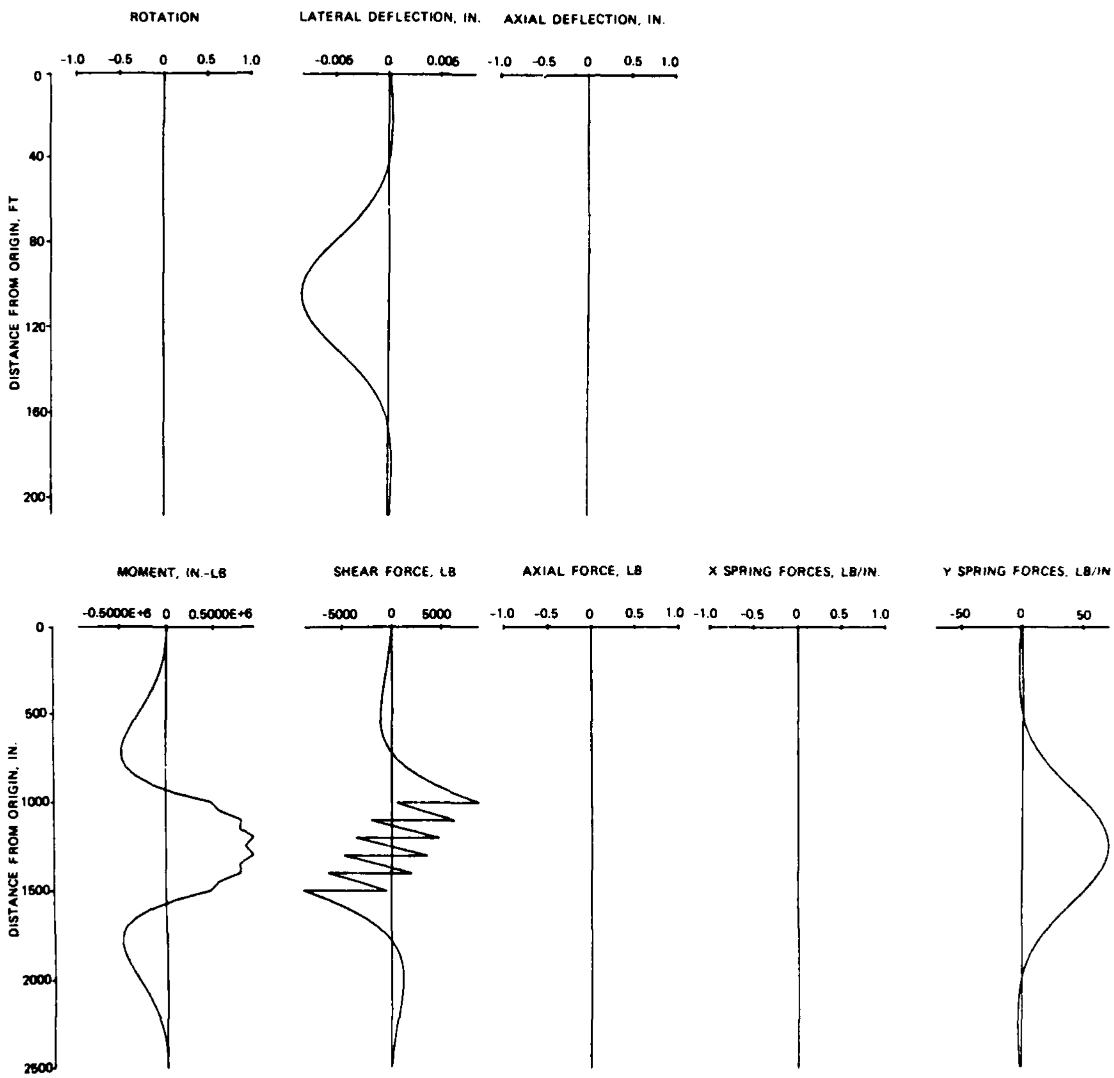


Figure C43. Beam-on-elastic foundation analysis for traverse loadings of load cases 1, 2, 5, and 6 with $K = 79.2\ \mathrm{lb/in.}^3$

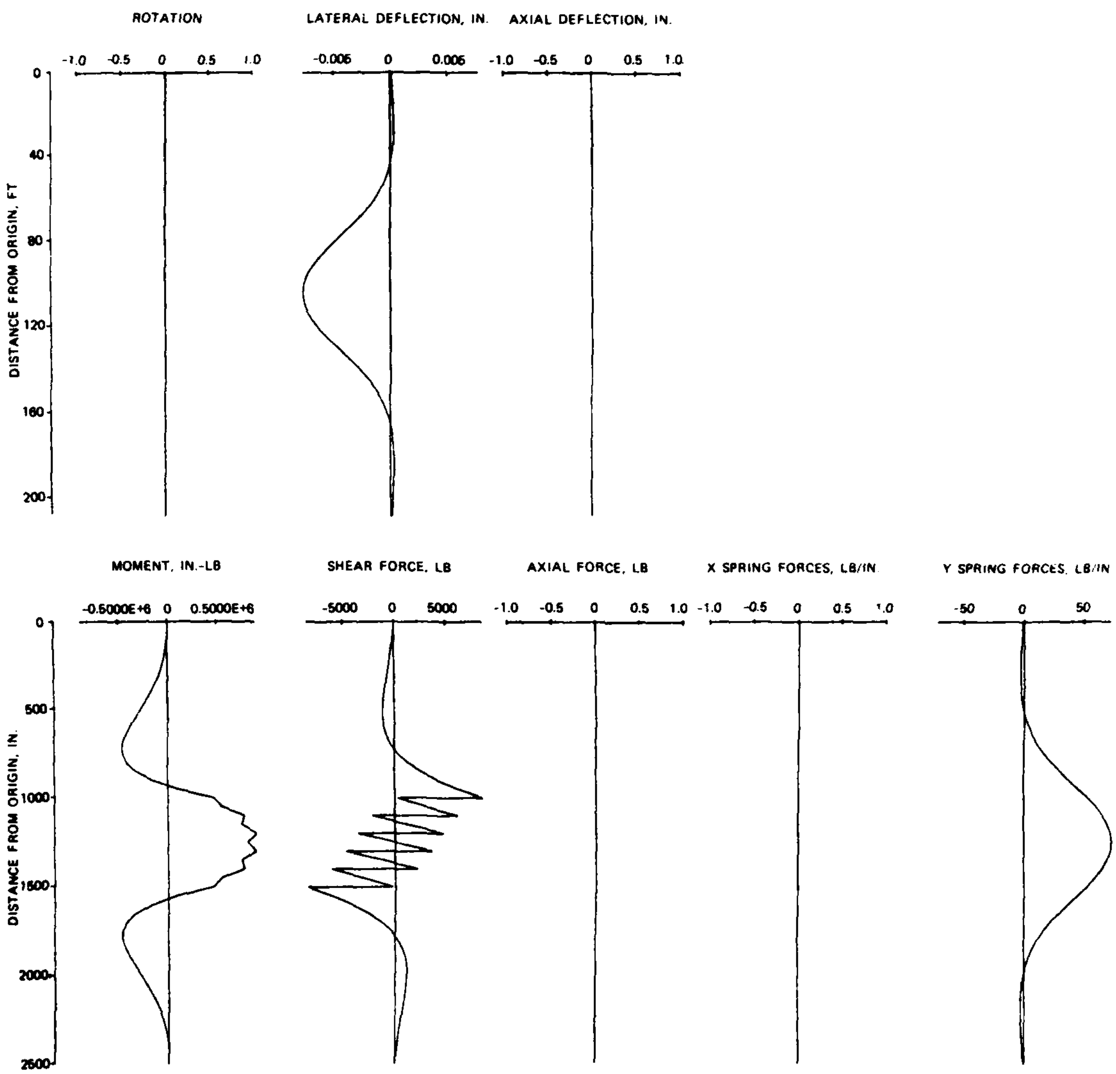


Figure C44. Beam-on-elastic foundation analysis for traverse loadings of load cases 1, 2, 5, and 6 with $K = 175\ lb/in.^3$

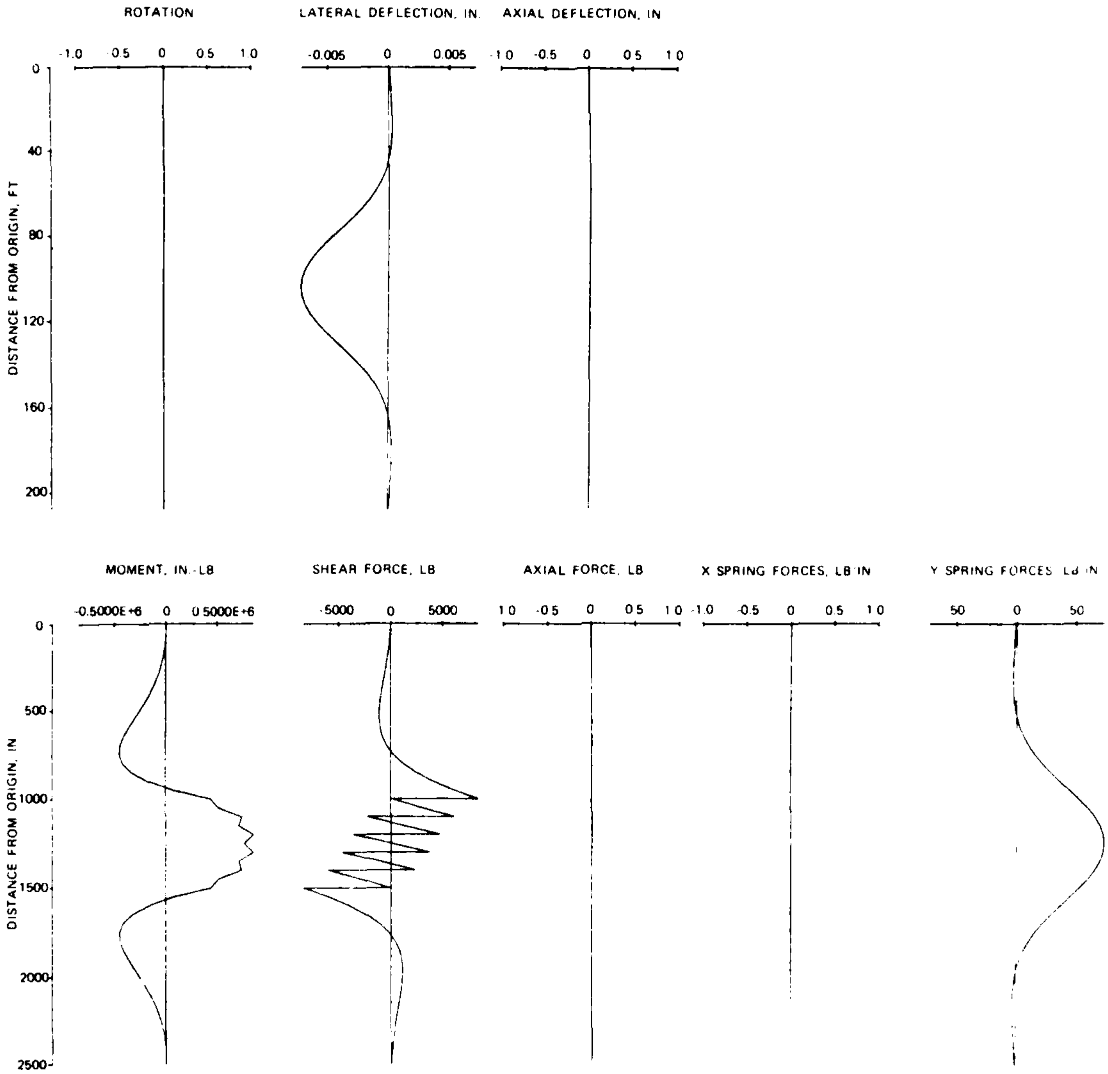


Figure C45. Beam-on-elastic foundation analysis for traverse loadings of load cases 1, 2, 5, and 6 with K = 27ı.1 lb/in.^{3}

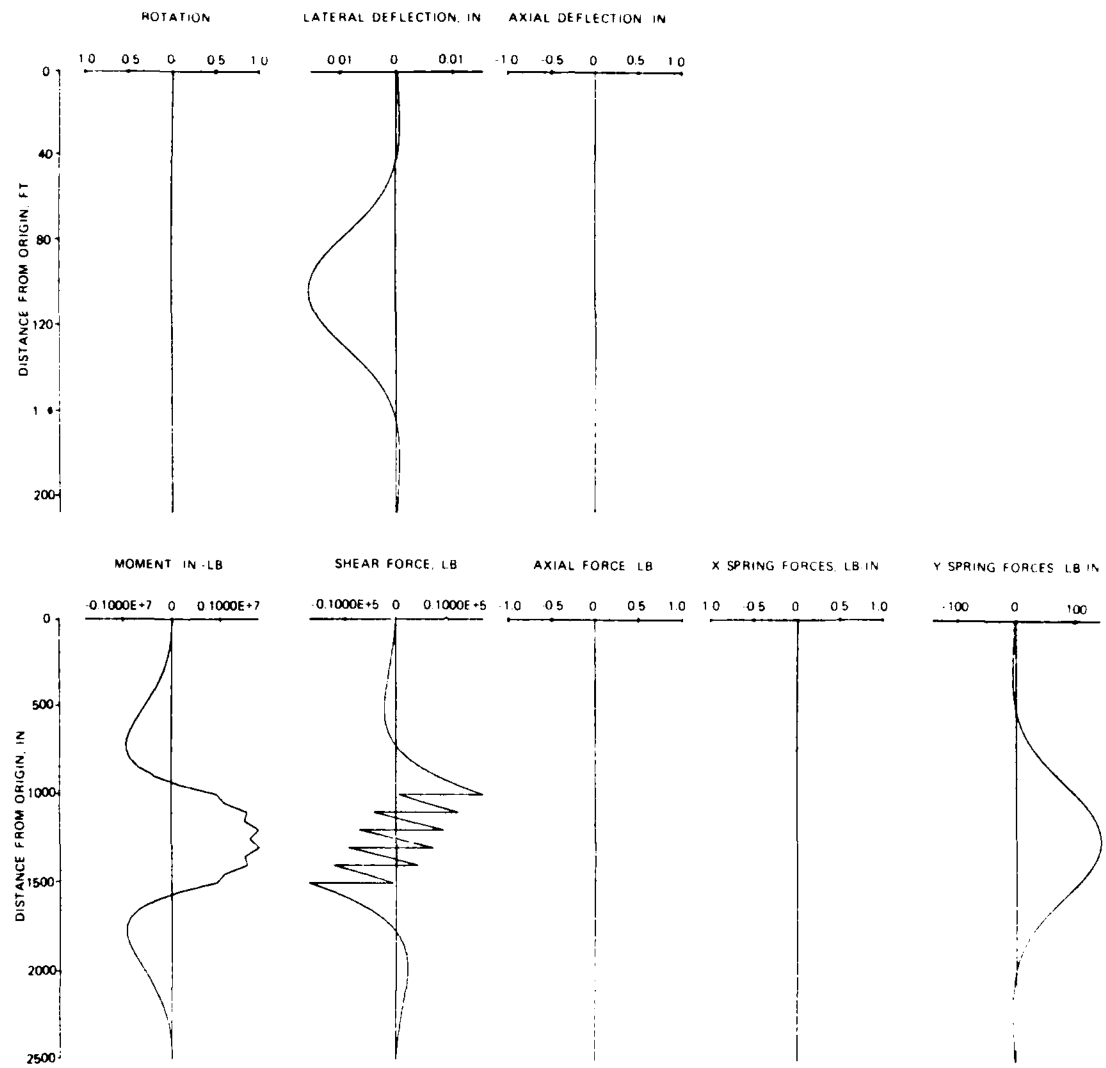


Figure C46. Beam-on-elastic foundation analysis for traverse loadings of load cases 3, 4, 7, and 8 with $K = 79.2$ lb/in.^{3}

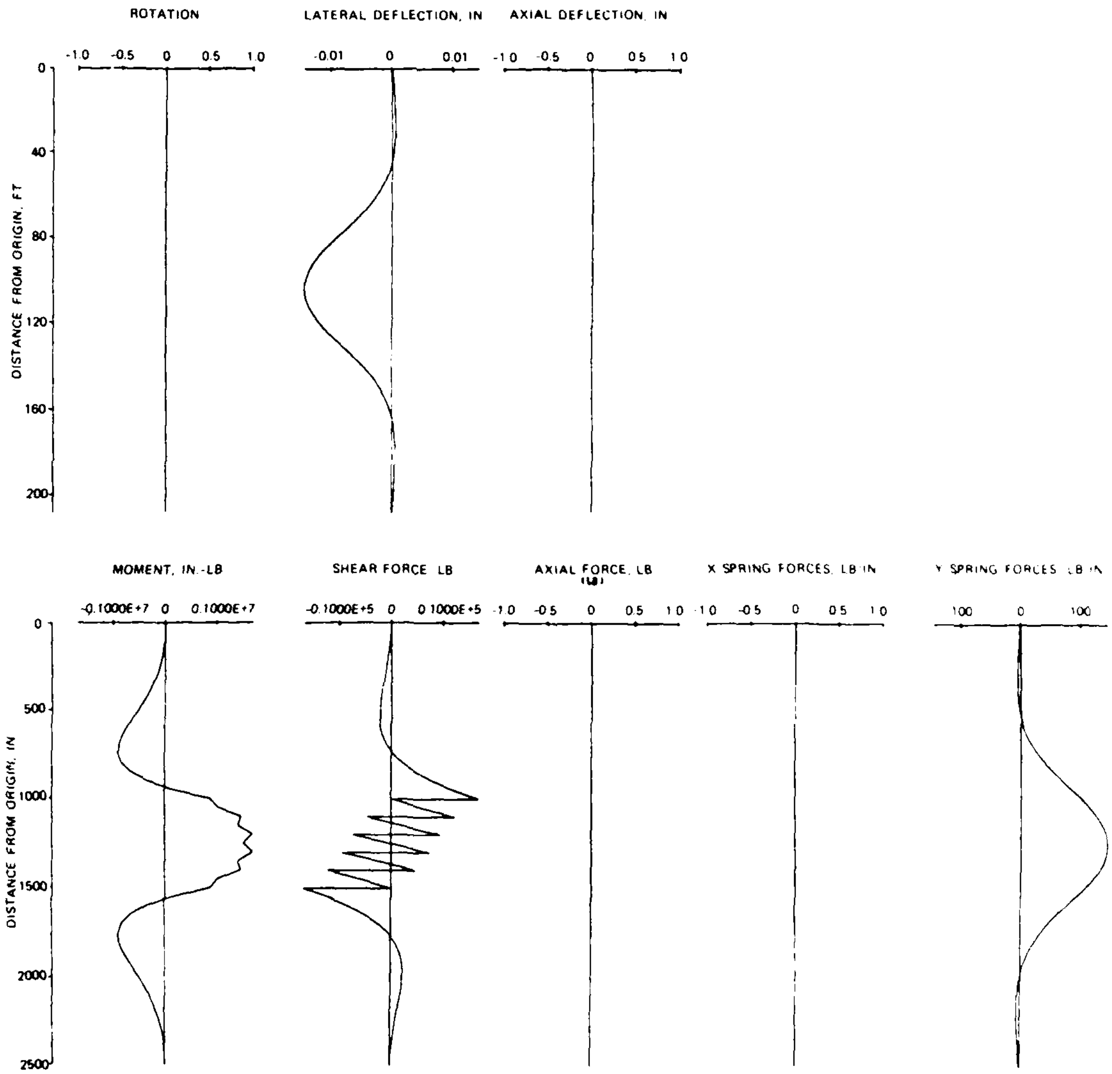


Figure C47. Beam-on-elastic foundation analysis for traverse loadings of load cases 3, 4, 7, and 8 with K = 175 lb/in.^{3}

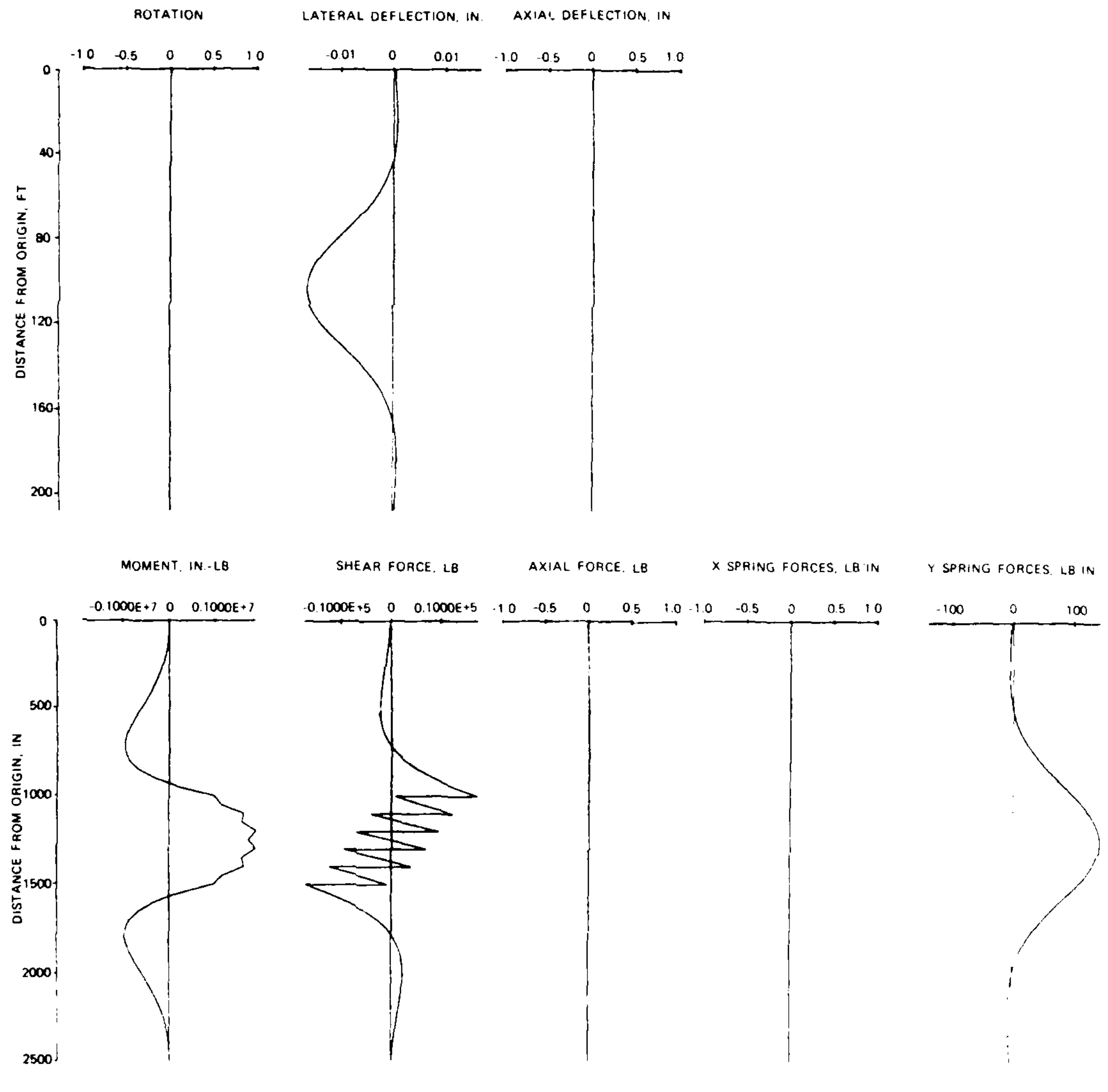


Figure C48. Beam-on-elastic foundation analysis for traverse loadings of load cases 3, 4, 7, and 8 with $K = 271.1$ lb/in.^{3}

AD-A140 036 CONDITION EVALUATION OF SUPERSONIC NAVAL ORDNANCE RESEARCH TRACK (SNORT)(U) ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG MS STRUC.. 3/3

UNCLASSIFIED B R SULLIVAN ET AL. FEB 84 WES/MP/SL-84-1 F/G 13/13 NL

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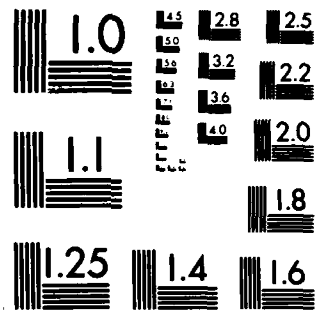
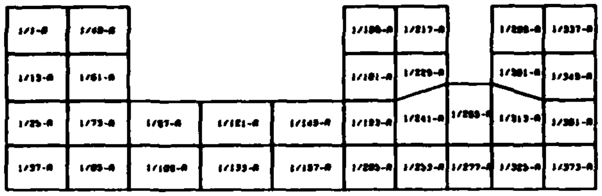


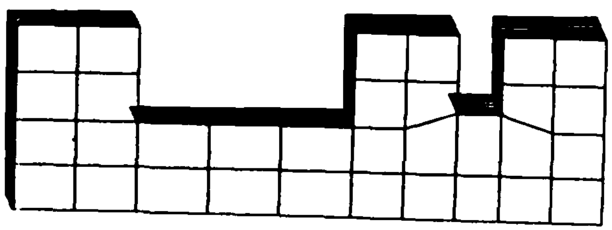
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

APPENDIX D: FINITE-ELEMENT ANALYSIS, PROPOSED SNORT TRACK

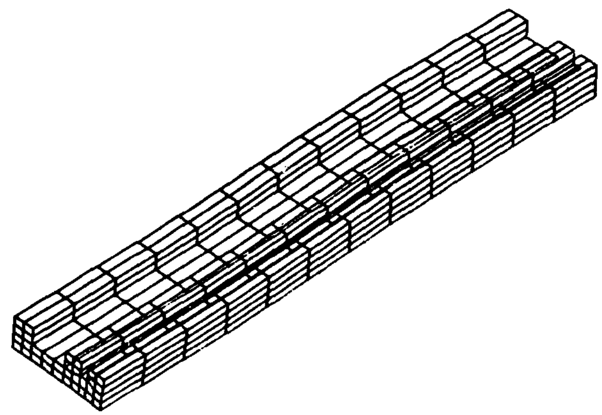


FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
UNDEFORMED GRID

FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
LOAD CASE NO-1



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
LOAD CASE NO-1



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
LOAD CASE NO-1

Figure D1. Finite-element analysis for load case 1 with K = 175 lb/ft^3 (Sheet 1 of 5)

NORMAL STRESSES FOR LOAD CASE 1 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
1	0	-19	-4	2	0	-20	-4	3	0	-20	-4	4	0	-20	-5	5	0	-17	-4	6	-1	-10	-6
7	0	9	1	8	0	16	-1	9	0	19	0	10	0	19	0	11	0	19	0	12	0	18	0
13	0	-16	-3	14	0	-16	-3	15	0	-15	-3	16	0	-14	-3	17	0	-11	-3	18	0	-5	-4
19	0	4	-1	20	0	10	-1	21	0	13	-1	22	0	15	-1	23	0	15	-1	24	0	15	-1
25	0	-13	-3	26	0	-12	-3	27	0	-11	-3	28	0	-9	-3	29	0	-6	-3	30	0	-2	-3
31	0	1	-2	32	0	5	-2	33	0	8	-2	34	0	10	-1	35	0	11	-1	36	0	12	-1
37	0	-10	-4	38	0	-9	-4	39	0	-7	-3	40	0	-4	-3	41	0	-1	-3	42	1	1	-3
43	0	-2	-2	44	0	0	-2	45	0	3	-2	46	0	6	-2	47	0	8	-2	48	0	9	-2
49	-3	-17	-7	50	-3	-17	-7	51	-3	-18	-7	52	-3	-18	-7	53	-3	-16	-6	54	-4	-9	-8
55	1	7	1	56	0	14	-1	57	0	16	0	58	0	16	0	59	0	15	0	60	0	15	0
61	0	-14	-9	62	0	-14	-9	63	0	-14	-9	64	0	-13	-9	65	-1	-11	-9	66	0	-5	-10
67	0	3	0	68	1	9	-1	69	0	11	-1	70	0	12	-1	71	0	12	-1	72	0	12	-1
73	0	-10	-6	74	0	-10	-6	75	0	-9	-6	76	0	-7	-6	77	-1	-5	-6	78	-1	-2	-6
79	1	0	-2	80	1	3	-2	81	0	6	-2	82	0	7	-2	83	0	8	-1	84	0	9	-1
85	-1	-7	-4	86	-1	-6	-4	87	-1	-4	-4	88	0	-1	-4	89	0	1	-4	90	0	2	-3
91	-2	-3	-3	92	-1	-2	-2	93	-1	0	-2	94	-1	3	-2	95	-1	5	-2	96	0	6	-2
97	4	-6	-4	98	4	-5	-4	99	3	-5	-4	100	3	-4	-4	101	2	-2	-4	102	2	-1	-4
103	4	1	-1	104	4	3	-1	105	3	4	-1	106	2	5	-1	107	2	6	-1	108	2	6	-1
109	-7	-5	-4	110	-6	-4	-4	111	-6	-2	-4	112	-6	0	-4	113	-5	2	-3	114	-4	1	-3
115	-5	-4	-2	116	-4	-4	-2	117	-3	-3	-2	118	-2	-1	-2	119	-2	1	-2	120	-2	2	-2
121	11	0	-1	122	11	0	-1	123	11	0	-1	124	11	1	0	125	10	1	0	126	8	1	0
127	6	1	-1	128	5	2	-1	129	4	2	0	130	4	2	0	131	3	3	0	132	3	3	0
133	-13	-2	-3	134	-13	-1	-3	135	-13	0	-3	136	-12	2	-3	137	-11	2	-3	138	-9	0	-2
139	-7	-5	-2	140	-6	-6	-2	141	-5	-6	-2	142	-4	-4	-2	143	-3	-3	-1	144	-3	-2	-1
145	15	4	0	146	15	4	0	147	15	4	0	148	14	4	0	149	13	4	0	150	11	3	0
151	7	1	0	152	5	0	0	153	4	0	0	154	4	0	0	155	4	0	0	156	3	0	0
157	-16	1	-3	158	-16	2	-3	159	-15	3	-3	160	-14	4	-3	161	-13	4	-3	162	-11	0	-2
163	-8	-5	-2	164	-6	-8	-2	165	-5	-9	-2	166	-4	-8	-2	167	-4	-6	-2	168	-4	-6	-2
169	0	-5	0	170	0	-6	0	171	0	-8	0	172	0	-10	0	173	0	-10	0	174	0	-5	-1
175	0	5	0	176	0	10	0	177	0	10	0	178	0	8	0	179	0	6	0	180	0	5	0
181	8	1	-1	182	8	0	-1	183	8	-1	-1	184	7	-2	-1	185	7	-2	-1	186	6	-1	-1
187	3	2	-1	188	2	4	-1	189	2	3	-1	190	2	2	-1	191	1	1	-1	192	1	1	-1
193	6	4	-4	194	6	4	-4	195	6	4	-4	196	6	4	-3	197	6	3	-3	198	5	1	-3
199	2	-1	-2	200	2	-3	-2	201	1	-4	-2	202	1	-4	-2	203	1	-4	-1	204	1	-4	-1
205	-14	4	-4	206	-14	5	-4	207	-13	6	-4	208	-13	7	-4	209	-12	6	-4	210	-10	1	-3
211	-7	-6	-3	212	-5	-10	-3	213	-4	-11	-2	214	-3	-10	-2	215	-3	-9	-2	216	-3	-9	-2
217	1	-2	0	218	0	-3	0	219	0	-5	0	220	0	-7	0	221	0	-7	0	222	0	-3	0
223	0	3	0	224	0	7	0	225	0	7	0	226	0	5	0	227	0	3	0	228	0	2	0
229	7	3	-2	230	7	2	-2	231	7	1	-2	232	7	0	-2	233	7	-1	-2	234	6	0	-1
235	3	1	-2	236	2	2	-2	237	1	1	-2	238	1	0	-2	239	1	-1	-1	240	1	-2	-1
241	4	6	-4	242	4	6	-4	243	4	6	-4	244	4	5	-3	245	4	4	-3	246	3	2	-3
247	1	-2	-3	248	1	-4	-2	249	1	-5	-2	250	1	-6	-2	251	1	-6	-2	252	1	-6	-2
253	-10	8	-5	254	-10	8	-5	255	-10	9	-5	256	-9	9	-4	257	-9	8	-4	258	-7	3	-4
259	-5	-6	-3	260	-4	-12	-3	261	-3	-13	-3	262	-2	-13	-2	263	-2	-12	-2	264	-2	-11	-2
265	7	9	-2	266	7	9	-2	267	7	8	-2	268	7	7	-2	269	7	6	-2	270	6	3	-2
271	2	-2	-1	272	1	-5	-1	273	1	-6	-1	274	1	-7	-1	275	1	-8	-1	276	1	-8	-1
277	-8	11	-5	278	-8	11	-5	279	-8	12	-5	280	-7	12	-4	281	-7	10	-4	282	-5	4	-4
283	-5	-7	-3	284	-3	-13	-3	285	-2	-15	-2	286	-2	-15	-2	287	-2	-14	-2	288	-2	-14	-2
289	-3	-2	-12	290	-3	-3	-12	291	-3	-6	-12	292	-3	-9	-12	293	-3	-10	-11	294	-4	-9	-16
295	1	6	4	296	0	7	-1	297	0	6	0	298	0	3	0	299	0	0	0	300	0	-1	0
301	3	5	-10	302	3	4	-10	303	3	2	-10	304	3	0	-10	305	2	-2	-10	306	2	-3	-12
307	2	1	1	308	1	0	-1	309	1	-2	-1	310	1	-4	-1	311	1	-5	-1	312	1	-6	-1

Figure D1. (Sheet 2 o 5)

NORMAL STRESSES FOR LOAD CASE 1 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
313	2	10	-6	314	2	10	-6	315	2	9	-6	316	2	8	-6	317	2	6	-6	318	2	2	-6
319	0	-3	-1	320	0	-7	-2	321	0	-9	-2	322	0	-10	-1	323	0	-11	-1	324	0	-11	-1
325	-3	14	-5	326	-3	15	-5	327	-3	15	-5	328	-3	15	-5	329	-2	13	-4	330	-2	6	-4
331	-3	-8	-3	332	-2	-15	-3	333	-2	-17	-2	334	-1	-18	-2	335	-1	-17	-2	336	-1	-17	-2
337	0	4	-1	338	0	3	-1	339	0	0	-1	340	-1	-3	-1	341	-1	-5	-1	342	-1	-4	-1
343	1	3	-1	344	0	5	0	345	0	3	0	346	0	0	0	347	0	-3	0	348	0	-5	0
349	0	9	-4	350	0	8	-4	351	0	6	-4	352	0	4	-4	353	0	2	-4	354	0	0	-4
355	0	-1	-2	356	0	-3	-2	357	0	-5	-1	358	0	-7	-1	359	0	-9	-1	360	0	-10	-1
361	0	13	-6	362	0	13	-6	363	0	12	-6	364	0	11	-5	365	0	8	-5	366	1	4	-5
367	0	-5	-3	368	0	-10	-2	369	0	-12	-2	370	0	-14	-2	371	0	-14	-2	372	0	-15	-2
373	-1	17	-6	374	-1	18	-6	375	-1	18	-5	376	-1	18	-5	377	-1	15	-5	378	0	7	-4
379	-2	-9	-4	380	-1	-17	-3	381	-1	-19	-3	382	-1	-20	-2	383	-1	-20	-2	384	0	-19	-2

	ELEM	SX	ELEM	SY	ELEM	SZ	
MIN.	157	-16	3	-20	294	-16	(COMPRESSIVE)
MAX.	145	15	10	19	295	4	(TENSILE)

Figure D1. (Sheet 3 of 5)

SHEAR STRESSES FOR LOAD CASE 1 (PSI)

ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
1	3	-4	-1	2	-4	3	-1	3	2	-5	-1	4	-5	3	-1	5	1	-4	0	6	-5	4	-1
7	-1	0	0	8	-2	0	0	9	-2	-1	0	10	-1	-1	0	11	-1	-1	0	12	0	0	0
13	1	-3	0	14	-1	2	0	15	0	-5	0	16	-1	1	0	17	0	-4	0	18	-2	3	0
19	-1	0	0	20	-1	-1	0	21	-1	-2	0	22	0	-2	0	23	0	-1	0	24	0	0	0
25	0	-3	0	26	0	1	0	27	0	-4	0	28	0	1	0	29	0	-3	0	30	-1	3	0
31	-1	1	1	32	0	-1	0	33	0	-2	0	34	0	-2	0	35	0	-1	0	36	0	0	0
37	0	-2	0	38	1	1	0	39	1	-3	0	40	1	1	0	41	1	-3	0	42	0	3	0
43	0	0	0	44	1	-1	0	45	1	-1	0	46	1	-1	0	47	1	-1	0	48	0	0	0
49	3	-6	4	50	-4	6	4	51	2	-5	4	52	-5	6	4	53	1	-4	4	54	-5	8	5
55	-1	2	-1	56	-2	2	0	57	-1	1	0	58	-1	0	0	59	-1	0	0	60	0	0	0
61	1	-4	4	62	-2	5	4	63	1	-3	4	64	-3	6	4	65	0	0	4	66	-4	10	4
67	-2	6	0	68	-2	4	0	69	-1	2	0	70	-1	1	0	71	0	1	0	72	0	0	0
73	0	-3	3	74	-1	3	3	75	0	-3	2	76	-1	3	2	77	-2	-1	2	78	-3	6	2
79	-3	4	1	80	-2	1	1	81	-1	1	1	82	-1	0	1	83	0	0	1	84	0	0	1
85	1	-2	2	86	0	2	2	87	1	-3	2	88	1	2	2	89	1	-2	2	90	-1	4	1
91	-1	2	2	92	0	0	1	93	1	0	1	94	1	0	1	95	1	0	1	96	0	0	1
97	0	-2	5	98	-2	2	5	99	-2	-2	5	100	-4	2	5	101	-5	-1	5	102	-8	5	5
103	-8	3	2	104	-6	1	1	105	-4	1	1	106	-2	0	1	107	-1	0	1	108	0	0	1
109	1	-2	5	110	0	1	5	111	1	-2	5	112	-1	2	4	113	-1	-1	4	114	-4	3	4
115	-3	2	2	116	-1	0	2	117	0	0	1	118	0	0	1	119	0	0	1	120	0	0	1
121	0	-1	3	122	-2	0	2	123	-3	-1	2	124	-4	0	2	125	-5	0	2	126	-7	2	2
127	-7	1	1	128	-5	0	1	129	-4	0	1	130	-3	0	1	131	-2	0	0	132	0	0	0
133	0	-1	3	134	-1	0	3	135	0	-1	3	136	-1	0	3	137	-1	0	3	138	-4	2	3
139	-3	1	1	140	-2	0	1	141	-1	0	1	142	0	0	1	143	0	0	1	144	0	0	1
145	-1	0	2	146	-2	-1	2	147	-3	-1	1	148	-5	-1	2	149	-6	-1	2	150	-7	0	1
151	-7	0	0	152	-6	-1	0	153	-5	-1	0	154	-3	-1	0	155	-2	-1	0	156	-1	0	0
157	0	0	0	158	0	0	0	159	0	-1	0	160	0	0	0	161	0	0	0	162	-2	1	0
163	-1	1	0	164	-1	0	0	165	0	-1	0	166	0	-1	0	167	0	0	0	168	0	0	0
169	0	-1	0	170	-1	-1	0	171	-1	-2	0	172	-2	-1	0	173	-2	-2	0	174	-4	0	0
175	-3	-1	0	176	-2	-1	0	177	-2	-2	0	178	-1	-1	0	179	-1	-1	0	180	0	0	0
181	0	-1	4	182	-1	-2	4	183	-1	-3	3	184	-2	-4	3	185	-2	-4	3	186	-4	-3	3
187	-3	-3	2	188	-2	-4	1	189	-2	-4	1	190	-1	-3	1	191	-1	-2	1	192	0	-1	1
193	0	-1	-3	194	-1	-1	-3	195	-1	-2	-3	196	-2	-2	-2	197	-2	-2	-2	198	-3	0	-2
199	-3	0	-1	200	-2	-1	-1	201	-2	-2	-1	202	-1	-2	-1	203	-1	-1	-1	204	0	0	-1
205	0	0	-3	206	0	0	-3	207	1	-1	-3	208	1	0	-2	209	1	0	-2	210	1	1	-2
211	1	1	-1	212	1	0	-1	213	1	0	-1	214	1	-1	-1	215	0	0	-1	216	0	0	-1
217	0	0	0	218	-1	1	0	219	-1	0	0	220	-3	2	0	221	-2	2	0	222	-4	5	0
223	-4	4	0	224	-3	2	0	225	-2	1	0	226	-1	1	0	227	-1	0	0	228	0	0	0
229	0	0	-2	230	-2	1	-2	231	-1	1	-2	232	-3	3	-2	233	-3	4	-2	234	-5	8	-2
235	-4	7	0	236	-3	4	0	237	-2	2	0	238	-2	1	0	239	-1	1	0	240	0	0	0
241	0	-1	-1	242	-1	0	-1	243	-1	-1	-1	244	-2	1	-1	245	-2	1	-1	246	-3	3	-1
247	-3	3	0	248	-2	1	0	249	-1	0	0	250	-1	0	0	251	-1	0	0	252	0	0	0
253	0	-1	-1	254	1	0	-1	255	1	-1	-1	256	2	0	-1	257	2	0	-1	258	3	2	-1
259	3	1	0	260	2	0	0	261	2	0	0	262	1	0	0	263	1	0	0	264	0	0	0
265	0	-2	-4	266	-2	1	-4	267	-2	-2	-4	268	-5	2	-4	269	-5	-1	-4	270	-8	4	-4
271	-7	2	0	272	-6	0	0	273	-4	0	0	274	-3	0	0	275	-2	0	0	276	-1	0	0
277	0	-2	-2	278	1	1	-2	279	1	-2	-2	280	2	1	-2	281	3	-1	-2	282	4	3	-1
283	4	1	0	284	3	0	0	285	2	0	0	286	1	0	0	287	1	0	0	288	0	0	0
289	2	-8	4	290	-2	7	4	291	1	-9	4	292	-3	6	4	293	-1	-9	4	294	-5	5	5
295	-3	-3	-1	296	-2	-1	0	297	-2	-2	0	298	-1	-1	0	299	-1	-1	0	300	0	0	0
301	2	-5	2	302	-3	3	2	303	1	-7	2	304	-4	1	2	305	-1	-8	2	306	-5	2	2
307	-3	-3	0	308	-3	-3	0	309	-2	-3	0	310	-1	-3	0	311	-1	-2	0	312	0	-1	0

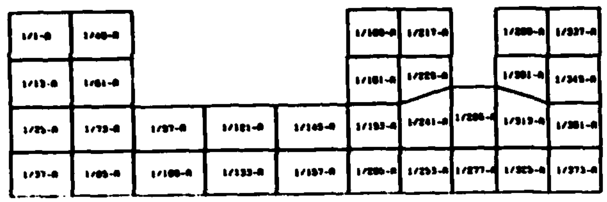
Figure D1. (Sheet 4 of 5)

SHEAR STRESSES FOR LOAD CASE 1 (PSI)

ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
313	1	-3	-2	314	-1	2	-2	315	0	-4	-2	316	-2	2	-2	317	0	-3	-2	318	-3	4	-1
319	-2	1	-1	320	-1	0	-1	321	-1	-1	-1	322	-1	-1	-1	323	0	-1	0	324	0	0	0
325	0	-2	-2	326	1	2	-2	327	1	-2	-2	328	2	2	-2	329	3	-2	-2	330	4	4	-1
331	4	2	-1	332	3	1	0	333	2	0	0	334	1	0	0	335	1	0	0	336	0	0	0
337	1	-4	0	338	-2	4	0	339	0	-3	0	340	-3	5	0	341	-1	-2	0	342	-5	7	0
343	-3	4	0	344	-2	2	0	345	-2	1	0	346	-1	0	0	347	-1	0	0	348	0	0	0
349	2	-3	1	350	-2	4	1	351	2	-3	1	352	-3	6	1	353	1	0	1	354	-3	11	2
355	-1	7	-1	356	-1	4	0	357	-1	2	0	358	0	1	0	359	0	0	0	360	0	0	0
361	1	-3	0	362	-1	4	0	363	1	-2	0	364	-1	6	0	365	1	1	0	366	-1	11	1
367	0	8	-1	368	0	4	0	369	0	2	0	370	0	1	0	371	0	1	0	372	0	0	0
373	0	-3	0	374	0	3	0	375	1	-2	0	376	1	4	0	377	2	-1	0	378	2	7	0
379	3	4	0	380	2	2	0	381	1	1	0	382	1	1	0	383	1	0	0	384	0	0	0

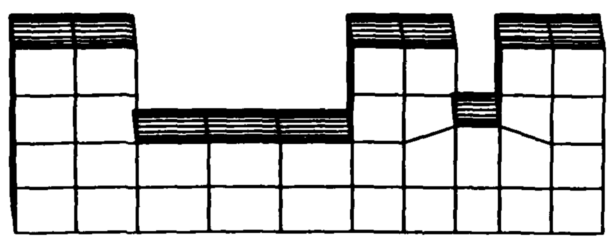
	ELEM	VXY	ELEM	VYZ	ELEM	VZX
MIN.	270	-8	291	-9	265	-4
MAX.	282	4	366	11	97	5

Figure D1. (Sheet 5 of 5)

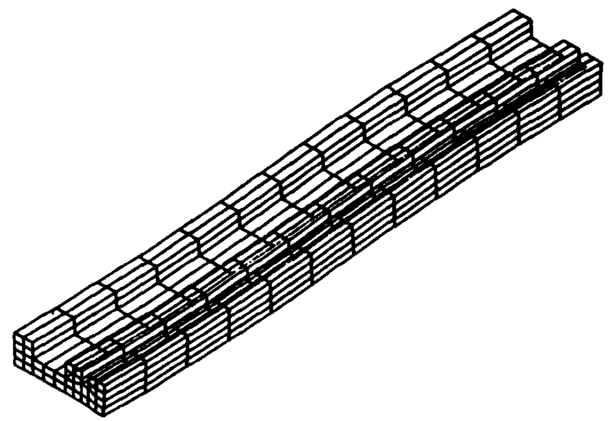


FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
UNDEFORMED GRID
SNORT STRUCTURE([illegible] NODES,304 ELEMENTS)

FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
LOAD CASE NO-2



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
LOAD CASE NO-2
SNORT STRUCTURE([illegible] NODES,304 ELEMENTS)



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
LOAD CASE NO-2

Figure D2. Finite-element analysis for load case 2 with K = 175 lb/in.^{3} (Sheet 1 of 5)

NORMAL STRESSES FOR LOAD CASE 2 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
1	-4	-40	-17	2	-4	-44	-17	3	-4	-49	-17	4	-4	-53	-18	5	-4	-48	-16	6	-6	-29	-23
7	3	25	5	8	0	44	-2	9	1	49	0	10	0	45	0	11	0	40	0	12	0	36	0
13	4	-25	-16	14	4	-26	-16	15	4	-28	-16	16	4	-28	-16	17	3	-24	-14	18	4	-12	-17
19	0	9	-1	20	1	22	-3	21	0	25	-2	22	0	25	-1	23	0	24	-1	24	0	23	-1
25	1	-12	-15	26	1	-11	-15	27	1	-9	-14	28	1	-6	-14	29	1	-3	-12	30	1	0	-12
31	0	-4	-4	32	0	0	-4	33	0	3	-3	34	0	6	-2	35	0	8	-1	36	0	9	-1
37	-1	1	-12	38	-1	4	-11	39	-1	10	-11	40	0	16	-10	41	0	19	-9	42	1	14	-7
43	-2	-16	-6	44	-1	-22	-4	45	-1	-19	-3	46	0	-12	-2	47	0	-7	-2	48	0	-3	-1
49	-6	-33	-20	50	-7	-42	-20	51	-7	-48	-20	52	-7	-52	-20	53	-6	-49	-18	54	-10	-30	-26
55	3	25	6	56	0	44	-1	57	0	47	0	58	0	43	0	59	0	37	0	60	0	33	0
61	7	-23	-22	62	7	-24	-22	63	6	-26	-22	64	6	-27	-22	65	4	-25	-22	66	5	-13	-25
67	3	10	2	68	3	22	-2	69	1	24	-1	70	1	23	-1	71	1	21	-1	72	0	19	-1
73	5	-9	-17	74	5	-8	-16	75	5	-6	-16	76	4	-4	-16	77	3	-2	-15	78	3	0	-15
79	3	-2	-3	80	2	0	-3	81	1	2	-2	82	1	4	-2	83	1	5	-1	84	1	6	-1
85	-9	2	-12	86	-9	5	-11	87	-8	11	-11	88	-7	16	-10	89	-5	19	-9	90	-3	12	-8
91	-7	-17	-5	92	-5	-23	-4	93	-3	-21	-3	94	-2	-15	-2	95	-1	-10	-1	96	-1	-7	-1
97	25	1	-7	98	24	1	-7	99	23	2	-7	100	22	3	-6	101	19	3	-6	102	14	3	-7
103	13	1	-1	104	8	1	-1	105	5	1	-1	106	4	2	-1	107	3	3	-1	108	2	3	0
109	-28	2	-9	110	-27	5	-9	111	-26	10	-9	112	-23	15	-8	113	-20	16	-7	114	-16	8	-6
115	-14	-16	-4	116	-10	-24	-3	117	-6	-23	-2	118	-4	-18	-2	119	-3	-13	-1	120	-2	-10	-1
121	42	9	-2	122	41	9	-2	123	40	10	-1	124	38	10	-1	125	35	9	-1	126	28	6	-1
127	17	2	-1	128	10	0	-1	129	7	-1	-1	130	5	-1	0	131	4	0	0	132	3	0	0
133	-44	3	-7	134	-43	6	-7	135	-41	10	-7	136	-38	15	-6	137	-34	14	-5	138	-28	4	-4
139	-18	-15	-4	140	-13	-25	-3	141	-8	-26	-2	142	-5	-21	-2	143	-3	-17	-1	144	-3	-14	-1
145	46	13	2	146	46	14	2	147	45	14	2	148	43	14	2	149	40	13	2	150	32	8	1
151	17	2	0	152	9	-3	0	153	6	-4	0	154	5	-4	0	155	4	-4	0	156	3	-3	0
157	-47	6	-7	158	-46	8	-7	159	-45	13	-6	160	-42	16	-6	161	-38	15	-5	162	-31	4	-4
163	-19	-16	-4	164	-12	-27	-3	165	-8	-28	-2	166	-5	-24	-2	167	-4	-20	-1	168	-3	-17	-1
169	0	-21	0	170	0	-25	0	171	0	-31	0	172	-1	-35	0	173	-1	-34	-1	174	-1	-16	-1
175	0	16	0	176	0	33	0	177	0	35	0	178	0	31	0	179	0	25	0	180	0	21	0
181	21	-3	0	182	21	-5	0	183	20	-7	0	184	19	-9	1	185	18	-9	1	186	14	-4	0
187	8	8	0	188	4	13	-1	189	3	14	-1	190	2	11	-1	191	1	9	-1	192	1	7	-1
193	17	8	-8	194	17	9	-8	195	16	9	-8	196	16	10	-7	197	15	9	-6	198	12	4	-5
199	6	-3	-4	200	3	-7	-3	201	2	-8	-2	202	1	-8	-2	203	1	-7	-1	204	1	-6	-1
205	-38	10	-9	206	-38	12	-9	207	-36	17	-9	208	-34	20	-8	209	-31	19	-7	210	-25	6	-6
211	-15	-16	-5	212	-9	-29	-4	213	-6	-30	-3	214	-4	-27	-2	215	-3	-23	-2	216	-2	-20	-2
217	1	-18	0	218	1	-22	0	219	1	-28	0	220	1	-33	0	221	1	-31	0	222	1	-14	0
223	1	14	-1	224	1	31	0	225	0	33	0	226	0	28	0	227	0	22	0	223	0	18	0
229	16	-3	-5	230	16	-5	-4	231	16	-8	-4	232	15	-11	-4	233	13	-10	-3	234	12	-4	-1
235	5	6	-4	236	3	13	-3	237	2	13	-2	238	1	10	-1	239	1	7	-1	240	1	6	-1
241	8	8	-8	242	8	8	-8	243	8	8	-8	244	8	8	-7	245	7	7	-6	246	6	4	-4
247	2	-4	-6	248	1	-7	-4	249	1	-8	-3	250	1	-8	-2	251	0	-8	-2	252	0	-8	-1
253	-24	15	-11	254	-23	17	-11	255	-22	22	-10	256	-21	25	-9	257	-19	23	-8	258	-15	10	-7
259	-10	-17	-6	260	-6	-30	-4	261	-4	-32	-3	262	-3	-29	-2	263	-2	-25	-2	264	-1	-22	-2
265	10	8	-12	266	10	8	-12	267	9	8	-11	268	9	8	-11	269	7	6	-11	270	7	3	-12
271	4	-3	0	272	3	-6	-2	273	1	-8	-1	274	1	-9	-1	275	1	-9	-1	276	1	-9	-1
277	-11	20	-11	278	-11	22	-11	279	-11	26	-11	280	-9	29	-10	281	-7	27	-9	282	-4	14	-8
283	-9	-19	-5	284	-5	-32	-4	285	-3	-34	-3	286	-2	-31	-2	287	-1	-27	-2	288	-1	-25	-2
289	-2	-24	-44	290	-2	-28	-44	291	-2	-34	-44	292	-2	-40	-45	293	-2	-40	-41	294	-4	-31	-58
295	2	21	14	296	0	31	-3	297	0	31	0	298	0	25	-1	299	0	18	0	300	0	14	0
301	-3	-10	-40	302	-3	-12	-39	303	-4	-15	-39	304	-4	-18	-39	305	-5	-20	-38	306	-7	-15	-47
307	4	7	6	308	2	12	-3	309	1	10	-1	310	1	7	-1	311	0	3	-1	312	0	1	-1

Figure D2. (Sheet 2 of 5)

NORMAL STRESSES FOR LOAD CASE 2 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
313	4	9	-21	314	4	9	-21	315	4	9	-21	316	4	9	-20	317	3	6	-20	318	4	2	-22
319	0	-6	-1	320	0	-10	-3	321	0	-12	-2	322	0	-13	-1	323	0	-13	-1	324	0	-12	-1
325	-1	24	-12	326	-1	27	-12	327	0	30	-11	328	0	33	-11	329	2	31	-10	330	4	17	-9
331	-6	-20	-5	332	-3	-34	-4	333	-2	-36	-3	334	-1	-33	-2	335	-1	-30	-2	336	-1	-27	-2
337	1	-11	1	338	1	-15	1	339	1	-22	1	340	0	-28	1	341	0	-28	1	342	0	-17	1
343	1	18	-1	344	0	28	0	345	0	28	0	346	0	22	0	347	0	15	0	348	0	11	0
349	-3	1	-3	350	-3	0	-3	351	-3	-3	-3	352	-3	-6	-2	353	-3	-8	-2	354	-4	-4	-1
355	1	3	-3	356	0	7	-2	357	0	5	-2	358	0	2	-1	359	0	-1	-1	360	0	-3	-1
361	0	15	-8	362	0	15	-8	363	0	15	-8	364	0	15	-7	365	0	12	-6	366	1	7	-6
367	-1	-9	-4	368	0	-14	-4	369	0	-17	-2	370	0	-17	-2	371	0	-17	-1	372	0	-16	-1
373	0	27	-10	374	0	30	-10	375	0	33	-10	376	1	35	-9	377	1	33	-8	378	3	19	-6
379	-3	-22	-6	380	-1	-35	-4	381	-1	-38	-3	382	-1	-36	-2	383	0	-32	-2	384	0	-30	-2

	ELEM	SX	ELEM	SY	ELEM	SZ	
MIN.	157	-47	4	-53	294	-58	(COMPRESSIVE)
MAX.	145	46	9	49	295	14	(TENSILE)

Figure D2. (Sheet 3 of 5)

SHEAR STRESSES FOR LOAD CASE 2 (PSI)

ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
1	2	-17	-6	2	-2	16	-6	3	2	-18	-6	4	-1	17	-7	5	4	-13	-6	6	3	23	-8
7	5	6	2	8	2	4	-1	9	1	0	0	10	0	-1	0	11	0	-1	0	12	0	0	0
13	-1	-13	-2	14	1	11	-2	15	-1	-14	-2	16	1	13	-2	17	-1	-7	-2	18	1	27	-3
19	0	15	1	20	0	6	0	21	0	1	0	22	0	-2	0	23	0	-2	0	24	0	-1	0
25	0	-11	2	26	0	8	2	27	0	-12	2	28	0	10	2	29	-2	-5	1	30	-2	25	1
31	-2	16	2	32	-1	5	1	33	-1	1	1	34	0	-2	1	35	0	-2	0	36	0	-1	0
37	1	-9	2	38	-1	8	2	39	0	-10	2	40	-2	9	2	41	-3	-6	1	42	-7	18	1
43	-7	9	1	44	-4	3	1	45	-2	0	1	46	0	-1	0	47	0	-1	0	48	0	0	0
49	2	-18	10	50	-2	16	10	51	2	-19	10	52	-1	16	11	53	3	-17	10	54	3	18	14
55	5	0	-3	56	2	1	1	57	1	-2	0	58	0	-2	0	59	0	-1	0	60	0	0	0
61	1	-13	6	62	-1	10	6	63	2	-15	6	64	-2	10	6	65	1	-12	6	66	-2	18	8
67	0	6	-3	68	0	0	-1	69	0	-2	0	70	0	-3	0	71	0	-2	0	72	0	-1	0
73	0	-9	10	74	0	7	10	75	0	-11	9	76	-1	8	9	77	-2	-8	8	78	-6	17	7
79	-5	8	4	80	-3	1	3	81	-1	-1	2	82	0	-2	1	83	0	-2	1	84	0	-1	1
85	1	-8	9	86	-1	6	9	87	0	-9	9	88	-4	7	8	89	-5	-7	7	90	-13	13	6
91	-12	5	4	92	-7	1	3	93	-3	-1	2	94	-1	-1	1	95	0	-1	1	96	0	0	1
97	0	-6	12	98	0	4	12	99	0	-7	12	100	-1	4	12	101	-2	-5	12	102	-5	9	11
103	-5	4	2	104	-2	0	2	105	-1	-1	1	106	0	-2	1	107	0	-1	1	108	0	0	1
109	2	-5	12	110	-2	4	12	111	1	-6	12	112	-4	4	11	113	-4	-4	11	114	-13	9	9
115	-12	4	4	116	-6	0	2	117	-3	-1	2	118	-1	-1	1	119	0	-1	1	120	0	0	1
121	0	-2	5	122	-1	0	5	123	-1	-2	5	124	-2	1	5	125	-3	-1	5	126	-3	5	4
127	-3	4	1	128	-3	1	0	129	-2	-1	0	130	-1	-1	0	131	-1	-1	0	132	0	0	0
133	1	-2	6	134	-2	0	6	135	0	-3	6	136	-4	1	6	137	-3	-1	6	138	-9	5	5
139	-8	4	2	140	-4	0	0	141	-2	-1	0	142	-1	-1	0	143	-1	-1	0	144	0	0	0
145	0	-1	1	146	-2	-1	1	147	-2	-2	2	148	-3	-1	2	149	-3	0	2	150	-3	4	1
151	-3	3	0	152	-3	0	-1	153	-3	-1	0	154	-3	-2	0	155	-2	-1	0	156	-1	-1	0
157	0	-1	-4	158	-1	-1	-4	159	-1	-2	-3	160	-2	-1	-3	161	-2	0	-3	162	-3	4	-2
163	-3	4	-2	164	-2	1	-1	165	-2	-1	-1	166	-1	-1	-1	167	-1	-1	0	168	0	0	0
169	2	-2	-1	170	-3	0	-1	171	2	-3	-1	172	-3	0	-1	173	1	-1	-1	174	-5	5	-1
175	-3	4	0	176	-1	1	0	177	-1	-1	0	178	-1	-2	0	179	0	-1	0	180	0	-1	0
181	1	-2	9	182	-2	-2	9	183	0	-5	9	184	-3	-2	8	185	0	-1	8	186	-3	5	6
187	-1	4	4	188	-1	0	2	189	-1	-3	1	190	-1	-3	1	191	-1	-3	1	192	0	-1	0
193	0	-2	-11	194	-2	-1	-11	195	-1	-3	-10	196	-2	-1	-10	197	-1	0	-9	198	-1	6	-7
199	-1	5	-4	200	-1	1	-2	201	-2	-2	-2	202	-1	-2	-1	203	-1	-2	-1	204	0	-1	-1
205	-1	-1	-11	206	0	0	-11	207	-1	-2	-10	208	0	0	-10	209	0	0	-9	210	2	5	-7
211	2	4	-4	212	0	1	-2	213	-1	-1	-2	214	-1	-1	-1	215	0	-1	-1	216	0	0	-1
217	2	-2	1	218	-3	1	1	219	2	-3	1	220	-3	2	1	221	1	0	1	222	-5	10	0
223	-3	8	1	224	-1	3	0	225	-1	0	0	226	-1	-1	0	227	0	-1	0	228	0	0	0
229	2	-3	-5	230	-3	1	-5	231	1	-3	-5	232	-3	3	-5	233	0	2	-5	234	-6	15	-5
235	-4	13	-1	236	-2	5	-1	237	-1	1	0	238	-1	-1	0	239	-1	-1	0	240	0	0	0
241	1	-3	-7	242	-2	1	-7	243	0	-4	-7	244	-2	2	-6	245	-1	-1	-7	246	-3	10	-6
247	-2	8	-1	248	-2	2	0	249	-1	-1	-1	250	-1	-2	0	251	-1	-1	0	252	0	-1	0
253	-1	-3	-9	254	0	2	-9	255	-1	-4	-8	256	1	2	-8	257	0	-2	-8	258	4	8	-7
259	4	5	-2	260	1	1	-1	261	0	-1	0	262	0	-1	0	263	0	-1	0	264	0	0	0
265	1	-8	-16	266	-3	6	-16	267	0	-9	-16	268	-4	7	-15	269	-3	-6	-15	270	-7	14	-16
271	-5	6	-1	272	-4	1	-1	273	-3	-1	-1	274	-2	-2	0	275	-1	-1	0	276	0	-1	0
277	0	-6	-7	278	0	5	-7	279	0	-7	-7	280	1	5	-7	281	1	-5	-6	282	6	11	-6
283	5	5	-1	284	2	1	0	285	1	-1	0	286	0	-1	0	287	0	-1	0	288	0	0	0
289	-6	-29	8	290	5	27	8	291	-6	-30	8	292	5	27	8	293	-7	-27	7	294	1	26	11
295	-5	-3	-3	296	-2	1	1	297	-1	-2	0	298	-1	-2	0	299	0	-1	0	300	0	-1	0
301	3	-18	2	302	-4	15	2	303	2	-20	2	304	-5	14	2	305	2	-18	1	306	-6	20	4
307	-3	3	-1	308	-2	-1	1	309	-1	-3	0	310	-1	-3	0	311	-1	-2	0	312	0	-1	0

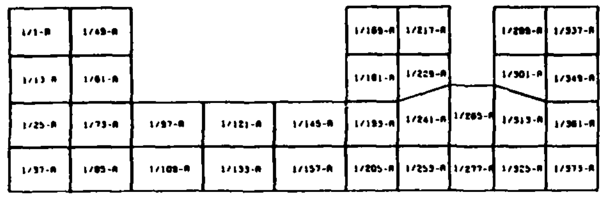
Figure D2. (Sheet 4 of 5)

SHEAR STRESSES FOR LOAD CASE 2 (PSI)

ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
313	3	-11	-3	314	-3	9	-3	315	2	-13	-3	316	-4	10	-2	317	2	-10	-2	318	-3	17	0
319	0	7	-3	320	-1	1	-1	321	-1	-1	-1	322	-1	-2	0	323	-1	-2	0	324	0	-1	0
325	1	-8	-3	326	-1	7	-3	327	1	-9	-3	328	0	7	-3	329	3	-7	-2	330	4	13	-2
331	5	5	-2	332	2	1	-1	333	1	0	-1	334	0	-1	0	335	0	-1	0	336	0	0	0
337	-4	-9	-3	338	4	8	-3	339	-5	-10	-3	340	3	9	-3	341	-6	-6	-3	342	0	15	-4
343	-4	6	1	344	-2	3	0	345	-1	0	0	346	-1	-1	0	347	0	-1	0	348	0	0	0
349	3	-10	3	350	-3	8	3	351	3	-11	3	352	-4	10	3	353	3	-5	3	354	-4	21	4
355	-1	12	-2	356	0	4	0	357	0	0	0	358	0	-1	0	359	0	-1	0	360	0	-1	0
361	4	-10	3	362	-4	8	3	363	3	-11	3	364	-4	10	4	365	4	-5	4	366	-3	22	5
367	1	13	-2	368	0	4	-1	369	0	1	-1	370	0	-1	0	371	0	-1	0	372	0	0	0
373	2	-9	1	374	-2	8	1	375	2	-10	1	376	-1	9	2	377	3	-6	2	378	2	16	2
379	3	8	-1	380	1	3	0	381	1	0	0	382	0	-1	0	383	0	-1	0	384	0	0	0

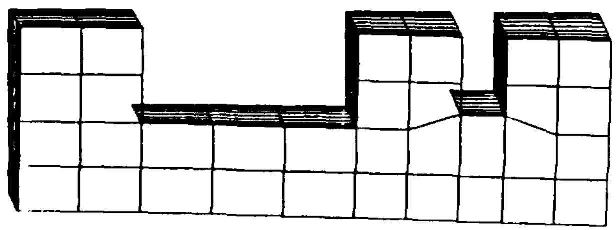
	ELEM	VXY	ELEM	VYZ	ELEM	VZX
MIN.	90	-13	291	-30	265	-16
MAX.	282	6	18	27	54	14

Figure D2. (Sheet 5 of 5)

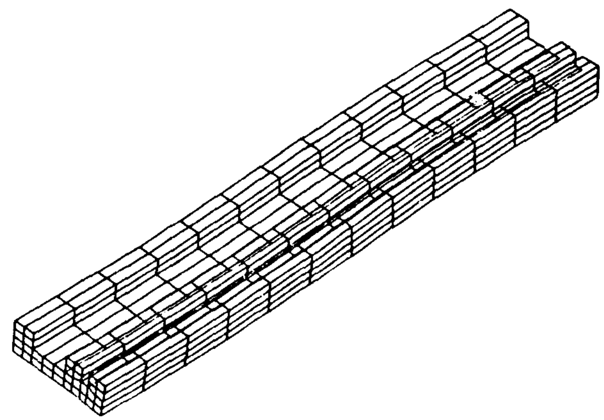


FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE, AUG 82
UNDEFORMED GRID
SNORT STRUCTURE(756 NODES,384 ELEMENTS)

FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE, AUG 82
LOAD CASE NO-3



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE, AUG 82
LOAD CASE NO-3
SNORT STRUCTURE(756 NODES,384 ELEMENTS)



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE, AUG 82
LOAD CASE NO-3

Figure D3. Finite-element analysis for load case 3 with K = 175 lb/in.^{3} (Sheet 1 of 5)

NORMAL STRESSES FOR LOAD CASE 3 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
1	0	-38	-9	2	-1	-39	-9	3	-1	-41	-9	4	-1	-40	-9	5	-1	-34	-8	6	-1	-19	-12
7	1	17	3	8	0	32	-1	9	0	38	0	10	0	39	0	11	0	38	0	12	0	36	0
13	1	-32	-6	14	1	-31	-6	15	1	-31	-6	16	1	-28	-5	17	0	-22	-5	18	1	-10	-6
19	0	9	0	20	0	21	-2	21	0	27	-1	22	0	30	-1	23	0	30	-1	24	0	30	-1
25	0	-26	-5	26	0	-24	-5	27	0	-22	-5	28	0	-17	-5	29	0	-12	-4	30	0	-4	-4
31	0	2	-2	32	0	10	-2	33	0	16	-2	34	0	20	-1	35	0	23	-1	36	0	25	-1
37	1	-20	-5	38	1	-18	-5	39	1	-13	-5	40	1	-7	-5	41	1	-1	-4	42	2	3	-3
43	-1	-4	-3	44	0	0	-2	45	0	6	-2	46	0	12	-1	47	0	16	-1	48	0	19	-1
49	-6	-33	-13	50	-6	-34	-13	51	-6	-36	-13	52	-6	-36	-13	53	-5	-32	-12	54	-8	-18	-16
55	2	14	3	56	0	28	-1	57	0	33	0	58	0	32	0	59	0	31	0	60	0	29	0
61	0	-27	-17	62	0	-27	-17	63	0	-27	-17	64	-1	-25	-17	65	-2	-21	-17	66	0	-10	-19
67	0	6	0	68	1	17	-2	69	0	22	-2	70	0	23	-1	71	0	23	-1	72	0	23	-1
73	-1	-21	-11	74	-1	-19	-11	75	-1	-17	-11	76	-1	-14	-10	77	-2	-10	-10	78	-2	-4	-10
79	1	1	-2	80	1	7	-2	81	0	11	-2	82	0	15	-2	83	0	17	-1	84	0	18	-1
85	-1	-14	-7	86	0	-12	-7	87	0	-7	-7	88	0	-2	-6	89	1	2	-6	90	2	4	-5
91	-3	-6	-3	92	-2	-4	-2	93	-1	1	-2	94	0	6	-2	95	0	10	-1	96	0	12	-1
97	5	-12	-7	98	5	-11	-7	99	4	-10	-6	100	3	-7	-6	101	2	-5	-6	102	1	-2	-6
103	6	2	-1	104	5	5	-1	105	3	7	-1	106	2	9	-1	107	2	11	-1	108	2	12	-1
109	-11	-9	-6	110	-10	-7	-6	111	-10	-3	-6	112	-9	1	-6	113	-7	4	-5	114	-5	3	-4
115	-7	-7	-3	116	-5	-8	-2	117	-3	-5	-2	118	-2	-1	-2	119	-2	3	-1	120	-1	5	-1
121	20	-1	-1	122	19	-1	-1	123	19	0	-1	124	18	1	-1	125	16	2	0	126	13	2	0
127	10	2	-1	128	7	2	-1	129	5	3	-1	130	4	4	0	131	3	5	0	132	3	5	0
133	-23	-4	-5	134	-23	-2	-5	135	-22	1	-4	136	-20	4	-4	137	-18	5	-4	138	-15	2	-3
139	-11	-8	-3	140	-8	-12	-2	141	-6	-11	-2	142	-4	-8	-2	143	-3	-5	-1	144	-3	-3	-1
145	27	7	1	146	27	8	1	147	26	8	1	148	25	8	2	149	24	7	2	150	20	5	1
151	12	2	0	152	7	-1	0	153	6	-1	0	154	5	-1	0	155	4	-1	0	156	4	-1	0
157	-29	3	-4	158	-28	4	-4	159	-27	7	-4	160	-26	9	-4	161	-23	8	-3	162	-20	2	-3
163	-13	-9	-3	164	-9	-16	-2	165	-7	-16	-2	166	-5	-14	-2	167	-4	-12	-1	168	-4	-10	-1
169	0	-10	-1	170	0	-13	-1	171	0	-17	-1	172	0	-20	-1	173	0	-20	-1	174	0	-10	-1
175	0	9	0	176	0	19	0	177	0	20	0	178	0	16	0	179	0	13	0	180	0	10	0
181	14	2	0	182	14	0	0	183	14	-2	0	184	14	-4	0	185	13	-4	0	186	11	-2	0
187	6	5	0	188	3	7	-1	189	3	7	0	190	2	5	0	191	2	3	0	192	2	2	0
193	11	9	-6	194	11	9	-6	195	11	9	-6	196	11	8	-5	197	10	7	-5	198	9	3	-4
199	4	-2	-3	200	2	-6	-3	201	2	-7	-2	202	2	-8	-2	203	1	-8	-1	204	1	-7	-1
205	-26	9	-7	206	-25	10	-7	207	-25	12	-6	208	-23	14	-6	209	-21	12	-5	210	-18	3	-4
211	-12	-11	-4	212	-8	-19	-3	213	-6	-21	-3	214	-5	-20	-2	215	-4	-18	-2	216	-4	-17	-2
217	1	-4	0	218	1	-6	0	219	1	-11	0	220	1	-15	0	221	1	-15	0	222	0	-7	0
223	1	7	-1	224	0	15	0	225	0	15	0	226	0	11	-1	227	0	6	-1	228	0	4	-1
229	14	6	-3	230	14	4	-3	231	14	2	-3	232	13	-1	-3	233	13	-2	-2	234	11	0	-2
235	4	2	-3	236	3	4	-3	237	2	3	-2	238	2	0	-2	239	2	-2	-2	240	1	-4	-2
241	7	12	-6	242	7	12	-6	243	7	12	-6	244	7	11	-5	245	7	8	-5	246	6	4	-4
247	2	-4	-4	248	1	-8	-3	249	1	-11	-3	250	1	-12	-2	251	1	-12	-2	252	1	-12	-2
253	-19	16	-7	254	-19	17	-7	255	-18	19	-7	256	-18	19	-7	257	-16	16	-6	258	-13	6	-5
259	-9	-12	-5	260	-6	-23	-4	261	-4	-26	-3	262	-4	-25	-2	263	-3	-23	-2	264	-3	-22	-2
265	14	18	-4	266	14	18	-3	267	14	17	-3	268	14	15	-3	269	13	11	-3	270	11	5	-4
271	4	-3	0	272	2	-9	-1	273	2	-12	-1	274	2	-14	-1	275	1	-16	-1	276	1	-16	-1
277	-15	22	-7	278	-15	23	-7	279	-15	24	-7	280	-14	24	-7	281	-12	21	-6	282	-10	9	-5
283	-8	-14	-4	284	-5	-26	-3	285	-4	-30	-3	286	-3	-30	-2	287	-3	-28	-2	288	-2	-27	-2
289	-6	-3	-24	290	-6	-6	-24	291	-6	-11	-24	292	-6	-17	-24	293	-5	-20	-22	294	-8	-18	-32
295	3	12	8	296	0	14	-2	297	0	11	0	298	0	5	0	299	0	0	0	300	0	-3	0
301	5	9	-19	302	5	7	-19	303	5	4	-19	304	5	0	-19	305	4	-4	-18	306	3	-5	-23
307	3	3	3	308	2	1	-2	309	1	-3	-1	310	1	-7	-1	311	1	-10	-1	312	1	-12	-1

Figure D3. (Sheet 2 of 5)

NORMAL STRESSES FOR LOAD CASE 3 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
313	4	20	-11	314	4	20	-11	315	4	19	-11	316	4	16	-11	317	4	12	-10	318	4	5	-11
319	0	-6	-1	320	0	-14	-2	321	0	-18	-2	322	0	-20	-1	323	0	-22	-1	324	0	-22	-1
325	-7	29	-8	326	-6	30	-8	327	-6	31	-8	328	-5	30	-7	329	-5	26	-7	330	-3	12	-6
331	-6	-16	-4	332	-4	-29	-4	333	-3	-34	-3	334	-2	-35	-2	335	-2	-33	-2	336	-2	-33	-2
337	-1	9	-1	338	-1	5	-1	339	-1	0	-1	340	-1	-6	-1	341	-1	-10	-1	342	-2	-7	-1
343	1	7	-1	344	0	9	0	345	0	6	-1	346	0	-1	-1	347	0	-6	-1	348	0	-9	-1
349	0	17	-7	350	0	16	-7	351	0	12	-7	352	0	8	-7	353	0	3	-6	354	-1	1	-6
355	1	-3	-3	356	0	-5	-2	357	0	-10	-2	358	0	-14	-2	359	0	-17	-1	360	0	-19	-1
361	0	26	-10	362	0	26	-10	363	0	25	-9	364	1	22	-9	365	1	17	-8	366	1	8	-8
367	-1	-10	-4	368	0	-19	-3	369	0	-24	-3	370	0	-27	-2	371	0	-28	-2	372	0	-29	-2
373	-3	35	-9	374	-3	36	-9	375	-3	37	-9	376	-2	35	-8	377	-2	30	-7	378	-1	15	-6
379	-3	-18	-5	380	-2	-33	-4	381	-2	-38	-3	382	-1	-40	-3	383	-1	-39	-2	384	-1	-38	-2

	ELEM	SX	ELEM	SY	ELEM	SZ	
MIN.	157	-29	3	-41	294	-32	(COMPRESSIVE)
MAX.	145	27	10	39	295	8	(TENSILE)

Figure D3. (Sheet 3 of 5)

SHEAR STRESSES FOR LOAD CASE 3 (PSI)

ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
1	6	-8	-1	2	-8	6	-1	3	4	-10	-1	4	-10	6	-1	5	3	-8	-1	6	-9	7	-2
7	-3	0	1	8	-4	-1	0	9	-3	-2	0	10	-2	-2	0	11	-1	-1	0	12	0	-1	0
13	1	-6	0	14	-2	3	0	15	1	-9	0	16	-3	2	0	17	0	-8	0	18	-3	6	-1
19	-2	1	1	20	-2	-2	0	21	-1	-4	0	22	-1	-4	0	23	0	-2	0	24	0	-1	0
25	0	-5	0	26	0	2	0	27	0	-8	0	28	-1	1	0	29	0	-7	0	30	-2	6	-1
31	-1	1	1	32	-1	-2	1	33	0	-4	0	34	0	-4	0	35	0	-2	0	36	0	-1	0
37	0	-5	0	38	1	3	0	39	2	-6	0	40	2	2	0	41	1	-5	0	42	0	5	0
43	0	1	1	44	1	-1	1	45	2	-2	0	46	2	-2	0	47	1	-1	0	48	0	-1	0
49	6	-11	8	50	-8	12	8	51	4	-11	8	52	-9	13	9	53	3	-8	8	54	-9	15	11
55	-3	4	-2	56	-4	4	1	57	-3	2	0	58	-2	1	0	59	-1	0	0	60	0	0	0
61	3	-8	7	62	-4	9	7	63	1	-6	7	64	-5	12	7	65	-1	-1	7	66	-7	20	8
67	-5	12	-1	68	-4	7	0	69	-3	4	0	70	-2	2	0	71	-1	1	0	72	0	0	0
73	1	-6	4	74	-1	5	4	75	0	-5	4	76	-3	7	4	77	-3	-2	3	78	-7	13	3
79	-6	7	2	80	-4	3	2	81	-2	1	1	82	-1	0	1	83	-1	0	1	84	0	0	1
85	1	-5	4	86	1	4	4	87	2	-5	3	88	1	4	3	89	1	-4	2	90	-2	8	2
91	-2	3	2	92	0	1	2	93	2	0	1	94	2	-1	1	95	1	0	1	96	0	0	1
97	0	-4	10	98	-3	4	10	99	-5	-3	10	100	-8	5	10	101	-11	-1	10	102	-16	9	9
103	-15	5	3	104	-11	2	2	105	-8	1	2	106	-5	0	2	107	-3	0	1	108	-1	0	1
109	1	-3	9	110	-1	3	9	111	1	-4	8	112	-2	3	8	113	-1	-3	8	114	-7	6	7
115	-6	3	3	116	-3	1	2	117	-1	0	2	118	0	0	2	119	0	0	1	120	0	0	1
121	-1	-1	5	122	-3	1	5	123	-5	-2	5	124	-8	1	5	125	-11	-1	5	126	-13	3	4
127	-13	2	2	128	-11	0	1	129	-8	0	1	130	-5	-1	1	131	-3	0	1	132	-1	0	1
133	1	-1	7	134	-1	1	7	135	0	-2	6	136	-3	1	6	137	-2	-1	6	138	-8	3	5
139	-7	2	2	140	-3	0	1	141	-2	0	1	142	-1	-1	1	143	0	-1	1	144	0	0	1
145	-1	-1	3	146	-4	-1	3	147	-6	-2	3	148	-10	-2	3	149	-12	-2	4	150	-15	-1	3
151	-14	-1	1	152	-12	-2	0	153	-9	-3	1	154	-7	-2	1	155	-4	-2	1	156	-1	-1	1
157	0	0	0	158	-1	-1	0	159	0	-1	0	160	-1	-1	0	161	-1	0	1	162	-3	1	0
163	-3	1	0	164	-1	0	0	165	-1	-1	0	166	0	-1	0	167	0	-1	0	168	0	0	0
169	1	-1	-1	170	-3	-1	-1	171	-1	-3	-1	172	-5	-3	-1	173	-4	-3	-1	174	-8	-1	-1
175	-7	-1	0	176	-5	-3	0	177	-4	-3	0	178	-2	-3	0	179	-1	-2	0	180	0	-1	0
181	0	-2	7	182	-3	-4	7	183	-2	-7	7	184	-5	-7	6	185	-4	-8	6	186	-7	-6	5
187	-6	-7	3	188	-5	-8	2	189	-4	-8	1	190	-3	-6	1	191	-2	-4	1	192	-1	-1	1
193	0	-1	-4	194	-2	-2	-4	195	-2	-3	-4	196	-4	-3	-4	197	-4	-3	-4	198	-6	-1	-3
199	-6	-1	-2	200	-5	-3	-1	201	-4	-3	-1	202	-3	-3	-1	203	-2	-2	-1	204	-1	-1	-1
205	0	-1	-4	206	1	-1	-4	207	1	-1	-4	208	2	-1	-4	209	2	0	-4	210	2	2	-3
211	2	2	-2	212	2	0	-1	213	2	-1	-1	214	1	-1	-1	215	1	-1	-1	216	0	0	-1
217	1	-1	1	218	-3	1	1	219	-1	0	1	220	-5	3	1	221	-4	4	0	222	-8	9	0
223	-7	8	1	224	-5	5	0	225	-4	2	0	226	-3	1	0	227	-2	0	0	228	0	0	0
229	1	-1	-4	230	-3	2	-4	231	-2	2	-4	232	-6	6	-4	233	-5	8	-4	234	-10	16	-3
235	-9	15	-1	236	-6	9	0	237	-5	5	0	238	-3	3	0	239	-2	1	0	240	-1	0	0
241	0	-1	-1	242	-2	1	-1	243	-1	-2	-1	244	-4	2	-1	245	-3	1	-1	246	-7	7	-1
247	-6	6	0	248	-4	2	0	249	-3	0	0	250	-2	0	0	251	-1	0	0	252	0	0	0
253	0	-2	-3	254	1	1	-3	255	2	-2	-3	256	3	1	-3	257	4	-1	-3	258	5	4	-2
259	5	2	0	260	4	0	0	261	3	-1	0	262	2	-1	0	263	1	-1	0	264	0	0	0
265	0	-4	-7	266	-5	3	-7	267	-4	-4	-7	268	-10	3	-7	269	-10	-3	-7	270	-16	7	-7
271	-15	4	0	272	-11	1	0	273	-8	0	0	274	-6	-1	0	275	-3	-1	0	276	-1	0	0
277	0	-3	-3	278	2	2	-3	279	3	-3	-3	280	5	3	-3	281	6	-2	-3	282	8	6	-3
283	8	3	0	284	6	1	0	285	4	0	0	286	3	-1	0	287	2	-1	0	288	1	0	0
289	3	-16	8	290	-5	13	8	291	1	-18	8	292	-7	11	8	293	-1	-17	7	294	-10	10	11
295	-7	-5	-3	296	-5	-2	1	297	-3	-4	0	298	-2	-3	0	299	-1	-2	0	300	0	-1	0
301	4	-10	4	302	-6	6	4	303	1	-14	4	304	-8	3	4	305	-1	-16	4	306	-11	3	5
307	-7	-6	0	308	-5	-7	1	309	-4	-6	0	310	-3	-5	0	311	-2	-3	0	312	-1	-1	0

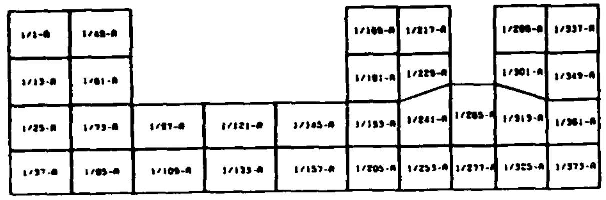
Figure D3. (Sheet 4 of 5)

SHEAR STRESSES FOR LOAD CASE 3 (PSI)

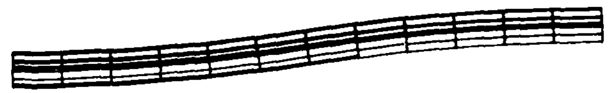
ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
313	2	-6	-4	314	-3	5	-4	315	1	-7	-4	316	-4	5	-3	317	-1	-6	-3	318	-5	9	-2
319	-3	3	-2	320	-3	0	-1	321	-2	-1	-1	322	-1	-2	-1	323	-1	-1	-1	324	0	0	0
325	1	-5	-3	326	1	4	-3	327	3	-5	-3	328	4	5	-3	329	6	-3	-3	330	8	8	-2
331	8	4	-1	332	6	1	0	333	4	0	0	334	3	0	0	335	2	0	0	336	1	0	0
337	3	-7	1	338	-4	7	1	339	1	-6	1	340	-7	9	1	341	-2	-3	1	342	-10	14	1
343	-7	7	0	344	-5	4	0	345	-3	2	0	346	-2	1	0	347	-1	0	0	348	0	0	0
349	4	-7	3	350	-5	8	3	351	3	-5	3	352	-5	11	3	353	3	1	3	354	-6	21	4
355	-2	14	-1	356	-2	8	0	357	-1	4	0	358	-1	2	0	359	0	1	0	360	0	0	0
361	3	-6	0	362	-3	8	0	363	3	-4	0	364	-3	11	0	365	3	1	1	366	-2	22	1
367	0	15	-2	368	0	8	-1	369	0	5	-1	370	0	2	0	371	0	1	0	372	0	0	0
373	1	-6	0	374	0	6	0	375	2	-5	0	376	2	8	0	377	4	-2	0	378	5	15	0
379	5	9	-1	380	4	4	0	381	3	2	0	382	2	1	0	333	1	0	0	334	0	0	0

	ELEM	VXY	ELEM	VYZ	ELEM	VZX
MIN.	270	-16	291	-18	265	-7
MAX.	282	8	366	22	54	11

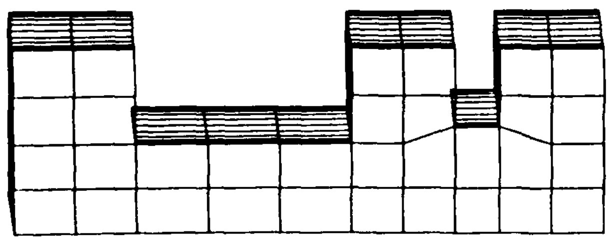
Figure D3. (Sheet 5 of 5)



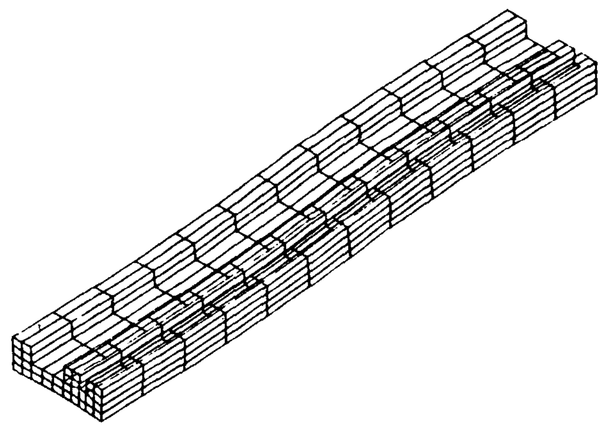
FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE, AUG 82
UNDEFORMED GRID
SNORT STRUCTURE(756 NODES,304 ELEMENTS)



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE, AUG 82
LOAD CASE NO-4



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE, AUG 82
LOAD CASE NO-4
SNORT STRUCTURE(756 NODES,304 ELEMENTS)



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE, AUG 82
LOAD CASE NO-4

Figure D4. Finite-element analysis for load case 4 with $K = 175$ lb/in.^{3} (Sheet 1 of 5)

NORMAL STRESSES FOR LOAD CASE 4 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
1	-7	-80	-34	2	-7	-88	-34	3	-7	-98	-34	4	-8	-106	-35	5	-8	-96	-31	6	-12	-59	-45
7	5	50	11	8	1	88	-3	9	1	98	0	10	0	90	-1	11	0	79	0	12	0	72	0
13	8	-50	-32	14	8	-52	-31	15	7	-56	-31	16	7	-56	-30	17	6	-49	-27	18	8	-23	-32
19	0	18	0	20	2	44	-5	21	0	51	-2	22	0	51	-1	23	0	48	-1	24	0	45	-1
25	2	-24	-29	26	2	-22	-28	27	2	-18	-27	28	2	-12	-26	29	1	-5	-23	30	3	1	-23
31	-1	-7	-7	32	1	0	-7	33	0	7	-4	34	0	13	-2	35	0	17	-1	36	0	19	-1
37	-2	2	-21	38	-2	8	-21	39	-1	20	-20	40	-1	32	-18	41	0	39	-16	42	3	27	-13
43	-5	-32	-9	44	-2	-43	-6	45	-2	-37	-4	46	-1	-24	-2	47	0	-13	-1	48	0	-6	-1
49	-13	-76	-39	50	-13	-84	-39	51	-13	-96	-39	52	-14	-105	-40	53	-13	-98	-37	54	-19	-61	-51
55	6	50	12	56	0	88	-2	57	1	94	0	58	0	85	0	59	0	74	0	60	0	66	0
61	13	-45	-44	62	13	-48	-43	63	12	-52	-43	64	12	-54	-43	65	8	-50	-42	66	9	-26	-49
67	5	20	5	68	5	44	-2	69	2	48	-1	70	1	46	-1	71	1	42	-1	72	0	39	-1
73	9	-17	-32	74	9	-16	-31	75	9	-12	-31	76	8	-8	-30	77	6	-4	-28	78	5	0	-28
79	5	-4	-4	80	4	-1	-4	81	2	3	-3	82	1	8	-2	83	1	11	-1	84	0	13	-1
85	-18	5	-21	86	-17	11	-21	87	-16	22	-20	88	-13	33	-19	89	-9	38	-17	90	-5	25	-14
91	-13	-33	-8	92	-9	-46	-5	93	-5	-41	-3	94	-3	-30	-2	95	-1	-19	-1	96	0	-13	-1
97	46	1	-13	98	46	2	-13	99	44	4	-13	100	41	6	-12	101	35	6	-12	102	25	5	-13
103	24	2	0	104	14	1	-1	105	8	1	-1	106	5	3	0	107	3	5	0	108	2	6	0
109	-53	5	-17	110	-52	11	-17	111	-49	21	-16	112	-44	31	-15	113	-37	33	-13	114	-29	17	-11
115	-25	-31	-7	116	-18	-48	-5	117	-10	-45	-3	118	-5	-36	-2	119	-3	-26	-1	120	-1	-20	-1
121	80	17	-3	122	79	17	-3	123	77	19	-2	124	73	19	-2	125	66	17	-2	126	52	12	-1
127	31	4	-2	128	17	-1	-1	129	10	-3	-1	130	6	-3	-1	131	4	-1	0	132	3	-1	0
133	-84	7	-13	134	-83	12	-13	135	-79	22	-12	136	-73	30	-11	137	-64	30	-9	138	-53	10	-7
139	-33	-30	-7	140	-22	-50	-5	141	-13	-50	-3	142	-7	-42	-2	143	-4	-32	-1	144	-2	-27	-1
145	89	26	5	146	88	27	5	147	86	28	5	148	83	28	5	149	77	25	5	150	61	16	3
151	32	3	1	152	16	-6	0	153	10	-9	0	154	6	-9	0	155	4	-8	0	156	3	-7	0
157	-91	12	-12	158	-90	18	-12	159	-86	27	-11	160	-81	34	-10	161	-72	32	-8	162	-59	9	-6
163	-35	-30	-6	164	-21	-53	-5	165	-13	-55	-3	166	-7	-48	-2	167	-4	-39	-1	168	-2	-34	-1
169	-1	-42	-1	170	-1	-50	-1	171	-1	-61	-1	172	-1	-71	-1	173	-1	-67	-1	174	-1	-33	-1
175	1	33	1	176	1	67	0	177	0	71	0	178	0	61	0	179	0	49	0	180	0	42	0
181	41	-6	1	182	40	-9	2	183	39	-14	2	184	38	-19	2	185	35	-18	3	186	27	-7	1
187	14	16	0	188	7	27	-2	189	4	27	-1	190	2	23	-1	191	2	18	0	192	1	14	0
193	33	16	-15	194	32	17	-15	195	32	19	-14	196	31	19	-12	197	29	17	-11	198	23	9	-9
199	10	-5	-7	200	4	-14	-5	201	3	-16	-3	202	2	-15	-2	203	1	-14	-1	204	1	-13	-1
205	-74	20	-17	206	-73	26	-16	207	-71	34	-15	208	-67	41	-14	209	-60	38	-12	210	-48	13	-9
211	-28	-32	-9	212	-16	-57	-6	213	-10	-60	-4	214	-6	-53	-2	215	-3	-45	-1	216	-2	-39	-1
217	3	-36	0	218	3	-43	0	219	2	-56	0	220	2	-66	0	221	1	-62	0	222	1	-28	0
223	2	28	-1	224	1	62	0	225	1	66	0	226	0	56	0	227	0	44	0	228	0	36	0
229	31	-7	-8	230	31	-10	-8	231	30	-16	-7	232	29	-22	-7	233	26	-21	-5	234	23	-7	-2
235	9	12	-7	236	6	26	-4	237	3	26	-2	238	2	21	-2	239	1	15	-1	240	1	11	-1
241	15	15	-15	242	15	16	-15	243	15	17	-14	244	15	17	-13	245	14	15	-10	246	12	8	-6
247	4	-8	-10	248	2	-15	-6	249	1	-17	-3	250	1	-17	-2	251	0	-16	-1	252	0	-15	-1
253	-46	30	-20	254	-45	36	-19	255	-44	44	-18	256	-41	50	-17	257	-36	46	-14	258	-29	20	-11
259	-19	-34	-10	260	-12	-60	-6	261	-7	-64	-4	262	-4	-57	-3	263	-2	-49	-2	264	-2	-44	-1
265	19	17	-22	266	19	17	-22	267	18	16	-22	268	17	15	-21	269	14	12	-21	270	13	5	-23
271	7	-6	0	272	5	-12	-2	273	2	-16	-1	274	1	-17	-1	275	1	-17	-1	276	1	-17	-1
277	-22	40	-21	278	-21	45	-20	279	-20	53	-19	280	-18	58	-18	281	-14	54	-16	282	-7	28	-13
283	-16	-37	-8	284	-10	-63	-5	285	-6	-67	-4	286	-3	-62	-2	287	-2	-54	-1	288	-1	-49	-1
289	-4	-47	-88	290	-4	-55	-88	291	-4	-68	-88	292	-5	-80	-90	293	-4	-80	-82	294	-8	-61	-117
295	4	43	28	296	0	61	-6	297	1	62	1	298	0	49	-1	299	0	37	0	300	0	29	0
301	-7	-20	-78	302	-7	-24	-78	303	-8	-31	-78	304	-8	-37	-77	305	-10	-41	-74	306	-14	-31	-92
307	7	14	14	308	4	24	-4	309	1	20	-1	310	1	14	-1	311	1	7	-1	312	0	3	0

Figure D.4 (Sheet 2 of 5)

NORMAL STRESSES FOR LOAD CASE 4 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
313	7	18	-41	314	7	18	-41	315	7	18	-40	316	7	17	-39	317	6	13	-38	318	8	5	-42
319	-1	-12	0	320	1	-20	-4	321	0	-24	-2	322	0	-25	-2	323	0	-25	-1	324	0	-25	-1
325	-1	49	-22	326	-1	54	-22	327	0	61	-21	328	1	66	-19	329	4	62	-18	330	8	35	-15
331	-11	-40	-8	332	-6	-67	-6	333	-4	-71	-4	334	-2	-66	-2	335	-1	-59	-2	336	-1	-54	-1
337	1	-22	2	338	1	-30	2	339	1	-43	2	340	1	-55	2	341	0	-56	2	342	-1	-34	3
343	2	35	-1	344	1	57	-1	345	1	56	-1	346	0	44	0	347	0	31	0	348	0	23	0
349	-5	3	-5	350	-5	-1	-5	351	-5	-7	-4	352	-5	-13	-4	353	-6	-16	-2	354	-8	-8	-1
355	3	6	-5	356	1	14	-3	357	0	11	-2	358	0	5	-1	359	0	-2	-1	360	0	-5	-1
361	1	29	-15	362	1	30	-15	363	1	31	-14	364	1	30	-13	365	0	25	-11	366	2	15	-9
367	-1	-18	-7	368	0	-28	-5	369	0	-33	-3	370	0	-34	-2	371	0	-33	-1	372	0	-32	-1
373	0	55	-19	374	0	60	-18	375	1	67	-17	376	1	71	-16	377	2	66	-14	378	5	39	-10
379	-6	-43	-10	380	-3	-70	-6	381	-2	-75	-4	382	-1	-71	-2	383	-1	-64	-2	384	-1	-59	-1

	ELEM	SX	ELEM	SY	ELEM	SZ	
MIN.	157	-91	4	-106	294	-117	(COMPRESSIVE)
MAX.	145	89	9	98	295	28	(TENSILE)

Figure D4. (Sheet 3 of 5)

SHEAR STRESSES FOR LOAD CASE 4 (PSI)

ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
1	4	-35	-13	2	-4	31	-13	3	5	-36	-13	4	-3	33	-13	5	8	-26	-11	6	5	46	-17
7	10	13	4	8	3	8	-2	9	1	0	0	10	0	-2	0	11	0	-2	0	12	0	-1	0
13	-2	-26	-4	14	2	22	-4	15	-2	-28	-4	16	2	26	-4	17	-3	-14	-3	18	2	54	-6
19	0	29	2	20	-1	11	0	21	0	1	1	22	0	-3	0	23	0	-3	0	24	0	-1	0
25	-1	-21	4	26	1	17	4	27	-1	-23	4	28	-1	21	3	29	-4	-10	2	30	-4	51	1
31	-5	31	3	32	-3	10	2	33	-1	1	1	34	0	-3	1	35	0	-3	0	36	0	-1	0
37	1	-19	4	38	-1	15	4	39	0	-20	3	40	-4	18	3	41	-6	-12	2	42	-15	36	1
43	-13	18	3	44	-7	6	2	45	-3	0	1	46	-1	-2	1	47	0	-2	0	48	0	-1	0
49	3	-36	21	50	-3	33	21	51	4	-39	20	52	-2	32	21	53	7	-34	19	54	6	36	27
55	9	1	-7	56	4	1	1	57	1	-3	0	58	0	-3	0	59	0	-3	0	60	0	-1	0
61	3	-26	11	62	-3	21	11	63	3	-30	12	64	-3	21	12	65	2	-25	12	66	-3	36	17
67	-1	12	-5	68	-1	0	-1	69	0	-4	-1	70	0	-5	0	71	0	-4	0	72	0	-1	0
73	1	-19	19	74	0	14	19	75	0	-21	18	76	-3	15	17	77	-5	-15	15	78	-11	33	13
79	-10	16	7	80	-6	2	5	81	-2	-2	3	82	0	-4	2	83	0	-3	1	84	0	-1	0
85	3	-16	17	86	-3	13	17	87	1	-18	16	88	-8	13	15	89	-11	-13	13	90	-26	26	11
91	-24	11	7	92	-13	2	5	93	-5	-1	3	94	-2	-3	2	95	0	-2	1	96	0	-1	1
97	1	-11	24	98	0	8	24	99	0	-13	24	100	-2	8	23	101	-4	-10	22	102	-10	19	21
103	-9	9	4	104	-5	0	2	105	-2	-2	2	106	0	-3	1	107	0	-2	1	108	0	-1	0
109	3	-10	24	110	-4	7	23	111	1	-12	23	112	-9	7	22	113	-9	-8	21	114	-26	17	18
115	-23	8	6	116	-12	1	4	117	-5	-2	2	118	-2	-3	1	119	0	-2	1	120	0	-1	1
121	0	-3	9	122	-2	1	9	123	-3	-5	9	124	-4	1	9	125	-5	-1	9	126	-6	10	7
127	-6	7	3	128	-5	1	0	129	-4	-1	1	130	-3	-2	0	131	-2	-2	0	132	-1	-1	0
133	2	-3	13	134	-3	1	13	135	0	-5	13	136	-7	1	12	137	-6	-2	12	138	-18	10	10
139	-16	7	3	140	-9	1	1	141	-5	-2	1	142	-2	-2	1	143	-1	-2	1	144	0	-1	1
145	-1	-2	3	146	-4	-2	3	147	-5	-4	4	148	-7	-2	4	149	-5	0	4	150	-6	7	3
151	-5	7	1	152	-6	0	-1	153	-6	-3	0	154	-5	-4	0	155	-3	-3	0	156	-1	-1	0
157	0	-1	-7	158	-2	-2	-7	159	-2	-3	-6	160	-4	-1	-5	161	-4	1	-4	162	-6	8	-4
163	-5	7	-3	164	-4	1	-2	165	-3	-2	-1	166	-2	-3	-1	167	-1	-2	0	168	0	-1	0
169	4	-3	-2	170	-5	-1	-2	171	3	-6	-2	172	-6	0	-2	173	2	-1	-2	174	-10	10	-2
175	-6	8	0	176	-2	1	0	177	-2	-3	0	178	-1	-4	0	179	-1	-3	0	180	0	-1	0
181	2	-4	18	182	-4	-3	18	183	1	-9	17	184	-6	-4	17	185	1	-3	15	186	-6	11	11
187	-3	8	7	188	-2	0	3	189	-3	-6	2	190	-2	-7	1	191	-1	-5	1	192	-1	-2	1
193	1	-3	-20	194	-3	-2	-20	195	-2	-7	-20	196	-5	-2	-19	197	-1	-1	-17	198	-2	11	-14
199	-1	10	-7	200	-2	1	-4	201	-3	-4	-2	202	-3	-5	-1	203	-2	-4	-1	204	-1	-1	0
205	-1	-3	-21	206	0	0	-20	207	-2	-5	-20	208	-1	0	-19	209	-1	0	-17	210	4	10	-14
211	3	8	-7	212	0	2	-4	213	-1	-2	-2	214	-1	-3	-1	215	-1	-2	-1	216	0	-1	0
217	4	-5	2	218	-5	3	2	219	3	-6	2	220	-6	4	2	221	2	1	1	222	-10	21	0
223	-6	16	1	224	-2	5	0	225	-2	0	0	226	-1	-2	0	227	-1	-2	0	228	0	-1	0
229	4	-6	-11	230	-5	3	-11	231	2	-7	-11	232	-7	6	-10	233	0	4	-10	234	-12	30	-9
235	-8	26	-1	236	-4	9	-1	237	-3	1	-1	238	-2	-2	0	239	-1	-2	0	240	0	-1	0
241	2	-7	-13	242	-3	3	-13	243	0	-9	-13	244	-5	4	-13	245	-1	-1	-13	246	-6	21	-11
247	-4	15	-3	248	-3	4	-1	249	-3	-1	-1	250	-2	-3	0	251	-1	-3	0	252	0	-1	0
253	-2	-7	-17	254	1	4	-17	255	-2	-9	-16	256	1	5	-16	257	0	-4	-16	258	9	15	-14
259	7	9	-3	260	2	2	-1	261	0	-1	-1	262	-1	-3	0	263	0	-2	0	264	0	-1	0
265	2	-16	-32	266	-6	12	-31	267	-1	-18	-31	268	-9	13	-31	269	-5	-13	-31	270	-14	28	-31
271	-10	13	-1	272	-9	2	-1	273	-6	-2	-1	274	-4	-3	0	275	-2	-3	0	276	-1	-1	0
277	-1	-12	-13	278	1	10	-13	279	-1	-14	-13	280	2	11	-13	281	3	-10	-13	282	11	21	-12
283	10	10	-1	284	4	2	-1	285	1	-1	0	286	0	-2	0	287	0	-2	0	288	0	-1	0
289	-12	-58	15	290	11	54	15	291	-13	-61	15	292	10	53	16	293	-15	-55	13	294	2	51	22
295	-10	-6	-7	296	-3	2	2	297	-2	-4	0	298	-1	-4	0	299	-1	-3	0	300	0	-1	0
301	6	-36	4	302	-8	29	4	303	5	-40	4	304	-9	29	5	305	3	-37	2	306	-12	40	7
307	-5	6	-3	308	-3	-3	2	309	-3	-5	0	310	-2	-6	0	311	-1	-5	0	312	0	-2	0

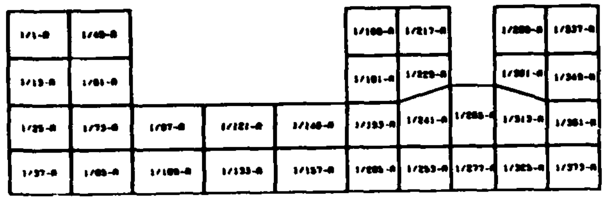
Figure D4. (Sheet 4 of 5)

SHEAR STRESSES FOR LOAD CASE 4 (PSI)

ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
313	5	-22	-5	314	-7	18	-5	315	4	-25	-5	316	-7	19	-4	317	4	-20	-4	318	-6	35	0
319	0	13	-5	320	-2	2	-2	321	-2	-2	-1	322	-2	-4	-1	323	-1	-3	0	324	0	-1	0
325	1	-16	-6	326	-1	14	-5	327	2	-18	-5	328	0	15	-5	329	6	-13	-4	330	9	26	-3
331	10	11	-3	332	4	2	-1	333	1	-1	-1	334	0	-2	0	335	0	-2	0	336	0	-1	0
337	-9	-18	-7	338	8	15	-7	339	-10	-19	-7	340	7	17	-7	341	-12	-12	-7	342	0	30	-8
343	-9	12	2	344	-3	6	0	345	-2	0	0	346	-1	-2	0	347	-1	-2	0	348	0	-1	0
349	6	-20	6	350	-7	16	6	351	6	-21	6	352	-7	20	6	353	6	-10	5	354	-8	42	9
355	-2	24	-3	356	-1	9	1	357	-1	1	0	358	-1	-2	0	359	0	-2	0	360	0	-1	0
361	7	-20	7	362	-7	16	7	363	7	-21	7	364	-7	20	7	365	7	-10	8	366	-6	44	11
367	1	26	-4	368	0	8	-1	369	0	1	-1	370	0	-2	0	371	0	-2	0	372	0	-1	0
373	4	-18	3	374	-3	16	3	375	4	-19	3	376	-2	18	3	377	6	-13	3	378	3	33	5
379	7	15	-2	380	3	5	-1	381	1	0	0	382	0	-2	0	383	0	-2	0	334	0	-1	0

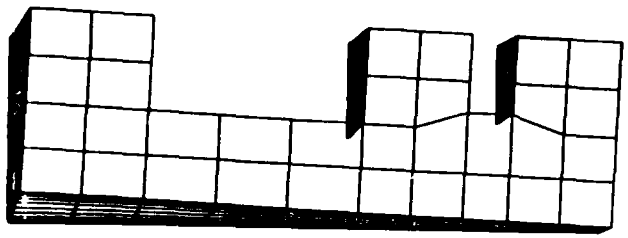
	ELEM	VXY	ELEM	VYZ	ELEM	VZX
MIN.	90	-26	291	-61	265	-32
MAX.	282	11	18	54	54	27

Figure D4. (Sheet 5 of 5)

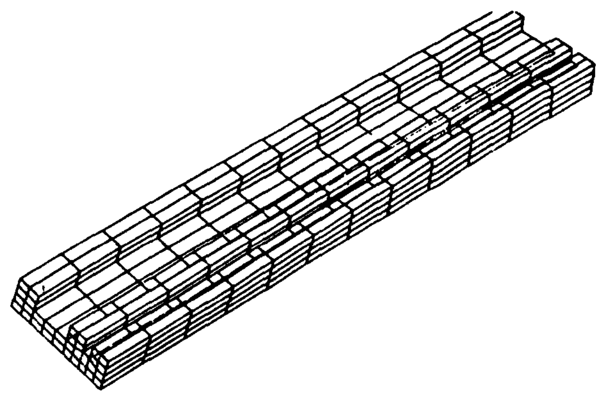


FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
UNDEFORMED GRID

FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
LOAD CASE NO-5



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
LOAD CASE NO-5



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
LOAD CASE NO-5

Figure D5. Finite-element analysis for load case 5 with $K = 175$ lb/in.^{3} (Sheet 1 of 5)

NORMAL STRESSES FOR LOAD CASE 5 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
1	2	-6	3	2	2	-5	3	3	2	-2	3	4	2	0	4	5	2	3	3	6	3	3	4
7	-1	-2	-1	8	0	-2	0	9	0	1	0	10	0	3	0	11	0	6	0	12	0	7	0
13	-2	-10	5	14	-2	-9	5	15	-2	-8	4	16	-2	-5	4	17	-2	-3	4	18	-2	-1	4
19	0	2	-1	20	0	3	0	21	0	6	-1	22	0	8	-1	23	0	10	-1	24	0	11	-1
25	-1	-14	4	26	-1	-13	4	27	-1	-12	4	28	-1	-11	3	29	-1	-8	3	30	-1	-4	3
31	0	4	0	32	0	8	-1	33	0	11	-1	34	0	12	-1	35	0	13	-1	36	0	14	-1
37	1	-17	1	38	1	-17	1	39	1	-17	1	40	1	-16	1	41	1	-13	1	42	0	-6	0
43	1	7	-1	44	0	13	-1	45	0	16	-1	46	0	17	-2	47	0	17	-2	48	0	17	-2
49	0	-3	1	50	0	-2	1	51	0	0	1	52	0	3	2	53	0	5	1	54	0	4	2
55	0	-4	-1	56	0	-5	0	57	0	-3	-1	58	0	0	0	59	0	2	0	60	0	3	0
61	-4	-8	-1	62	-4	-7	-1	63	-4	-6	-1	64	-4	-4	-1	65	-4	-2	-1	66	-3	0	-1
67	-1	-1	-2	68	0	0	-1	69	0	2	-1	70	0	4	-2	71	0	6	-1	72	0	7	-1
73	-4	-11	0	74	-4	-11	0	75	-4	-10	0	76	-3	-9	0	77	-3	-7	0	78	-3	-3	0
79	-1	2	-1	80	0	6	-1	81	0	8	-1	82	0	9	-2	83	0	10	-2	84	0	10	-2
85	4	-13	0	86	4	-13	0	87	4	-13	0	88	4	-12	0	89	3	-10	0	90	3	-5	-1
91	2	5	-1	92	1	11	-1	93	0	13	-1	94	0	14	-2	95	0	14	-2	96	0	14	-2
97	-9	-10	-2	98	-9	-9	-2	99	-9	-9	-2	100	-9	-8	-2	101	-8	-6	-2	102	-6	-3	-2
103	-2	1	-1	104	1	4	-1	105	1	6	-1	106	1	7	-1	107	2	7	-1	108	2	8	-1
109	6	-9	-1	110	6	-9	-1	111	6	-9	-1	112	5	-9	-1	113	5	-7	-1	114	3	-3	-1
115	1	3	-1	116	0	8	-1	117	-1	10	-1	118	-1	10	-2	119	-2	10	-2	120	-2	10	-2
121	-7	-6	0	122	-7	-6	0	123	-7	-5	0	124	-7	-5	0	125	-6	-4	0	126	-4	-2	0
127	0	1	0	128	2	3	0	129	3	4	0	130	3	4	0	131	3	5	0	132	3	5	0
133	6	-6	-1	134	5	-6	-1	135	5	-6	-1	136	4	-6	-1	137	4	-5	-1	138	2	-2	-1
139	0	2	-1	140	-2	5	-1	141	-2	6	-1	142	-3	6	-2	143	-3	6	-2	144	-4	6	-2
145	-4	-2	-1	146	-4	-2	-1	147	-4	-2	-1	148	-4	-2	-1	149	-3	-2	-1	150	-1	-1	0
151	1	1	0	152	3	1	0	153	3	2	0	154	4	2	0	155	4	2	0	156	4	2	0
157	4	-2	-1	158	4	-3	-1	159	3	-3	-1	160	3	-4	-1	161	2	-4	-1	162	1	-2	-1
163	-1	1	-1	164	-2	3	-1	165	-3	3	-2	166	-4	3	-2	167	-4	2	-2	168	-4	2	-2
169	0	5	0	170	0	5	0	171	0	6	0	172	0	6	0	173	0	5	0	174	0	2	0
175	0	-2	0	176	0	-5	0	177	0	-6	0	178	0	-6	0	179	0	-5	0	180	0	-5	0
181	0	3	-1	182	0	3	-1	183	0	3	-1	184	0	3	-1	185	0	2	-1	186	1	1	-1
187	1	-1	-1	188	1	-2	-1	189	1	-3	-1	190	2	-3	-1	191	2	-3	-1	192	2	-3	-1
193	-1	2	-1	194	0	2	-1	195	0	1	-1	196	0	1	-1	197	0	0	-1	198	0	0	-1
199	1	0	-1	200	1	0	-1	201	1	-1	-1	202	1	-1	-2	203	1	-2	-2	204	1	-2	-2
205	1	1	-1	206	1	0	-1	207	1	-1	-1	208	1	-2	-1	209	0	-2	-2	210	0	-2	-2
211	-2	1	-2	212	-2	1	-2	213	-3	1	-2	214	-3	0	-2	215	-3	-1	-2	216	-3	-2	-2
217	0	8	0	218	0	8	0	219	0	9	0	220	0	8	0	221	0	7	0	222	0	3	0
223	0	-3	0	224	0	-7	0	225	0	-9	0	226	0	-9	0	227	0	-8	0	228	0	-8	0
229	2	7	-1	230	2	7	-1	231	2	7	-1	232	2	6	-1	233	3	5	-1	234	2	2	-1
235	1	-2	-1	236	1	-5	-1	237	1	-6	-2	238	1	-7	-2	239	1	-7	-2	240	1	-7	-2
241	1	5	-1	242	1	5	-1	243	1	4	-1	244	1	3	-1	245	2	2	-1	246	1	0	-2
247	0	-1	-1	248	0	-2	-2	249	1	-3	-2	250	1	-4	-2	251	1	-5	-2	252	1	-5	-2
253	-2	3	-1	254	-2	2	-1	255	-2	1	-1	256	-2	0	-1	257	-2	-1	-1	258	-2	-2	-2
259	-2	0	-2	260	-2	0	-2	261	-2	-1	-2	262	-2	-3	-2	263	-2	-4	-2	264	-2	-4	-2
265	6	9	4	266	6	9	4	267	6	8	4	268	6	7	3	269	7	6	4	270	6	3	3
271	1	-1	-1	272	0	-4	-1	273	1	-5	-1	274	1	-6	-1	275	1	-7	-1	276	1	-8	-1
277	-6	5	-1	278	-6	4	-1	279	-6	3	-1	280	-6	1	-1	281	-6	0	-1	282	-6	-2	-1
283	-2	0	-2	284	-2	-2	-2	285	-2	-4	-2	286	-2	-5	-2	287	-2	-7	-2	288	-2	-7	-2
289	-3	12	8	290	-3	12	8	291	-3	12	8	292	-3	11	8	293	-3	9	7	294	-4	4	10
295	1	-3	-3	296	0	-8	0	297	0	-10	0	298	0	-11	0	299	0	-11	0	300	0	-11	0
301	7	14	8	302	7	13	8	303	7	13	8	304	7	12	8	305	7	9	8	306	7	5	9
307	0	-2	-2	308	0	-7	-1	309	1	-9	-1	310	1	-10	-1	311	1	-10	-1	312	1	-11	-1

Figure D5. (Sheet 2 of 5)

NORMAL STRESSES FOR LOAD CASE 5 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
313	1	11	3	314	1	10	3	315	1	9	3	316	1	8	3	317	1	6	3	318	1	2	3
319	0	-2	-2	320	0	-5	-1	321	0	-7	-1	322	0	-9	-1	323	0	-10	-1	324	0	-10	-1
325	-5	8	-1	326	-5	7	-1	327	-5	6	-1	328	-5	4	-1	329	-5	1	-1	330	-5	-1	-1
331	-1	-1	-2	332	-1	-3	-2	333	-1	-6	-2	334	-1	-8	-2	335	-1	-9	-2	336	-1	-10	-2
337	-1	14	-2	338	-1	14	-2	339	-1	13	-2	340	-1	12	-2	341	-1	9	-2	342	-1	5	-2
343	0	-6	0	344	0	-10	0	345	0	-13	0	346	0	-14	0	347	0	-14	0	348	0	-15	0
349	2	13	-5	350	2	13	-5	351	2	12	-5	352	2	10	-5	353	2	7	-5	354	2	3	-5
355	0	-4	-1	356	0	-8	-1	357	0	-11	-1	358	0	-13	-1	359	0	-14	-1	360	0	-14	-1
361	0	12	-4	362	0	12	-4	363	0	10	-4	364	0	8	-4	365	0	6	-4	366	0	2	-4
367	0	-3	-2	368	0	-7	-2	369	0	-10	-2	370	0	-12	-2	371	0	-13	-2	372	0	-13	-2
373	-2	11	-3	374	-2	10	-3	375	-2	9	-3	376	-2	6	-3	377	-2	4	-3	378	-2	0	-3
379	-1	-2	-2	380	-1	-5	-2	381	-1	-8	-2	382	-1	-10	-2	383	-1	-12	-3	384	-1	-13	-3

	ELEM	SX	ELEM	SY	ELEM	SZ	
MIN.	97	-9	38	-17	354	-5	(COMPRESSIVE)
MAX.	305	7	47	17	294	10	(TENSILE)

Figure D5. (Sheet 3 of 5)

SHEAR STRESSES FOR LOAD CASE 5 (PSI)

ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
1	4	4	3	2	-5	-5	3	3	2	3	3	4	-7	-6	3	5	0	1	3	6	-9	-8	4
7	-5	-4	-1	8	-4	-3	0	9	-3	-2	0	10	-2	-1	0	11	-1	0	0	12	0	0	0
13	2	3	1	14	-2	-4	1	15	1	1	1	16	-3	-6	1	17	1	-2	1	18	-3	-12	1
19	-1	-9	0	20	-1	-5	0	21	-1	-3	0	22	-1	-2	0	23	0	-1	0	24	0	0	0
25	1	2	-1	26	0	-3	-1	27	1	1	-1	28	0	-6	-1	29	1	-3	-1	30	0	-11	-1
31	0	-9	0	32	0	-5	0	33	0	-3	0	34	0	-2	0	35	0	-1	0	36	0	0	0
37	0	2	-1	38	1	-3	-1	39	1	1	-1	40	3	-4	-1	41	3	-1	-1	42	5	-7	-1
43	4	-5	0	44	3	-3	0	45	2	-2	0	46	2	-1	0	47	1	0	0	48	0	0	0
49	4	2	0	50	-5	-1	0	51	2	4	0	52	-7	0	0	53	0	4	0	54	-9	1	0
55	-5	3	0	56	-4	3	0	57	-3	2	0	58	-2	2	0	59	-1	1	0	60	0	0	0
61	1	2	2	62	-2	1	2	63	0	5	2	64	-3	4	2	65	-1	7	2	66	-5	5	2
67	-3	6	1	68	-3	6	0	69	-2	5	0	70	-1	4	0	71	-1	2	0	72	0	1	0
73	0	1	-2	74	-1	0	-2	75	-1	2	-2	76	-1	1	-2	77	-1	3	-2	78	-2	0	-1
79	-2	1	0	80	-1	2	0	81	-1	2	1	82	-1	1	1	83	-1	1	1	84	0	0	1
85	0	1	-2	86	1	-1	-2	87	2	1	-2	88	3	-1	-2	89	4	1	-2	90	6	-2	-1
91	6	-1	0	92	4	0	0	93	3	0	1	94	2	0	1	95	1	0	1	96	0	0	1
97	-1	0	1	98	-2	1	1	99	-4	1	1	100	-6	1	1	101	-7	2	1	102	-10	2	1
103	-10	2	1	104	-7	2	1	105	-6	2	1	106	-4	1	1	107	-2	1	1	108	-1	0	1
109	0	0	0	110	1	0	0	111	1	1	0	112	1	0	0	113	2	1	0	114	2	0	0
115	2	0	1	116	2	0	1	117	1	1	1	118	1	0	1	119	0	0	1	120	0	0	1
121	-1	0	1	122	-2	0	1	123	-3	0	1	124	-5	0	1	125	-7	0	1	126	-9	0	1
127	-9	-1	1	128	-7	0	1	129	-5	0	1	130	-3	0	1	131	-2	0	1	132	-1	0	1
133	0	0	2	134	0	0	2	135	0	0	1	136	0	0	1	137	0	0	1	138	-1	0	1
139	-1	-1	1	140	0	0	1	141	0	0	1	142	0	0	1	143	0	0	1	144	0	0	1
145	-1	0	2	146	-2	0	2	147	-4	-1	1	148	-6	-1	1	149	-8	-2	1	150	-10	-3	1
151	-10	-3	1	152	-8	-2	0	153	-6	-1	0	154	-4	-1	0	155	-2	0	0	156	-1	0	0
157	0	0	2	158	0	0	2	159	1	0	2	160	0	0	2	161	0	-1	2	162	-1	-1	1
163	-1	-1	1	164	0	-1	0	165	1	0	0	166	1	0	0	167	0	0	0	168	0	0	0
169	-1	0	0	170	-1	-1	0	171	-2	-1	0	172	-2	-2	0	173	-4	-2	0	174	-3	-4	0
175	-4	-3	0	176	-3	-3	0	177	-2	-2	0	178	-2	-1	0	179	-1	-1	0	180	0	0	0
181	0	0	0	182	-1	-2	0	183	-2	-3	0	184	-2	-5	0	185	-4	-6	0	186	-4	-8	1
187	-4	-8	0	188	-3	-6	1	189	-2	-5	1	190	-2	-3	1	191	-1	-2	1	192	0	-1	1
193	0	0	2	194	-1	-1	2	195	-1	-1	2	196	-2	-2	2	197	-3	-2	2	198	-4	-4	1
199	-4	-4	0	200	-3	-3	0	201	-2	-2	-1	202	-1	-1	-1	203	-1	-1	-1	204	0	0	-1
205	1	0	2	206	1	0	2	207	2	0	2	208	2	-1	2	209	2	0	2	210	1	-2	1
211	1	-1	0	212	2	-1	0	213	2	0	-1	214	1	0	-1	215	1	0	-1	216	0	0	-1
217	-1	1	0	218	-1	0	0	219	-2	2	0	220	-2	1	0	221	-4	3	0	222	-3	1	0
223	-4	2	0	224	-3	2	0	225	-2	2	0	226	-2	1	0	227	-1	1	0	228	0	0	0
229	-1	1	0	230	-1	1	0	231	-2	3	0	232	-3	3	0	233	-4	5	0	234	-5	3	0
235	-5	4	0	236	-4	4	0	237	-3	4	0	238	-2	3	0	239	-1	2	0	240	0	1	0
241	0	1	3	242	-1	0	3	243	-1	1	3	244	-2	0	3	245	-2	1	3	246	-4	-1	2
247	-4	0	1	248	-2	1	0	249	-2	1	0	250	-1	1	0	251	-1	0	0	252	0	0	0
253	1	1	3	254	1	-1	3	255	2	1	3	256	2	-1	3	257	3	1	3	258	2	-2	2
259	2	-1	0	260	3	0	0	261	3	0	0	262	2	0	0	263	1	0	0	264	0	0	0
265	-1	2	4	266	-2	-2	4	267	-3	2	4	268	-5	-2	4	269	-6	2	4	270	-9	-3	4
271	-9	-1	0	272	-7	0	0	273	-5	0	0	274	-3	0	0	275	-2	0	0	276	-1	0	0
277	1	1	2	278	1	-1	2	279	2	2	1	280	3	-1	1	281	4	1	1	282	3	-2	1
283	3	-1	0	284	4	0	0	285	3	0	0	286	2	0	0	287	1	0	0	288	0	0	0
289	6	5	2	290	-7	-6	2	291	5	5	2	292	-9	-7	2	293	4	3	2	294	-9	-8	2
295	-2	-2	0	296	-3	-3	0	297	-2	-2	0	298	-2	-1	0	299	-1	-1	0	300	0	0	0
301	1	3	2	302	-2	-4	2	303	0	1	2	304	-4	-7	2	305	-2	-1	2	306	-5	-10	2
307	-4	-6	1	308	-3	-4	0	309	-2	-3	0	310	-2	-2	0	311	-1	-1	0	312	0	0	0

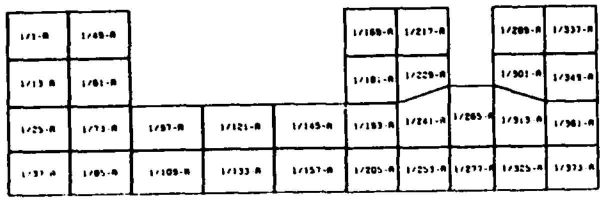
Figure D5. (Sheet 4 of 5)

SHEAR STRESSES FOR LOAD CASE 5 (PSI)

ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
313	0	2	-2	314	0	-2	-2	315	-1	2	-2	316	-1	-2	-2	317	-2	1	-2	318	-2	-4	-2
319	-2	-2	0	320	-2	-1	0	321	-1	0	0	322	-1	0	-1	323	0	0	-1	324	0	0	-1
325	0	1	-1	326	2	-1	-1	327	2	2	-1	328	3	-1	-1	329	3	2	-1	330	4	-1	-1
331	3	0	0	332	3	0	0	333	3	0	0	334	2	0	0	335	1	0	0	336	0	0	0
337	5	0	3	338	-6	1	3	339	4	1	3	340	-7	2	3	341	2	1	3	342	-8	3	3
343	-3	2	0	344	-3	2	0	345	-2	2	0	346	-1	1	0	347	-1	1	0	348	0	0	0
349	1	1	0	350	-2	2	0	351	1	2	0	352	-2	3	0	353	0	4	0	354	-2	4	0
355	-1	4	0	356	-1	4	0	357	-1	3	0	358	0	2	0	359	0	2	0	360	0	1	0
361	0	1	-2	362	0	1	-2	363	0	3	-2	364	0	3	-2	365	0	4	-2	366	0	4	-2
367	0	4	0	368	0	4	0	369	0	3	0	370	0	3	0	371	0	2	0	372	0	1	0
373	0	1	-1	374	1	0	-1	375	1	2	-1	376	2	1	-1	377	2	3	-1	378	3	2	-1
379	2	2	0	380	2	2	0	381	2	2	0	382	1	1	0	383	1	1	0	384	0	0	0

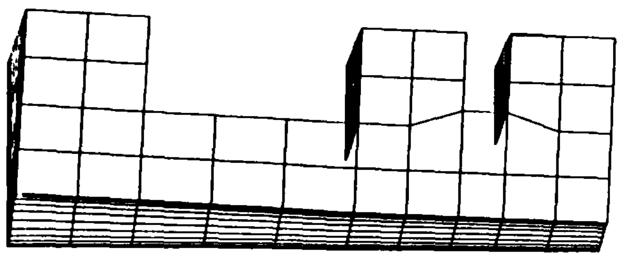
	ELEM	VXY	ELEM	VYZ	ELEM	VZX
MIN.	150	-10	18	-12	366	-2
MAX.	90	6	65	7	265	4

Figure D5. (Sheet 5 of 5)

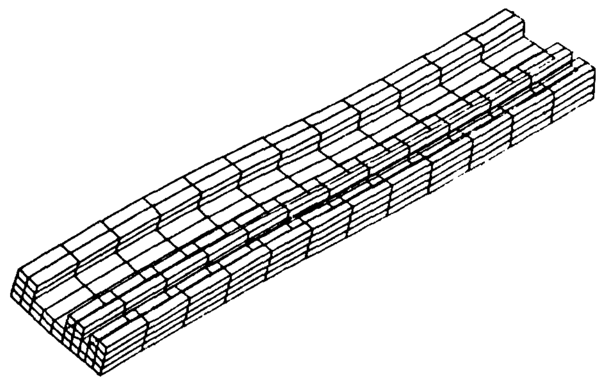


FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE, AUG 82
UNDEFORMED GRID
SNORT STRUCTURE(756 NODES,384 ELEMENTS)

FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE, AUG 82
LOAD CASE NO-6



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE, AUG 82
LOAD CASE NO-6
SNORT STRUCTURE(756 NODES,384 ELEMENTS)



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE, AUG 82
LOAD CASE NO-6

Figure D6. Finite-element analysis for load case 6 with $K = 175\ lb/in.^3$ (Sheet 1 of 5)

NORMAL STRESSES FOR LOAD CASE 6 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
1	3	3	9	2	3	6	9	3	3	10	9	4	4	15	9	5	3	16	8	6	5	11	12
7	-2	-9	-3	8	0	-14	0	9	0	-13	0	10	0	-8	0	11	0	-3	0	12	0	-1	0
13	-3	-6	10	14	-3	-5	10	15	-3	-2	10	16	-3	1	10	17	-3	3	9	18	-3	2	10
19	0	0	-1	20	-1	-2	0	21	0	1	0	22	0	3	-1	23	0	6	-1	24	0	7	-1
25	-1	-14	9	26	-1	-14	9	27	-1	-13	8	28	-1	-12	8	29	-1	-9	7	30	-1	-5	7
31	0	6	1	32	0	10	0	33	0	13	-1	34	0	14	-1	35	0	15	-1	36	0	15	-1
37	2	-22	5	38	2	-23	5	39	1	-24	5	40	1	-24	4	41	1	-22	3	42	0	-12	2
43	2	13	1	44	1	23	0	45	1	25	-1	46	0	25	-1	47	0	24	-2	48	0	23	-2
49	1	6	7	50	1	9	7	51	1	14	7	52	1	18	7	53	1	20	7	54	2	14	10
55	-1	-12	-3	56	0	-18	0	57	0	-17	-1	58	0	-12	0	59	0	-8	0	60	0	-5	0
61	-7	-4	5	62	-7	-3	5	63	-7	0	5	64	-6	3	5	65	-6	5	4	66	-5	3	6
67	-2	-4	-3	68	-1	-6	-1	69	0	-3	-2	70	0	-1	-2	71	0	2	-2	72	0	3	-2
73	-6	-12	5	74	-6	-12	5	75	-6	-11	5	76	-6	-10	4	77	-5	-8	4	78	-4	-4	4
79	-1	3	-1	80	0	7	-1	81	0	10	-1	82	0	11	-2	83	0	11	-2	84	0	12	-2
85	8	-17	3	86	8	-18	3	87	8	-20	3	88	7	-20	3	89	6	-18	2	90	4	-9	1
91	4	11	0	92	2	20	-1	93	1	22	-1	94	0	21	-2	95	0	20	-2	96	0	19	-2
97	-19	-12	0	98	-18	-12	0	99	-18	-12	0	100	-17	-11	0	101	-15	-8	0	102	-11	-4	0
103	-6	1	-1	104	-1	5	-1	105	0	7	-1	106	1	8	-1	107	1	9	-1	108	2	9	-1
109	16	-12	2	110	15	-13	2	111	15	-15	2	112	13	-16	1	113	11	-14	1	114	9	-6	0
115	5	9	0	116	3	17	-1	117	1	19	-1	118	-1	18	-2	119	-1	16	-2	120	-2	15	-2
121	-20	-9	0	122	-20	-9	0	123	-20	-9	0	124	-19	-9	0	125	-17	-7	0	126	-12	-4	0
127	-5	0	0	128	0	3	0	129	2	5	0	130	3	6	0	131	3	6	0	132	3	6	0
133	19	-8	1	134	19	-9	1	135	18	-11	1	136	16	-12	1	137	14	-11	0	138	10	-4	0
139	5	7	0	140	2	14	-1	141	-1	15	-1	142	-2	14	-1	143	-3	12	-2	144	-4	11	-2
145	-18	-6	-1	146	-18	-6	-1	147	-17	-6	-1	148	-16	-6	-1	149	-15	-6	-1	150	-10	-3	-1
151	-4	0	-1	152	1	3	0	153	2	3	0	154	3	3	0	155	4	3	0	156	4	3	0
157	17	-4	1	158	17	-6	1	159	16	-8	1	160	15	-9	0	161	13	-9	0	162	9	-3	0
163	4	6	-1	164	0	11	-1	165	-2	12	-1	166	-3	10	-2	167	-4	8	-2	168	-4	7	-2
169	0	12	0	170	0	13	0	171	0	15	0	172	0	17	0	173	0	15	0	174	0	7	0
175	0	-8	-1	176	0	-15	0	177	0	-17	0	178	0	-16	0	179	0	-13	0	180	0	-12	0
181	-6	5	-2	182	-6	5	-2	183	-6	6	-2	184	-5	6	-2	185	-5	5	-2	186	-3	2	-1
187	-1	-4	-1	188	0	-7	0	189	1	-8	0	190	2	-7	-1	191	2	-7	-1	192	2	-6	-1
193	-5	0	1	194	-5	0	1	195	-5	-1	1	196	-5	-2	0	197	-4	-2	0	198	-3	-2	0
199	-1	1	0	200	0	1	-1	201	1	1	-1	202	1	0	-1	203	1	-1	-2	204	1	-1	-2
205	12	-2	1	206	12	-3	1	207	11	-6	1	208	10	-8	0	209	9	-8	0	210	6	-4	-1
211	2	5	-1	212	0	10	-1	213	-2	9	-2	214	-3	7	-2	215	-3	5	-2	216	-4	3	-2
217	0	15	0	218	0	16	0	219	0	19	0	220	0	20	0	221	0	17	0	222	0	8	0
223	0	-8	0	224	0	-18	-1	225	0	-20	-1	226	0	-19	0	227	0	-17	0	228	0	-15	0
229	-2	10	0	230	-2	10	0	231	-2	11	0	232	-1	11	0	233	0	9	0	234	0	4	-1
235	0	-4	0	236	0	-9	-1	237	1	-11	-2	238	1	-11	-2	239	1	-10	-2	240	1	-10	-2
241	-1	4	1	242	-1	4	1	243	0	3	1	244	0	2	0	245	0	1	0	246	0	0	-1
247	0	0	0	248	0	-1	-1	249	0	-2	-2	250	1	-3	-2	251	1	-4	-2	252	1	-5	-2
253	4	0	2	254	4	-2	2	255	4	-4	1	256	3	-7	1	257	2	-8	1	258	1	-5	0
259	1	5	-1	260	-1	8	-1	261	-2	7	-2	262	-2	4	-2	263	-2	2	-2	264	-3	0	-3
265	5	10	8	266	5	9	8	267	5	8	8	268	5	7	8	269	6	5	7	270	5	3	8
271	1	0	-1	272	0	-3	-1	273	1	-5	-1	274	1	-6	-1	275	1	-7	-1	276	1	-7	-1
277	-4	1	2	278	-5	0	2	279	-5	-3	2	280	-5	-6	2	281	-6	-8	1	282	-6	-6	1
283	0	5	-1	284	-1	6	-2	285	-2	5	-2	286	-2	2	-2	287	-2	-1	-2	288	-2	-2	-2
289	-4	22	22	290	-4	23	22	291	-4	24	22	292	-4	25	23	293	-3	22	21	294	-5	13	29
295	1	-10	-7	296	-1	-18	1	297	0	-21	-1	298	0	-21	0	299	0	-19	0	300	0	-18	0
301	9	20	21	302	9	20	21	303	9	20	21	304	10	20	21	305	10	18	20	306	11	11	25
307	0	-5	-5	308	0	-11	0	309	1	-14	-1	310	1	-14	-1	311	1	-14	-1	312	1	-14	-1

Figure D6. (Sheet 2 of 5)

NORMAL STRESSES FOR LOAD CASE 6 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
313	0	11	10	314	0	11	10	315	0	9	9	316	0	8	9	317	1	5	9	318	0	2	10
319	0	0	-2	320	0	-4	-1	321	0	-6	-1	322	0	-8	-1	323	0	-9	-1	324	0	-10	-2
325	-6	4	2	326	-6	2	2	327	-6	-1	2	328	-7	-4	2	329	-7	-6	1	330	-7	-6	1
331	0	4	-1	332	-1	5	-2	333	-1	2	-2	334	-1	-1	-2	335	-1	-4	-2	336	-1	-5	-2
337	-2	21	-3	338	-2	22	-3	339	-2	23	-3	340	-1	23	-3	341	-1	19	-3	342	-2	11	-3
343	0	-12	0	344	0	-20	0	345	0	-24	0	346	0	-24	0	347	0	-23	0	348	0	-22	0
349	3	16	-5	350	3	16	-5	351	3	16	-5	352	3	15	-6	353	3	12	-6	354	3	5	-6
355	-1	-6	-1	356	0	-13	-1	357	0	-16	-1	358	0	-17	-1	359	0	-17	-1	360	0	-17	-2
361	0	11	-3	362	0	11	-3	363	0	9	-3	364	0	7	-3	365	0	4	-4	366	0	0	-4
367	0	-1	-1	368	0	-5	-1	369	0	-8	-2	370	0	-10	-2	371	0	-12	-2	372	0	-12	-2
373	-3	7	0	374	-3	5	-1	375	-3	2	-1	376	-3	-2	-1	377	-3	-4	-1	378	-3	-5	-2
379	0	4	-1	380	-1	3	-2	381	-1	0	-2	382	-1	-3	-3	383	-1	-6	-3	384	-1	-8	-3

	ELEM	SX	ELEM	SY	ELEM	SZ	
MIN.	121	-20	40	-24	295	-7	(COMPRESSIVE)
MAX.	133	19	45	25	294	29	(TENSILE)

Figure D6. (Sheet 3 of 5)

SHEAR STRESSES FOR LOAD CASE 6 (PSI)

ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
1	4	10	6	2	-6	-10	6	3	2	9	6	4	-8	-12	6	5	-1	5	5	6	-13	-17	7
7	-8	-7	-1	8	-6	-5	1	9	-4	-2	0	10	-3	-1	0	11	-1	0	0	12	0	0	0
13	3	7	2	14	-3	-8	2	15	2	5	2	16	-4	-12	2	17	1	-1	2	18	-5	-23	3
19	-2	-15	-1	20	-1	-8	0	21	-1	-4	0	22	-1	-2	0	23	0	-1	0	24	0	0	0
25	1	6	-2	26	-1	-7	-2	27	1	4	-2	28	0	-10	-2	29	2	-2	-1	30	1	-21	-1
31	1	-15	-1	32	1	-8	0	33	0	-4	0	34	0	-2	0	35	0	-1	0	36	0	0	0
37	0	5	-2	38	2	-5	-2	39	1	4	-2	40	4	-7	-2	41	5	1	-1	42	8	-14	-1
43	7	-8	-1	44	5	-4	0	45	3	-2	0	46	2	-1	0	47	1	0	0	48	0	0	0
49	4	8	-2	50	-6	-5	-2	51	2	10	-2	52	-9	-4	-2	53	-1	10	-2	54	-13	-3	-3
55	-8	4	1	56	-6	3	0	57	-4	3	0	58	-3	3	0	59	-1	2	0	60	0	1	0
61	1	6	1	62	-2	-2	1	63	0	10	1	64	-4	2	1	65	-2	12	1	66	-6	2	0
67	-4	7	2	68	-3	7	1	69	-3	7	1	70	-2	5	0	71	-1	3	0	72	0	1	0
73	0	4	-5	74	-1	-2	-5	75	-1	6	-5	76	-1	-1	-5	77	-1	6	-4	78	-1	-4	-3
79	-1	-1	-1	80	-1	2	0	81	-1	2	0	82	-1	2	0	83	-1	2	1	84	0	1	1
85	0	3	-5	86	2	-3	-5	87	2	4	-5	88	5	-3	-4	89	7	3	-4	90	12	-6	-3
91	11	-2	-1	92	7	0	0	93	5	1	0	94	3	1	1	95	1	1	1	96	0	0	1
97	-1	2	-2	98	-3	0	-2	99	-5	4	-2	100	-7	1	-2	101	-9	4	-2	102	-11	-1	-1
103	-11	1	1	104	-9	2	1	105	-7	2	1	106	-5	2	1	107	-3	1	1	108	-1	0	1
109	0	2	-3	110	1	-1	-3	111	1	2	-3	112	3	-1	-3	113	3	2	-3	114	6	-3	-2
115	6	-1	0	116	4	0	1	117	2	1	1	118	1	1	1	119	1	1	1	120	0	0	1
121	-1	0	0	122	-2	0	0	123	-4	1	0	124	-6	0	0	125	-8	0	0	126	-11	-2	0
127	-11	-2	1	128	-8	0	1	129	-6	0	1	130	-4	1	1	131	-2	0	1	132	-1	0	1
133	0	0	0	134	1	0	0	135	0	1	0	136	1	0	0	137	1	0	0	138	2	-2	0
139	1	-2	1	140	1	0	1	141	1	0	1	142	0	1	1	143	0	0	1	144	0	0	1
145	-1	0	2	146	-2	0	2	147	-4	0	1	148	-6	-1	1	149	-9	-2	1	150	-12	-4	1
151	-12	-4	1	152	-9	-2	1	153	-6	-1	1	154	-4	0	0	155	-2	0	0	156	-1	0	0
157	0	0	3	158	1	0	3	159	1	0	3	160	1	0	3	161	1	-1	3	162	0	-3	2
163	0	-2	1	164	1	-1	1	165	1	0	0	166	1	0	0	167	1	0	0	168	0	0	0
169	-1	1	0	170	0	-1	0	171	-3	0	0	172	-2	-3	0	173	-5	-3	0	174	-3	-6	0
175	-4	-5	0	176	-4	-3	0	177	-3	-2	0	178	-2	-1	0	179	-1	0	0	180	0	0	0
181	-1	0	-2	182	0	-2	-2	183	-2	-2	-2	184	-2	-6	-2	185	-5	-7	-2	186	-4	-12	-1
187	-5	-11	0	188	-4	-8	0	189	-3	-5	1	190	-2	-3	1	191	-1	-1	1	192	0	0	1
193	0	1	6	194	0	-1	6	195	-1	0	6	196	-2	-2	5	197	-4	-3	5	198	-5	-7	4
199	-5	-6	1	200	-4	-3	0	201	-2	-2	0	202	-1	-1	-1	203	-1	0	-1	204	0	0	-1
205	1	1	6	206	1	0	6	207	2	1	6	208	2	-1	5	209	3	0	5	210	0	-3	4
211	1	-3	1	212	2	-1	0	213	3	0	0	214	2	0	-1	215	1	0	-1	216	0	0	-1
217	-1	2	0	218	0	0	0	219	-3	3	0	220	-2	1	0	221	-5	3	0	222	-3	-1	0
223	-4	0	0	224	-4	2	0	225	-3	2	0	226	-2	2	0	227	-1	1	0	228	0	0	0
229	-1	2	2	230	0	1	2	231	-3	5	1	232	-2	3	1	233	-5	6	1	234	-4	0	1
235	-5	2	0	236	-4	4	0	237	-3	4	0	238	-2	4	0	239	-1	2	0	240	0	1	0
241	0	2	6	242	0	-1	6	243	-1	3	5	244	-1	-1	5	245	-3	2	5	246	-4	-4	5
247	-4	-2	1	248	-3	0	0	249	-2	1	0	250	-1	1	0	251	-1	1	0	252	0	0	0
253	1	2	6	254	1	-2	6	255	3	2	6	256	3	-2	6	257	4	1	6	258	1	-4	5
259	2	-2	1	260	3	-1	0	261	3	0	0	262	2	0	0	263	2	0	0	264	1	0	0
265	-1	5	9	266	-2	-4	9	267	-4	5	9	268	-5	-4	9	269	-8	4	9	270	-9	-7	9
271	-10	-3	0	272	-7	0	0	273	-6	0	0	274	-4	1	0	275	-2	1	0	276	-1	0	0
277	1	3	4	278	2	-3	4	279	3	4	4	280	4	-3	4	281	4	3	3	282	3	-5	3
283	3	-2	0	284	4	0	0	285	4	0	0	286	3	1	0	287	2	0	0	288	1	0	0
289	9	15	0	290	-11	-15	0	291	8	14	0	292	-12	-16	0	293	7	11	0	294	-12	-17	-1
295	-2	-2	1	296	-3	-4	0	297	-2	-2	0	298	-2	-1	0	299	-1	0	0	300	0	0	0
301	0	9	2	302	-2	-10	2	303	-1	7	2	304	-3	-12	2	305	-3	4	3	306	-5	-18	1
307	-4	-9	1	308	-4	-5	0	309	-3	-3	0	310	-2	-2	0	311	-1	-1	0	312	0	0	0

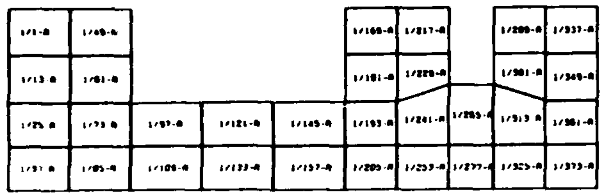
Figure D6. (Sheet 4 of 5)

SHEAR STRESSES FOR LOAD CASE 6 (PSI)

ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
313	-1	6	-1	314	0	-5	-1	315	-1	6	-1	316	0	-5	-2	317	-3	4	-2	318	-2	-9	-2
319	-3	-4	0	320	-2	-1	0	321	-1	0	0	322	-1	0	-1	323	0	0	-1	324	0	0	-1
325	0	4	0	326	2	-3	0	327	2	5	0	328	4	-3	-1	329	3	4	-1	330	4	-5	-1
331	3	-2	0	332	4	0	0	333	3	1	0	334	3	1	0	335	2	1	0	336	1	0	0
337	7	2	4	338	-9	-1	4	339	6	4	4	340	-10	0	4	341	5	3	4	342	-10	-1	5
343	-2	1	-1	344	-3	1	0	345	-3	2	0	346	-2	2	0	347	-1	1	0	348	0	0	0
349	1	3	0	350	-1	0	0	351	0	6	0	352	-2	1	0	353	0	6	0	354	-2	0	-1
355	-1	2	0	356	-1	3	0	357	-1	4	0	358	-1	3	0	359	0	2	0	360	0	1	0
351	-1	4	-3	362	1	-1	-3	363	-1	7	-3	364	1	1	-4	365	-1	7	-4	366	1	-1	-4
367	0	2	1	368	0	4	0	369	0	4	0	370	0	4	0	371	0	2	0	372	0	1	0
373	-1	4	-2	374	2	-2	-2	375	0	5	-2	376	3	-1	-2	377	1	5	-2	378	3	-2	-2
379	2	1	0	380	2	2	0	381	2	2	0	382	2	2	0	383	1	1	0	384	0	0	0

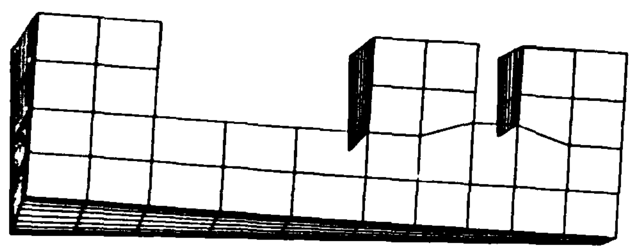
	ELEM	VXY	ELEM	VYZ	ELEM	VZX
MIN.	54	-13	18	-23	73	-5
MAX.	90	12	289	15	265	9

Figure D6. (Sheet 5 of 5)

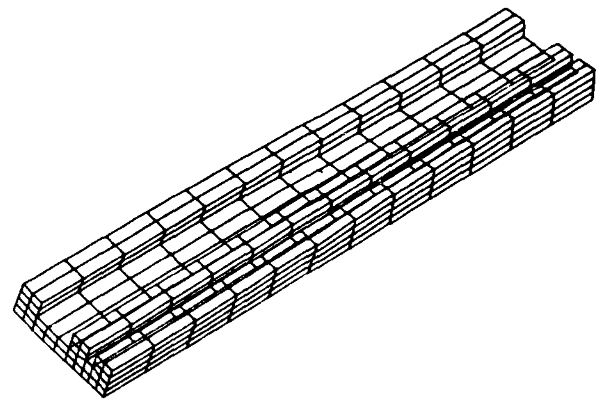


FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE, AUG 82
UNDEFORMED GRID
SNORT STRUCTURE(756 NODES,394 ELEMENTS)

FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE, AUG 82
LOAD CASE NO-7



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE, AUG 82
LOAD CASE NO-7
SNORT STRUCTURE(756 NODES 394 ELEMENTS)



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE, AUG 82
LOAD CASE NO-7

Figure D7. Finite-element analysis for load case 7 with K = 175 lb/in.^{3} (Sheet 1 of 5)

NORMAL STRESSES FOR LOAD CASE 7 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
1	4	-12	7	2	4	-10	7	3	4	-5	7	4	4	1	7	5	4	5	7	6	5	5	9
7	-2	-3	-2	8	0	-3	0	9	0	1	0	10	0	7	0	11	0	12	0	12	0	14	0
13	-4	-20	10	14	-4	-18	10	15	-4	-15	10	16	-4	-11	10	17	-3	-6	9	18	-4	-2	10
19	0	4	0	20	-1	7	0	21	0	12	0	22	0	16	0	23	0	20	0	24	0	21	-1
25	-2	-27	9	26	-2	-26	9	27	-2	-24	9	28	-2	-21	8	29	-2	-15	8	30	-2	-7	7
31	0	8	1	32	0	17	0	33	0	22	0	34	0	25	-1	35	0	27	-1	36	0	28	-1
37	2	-33	5	38	2	-33	5	39	2	-33	4	40	2	-31	4	41	2	-25	3	42	1	-12	2
43	2	14	1	44	1	27	0	45	1	32	-1	46	1	34	-1	47	0	35	-1	48	0	35	-1
49	-1	-6	3	50	-1	-4	3	51	-1	1	3	52	-1	6	3	53	-1	10	3	54	-1	9	5
55	0	-9	-3	56	0	-9	0	57	0	-6	-1	58	0	-1	-1	59	0	4	-1	60	0	6	0
61	-9	-16	-1	62	-9	-14	-1	63	-8	-11	-1	64	-8	-7	-1	65	-8	-3	-1	66	-6	0	0
67	-2	-2	-3	68	-1	1	-2	69	-1	5	-2	70	-1	9	-2	71	0	12	-2	72	0	14	-2
73	-8	-23	2	74	-8	-22	2	75	-8	-20	2	76	-7	-18	2	77	-7	-13	1	78	-6	-6	1
79	-2	4	-1	80	0	11	-1	81	0	16	-1	82	0	19	-2	83	0	20	-2	84	0	21	-2
85	10	-25	2	86	10	-26	2	87	9	-26	2	88	9	-24	2	89	8	-20	1	90	6	-9	0
91	4	11	0	92	3	22	-1	93	2	26	-1	94	1	28	-1	95	1	28	-2	96	0	28	-2
97	-21	-20	-3	98	-21	-19	-3	99	-21	-18	-3	100	-20	-16	-3	101	-19	-12	-3	102	-15	-6	-2
103	-6	1	-1	104	-1	7	-1	105	0	11	-1	106	0	13	-1	107	1	14	-1	108	1	15	-1
109	15	-17	1	110	15	-18	0	111	14	-18	0	112	13	-17	0	113	12	-14	0	114	9	-5	-1
115	5	8	-1	116	3	17	-1	117	1	20	-1	118	0	21	-2	119	-1	20	-2	120	-1	20	-2
121	-18	-12	1	122	-18	-12	1	123	-17	-11	0	124	-16	-10	0	125	-15	-8	0	126	-11	-4	0
127	-4	1	0	128	1	5	0	129	2	7	0	130	3	8	0	131	3	9	0	132	3	9	0
133	14	-10	1	134	14	-11	0	135	13	-12	0	136	12	-12	0	137	10	-10	0	138	8	-3	0
139	3	5	-1	140	0	12	-1	141	-2	14	-1	142	-3	13	-1	143	-3	13	-2	144	-4	12	-2
145	-11	-4	0	146	-11	-4	-1	147	-11	-5	-1	148	-10	-5	-1	149	-9	-4	-1	150	-6	-2	0
151	-1	1	0	152	2	2	0	153	3	3	0	154	4	3	0	155	4	3	0	156	4	3	0
157	10	-3	0	158	10	-4	0	159	10	-6	0	160	9	-7	0	161	7	-6	0	162	5	-3	-1
163	1	4	-1	164	-2	7	-1	165	-3	8	-1	166	-4	6	-2	167	-5	5	-2	168	-5	4	-2
169	0	10	-1	170	0	10	-1	171	0	11	-1	172	0	11	-1	173	0	10	-1	174	0	5	0
175	0	-5	0	176	0	-10	0	177	0	-11	0	178	0	-11	0	179	0	-10	0	180	0	-10	0
18[illegible]	-2	6	-2	182	-2	6	-2	183	-2	6	-2	184	-1	6	-2	185	-1	5	-2	186	0	2	-1
187	0	-2	-1	188	1	-5	0	189	2	-6	0	190	2	-7	0	191	2	-7	0	192	2	-6	0
193	-2	4	0	194	-2	3	0	195	-2	2	0	196	-2	1	-1	197	-1	0	-1	198	0	0	-1
199	0	0	-1	200	1	-1	-1	201	1	-2	-1	202	1	-3	-1	203	2	-4	-2	204	2	-4	-2
205	4	2	-1	206	4	1	-1	207	4	-1	-1	208	4	-3	-1	209	2	-4	-1	210	1	-3	-2
211	-1	2	-1	212	-3	4	-2	213	-4	2	-2	214	-4	0	-2	215	-5	-1	-2	216	-5	-3	-2
217	0	16	0	218	0	17	0	219	0	17	0	220	0	17	0	221	0	14	0	222	0	6	0
223	0	-6	0	224	0	-14	-1	225	0	-17	-1	226	0	-17	-1	227	0	-17	-1	228	0	-16	-1
229	3	14	0	230	3	14	0	231	3	13	0	232	4	12	0	233	4	10	-1	234	4	4	-2
235	1	-4	-1	236	1	-9	-2	237	1	-12	-2	238	2	-13	-2	239	2	-13	-2	240	2	-13	-2
241	2	10	-1	242	2	10	-1	243	2	9	-1	244	2	7	-1	245	3	4	-1	246	2	1	-2
247	0	-1	-1	248	0	-4	-2	249	1	-7	-2	250	1	-9	-2	251	1	-10	-2	252	1	-10	-2
253	-3	7	0	254	-3	5	0	255	-3	3	0	256	-3	1	0	257	-4	-2	0	258	-4	-3	-1
259	-2	1	-1	260	-2	0	-2	261	-3	-2	-2	262	-3	-5	-2	263	-3	-7	-3	264	-3	-8	-3
265	11	19	8	266	11	18	8	267	11	17	8	268	11	14	8	269	12	11	8	270	11	5	8
271	2	-1	-1	272	0	-7	-1	273	1	-10	-1	274	2	-13	-1	275	2	-14	-1	276	2	-15	-1
277	-11	11	1	278	-11	9	1	279	-11	7	1	280	-11	3	1	281	-12	0	0	282	-11	-3	0
283	-3	0	-2	284	-3	-3	-2	285	-3	-7	-2	286	-3	-10	-2	287	-3	-13	-2	288	-3	-14	-2
289	-7	24	16	290	-7	24	16	291	-7	24	16	292	-7	22	17	293	-6	18	15	294	-9	8	21
295	2	-6	-5	296	-1	-16	1	297	0	-20	0	298	0	-22	0	299	0	-22	0	300	0	-22	0
301	13	27	17	302	13	27	17	303	13	26	17	304	13	23	17	305	14	19	17	306	13	10	20
307	1	-4	-4	308	0	-13	0	309	1	-17	-1	310	1	-20	-1	311	1	-21	-1	312	1	-21	-1

Figure D7. (Sheet 2 of 5)

NORMAL STRESSES FOR LOAD CASE 7 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
313	2	22	7	314	2	21	7	315	2	19	7	316	2	16	7	317	3	11	7	318	2	5	8
319	0	-3	-2	320	-1	-10	-1	321	0	-14	-1	322	0	-17	-1	323	0	-19	-1	324	0	-20	-1
325	-10	16	0	326	-10	15	0	327	-10	12	0	328	-10	8	0	329	-10	3	0	330	-10	-2	0
331	-2	-1	-2	332	-2	-6	-2	333	-2	-11	-2	334	-2	-15	-2	335	-2	-18	-3	336	-2	-19	-3
337	-2	28	-4	338	-2	28	-4	339	-2	27	-4	340	-2	25	-4	341	-2	19	-4	342	-3	10	-4
343	1	-11	-1	344	0	-20	0	345	0	-26	-1	346	0	-28	-1	347	0	-29	-1	348	0	-29	-1
349	3	26	-9	350	3	26	-9	351	3	24	-9	352	3	21	-9	353	3	15	-9	354	4	7	-9
355	0	-8	-1	356	0	-17	-1	357	0	-22	-2	358	0	-25	-2	359	0	-27	-2	360	0	-28	-2
361	0	25	-6	362	0	23	-6	363	0	21	-6	364	0	17	-7	365	1	11	-7	366	1	3	-7
367	0	-5	-2	368	0	-13	-2	369	0	-19	-2	370	0	-23	-2	371	0	-25	-2	372	0	-26	-2
373	-5	23	-3	374	-5	21	-3	375	-5	18	-3	376	-4	13	-3	377	-4	8	-3	378	-4	1	-4
379	-2	-3	-2	380	-1	-10	-3	381	-1	-15	-3	382	-1	-20	-3	383	-1	-23	-3	384	-1	-25	-3

	ELEM	SX	ELEM	SY	ELEM	SZ	
MIN.	97	-21	38	-33	354	-9	(COMPRESSIVE)
MAX.	109	15	47	35	294	21	(TENSILE)

Figure D7. (Sheet 3 of 5)

SHEAR STRESSES FOR LOAD CASE 7 (PSI)

ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
1	7	8	6	2	-10	-9	6	3	4	7	6	4	-14	-11	6	5	0	3	6	6	-19	-17	8
7	-11	-8	-1	8	-8	-6	1	9	-6	-3	0	10	-4	-2	0	11	-2	-1	0	12	-1	0	0
13	4	6	2	14	-4	-8	2	15	3	3	2	16	-5	-13	2	17	2	-4	2	18	-7	-24	3
19	-3	-17	0	20	-2	-11	0	21	-2	-7	0	22	-1	-4	0	23	-1	-2	0	24	0	-1	0
25	1	4	-2	26	-1	-7	-2	27	1	1	-2	28	0	-11	-2	29	2	-5	-2	30	0	-22	-2
31	1	-17	-1	32	1	-10	-1	33	0	-6	0	34	0	-4	0	35	0	-2	0	36	0	-1	0
37	0	4	-2	38	2	-5	-2	39	2	2	-2	40	5	-8	-2	41	6	-1	-2	42	10	-14	-2
43	9	-10	0	44	7	-6	0	45	5	-3	0	46	3	-2	0	47	2	-1	0	48	1	0	0
49	7	4	1	50	-10	-2	1	51	4	7	1	52	-14	1	1	53	0	9	1	54	-18	2	1
55	-10	6	0	56	-8	5	0	57	-6	5	0	58	-4	3	0	59	-2	2	0	60	-1	1	0
61	2	4	5	62	-4	2	5	63	0	10	4	64	-7	7	4	65	-2	14	4	66	-10	10	3
67	-7	13	2	68	-5	12	1	69	-4	10	1	70	-3	7	1	71	-2	4	1	72	-1	1	1
73	0	3	-5	74	-2	0	-5	75	-1	5	-5	76	-3	1	-4	77	-2	6	-4	78	-4	0	-3
79	-3	2	-1	80	-3	4	0	81	-2	3	0	82	-2	3	0	83	-1	2	1	84	0	1	1
85	0	2	-5	86	3	-1	-5	87	3	3	-5	88	7	-1	-4	89	8	2	-4	90	12	-3	-3
91	12	-1	-1	92	9	0	0	93	6	1	0	94	4	1	1	95	2	1	1	96	1	0	1
97	-1	1	2	98	-5	1	2	99	-7	3	1	100	-12	3	2	101	-15	4	2	102	-19	3	2
103	-19	3	2	104	-15	3	2	105	-11	3	2	106	-8	2	2	107	-5	2	2	108	-1	1	2
109	0	1	-1	110	1	0	-1	111	1	1	-1	112	3	1	-1	113	3	1	0	114	5	0	0
115	4	0	1	116	3	1	1	117	2	1	2	118	1	1	2	119	1	1	2	120	0	0	2
121	-1	0	2	122	-4	0	2	123	-7	0	2	124	-10	0	2	125	-14	0	2	126	-18	-1	2
127	-18	-1	1	128	-14	0	1	129	-10	0	1	130	-7	0	1	131	-4	0	1	132	-1	0	1
133	0	0	3	134	0	0	3	135	0	0	3	136	0	0	3	137	0	0	3	138	-1	-1	2
139	-1	-1	2	140	0	0	2	141	0	0	2	142	0	0	2	143	0	0	1	144	0	0	1
145	-1	0	4	146	-4	-1	3	147	-7	-1	3	148	-11	-2	3	149	-16	-4	3	150	-20	-5	3
151	-20	-5	2	152	-16	-4	1	153	-11	-2	1	154	-7	-1	1	155	-4	-1	1	156	-1	0	1
157	1	0	4	158	0	0	4	159	1	0	4	160	1	-1	4	161	1	-1	4	162	-2	-2	3
163	-1	-2	2	164	0	-1	1	165	1	-1	1	166	1	0	1	167	1	0	0	168	0	0	0
169	-1	0	0	170	-1	-2	0	171	-4	-2	0	172	-4	-4	0	173	-7	-4	0	174	-7	-7	0
175	-7	-7	0	176	-6	-5	0	177	-5	-4	0	178	-3	-2	0	179	-2	-1	0	180	-1	0	0
181	-1	0	0	182	-1	-4	0	183	-3	-5	0	184	-4	-10	0	185	-7	-12	0	186	-8	-17	1
187	-9	-16	1	188	-7	-13	1	189	-5	-9	1	190	-3	-6	1	191	-2	-3	1	192	-1	-1	1
193	0	0	6	194	-1	-2	6	195	-2	-1	5	196	-4	-4	5	197	-6	-4	5	198	-9	-8	4
199	-9	-7	1	200	-6	-5	0	201	-4	-3	0	202	-2	-2	-1	203	-1	-1	-1	204	0	0	-1
205	1	1	6	206	1	-1	5	207	3	1	5	208	3	-1	5	209	4	0	5	210	1	-3	4
211	2	-2	1	212	4	-1	0	213	4	-1	0	214	3	0	0	215	2	0	-1	216	1	0	-1
217	-1	2	0	218	-1	1	0	219	-4	4	0	220	-4	2	0	221	-7	5	0	222	-7	2	0
223	-8	3	0	224	-7	4	0	225	-5	4	0	226	-3	3	0	227	-2	2	0	228	-1	1	0
229	-1	2	0	230	-2	2	0	231	-4	7	0	232	-5	6	0	233	-8	10	0	234	-9	6	0
235	-10	8	0	236	-8	9	0	237	-6	7	0	238	-4	5	0	239	-2	3	0	240	-1	1	0
241	0	2	6	242	-1	-1	6	243	-2	3	6	244	-3	0	6	245	-5	3	6	246	-7	-2	5
247	-7	0	1	248	-5	1	0	249	-3	1	0	250	-2	1	0	251	-1	1	0	252	0	0	0
253	1	2	6	254	2	-2	6	255	4	2	6	256	4	-2	6	257	6	1	6	258	3	-4	5
259	4	-2	1	260	5	-1	0	261	5	0	0	262	4	0	0	263	2	0	0	264	1	0	0
265	-1	4	8	266	-4	-3	8	267	-6	4	8	268	-10	-3	8	269	-13	4	8	270	-18	-6	8
271	-17	-2	0	272	-13	0	1	273	-10	0	0	274	-7	1	0	275	-4	0	0	276	-1	0	0
277	1	3	3	278	3	-2	3	279	5	3	3	280	6	-2	3	281	7	3	3	282	6	-4	3
283	7	-1	1	284	7	0	0	285	6	0	0	286	5	0	0	287	3	0	0	288	1	0	0
289	12	11	3	290	-15	-12	3	291	10	9	3	292	-17	-15	3	293	7	6	3	294	-18	-16	4
295	-5	-5	0	296	-6	-5	0	297	-4	-3	0	298	-3	-2	0	299	-2	-1	0	300	-1	0	0
301	2	6	4	302	-4	-9	4	303	-1	2	4	304	-7	-13	4	305	-4	-2	5	306	-10	-19	4
307	-7	-13	1	308	-6	-9	0	309	-5	-7	1	310	-3	-4	0	311	-2	-2	0	312	-1	-1	0

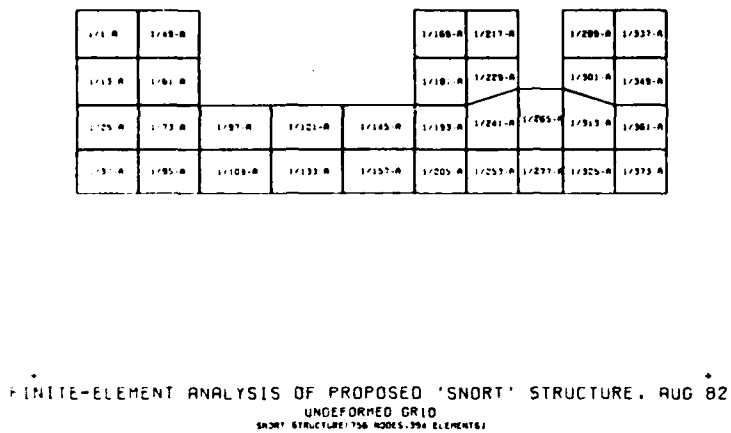
Figure D7. (Sheet 4 of 5)

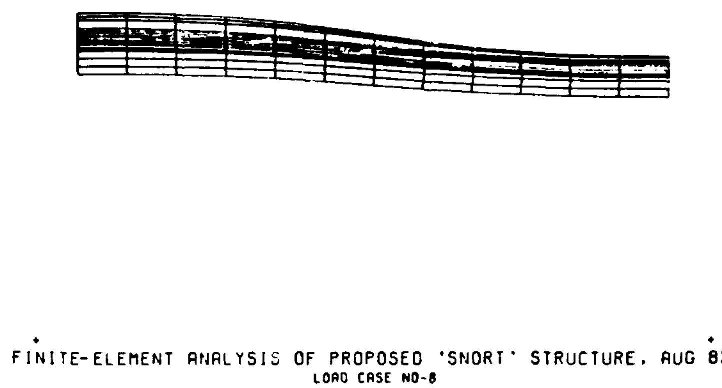
SHEAR STRESSES FOR LOAD CASE 7 (PSI)

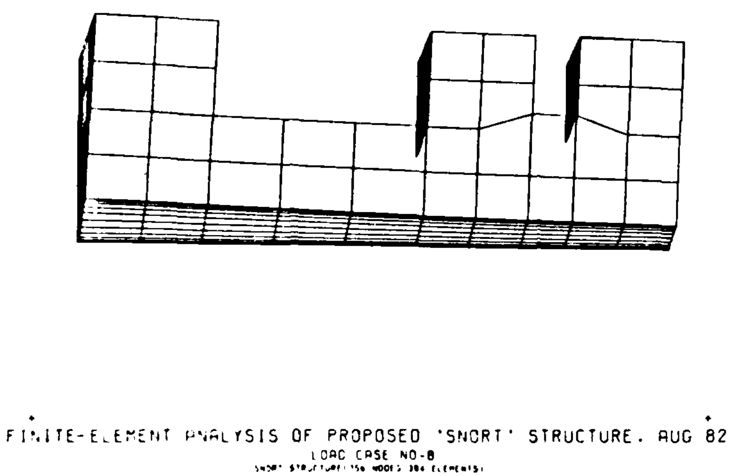
ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
313	0	4	-3	314	-1	-4	-3	315	-1	4	-3	316	-2	-4	-3	317	-3	3	-3	318	-5	-7	-3
319	-5	-3	0	320	-3	-1	0	321	-2	-1	0	322	-1	0	-1	323	-1	0	-1	324	0	0	-1
325	0	3	-2	326	3	-2	-2	327	4	3	-2	328	6	-2	-2	329	6	3	-2	330	8	-3	-2
331	7	0	0	332	7	1	0	333	6	1	0	334	4	1	0	335	3	1	0	336	1	0	0
337	10	0	5	338	-12	3	5	339	7	2	5	340	-15	4	5	341	5	2	5	342	-16	5	6
343	-6	4	-1	344	-5	3	0	345	-4	3	0	346	-3	2	0	347	-2	2	0	348	-1	1	0
349	3	1	1	350	-3	3	1	351	2	5	1	352	-4	6	1	353	1	7	1	354	-5	8	1
355	-2	8	0	356	-2	7	0	357	-1	6	0	358	-1	5	0	359	-1	3	0	360	0	1	0
361	0	2	-4	362	0	2	-4	363	0	6	-4	364	0	6	-4	365	0	9	-4	366	0	7	-4
367	0	8	0	368	0	8	0	369	0	7	0	370	0	5	0	371	0	3	0	372	0	1	0
373	-1	2	-2	374	3	1	-2	375	1	4	-2	376	5	2	-2	377	3	5	-3	378	6	3	-3
379	4	4	0	380	4	4	0	381	3	4	0	382	3	3	0	383	2	2	0	384	1	1	0

	ELEM	VXY	ELEM	VYZ	ELEM	VZX
MIN.	150	-20	18	-24	85	-5
MAX.	90	12	65	14	265	8

Figure D7. (Sheet 5 of 5)







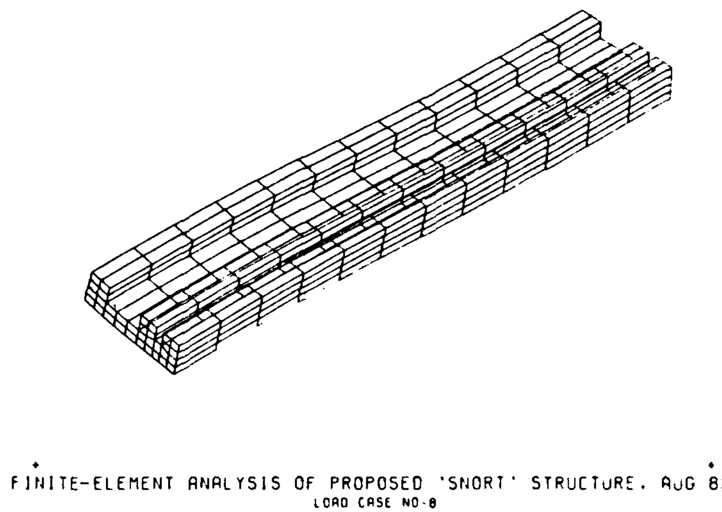


Figure D8. Finite-element analysis for load case 8 with $K = 175$ lb/in.^{3} (Sheet 1 of 5)

NORMAL STRESSES FOR LOAD CASE 8 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
1	7	6	19	2	7	12	19	3	7	21	19	4	7	30	19	5	7	33	17	6	10	23	24
7	-4	-18	-5	8	0	-28	1	9	-1	-25	0	10	0	-16	0	11	0	-7	0	12	0	-1	0
13	-7	-12	22	14	-7	-9	22	15	-7	-4	21	16	-7	2	21	17	-6	6	19	18	-7	3	21
19	0	0	0	20	-1	-3	2	21	0	1	1	22	0	7	0	23	0	12	0	24	0	15	-1
25	-3	-27	19	26	-3	-27	19	27	-3	-26	18	28	-3	-23	18	29	-2	-18	16	30	-3	-9	15
31	0	12	3	32	0	21	2	33	0	26	1	34	0	29	0	35	0	30	-1	36	0	30	-1
37	4	-43	12	38	3	-45	11	39	3	-47	11	40	3	-48	10	41	2	-43	9	42	0	-23	6
43	4	26	4	44	2	46	1	45	1	51	0	46	1	50	-1	47	1	48	-1	48	0	46	-2
49	2	13	15	50	2	18	15	51	2	27	15	52	3	36	15	53	2	39	14	54	4	28	21
55	-2	-25	-7	56	0	-36	0	57	0	-33	-1	58	0	-24	-1	59	0	-15	-1	60	0	-10	-1
61	-15	-8	11	62	-14	-5	11	63	-14	0	11	64	-14	5	11	65	-12	10	10	66	-11	7	13
67	-4	-8	-5	68	-3	-11	-2	69	-2	-7	-2	70	-1	-1	-2	71	-1	4	-2	72	0	7	-2
73	-12	-24	11	74	-12	-24	11	75	-12	-22	11	76	-12	-20	10	77	-11	-15	9	78	-9	-7	9
79	-3	7	0	80	-1	15	0	81	-1	19	-1	82	0	22	-2	83	0	23	-2	84	0	23	-2
85	18	-34	9	86	17	-36	9	87	16	-38	8	88	15	-40	7	89	12	-35	6	90	9	-18	4
91	9	23	2	92	6	40	1	93	4	45	0	94	2	43	-1	95	1	41	-2	96	1	39	-2
97	-40	-25	0	98	-39	-25	0	99	-38	-24	0	100	-36	-22	0	101	-33	-17	0	102	-25	-9	0
103	-14	1	-2	104	-5	9	-1	105	-3	14	-1	106	-1	16	-1	107	0	17	-1	108	1	17	-1
109	34	-24	5	110	33	-26	5	111	32	-29	5	112	29	-31	4	113	25	-27	3	114	20	-11	2
115	13	18	1	116	8	34	0	117	4	38	-1	118	1	36	-1	119	0	33	-2	120	-1	31	-2
121	-44	-20	1	122	-44	-20	1	123	-43	-19	1	124	-41	-18	1	125	-37	-14	1	126	-28	-8	0
127	-13	0	1	128	-4	6	0	129	0	10	0	130	2	11	0	131	3	12	0	132	3	12	0
133	41	-15	4	134	40	-17	4	135	39	-21	4	136	36	-23	3	137	31	-20	2	138	24	-7	1
139	13	15	1	140	6	28	0	141	2	31	-1	142	-1	29	-1	143	-3	25	-2	144	-4	23	-2
145	-39	-12	-2	146	-38	-13	-2	147	-37	-13	-2	148	-36	-13	-2	149	-32	-12	-2	150	-24	-7	-1
151	-10	0	-1	152	-2	5	0	153	2	6	0	154	3	6	0	155	4	6	0	156	5	5	0
157	38	-8	3	158	37	-10	3	159	36	-14	3	160	33	-18	2	161	29	-17	2	162	22	-6	1
163	10	13	1	164	4	24	0	165	-1	25	-1	166	-4	21	-1	167	-5	17	-2	168	-6	15	-2
169	1	24	-1	170	1	27	-1	171	1	31	-1	172	1	34	-1	173	1	31	0	174	1	15	0
175	0	-15	-1	176	0	-31	0	177	0	-34	0	178	0	-31	0	179	0	-27	0	180	0	-24	0
181	-13	9	-2	182	-13	10	-3	183	-13	12	-3	184	-12	13	-3	185	-10	11	-3	186	-7	4	-2
187	-3	-7	-1	188	0	-14	0	189	1	-15	0	190	2	-15	0	191	2	-13	0	192	2	-12	0
193	-11	0	4	194	-11	-1	4	195	-11	-2	3	196	-11	-4	3	197	-9	-4	2	198	-7	-3	1
199	-3	1	1	200	0	3	0	201	1	2	-1	202	1	1	-1	203	2	-1	-2	204	2	-2	-2
205	26	-3	4	206	25	-6	4	207	25	-11	3	208	23	-15	3	209	19	-16	2	210	14	-7	0
211	6	11	1	212	1	20	0	213	-2	19	-1	214	-4	15	-2	215	-5	10	-2	216	-5	7	-3
217	-1	30	0	218	-1	33	0	219	-1	37	0	220	-1	39	0	221	0	35	0	222	0	15	-1
223	-1	-16	0	224	0	-35	-1	225	0	-40	-1	226	0	-37	-1	227	0	-33	-1	228	0	-31	-1
229	-4	19	2	230	-4	20	2	231	-4	22	1	232	-3	22	1	233	-2	18	0	234	-2	7	-2
235	-1	-8	1	236	-1	-19	-1	237	1	-22	-2	238	2	-22	-2	239	2	-21	-2	240	2	-20	-2
241	-1	9	3	242	-1	8	3	243	-1	6	3	244	-1	4	2	245	0	1	1	246	0	-1	-1
247	-1	1	1	248	0	-1	-1	249	1	-4	-2	250	1	-6	-2	251	1	-8	-2	252	1	-9	-3
253	9	0	5	254	9	-3	5	255	8	-8	5	256	7	-13	4	257	5	-15	3	258	3	-9	2
259	2	11	1	260	0	17	-1	261	-2	14	-2	262	-3	9	-2	263	-4	4	-3	264	-4	1	-3
265	9	20	16	266	9	19	16	267	9	17	16	268	9	14	16	269	12	11	16	270	10	5	16
271	1	0	-1	272	-1	-6	-1	273	1	-9	-1	274	2	-12	-1	275	2	-14	-1	276	2	-14	-1
277	-8	3	7	278	-8	0	6	279	-8	-6	6	280	-9	-11	6	281	-11	-15	5	282	-12	-12	4
283	0	10	0	284	-1	14	-1	285	-2	10	-2	286	-3	4	-2	287	-4	-1	-3	288	-4	-4	-3
289	-7	44	45	290	-7	46	45	291	-7	49	45	292	-7	50	45	293	-6	44	42	294	-9	27	58
295	2	-20	-14	296	-1	-37	3	297	0	-43	-1	298	0	-41	0	299	0	-33	0	300	0	-36	0
301	19	40	43	302	19	41	43	303	19	41	43	304	19	40	43	305	20	35	41	306	21	22	51
307	-1	-9	-8	308	0	-23	1	309	1	-27	0	310	1	-29	-1	311	1	-28	-1	312	1	-28	-1

Figure D8. (Sheet 2 of 5)

NORMAL STRESSES FOR LOAD CASE 8 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
313	1	23	21	314	1	22	20	315	1	19	20	316	1	15	20	317	2	11	19	318	0	4	22
319	1	0	-3	320	-1	-7	0	321	0	-11	-1	322	0	-15	-1	323	0	-18	-2	324	0	-19	-2
325	-12	8	6	326	-12	4	6	327	-12	-1	6	328	-13	-8	5	329	-13	-12	5	330	-14	-12	4
331	0	9	0	332	-1	10	-1	333	-2	5	-2	334	-2	-1	-3	335	-2	-7	-3	336	-2	-10	-3
337	-3	41	-5	338	-3	43	-5	339	-3	46	-5	340	-3	46	-5	341	-3	39	-5	342	-3	22	-5
343	0	-24	-1	344	0	-41	0	345	0	-48	-1	346	0	-43	-1	347	0	-45	-1	348	0	-43	-1
349	5	33	-10	350	5	33	-10	351	5	32	-10	352	6	30	-10	353	6	24	-11	354	7	11	-11
355	-1	-12	0	356	0	-25	-1	357	0	-31	-1	358	0	-34	-2	359	0	-34	-2	360	0	-34	-2
361	0	23	-4	362	0	22	-4	363	0	18	-4	364	0	13	-5	365	1	8	-6	366	0	0	-6
367	0	-2	-1	368	-1	-9	-1	369	0	-15	-2	370	0	-20	-2	371	0	-23	-3	372	0	-25	-3
373	-6	14	1	374	-6	11	1	375	-6	4	1	376	-6	-3	0	377	-6	-8	0	378	-7	-10	-2
379	0	8	0	380	-1	6	-2	381	-1	1	-2	382	-1	-6	-3	383	-1	-12	-3	384	-1	-16	-3

	ELEM	SX	ELEM	SY	ELEM	SZ	
MIN.	121	-44	345	-48	295	-14	(COMPRESSIVE)
MAX.	133	41	45	51	294	58	(TENSILE)

Figure D8. (Sheet 3 of 5)

SHEAR STRESSES FOR LOAD CASE 8 (PSI)

ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
1	8	20	12	2	-12	-20	12	3	4	18	12	4	-17	-24	12	5	-2	10	11	6	-25	-34	14
7	-16	-14	-3	8	-11	-9	1	9	-8	-4	0	10	-5	-2	0	11	-3	0	0	12	-1	0	0
13	5	14	4	14	-6	-17	4	15	4	11	4	16	-7	-24	4	17	3	-2	4	18	-9	-45	5
19	-4	-30	-1	20	-2	-17	0	21	-2	-9	0	22	-1	-4	0	23	-1	-2	0	24	0	0	0
25	1	11	-4	26	-1	-13	-4	27	2	8	-4	28	0	-20	-4	29	3	-4	-3	30	1	-42	-2
31	3	-30	-2	32	2	-16	-1	33	1	-8	-1	34	0	-4	0	35	0	-2	0	36	0	0	0
37	-1	10	-4	38	4	-11	-4	39	[illegible]	8	-4	40	8	-15	-3	41	9	2	-3	42	16	-27	-2
43	15	-17	-1	44	10	-9	-1	45	7	-4	0	46	4	-2	0	47	2	-1	0	48	1	0	0
49	8	15	-4	50	-12	-11	-4	51	4	20	-4	52	-17	-8	-5	53	-2	20	-4	54	-25	-7	-7
55	-16	7	2	56	-11	6	0	57	-8	7	0	58	-5	5	0	59	-3	3	0	60	-1	1	0
61	2	12	3	62	-5	-3	3	63	-1	20	2	64	-8	3	2	65	-4	25	2	66	-11	3	-1
67	-9	13	4	68	-6	15	1	69	-5	13	1	70	-4	10	1	71	-2	6	1	72	-1	2	1
73	0	9	-11	74	-2	-4	-11	75	-1	12	-11	76	-3	-2	-10	77	-1	11	-9	78	-2	-9	-8
79	-1	-1	-3	80	-2	4	-2	81	-2	5	0	82	-2	5	0	83	-1	3	1	84	0	1	1
85	-1	7	-11	86	4	-5	-11	87	4	8	-10	88	11	-5	-10	89	13	6	-9	90	23	-11	-7
91	22	-5	-3	92	15	0	-1	93	9	1	0	94	5	2	0	95	3	1	1	96	1	0	1
97	-2	4	-5	98	-6	-1	-5	99	-10	7	-5	100	-14	2	-4	101	-17	8	-4	102	-22	-1	-3
103	-22	2	1	104	-18	4	2	105	-14	5	2	106	-10	4	2	107	-6	3	2	108	-2	1	2
109	-1	3	-7	110	2	-2	-7	111	1	5	-7	112	6	-1	-7	113	6	4	-6	114	13	-5	-5
115	12	-2	-1	116	8	1	1	117	4	2	1	118	2	2	2	119	1	1	2	120	0	0	2
121	-1	1	0	122	-5	0	0	123	-8	2	0	124	-12	0	0	125	-16	0	0	126	-21	-4	0
127	-21	-3	1	128	-16	-1	2	129	-12	1	2	130	-8	1	1	131	-5	1	1	132	-1	0	1
133	0	1	0	134	1	0	0	135	0	2	0	136	2	0	0	137	2	0	0	138	3	-4	0
139	3	-3	2	140	2	-1	2	141	2	1	2	142	1	1	2	143	0	1	2	144	0	0	2
145	-2	0	4	146	-4	0	3	147	-8	-1	3	148	-13	-2	3	149	-19	-5	3	150	-24	-9	3
151	-24	-9	2	152	-19	-5	2	153	-13	-2	2	154	-8	-1	1	155	-4	0	1	156	-1	0	1
157	1	0	7	158	1	0	7	159	2	1	7	160	2	0	6	161	2	-2	6	162	-1	-5	5
163	0	-5	3	164	2	-2	2	165	2	0	1	166	2	0	1	167	1	1	0	168	0	0	0
169	-3	1	0	170	0	-2	0	171	-6	0	0	172	-3	-5	0	173	-9	-5	0	174	-6	-12	0
175	-8	-11	0	176	-7	-7	0	177	-5	-4	0	178	-4	-2	0	179	-2	-1	0	180	-1	0	0
181	-2	1	-5	182	-1	-4	-5	183	-5	-4	-5	184	-4	-11	-4	185	-9	-15	-4	186	-9	-24	-2
187	-10	-23	-1	188	-8	-16	0	189	-5	-10	1	190	-3	-5	1	191	-2	-3	1	192	-1	-1	1
193	-1	1	13	194	-1	-2	13	195	-3	0	12	196	-4	-5	12	197	-7	-6	11	198	-10	-13	8
199	-11	-12	3	200	-7	-7	1	201	-4	-3	0	202	-2	-1	0	203	-1	0	-1	204	0	0	-1
205	2	2	13	206	2	-1	13	207	5	2	12	208	4	-2	12	209	6	-1	11	210	1	-7	8
211	1	-5	4	212	5	-2	1	213	5	0	0	214	4	1	0	215	3	1	-1	216	1	0	-1
217	-3	4	-1	218	0	0	-1	219	-6	7	-1	220	-4	2	-1	221	-10	7	0	222	-6	-3	0
223	-8	0	0	224	-3	4	0	225	-6	5	0	226	-4	4	0	227	-2	3	0	228	-1	1	0
229	-2	5	3	230	-1	2	3	231	-6	10	3	232	-5	6	3	233	-10	12	3	234	-9	0	3
235	-10	3	0	236	-9	9	0	237	-6	9	0	238	-4	7	0	239	-3	5	0	240	-1	2	0
241	-1	4	11	242	-1	-2	11	243	-2	6	11	244	-3	-1	11	245	-6	4	11	246	-8	-8	9
247	-8	-4	2	248	-5	1	1	249	-3	2	1	250	-2	2	0	251	-1	2	0	252	0	1	0
253	2	4	12	254	2	-3	12	255	6	5	12	256	5	-4	12	257	8	3	12	258	2	-9	10
259	3	-5	2	260	6	-1	1	261	6	0	0	262	5	1	0	263	3	1	0	264	1	0	0
265	-2	9	19	266	-4	-8	19	267	-8	10	19	268	-10	-8	18	269	-15	8	18	270	-19	-15	19
271	-17	-6	0	272	-14	-1	1	273	-11	1	1	274	-7	2	0	275	-4	1	0	276	-1	0	0
277	2	7	8	278	3	-6	8	279	6	8	8	280	7	-6	7	281	9	6	7	282	5	-11	7
283	6	-4	1	284	8	0	1	285	8	1	1	286	6	1	0	287	4	1	0	288	1	0	0
289	19	30	0	290	-22	-31	0	291	16	28	0	292	-25	-33	0	293	13	22	1	294	-23	-34	-2
295	-4	-4	2	296	-7	-8	-1	297	-5	-3	0	298	-4	-2	0	299	-2	-1	0	300	-1	0	0
301	1	17	4	302	-3	-19	4	303	-2	14	4	304	-7	-24	4	305	-6	7	6	306	-9	-35	3
307	-3	-18	2	308	-7	-11	-1	309	-5	-7	1	310	-4	-4	0	311	-2	-2	0	312	-1	0	0

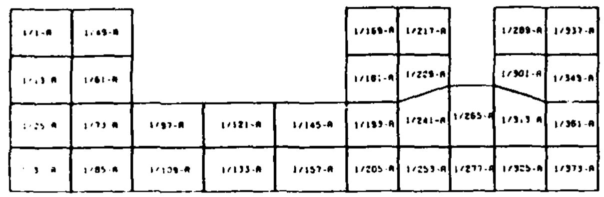
Figure D8. (Sheet 4 of 5)

SHEAR STRESSES FOR LOAD CASE 8 (PSI)

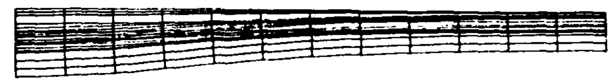
ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
313	-2	11	-2	314	1	-10	-2	315	-3	12	-2	316	-1	-11	-3	317	-5	9	-3	318	-4	-19	-4
319	-6	-8	1	320	-4	-2	0	321	-2	0	0	322	-1	1	-1	323	-1	1	-1	324	0	0	-1
325	0	8	0	326	4	-6	-1	327	4	9	-1	328	8	-6	-1	329	6	8	-1	330	7	-11	-2
331	6	-3	1	332	7	0	1	333	7	1	0	334	5	2	0	335	3	1	0	336	1	0	0
337	15	4	9	338	-17	-1	9	339	12	7	9	340	-20	1	9	341	9	6	8	342	-20	-2	10
343	-5	2	-1	344	-6	3	0	345	-5	4	0	346	-3	4	0	347	-2	3	0	348	-1	1	0
349	2	7	0	350	-2	-1	0	351	1	12	0	352	-3	3	-1	353	0	12	0	354	-4	-1	-1
355	-2	4	1	356	-2	7	0	357	-2	8	0	358	-1	7	0	359	-1	5	0	360	0	2	0
361	-2	8	-7	362	3	-2	-7	363	-2	13	-7	364	3	2	-7	365	-2	14	-7	366	1	-3	-8
367	-1	4	1	368	0	7	0	369	0	8	0	370	0	7	0	371	0	5	0	372	0	2	0
373	-2	7	-4	374	5	-4	-4	375	1	10	-4	376	7	-2	-4	377	2	10	-4	378	6	-5	-5
379	4	1	1	380	5	4	0	381	4	5	0	382	3	4	0	383	2	3	0	384	1	1	0

	ELEM	VXY	ELEM	VYZ	ELEM	VZX
MIN.	54	-25	18	-45	73	-11
MAX.	90	23	289	30	265	19

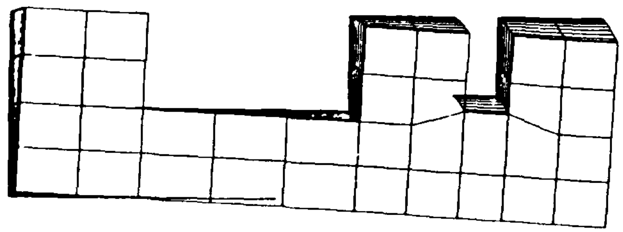
Figure D8. (Sheet 5 of 5)



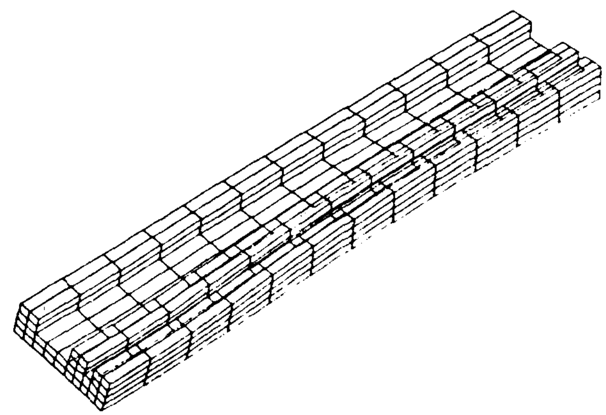
FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
UNDEFORMED GRID
SNORT STRUCTURE(756 NODES,394 ELEMENTS)



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
LOAD CASE NO-9



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
LOAD CASE NO-9
SNORT STRUCTURE(756 NODES,394 ELEMENTS)



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
LOAD CASE NO-9

Figure D9. Finite-element analysis for load case 9 with $K = 175$ lb/in.^{3} (Sheet 1 of 5)

NORMAL STRESSES FOR LOAD CASE 9 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
1	0	-32	-1	2	0	-28	-1	3	0	-18	-1	4	0	-7	0	5	0	2	0	6	0	9	0
7	0	12	0	8	0	13	0	9	0	13	0	10	0	13	0	11	0	12	0	12	0	12	0
13	1	-32	-3	14	1	-28	-3	15	1	-19	-2	16	0	-9	-1	17	0	1	-1	18	0	7	0
19	0	11	0	20	0	13	0	21	0	13	0	22	0	14	-1	23	0	14	-1	24	0	14	-1
25	1	-31	-4	26	1	-27	-3	27	0	-20	-3	28	0	-10	-1	29	0	-1	-1	30	0	5	-1
31	0	9	-1	32	0	12	-1	33	0	14	-1	34	0	15	-1	35	0	15	-1	36	0	16	-1
37	-2	-30	-2	38	-2	-27	-2	39	-1	-20	-1	40	0	-11	-1	41	0	-2	-1	42	0	4	-1
43	0	8	-1	44	0	12	-1	45	0	14	-1	46	0	16	-1	47	0	17	-1	48	0	17	-1
49	0	-19	0	50	0	-16	0	51	0	-11	0	52	0	-5	0	53	0	0	0	54	0	5	-1
55	0	7	-1	56	0	8	-1	57	0	8	-1	58	0	8	0	59	0	7	0	60	0	7	0
61	5	-19	1	62	5	-16	1	63	3	-12	0	64	1	-6	-1	65	0	-1	-2	66	0	3	-2
67	0	6	-2	68	0	8	-2	69	0	9	-2	70	0	9	-2	71	0	9	-2	72	0	9	-2
73	5	-20	-1	74	5	-17	-1	75	3	-13	-1	76	1	-7	-1	77	0	-2	-2	78	0	2	-2
79	0	6	-2	80	0	8	-2	81	0	10	-2	82	0	11	-2	83	0	11	-2	84	0	12	-2
85	-8	-21	-1	86	-7	-19	-1	87	-5	-15	-1	88	-2	-9	-1	89	0	-3	-1	90	1	1	-1
91	1	5	-1	92	1	8	-1	93	0	10	-2	94	0	12	-2	95	0	13	-2	96	0	13	-2
97	18	-9	1	98	17	-8	1	99	13	-6	0	100	7	-4	-1	101	2	-1	-1	102	1	1	-1
103	1	3	-1	104	1	5	-1	105	1	6	-1	106	1	7	-1	107	1	8	-1	108	1	8	-1
109	-13	-12	-1	110	-12	-11	-1	111	-9	-10	-2	112	-6	-7	-2	113	-3	-5	-2	114	-2	-2	-2
115	-1	1	-2	116	-1	3	-2	117	-1	5	-2	118	-1	7	-2	119	-1	8	-2	120	-1	9	-2
121	23	-2	-1	122	22	-1	-1	123	17	-1	-1	124	10	-1	-1	125	6	0	-1	126	4	1	0
127	4	2	0	128	3	3	0	129	3	4	0	130	3	4	0	131	3	5	0	132	3	5	0
133	-15	-1	-2	134	-14	-2	-2	135	-11	-4	-2	136	-9	-5	-2	137	-7	-6	-2	138	-5	-5	-2
139	-4	-4	-2	140	-4	-1	-1	141	-3	1	-1	142	-3	2	-1	143	-3	3	-1	144	-3	4	-1
145	24	6	2	146	24	5	2	147	20	4	2	148	12	3	0	149	7	1	0	150	6	1	0
151	6	1	0	152	5	1	0	153	4	1	0	154	4	1	0	155	4	1	0	156	4	1	0
157	-14	9	-3	158	-13	7	-2	159	-12	2	-2	160	-10	-4	-2	161	-9	-8	-2	162	-7	-9	-2
163	-6	-8	-2	164	-5	-6	-2	165	-5	-4	-1	166	-4	-2	-1	167	-4	-1	-2	168	-4	-1	-2
169	1	-28	-3	170	1	-24	-2	171	1	-15	-4	172	0	7	1	173	0	14	0	174	0	15	0
175	0	13	0	176	0	9	0	177	0	5	0	178	0	2	0	179	0	0	0	180	0	-1	0
181	10	-7	0	182	10	-6	1	183	8	-3	1	184	5	5	0	185	4	8	0	186	3	7	0
187	3	5	0	188	3	3	0	189	2	1	0	190	2	0	0	191	2	-1	0	192	2	-2	0
193	11	9	-5	194	11	8	-4	195	9	5	-4	196	4	2	-3	197	3	0	-2	198	2	-2	-2
199	2	-3	-1	200	2	-3	-1	201	2	-3	-1	202	2	-3	-1	203	1	-3	-1	204	1	-3	-1
205	-9	20	-5	206	-9	17	-5	207	-8	9	-4	208	-9	-2	-4	209	-8	-9	-3	210	-7	-11	-3
211	-6	-11	-2	212	-5	-10	-2	213	-4	-8	-2	214	-4	-6	-2	215	-3	-5	-2	216	-3	-5	-2
217	-1	-18	-10	218	-1	-15	-10	219	-2	-8	-13	220	1	6	2	221	0	12	-1	222	0	11	-1
223	0	8	-1	224	0	5	-1	225	0	1	-1	226	0	-2	-1	227	0	-4	0	228	0	-5	0
229	5	-3	-14	230	5	-3	-13	231	4	0	-16	232	4	5	-1	233	3	6	-3	234	3	4	-3
235	2	2	-2	236	2	0	-2	237	2	-2	-2	238	2	-4	-2	239	1	-5	-2	240	1	-5	-2
241	6	14	-10	242	6	12	-9	243	6	8	-10	244	2	3	-3	245	1	-1	-4	246	1	-4	-3
247	1	-5	-3	248	1	-6	-2	249	1	-6	-2	250	1	-6	-2	251	1	-6	-2	252	1	-6	-2
253	-5	30	-6	254	-4	26	-6	255	-4	16	-5	256	-7	-1	-4	257	-6	-11	-4	258	-5	-14	-3
259	-4	-14	-3	260	-4	-13	-3	261	-3	-11	-2	262	-3	-10	-2	263	-2	-9	-2	264	-2	-8	-2
265	8	20	-4	266	8	18	-4	267	7	13	-4	268	4	5	-1	269	3	0	-1	270	3	-4	-1
271	2	-6	-1	272	2	-7	-1	273	2	-8	-1	274	2	-9	-1	275	1	-9	-1	276	1	-9	-1
277	-5	40	-6	278	-5	35	-6	279	-4	23	-5	280	-7	-1	-4	281	-6	-12	-4	282	-5	-17	-3
283	-4	-17	-3	284	-3	-16	-2	285	-3	-15	-2	286	-2	-13	-2	287	-2	-12	-2	288	-2	-12	-2
289	0	-21	-6	290	0	-18	-5	291	-1	-12	-8	292	1	14	2	293	0	13	-1	294	0	16	0
295	0	11	0	296	0	5	0	297	0	0	0	298	0	-4	0	299	0	-6	0	300	0	-7	0
301	7	4	-4	302	7	4	-4	303	7	4	-4	304	2	10	-1	305	2	9	-1	306	2	5	0
307	2	1	0	308	1	-2	-1	309	1	-5	-1	310	1	-8	-1	311	1	-9	-1	312	1	-10	-1

Figure D9. *(Sheet 2 of 5)*

NORMAL STRESSES FOR LOAD CASE 9 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
313	2	27	-4	314	3	24	-3	315	2	17	-3	316	0	5	-3	317	0	-2	-2	318	0	-7	-2
319	0	-9	-1	320	0	-11	-1	321	0	-12	-1	322	0	-12	-1	323	0	-12	-1	324	0	-12	-1
325	-4	49	-6	326	-3	44	-6	327	-3	29	-5	328	-4	0	-5	329	-4	-14	-4	330	-3	-19	-3
331	-3	-20	-3	332	-2	-20	-3	333	-2	-18	-2	334	-2	-17	-2	335	-1	-15	-2	336	-1	-15	-2
337	-3	-9	-7	338	-3	-8	-7	339	-5	-2	-9	340	2	12	1	341	0	15	-1	342	0	12	-1
343	0	6	-1	344	0	1	-1	345	0	-4	-1	346	0	-8	-1	347	0	-10	0	348	0	-11	0
349	2	15	-11	350	2	13	-11	351	3	12	-11	352	0	8	-2	353	1	5	-3	354	0	0	-2
355	0	-4	-2	356	0	-7	-2	357	0	-10	-2	358	0	-12	-2	359	0	-13	-1	360	0	-14	-1
361	0	36	-10	362	0	33	-10	363	1	23	-10	364	-1	5	-4	365	0	-5	-4	366	0	-10	-3
367	0	-14	-3	368	0	-15	-3	369	0	-16	-2	370	0	-16	-2	371	0	-16	-2	372	0	-16	-2
373	-2	58	-8	374	-2	52	-8	375	-1	36	-7	376	-2	1	-6	377	-2	-15	-5	378	-2	-21	-4
379	-1	-23	-3	380	-1	-23	-3	381	-1	-21	-3	382	-1	-20	-3	383	0	-19	-2	384	0	-18	-2

	ELEM	SX	ELEM	SY	ELEM	SZ	
MIN.	133	-15	1	-32	231	-16	(COMPRESSIVE)
MAX.	145	24	373	58	220	2	(TENSILE)

Figure D9. *(Sheet 3 of 5)*

SHEAR STRESSES FOR LOAD CASE 9 (PSI)

ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
1	-3	-1	-1	2	-8	-4	-1	3	-11	-6	0	4	-13	-7	0	5	-12	-7	0	6	-10	-6	0
7	-8	-5	0	8	-6	-4	0	9	-4	-3	0	10	-3	-2	0	11	-2	-1	0	12	0	0	0
13	-1	-3	0	14	-2	-8	0	15	-4	-12	0	16	-4	-14	0	17	-3	-14	0	18	-2	-12	0
19	-2	-10	0	20	-1	-8	0	21	-1	-6	0	22	-1	-4	0	23	0	-2	0	24	0	-1	0
25	0	-3	2	26	0	-8	2	27	0	-12	2	28	0	-14	1	29	1	-13	0	30	1	-12	0
31	1	-10	0	32	1	-8	0	33	1	-6	0	34	1	-4	0	35	0	-2	0	36	0	-1	0
37	2	-1	2	38	6	-4	2	39	8	-6	1	40	9	-7	1	41	9	-7	0	42	9	-6	0
43	7	-5	0	44	5	-4	0	45	4	-3	0	46	3	-2	0	47	2	-1	0	48	1	0	0
49	-3	2	0	50	-7	5	0	51	-11	8	0	52	-12	9	0	53	-12	8	0	54	-10	7	0
55	-7	5	0	56	-6	4	0	57	-4	3	0	58	-3	2	0	59	-2	1	0	60	0	0	0
61	-2	4	-2	62	-5	11	-2	63	-8	16	-1	64	-9	18	0	65	-8	17	1	66	-6	14	1
67	-5	11	1	68	-3	8	1	69	-2	5	1	70	-1	4	0	71	-1	2	0	72	0	1	0
73	-1	1	5	74	-3	4	4	75	-5	5	3	76	-5	6	2	77	-4	6	1	78	-2	4	1
79	-1	3	1	80	-1	2	1	81	0	1	1	82	0	1	1	83	0	0	1	84	0	0	1
85	3	0	5	86	8	1	5	87	10	1	4	88	12	1	2	89	13	1	1	90	12	1	1
91	10	0	1	92	8	0	1	93	6	0	1	94	4	0	1	95	2	0	1	96	1	0	1
97	-5	1	1	98	-14	4	1	99	-21	5	2	100	-23	6	2	101	-20	5	2	102	-16	4	2
103	-12	3	2	104	-9	2	2	105	-6	1	2	106	-4	1	1	107	-2	1	1	108	-1	0	1
109	2	0	3	110	4	1	3	111	5	2	3	112	6	2	3	113	7	2	2	114	7	1	2
115	6	1	2	116	5	0	2	117	4	0	1	118	3	0	1	119	2	0	1	120	1	0	1
121	-4	0	0	122	-13	1	1	123	-20	1	1	124	-22	1	1	125	-19	0	2	126	-15	0	2
127	-11	0	2	128	-8	0	1	129	-6	0	1	130	-4	0	1	131	-2	0	1	132	-1	0	1
133	1	0	1	134	3	1	1	135	4	0	2	136	4	0	2	137	5	0	2	138	5	0	2
139	4	0	2	140	3	0	2	141	2	0	1	142	2	0	1	143	1	0	1	144	0	0	1
145	-5	-1	0	146	-14	-3	1	147	-23	-5	1	148	-25	-5	1	149	-22	-5	2	150	-17	-5	2
151	-13	-4	1	152	-10	-3	1	153	-7	-2	1	154	-4	-2	1	155	-3	-1	1	156	-1	0	0
157	2	0	-2	158	5	-1	-2	159	8	0	-1	160	9	-1	0	161	9	-1	1	162	7	-2	1
163	6	-1	1	164	4	-1	0	165	3	-1	0	166	2	-1	0	167	1	0	0	168	0	0	0
169	-11	0	1	170	0	-7	1	171	-21	-6	2	172	-13	-9	0	173	-12	-8	0	174	-9	-8	0
175	-7	-6	0	176	-5	-5	0	177	-4	-4	0	178	-2	-2	0	179	-1	-1	0	180	0	0	0
181	-5	-3	5	182	-4	-14	5	183	-13	-18	5	184	-11	-22	3	185	-10	-20	2	186	-8	-18	2
187	-6	-14	2	188	-4	-11	1	189	-3	-8	1	190	-2	-5	1	191	-1	-3	1	192	0	-1	1
193	-2	0	-5	194	-3	-5	-5	195	-7	-4	-4	196	-7	-6	-2	197	-5	-7	-1	198	-4	-7	-1
199	-3	-6	-1	200	-2	-5	-1	201	-2	-3	-1	202	-1	-2	-1	203	-1	-1	-1	204	0	0	-1
205	4	1	-5	206	10	-1	-5	207	15	2	-4	208	17	0	-2	209	15	-1	-1	210	12	-1	-1
211	9	-2	-1	212	7	-1	-1	213	5	-1	-1	214	4	-1	-1	215	2	0	-1	216	1	0	-1
217	-12	10	6	218	1	0	6	219	-21	19	8	220	-14	12	-1	221	-12	10	1	222	-10	7	0
223	-7	5	0	224	-5	3	0	225	-4	2	0	226	-2	1	0	227	-1	1	0	228	0	0	0
229	-6	10	2	230	-5	9	2	231	-18	29	3	232	-16	25	-1	233	-13	19	0	234	-10	14	0
235	-8	10	0	236	-5	7	0	237	-4	5	0	238	-3	3	0	239	-1	2	0	240	0	1	0
241	-2	4	-1	242	-2	0	-1	243	-7	10	-1	244	-7	7	0	245	-5	4	0	246	-3	2	0
247	-3	1	0	248	-2	0	0	249	-1	0	0	250	-1	0	0	251	0	0	0	252	0	0	0
253	4	2	-2	254	12	-2	-2	255	18	4	-1	256	20	1	0	257	18	0	0	258	14	-1	0
259	11	-1	0	260	8	-1	0	261	6	-1	0	262	4	-1	0	263	2	0	0	264	1	0	0
265	-6	4	2	266	-13	-2	2	267	-26	8	4	268	-27	5	-1	269	-22	1	0	270	-17	0	0
271	-13	-1	0	272	-10	-1	0	273	-7	-1	0	274	-4	-1	0	275	-2	0	0	276	-1	0	0
277	4	3	0	278	14	-2	0	279	20	6	0	280	23	3	0	281	21	1	0	282	16	0	0
283	13	0	0	284	10	-1	0	285	7	-1	0	286	5	0	0	287	3	0	0	288	1	0	0
289	-11	3	2	290	1	-10	2	291	-20	-2	3	292	-13	-8	0	293	-11	-8	0	294	-9	-8	0
295	-7	-6	0	296	-5	-5	0	297	-3	-4	0	298	-2	-2	0	299	-1	-1	0	300	0	0	0
301	-6	1	3	302	-4	-13	3	303	-15	-8	3	304	-13	-14	1	305	-11	-15	0	306	-9	-13	1
307	-7	-11	0	308	-5	-9	0	309	-3	-6	0	310	-2	-4	0	311	-1	-2	0	312	0	-1	0

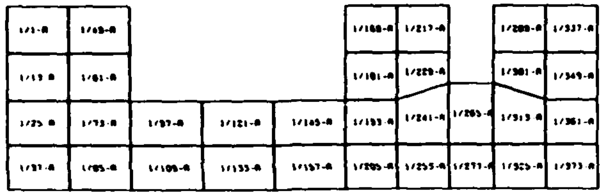
Figure D9. (Sheet 4 of 5)

SHEAR STRESSES FOR LOAD CASE 9 (PSI)

ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
313	-2	4	-2	314	-1	-3	-2	315	-5	7	-2	316	-4	3	-1	317	-3	0	-1	318	-3	-1	-1
319	-2	-2	-1	320	-1	-2	-1	321	-1	-1	-1	322	-1	-1	-1	323	0	-1	-1	324	0	0	-1
325	4	4	-1	326	12	-1	-1	327	19	9	-1	328	21	6	-1	329	18	3	-1	330	15	1	0
331	11	1	0	332	8	0	0	333	6	0	0	334	4	0	0	335	2	0	0	336	1	0	0
337	-11	11	6	338	1	-2	5	339	-20	21	7	340	-13	13	-1	341	-11	9	1	342	-9	6	0
343	-7	4	0	344	-5	3	0	345	-3	2	0	346	-2	1	0	347	-1	1	0	348	0	0	0
349	-5	11	2	350	2	6	2	351	-7	32	2	352	-4	26	-1	353	-3	18	0	354	-2	13	0
355	-2	10	0	356	-1	7	0	357	-1	5	0	358	-1	3	0	359	0	2	0	360	0	1	0
361	-1	10	-1	362	2	8	-1	363	0	31	-1	364	1	27	-1	365	1	19	-1	366	1	14	-1
367	1	10	-1	368	1	7	-1	369	1	5	0	370	0	3	0	371	0	2	0	372	0	1	0
373	2	7	-1	374	7	3	-1	375	11	19	-1	376	12	15	0	377	11	10	0	378	8	7	0
379	7	5	0	380	5	4	0	381	4	2	0	382	2	2	0	383	1	1	0	384	0	0	0

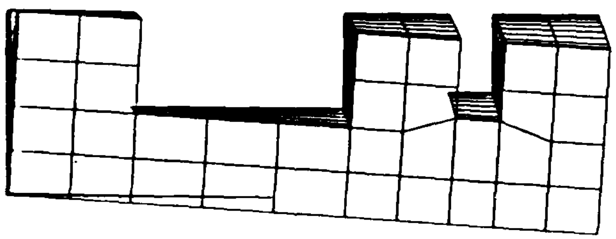
	ELEM	VXY	ELEM	VYZ	ELEM	VZX
MIN.	268	-27	184	-22	193	-5
MAX.	280	23	351	32	219	8

Figure D9. (Sheet 5 of 5)

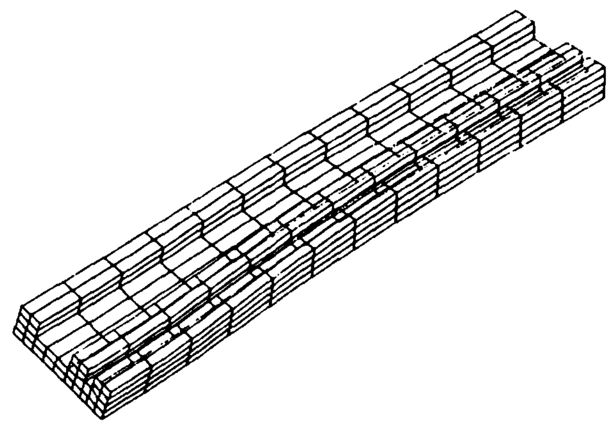


FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
UNDEFORMED GRID
SNORT STRUCTURE(756 NODES,394 ELEMENTS)

FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
LOAD CASE NO-10



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
LOAD CASE NO-10
SNORT STRUCTURE(756 NODES,394 ELEMENTS)



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
LOAD CASE NO-10

Figure D10. Finite-element analysis for load case 10 with K = 175 lb/in.^{3} (Sheet 1 of 5)

NORMAL STRESSES FOR LOAD CASE 10 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
1	1	-91	-3	2	1	-74	-2	3	0	-40	-2	4	0	-1	0	5	0	29	1	6	0	42	1
7	0	42	1	8	0	34	0	9	0	25	0	10	0	17	0	11	0	10	0	12	0	7	0
13	4	-65	-10	14	4	-54	-9	15	3	-33	-6	16	1	-7	-1	17	0	13	1	18	-1	24	2
19	-1	26	2	20	-1	25	2	21	-1	22	1	22	-1	18	1	23	-1	16	1	24	-1	15	1
25	2	-37	-10	26	2	-33	-9	27	1	-25	-6	28	0	-13	-1	29	0	-3	1	30	0	5	2
31	0	10	2	32	0	14	2	33	0	17	2	34	0	20	1	35	0	21	1	36	0	21	1
37	-7	-12	-3	38	-6	-15	-3	39	-4	-17	-1	40	-1	-19	0	41	1	-17	1	42	1	-12	1
43	2	-4	1	44	2	5	1	45	1	14	1	46	1	21	1	47	1	26	0	48	1	29	0
49	-1	-59	2	50	-1	-46	1	51	-1	-23	1	52	0	1	0	53	0	21	-1	54	0	30	-1
55	0	29	-1	56	0	23	-1	57	0	15	-1	58	0	7	-1	59	0	1	-1	60	0	-2	-1
61	16	-32	9	62	15	-26	8	63	10	-15	4	64	3	-4	-2	65	-2	6	-5	66	-3	12	-5
67	-3	14	-5	68	-3	14	-4	69	-2	11	-3	70	-2	9	-3	71	-2	7	-3	72	-2	6	-3
73	14	-13	0	74	13	-12	0	75	9	-11	-1	76	2	-10	-2	77	-2	-7	-3	78	-2	-3	-3
79	-2	2	-2	80	-2	6	-2	81	-2	9	-2	82	-1	12	-1	83	-1	14	-1	84	-1	14	-1
85	-27	6	-3	86	-24	1	-2	87	-16	-8	-2	88	-6	-17	-2	89	2	-22	-2	90	5	-19	-1
91	5	-12	-1	92	5	-2	0	93	4	7	0	94	4	14	0	95	3	20	-1	96	3	22	-1
97	46	7	6	98	43	5	5	99	31	1	3	100	12	-4	-1	101	0	-7	-3	102	-3	-6	-4
103	-3	-3	-3	104	-3	1	-3	105	-3	4	-2	106	-2	6	-2	107	-2	8	-2	108	-2	9	-2
109	-39	27	-3	110	-35	19	-3	111	-27	3	-3	112	-13	-16	-3	113	-4	-28	-3	114	1	-28	-2
115	3	-21	-2	116	3	-11	-1	117	3	-2	-1	118	3	6	-1	119	3	12	-1	120	2	14	-1
121	42	11	-2	122	40	9	-2	123	33	5	-1	124	18	0	-1	125	9	-3	-1	126	7	-4	-1
127	5	-3	0	128	4	-1	0	129	3	2	0	130	2	3	0	131	2	5	0	132	2	5	0
133	-32	50	-7	134	-29	40	-6	135	-26	17	-5	136	-19	-16	-5	137	-14	-34	-3	138	-10	-37	-2
139	-6	-31	-1	140	-4	-21	-1	141	-3	-11	-1	142	-2	-2	-1	143	-1	3	-1	144	-1	6	-1
145	24	14	-10	146	24	11	-9	147	22	7	-7	148	20	3	0	149	17	0	2	150	15	-3	3
151	13	-3	3	152	10	-2	2	153	8	0	2	154	7	1	1	155	6	2	1	156	5	2	1
157	-11	76	-13	158	-11	64	-11	159	-14	34	-9	160	-20	-17	-7	161	-22	-42	-4	162	-18	-47	-2
163	-14	-41	-1	164	-11	-30	-1	165	-8	-20	-1	166	-7	-11	-1	167	-6	-5	-1	168	-5	-1	-1
169	-4	-163	-28	170	-4	-146	-25	171	-7	-93	-36	172	3	29	10	173	0	74	-1	174	0	83	1
175	0	72	0	176	0	55	0	177	0	36	0	178	0	21	0	179	0	11	0	180	0	6	0
181	3	-73	-31	182	3	-65	-28	183	6	-38	-31	184	9	13	4	185	11	36	1	186	9	38	3
187	8	33	3	188	6	24	3	189	5	16	2	190	4	9	2	191	4	4	1	192	3	2	1
193	7	19	-24	194	7	16	-22	195	7	10	-22	196	7	-1	-5	197	7	-6	-4	198	6	-9	-2
199	5	-9	-1	200	4	-8	-1	201	4	-6	-1	202	3	-5	-1	203	3	-4	-1	204	2	-3	-1
205	8	102	-18	206	7	88	-16	207	2	53	-14	208	-17	-19	-10	209	-20	-50	-7	210	-19	-56	-5
211	-15	-50	-3	212	-12	-39	-2	213	-9	-28	-2	214	-8	-18	-2	215	-7	-12	-2	216	-6	-8	-2
217	-8	-143	-47	218	-7	-124	-43	219	-11	-78	-62	220	5	27	14	221	1	65	-5	222	1	72	-1
223	1	61	-1	224	1	44	-1	225	0	27	-1	226	0	13	-1	227	0	3	-1	228	0	-2	-1
229	-4	-63	-41	230	-5	-56	-40	231	-1	-32	-52	232	6	11	3	233	9	31	-9	234	7	32	-7
235	7	27	-6	236	5	18	-5	237	4	9	-4	238	3	3	-3	239	3	-2	-3	240	3	-4	-3
241	3	27	-25	242	3	23	-24	243	4	16	-28	244	3	-1	-6	245	4	-8	-9	246	4	-12	-7
247	3	-12	-6	248	3	-12	-5	249	2	-11	-4	250	2	-9	-3	251	2	-9	-3	252	2	-8	-3
253	15	126	-20	254	14	110	-19	255	9	69	-16	256	-12	-20	-12	257	-15	-56	-9	258	-14	-64	-7
259	-12	-58	-5	260	-9	-47	-4	261	-7	-35	-3	262	-6	-25	-3	263	-5	-18	-2	264	-5	-14	-2
265	-8	27	-27	266	-7	23	-26	267	-4	16	-27	268	6	3	-2	269	8	-5	-3	270	8	-9	-1
271	7	-11	-1	272	6	-11	0	273	5	-11	0	274	4	-11	0	275	3	-11	0	276	3	-11	0
277	16	149	-22	278	15	131	-21	279	11	83	-17	280	-11	-20	-13	281	-14	-63	-9	282	-14	-72	-6
283	-11	-66	-5	284	-9	-54	-3	285	-7	-42	-3	286	-6	-31	-2	287	-5	-24	-2	288	-5	-20	-2
289	-6	-182	-46	290	-5	-160	-42	291	-9	-103	-59	292	5	39	15	293	1	86	-3	294	1	93	2
295	1	78	0	296	0	57	0	297	0	36	0	298	0	19	0	299	0	7	0	300	0	2	0
301	-2	-70	-44	302	-2	-62	-41	303	3	-35	-47	304	3	18	4	305	7	39	-2	306	6	39	1
307	5	31	1	308	4	20	1	309	3	10	1	310	3	2	1	311	2	-4	0	312	2	-7	0

Figure D10. (Sheet 2 of 5)

NORMAL STRESSES FOR LOAD CASE 10 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
313	1	49	-27	314	2	44	-25	315	3	30	-25	316	0	0	-6	317	1	-13	-5	318	1	-19	-3
319	1	-20	-2	320	1	-20	-1	321	1	-19	-1	322	1	-18	-1	323	1	-17	-1	324	0	-16	-1
325	10	169	-24	326	10	150	-22	327	7	96	-18	328	-8	-20	-15	329	-9	-68	-10	330	-9	-79	-7
331	-8	-74	-5	332	-6	-61	-4	333	-5	-48	-3	334	-4	-37	-3	335	-3	-30	-2	336	-3	-26	-2
337	-9	-150	-29	338	-9	-131	-27	339	-13	-80	-39	340	6	36	9	341	1	77	-3	342	1	81	-1
343	1	67	-1	344	1	46	-1	345	0	26	-1	346	0	10	-1	347	0	-1	-1	348	0	-6	-1
349	3	-31	-27	350	3	-27	-26	351	6	-10	-32	352	-1	13	-2	353	2	26	-8	354	1	23	-6
355	1	16	-5	356	1	7	-4	357	1	-2	-3	358	0	-8	-3	359	0	-13	-2	360	0	-15	-2
361	0	77	-27	362	0	69	-26	363	2	47	-27	364	-2	-2	-10	365	0	-23	-11	366	0	-31	-8
367	0	-32	-6	368	0	-31	-5	369	0	-28	-4	370	0	-26	-3	371	0	-24	-3	372	0	-23	-3
373	3	186	-26	374	3	165	-24	375	4	107	-20	376	-5	-20	-17	377	-4	-73	-13	378	-4	-85	-9
379	-3	-80	-7	380	-2	-68	-5	381	-2	-54	-4	382	-1	-43	-3	383	-1	-35	-3	384	-1	-31	-3

	ELEM	SX	ELEM	SY	ELEM	SZ	
MIN.	109	-39	289	-182	219	-62	(COMPRESSIVE)
MAX.	97	46	373	186	292	15	(TENSILE)

Figure D10. (Sheet 3 of 5)

SHEAR STRESSES FOR LOAD CASE 10 (PSI)

ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
1	-10	-6	-3	2	-30	-15	2	3	-45	-23	-1	4	-50	-27	0	5	-45	-27	1	6	-37	-25	1
7	-28	-21	1	8	-21	-17	1	9	-15	-13	1	10	-10	-9	0	11	-6	-5	0	12	-2	-2	0
13	-2	-11	1	14	-8	-32	0	15	-12	-48	1	16	-14	-56	1	17	-11	-55	1	18	-8	-49	0
19	-6	-41	0	20	-4	-32	0	21	-3	-24	0	22	-2	-16	0	23	-1	-10	0	24	0	-3	0
25	2	-11	8	26	4	-31	7	27	6	-48	5	28	7	-55	2	29	8	-54	0	30	7	-48	-1
31	6	-40	-1	32	5	-32	-1	33	4	-24	-1	34	3	-16	-1	35	1	-9	-1	36	0	-3	-1
37	10	-6	7	38	26	-16	6	39	39	-24	4	40	44	-28	1	41	42	-28	0	42	36	-25	-1
43	29	-21	-1	44	22	-17	-1	45	16	-13	-1	46	11	-9	-1	47	6	-5	-1	48	2	-2	-1
49	-10	8	-1	50	-30	24	-1	51	-45	34	-1	52	-50	38	0	53	-45	33	1	54	-36	25	1
55	-28	18	1	56	-21	13	1	57	-15	8	1	58	-10	5	0	59	-6	3	0	60	-2	1	0
61	-6	16	-9	62	-19	46	-8	63	-29	68	-5	64	-31	75	0	65	-27	66	3	66	-20	51	3
67	-15	37	3	68	-11	26	2	69	-8	18	2	70	-5	12	2	71	-3	6	2	72	-1	2	1
73	-1	5	12	74	-6	17	11	75	-9	24	8	76	-9	25	4	77	-6	21	2	78	-3	15	0
79	-1	9	0	80	0	6	0	81	0	3	0	82	0	2	0	83	0	1	0	84	0	0	0
85	14	1	12	86	39	5	11	87	59	6	9	88	67	6	4	89	64	4	1	90	55	1	0
91	44	0	0	92	33	-1	0	93	24	-1	0	94	16	-1	0	95	9	-1	0	96	3	0	0
97	-15	5	-5	98	-44	16	-4	99	-66	24	0	100	-73	26	4	101	-64	21	7	102	-50	15	7
103	-38	10	6	104	-27	7	5	105	-19	4	4	106	-12	3	3	107	-7	1	3	108	-2	0	3
109	11	2	1	110	28	6	2	111	45	10	3	112	50	10	5	113	47	7	6	114	39	4	6
115	32	2	5	116	24	0	4	117	18	0	3	118	12	0	2	119	7	0	2	120	2	0	2
121	-12	3	-7	122	-36	1	-6	123	-57	8	-3	124	-63	6	2	125	-55	2	5	126	-44	-1	6
127	-34	-2	5	128	-25	-2	4	129	-18	-2	3	130	-12	-1	3	131	-7	-1	2	132	-2	0	2
133	11	3	-9	134	25	1	-8	135	43	9	-4	136	46	6	3	137	40	2	7	138	32	-1	7
139	25	-2	6	140	19	-2	5	141	13	-2	4	142	9	-2	3	143	5	-1	3	144	2	0	3
145	-14	4	-18	146	-40	-15	-16	147	-60	-1	-12	148	-68	-11	2	149	-63	-17	5	150	-53	-17	6
151	-42	-16	6	152	-32	-13	5	153	-23	-10	4	154	-15	-7	4	155	-9	-4	3	156	-3	-1	3
157	15	7	-15	158	33	-6	-14	159	59	11	-11	160	62	3	-1	161	52	-3	2	162	40	-6	3
163	53	-6	3	164	22	-6	3	165	15	-4	2	166	10	-3	2	167	6	-2	2	168	2	-1	2
169	-22	19	-8	170	-16	-40	-7	171	-58	1	-11	172	-50	-29	3	173	-43	-28	0	174	-34	-29	1
175	-26	-24	0	176	-19	-20	0	177	-13	-15	0	178	-9	-10	0	179	-5	-6	0	180	-2	-2	0
181	-9	4	-9	182	-17	-58	-7	183	-33	-36	-8	184	-34	-64	7	185	-30	-70	5	186	-25	-64	6
187	-19	-53	5	188	-15	-42	4	189	-10	-31	3	190	-7	-21	3	191	-4	-12	2	192	-1	-4	2
193	-1	10	-14	194	-3	-24	-14	195	-5	7	-13	196	-6	-11	-3	197	-7	-22	-2	198	-7	-24	-1
199	-6	-22	-1	200	-5	-18	0	201	-4	-14	0	202	-3	-9	0	203	-1	-5	0	204	0	-2	0
205	19	13	-11	206	47	-10	-11	207	79	21	-10	208	84	7	-4	209	73	-2	-3	210	58	-5	-2
211	43	-5	-1	212	32	-6	-1	213	22	-5	-1	214	15	-3	0	215	8	-2	0	216	3	-1	0
217	-24	48	13	218	-16	-8	12	219	-61	83	18	220	-51	47	-3	221	-45	40	2	222	-35	26	1
223	-27	18	1	224	-20	12	1	225	-14	8	1	226	-9	5	1	227	-5	3	1	228	-2	1	1
229	-15	44	6	230	-23	27	6	231	-52	117	8	232	-51	97	-2	233	-43	72	0	234	-34	52	0
235	-26	36	0	236	-19	24	0	237	-13	16	0	238	-9	10	0	239	-5	6	0	240	-2	2	0
241	-2	24	-5	242	-3	-3	-5	243	-9	54	-3	244	-9	35	0	245	-7	17	1	246	-6	8	1
247	-5	3	1	248	-3	0	1	249	-2	-1	1	250	-2	-1	1	251	-1	-1	1	252	0	0	1
253	20	17	-5	254	52	-12	-5	255	84	28	-4	256	91	11	-1	257	80	1	0	258	64	-3	0
259	49	-5	0	260	36	-5	0	261	25	-4	0	262	17	-3	0	263	9	-2	0	264	3	-1	0
265	-17	24	-2	266	-44	-10	-2	267	-73	47	1	268	-79	25	-1	269	-69	8	2	270	-57	1	2
271	-44	-3	2	272	-33	-4	2	273	-23	-4	2	274	-15	-3	1	275	-9	-2	1	276	-3	-1	1
277	20	20	-2	278	58	-10	-1	279	89	36	0	280	98	17	-1	281	87	5	0	282	70	0	1
283	53	-2	1	284	39	-3	1	285	28	-3	0	286	18	-2	0	287	10	-1	0	288	3	0	0
289	-16	32	-8	290	-21	-51	-7	291	-50	18	-9	292	-48	-24	3	293	-42	-26	0	294	-33	-28	1
295	-25	-24	1	296	-18	-20	1	297	-13	-15	0	298	-8	-10	0	299	-5	-6	0	300	-2	-2	0
301	-12	17	-5	302	-21	-53	-4	303	-40	-1	-4	304	-41	-36	2	305	-37	-50	2	306	-30	-48	2
307	-23	-41	2	308	-17	-33	2	309	-12	-25	1	310	-8	-17	1	311	-5	-10	1	312	-2	-3	1

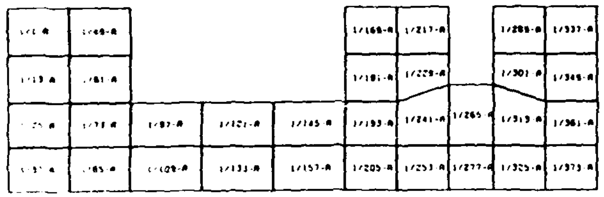
Figure D10. (Sheet 4 of 5)

SHEAR STRESSES FOR LOAD CASE 10 (PSI)

ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
313	-3	23	1	314	-1	-14	1	315	-7	45	0	316	-6	22	-2	317	-5	3	-3	318	-5	-4	-2
319	-4	-7	-2	320	-3	-7	-2	321	-2	-6	-1	322	-2	-4	-1	323	-1	-3	-1	324	0	-1	-1
325	17	22	2	326	51	-7	2	327	76	45	2	328	85	26	-2	329	76	12	-2	330	61	5	-2
331	46	1	-1	332	34	0	-1	333	24	-1	-1	334	16	-1	-1	335	9	-1	-1	336	3	0	-1
337	-17	45	13	338	-21	-5	12	339	-51	84	18	340	-48	51	-4	341	-41	39	2	342	-33	25	1
343	-25	16	1	344	-18	10	1	345	-13	7	1	346	-8	4	0	347	-5	2	0	348	-2	1	0
349	-9	46	7	350	0	27	6	351	-18	124	8	352	-12	102	-2	353	-10	74	0	354	-8	52	0
355	-6	35	0	356	-4	24	0	357	-3	16	0	358	-2	10	0	359	-1	5	0	360	0	2	0
361	-2	41	5	362	8	34	4	363	4	123	3	364	8	106	-1	365	7	76	-2	366	6	54	-2
367	4	37	-2	368	3	25	-2	369	2	17	-1	370	2	11	-1	371	1	6	-1	372	0	2	-1
373	9	30	2	374	29	11	2	375	43	77	1	376	49	60	-1	377	43	41	-1	378	35	28	-1
379	26	19	-1	380	19	12	-1	381	14	8	-1	382	9	5	-1	383	5	3	-1	384	2	1	-1

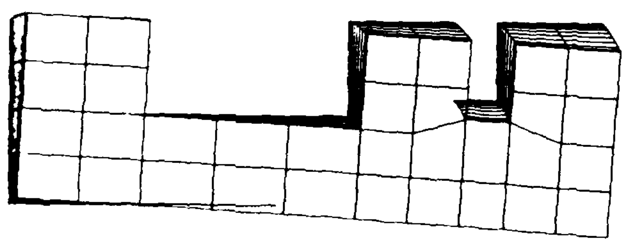
	ELEM	VXY	ELEM	VYZ	ELEM	VZX
MIN.	268	-79	185	-70	145	-18
MAX.	280	98	351	124	219	18

Figure D10. (Sheet 5 of 5)

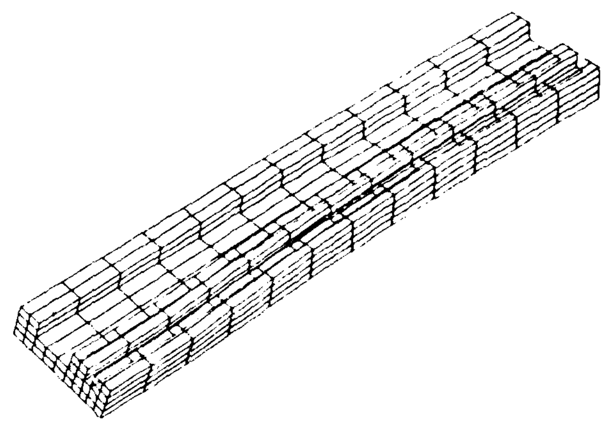


FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE, AUG 82
UNDEFORMED GRID

FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE, AUG 82
LOAD CASE NO-11



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE, AUG 82
LOAD CASE NO-11



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE, AUG 82
LOAD CASE NO-11

Figure D11. Finite-element analysis for load case 11 with K = 175 lb/in.^{3} (Sheet 1 of 5)

NORMAL STRESSES FOR LOAD CASE 11 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
1	0	-65	-2	2	0	-55	-1	3	0	-37	-1	4	0	-15	0	5	0	4	0	6	0	17	0
7	0	24	0	8	0	26	0	9	0	26	0	10	0	25	0	11	0	24	0	12	0	24	0
13	2	-64	-6	14	2	-55	-5	15	1	-38	-3	16	1	-17	-1	17	0	2	0	18	0	14	1
19	0	21	1	20	0	25	0	21	0	27	0	22	0	28	0	23	0	28	0	24	0	28	0
25	1	-62	-5	26	1	-54	-5	27	1	-39	-3	28	0	-19	-1	29	0	-2	0	30	0	11	1
31	0	19	0	32	0	24	0	33	0	28	0	34	0	30	0	35	0	31	0	36	0	32	0
37	-3	-60	-1	38	-3	-54	-1	39	-2	-40	-1	40	0	-21	0	41	1	-4	0	42	1	8	0
43	1	17	0	44	1	23	0	45	1	29	0	46	1	32	-1	47	1	34	-1	48	0	35	-1
49	-1	-38	1	50	-1	-32	0	51	0	-22	0	52	0	-10	0	53	0	1	-1	54	0	9	-1
55	0	14	-1	56	0	16	-1	57	0	16	-1	58	0	16	-1	59	0	15	-1	60	0	15	-1
61	10	-37	4	62	9	-32	3	63	6	-23	1	64	2	-12	-1	65	0	-2	-2	66	-1	7	-3
67	-2	12	-3	68	-1	16	-3	69	-1	17	-2	70	-1	18	-2	71	-1	19	-2	72	-1	19	-2
73	9	-39	0	74	9	-35	-1	75	6	-26	-1	76	2	-14	-1	77	0	-4	-2	78	-1	5	-2
79	-1	11	-2	80	-1	16	-2	81	-1	19	-2	82	0	21	-2	83	0	23	-2	84	0	23	-2
85	-14	-42	-1	86	-12	-38	-1	87	-8	-30	-1	88	-4	-18	-1	89	0	-6	-1	90	2	2	-1
91	3	10	-1	92	2	16	-1	93	2	21	-1	94	2	24	-1	95	1	26	-1	96	1	27	-1
97	34	-18	3	98	32	-16	3	99	23	-12	1	100	11	-8	0	101	2	-3	-2	102	0	2	-2
103	-1	6	-2	104	-1	10	-2	105	0	12	-2	106	0	14	-1	107	0	15	-1	108	0	16	-1
109	-24	-22	-1	110	-21	-21	-1	111	-16	-19	-1	112	-9	-14	-1	113	-4	-9	-2	114	-1	-4	-2
115	1	2	-2	116	1	7	-1	117	1	12	-1	118	0	15	-1	119	0	17	-1	120	0	18	-1
121	42	-4	-2	122	40	-4	-2	123	31	-3	-2	124	16	-2	-1	125	8	0	-1	126	5	2	-1
127	4	4	0	128	3	5	0	129	3	7	0	130	3	8	0	131	3	8	0	132	3	9	0
133	-26	-2	-3	134	-24	-4	-2	135	-20	-7	-2	136	-15	-10	-2	137	-10	-11	-2	138	-7	-10	-2
139	-5	-6	-1	140	-4	-2	-1	141	-3	2	-1	142	-3	5	-1	143	-3	7	-1	144	-3	9	-1
145	46	11	4	146	45	10	4	147	37	8	4	148	20	5	1	149	12	2	1	150	10	1	1
151	8	1	1	152	7	1	1	153	6	1	1	154	5	1	1	155	5	2	0	156	5	2	0
157	-25	20	-3	158	-23	15	-3	159	-21	6	-2	160	-18	-6	-3	161	-15	-14	-2	162	-12	-16	-2
163	-9	-14	-1	164	-7	-11	-1	165	-6	-7	-1	166	-5	-4	-1	167	-5	-2	-1	168	-5	-1	-1
169	2	-55	-5	170	2	-48	-4	171	2	-30	-8	172	0	15	3	173	0	28	0	174	0	31	0
175	0	25	0	176	0	18	0	177	0	11	0	178	0	5	0	179	0	1	0	180	0	-1	0
181	18	-15	2	182	18	-13	2	183	15	-6	2	184	10	10	1	185	7	15	1	186	6	14	2
187	5	11	1	188	4	7	1	189	3	3	1	190	3	0	0	191	3	-2	0	192	2	-3	0
193	20	19	-8	194	20	16	-7	195	17	11	-6	196	8	5	-3	197	4	0	-3	198	4	-4	-2
199	3	-5	-1	200	3	-6	-1	201	2	-6	-1	202	2	-6	-1	203	2	-6	-1	204	2	-6	-1
205	-17	41	-8	206	-16	34	-7	207	-15	20	-6	208	-16	-4	-5	209	-15	-17	-4	210	-12	-22	-3
211	-10	-21	-3	212	-8	-18	-2	213	-7	-15	-2	214	-6	-12	-2	215	-5	-10	-2	216	-5	-9	-2
217	-3	-35	-20	218	-3	-30	-19	219	-4	-15	-26	220	2	12	5	221	1	23	-2	222	1	23	-1
223	0	17	-1	224	0	9	-1	225	0	2	-1	226	0	-4	-1	227	0	-7	-1	228	0	-9	-1
229	10	6	-26	230	9	-5	-25	231	7	0	-31	232	8	9	0	233	6	12	-5	234	4	9	-4
235	4	4	-4	236	3	0	-3	237	3	-4	-3	238	2	-8	-2	239	2	-10	-2	240	2	-11	-2
241	13	28	-18	242	12	24	-17	243	11	17	-19	244	4	6	-5	245	2	-2	-6	246	2	-7	-5
247	2	-10	-4	248	2	-11	-3	249	1	-12	-3	250	1	-13	-2	251	1	-13	-2	252	1	-13	-2
253	-8	61	-10	254	-7	53	-10	255	-7	33	-9	256	-13	-2	-6	257	-12	-20	-5	258	-9	-27	-4
259	8	[illegible]	-3	260	-6	-25	-3	261	-5	-22	-3	262	-4	-19	-2	263	-4	-17	-2	264	-3	-16	-2
265	15	40	-7	266	15	35	-6	267	13	25	-7	268	8	11	-1	269	5	0	-2	270	5	-7	-1
271	4	-12	-1	272	3	-14	-1	273	3	-16	-1	274	2	-17	-1	275	2	-17	-1	276	2	-18	-1
277	-9	60	-10	278	-9	70	-9	279	-8	46	-8	280	-12	-1	-6	281	-11	-24	-5	282	-9	-33	-4
283	8	-34	-3	284	-6	-32	-3	285	-5	-29	-2	286	-4	-26	-2	287	-3	-24	-2	288	-3	-23	-2
289	9	41	-11	290	0	-37	-10	291	-1	-23	-15	292	2	28	5	293	0	37	-1	294	0	32	0
295	0	22	0	296	0	10	0	297	0	0	0	298	0	-7	0	299	0	-12	0	300	0	-15	0
301	13	9	-7	302	13	8	-6	303	13	9	-7	304	5	19	0	305	4	17	-1	306	4	11	0
307	3	3	0	308	2	-5	0	309	2	-11	0	310	2	-15	0	311	1	-18	0	312	1	-19	0

Figure D11. (Sheet 2 of 5)

NORMAL STRESSES FOR LOAD CASE 11 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
313	5	55	-6	314	5	49	-5	315	4	35	-5	316	1	11	-4	317	0	-4	-3	318	0	-13	-2
319	0	-18	-2	320	0	-21	-1	321	0	-23	-1	322	0	-24	-1	323	0	-24	-1	324	0	-24	-1
325	-7	99	-10	326	-6	88	-10	327	-6	59	-8	328	-8	1	-8	329	-8	-27	-6	330	-6	-33	-4
331	-5	-40	-4	332	-4	-39	-3	333	-3	-36	-3	33	-3	-33	-2	335	-2	-30	-2	336	-2	-29	-2
337	-6	-19	-14	338	-6	-16	-13	339	-9	-4	-18	340	3	24	2	341	0	31	-2	342	1	24	-1
343	0	13	-1	344	0	1	-1	345	0	-8	-1	346	0	-16	-1	347	0	-20	-1	348	0	-23	-1
349	5	29	-20	350	4	26	-20	351	6	24	-22	352	0	15	-3	353	1	10	-4	354	1	1	-3
355	1	-8	-3	356	0	-15	-3	357	0	-20	-2	358	0	-24	-2	359	0	-26	-2	360	0	-27	-2
361	1	73	-19	362	1	65	-18	363	1	47	-18	364	-1	10	-6	365	-1	-10	-6	366	-1	-21	-5
367	0	-27	-4	368	0	-30	-3	369	0	-31	-3	370	0	-32	-3	371	0	-32	-2	372	0	-32	-2
373	-3	117	-14	374	-3	105	-13	375	-2	72	-11	376	-5	3	-9	377	-4	-30	-7	378	-3	-42	-5
379	-2	-46	-4	380	-2	-45	-4	381	-1	-42	-3	382	-1	-39	-3	383	-1	-37	-3	384	-1	-36	-3

	ELEM	SX	ELEM	SY	ELEM	SZ	
MIN.	133	-26	1	-65	231	-31	(COMPRESSIVE)
MAX.	145	46	373	117	220	5	(TENSILE)

Figure D11. (Sheet 3 of 5)

SHEAR STRESSES FOR LOAD CASE 11 (PSI)

ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
1	-5	-3	-1	2	-15	-8	-1	3	-22	-12	-1	4	-25	-14	0	5	-23	-14	0	6	-19	-12	0
7	-15	-10	0	8	-11	-8	0	9	-8	-6	0	10	-5	-4	0	11	-3	-2	0	12	-1	-1	0
13	-2	-6	0	14	-5	-16	0	15	-7	-24	0	16	-8	-28	0	17	-7	-27	0	18	-5	-24	0
19	-4	-20	0	20	-3	-16	0	21	-2	-12	0	22	-1	-8	0	23	-1	-5	0	24	0	-1	0
25	0	-6	5	26	1	-16	4	27	0	-24	3	28	1	-27	1	29	2	-27	0	30	3	-24	0
31	2	-20	0	32	2	-15	0	33	2	-11	0	34	1	-8	0	35	1	-4	0	36	0	-1	0
37	4	-3	4	38	11	-9	4	39	16	-13	3	40	18	-15	1	41	19	-14	0	42	17	-13	0
43	14	-10	0	44	11	-8	0	45	8	-6	0	46	5	-4	0	47	3	-2	0	48	1	-1	0
49	-5	4	-1	50	-15	11	0	51	-22	15	0	52	-25	17	0	53	-23	16	0	54	-19	13	0
55	-15	10	0	56	-11	7	0	57	-8	5	0	58	-5	3	0	59	-3	2	0	60	-1	1	0
61	-4	8	-5	62	-11	23	-4	63	-16	33	-3	64	-18	36	0	65	-16	34	1	66	-12	28	2
67	-9	22	2	68	-7	16	1	69	-5	11	1	70	-3	7	1	71	-2	4	1	72	-1	1	1
73	-2	3	8	74	-6	8	7	75	-10	11	6	76	-10	12	3	77	-7	11	2	78	-5	9	1
79	-3	6	0	80	-2	4	0	81	-1	3	0	82	0	2	0	83	0	1	0	84	0	0	0
85	6	0	9	86	15	2	8	87	21	2	6	88	25	2	4	89	26	2	2	90	24	1	1
91	20	0	0	92	16	0	0	93	12	0	0	94	8	0	0	95	5	0	0	96	1	0	0
97	-9	2	1	98	-28	8	2	99	-42	10	3	100	-46	11	3	101	-41	11	4	102	-32	9	4
103	-24	6	4	104	-17	4	3	105	-12	3	3	106	-8	2	2	107	-4	1	2	108	-1	0	2
109	3	1	5	110	8	3	5	111	11	3	5	112	13	3	4	113	15	3	4	114	14	2	4
115	12	1	3	116	10	1	3	117	7	0	2	118	5	0	2	119	3	0	2	120	1	0	2
121	-9	0	1	122	-25	1	1	123	-40	1	2	124	-44	1	3	125	-37	1	3	126	-29	0	3
127	-22	-1	3	128	-16	-1	2	129	-11	-1	2	130	-7	0	2	131	-4	0	1	132	-1	0	1
133	2	0	2	134	6	1	2	135	7	1	3	136	9	1	3	137	10	0	4	138	10	0	4
139	8	-1	4	140	7	-1	3	141	5	-1	3	142	4	-1	2	143	2	0	2	144	1	0	2
145	-10	-2	1	146	-28	-6	2	147	-47	-9	3	148	-51	-11	2	149	-43	-11	3	150	-35	-10	4
151	-27	-8	3	152	-19	-7	3	153	-14	-5	2	154	-9	-3	2	155	-5	-2	1	156	-2	-1	1
157	4	0	-4	158	11	-1	-3	159	16	0	-2	160	18	-2	0	161	17	-2	2	162	14	-3	2
163	11	-3	2	164	9	-3	2	165	6	-2	1	166	4	-1	1	167	3	-1	1	168	1	0	1
169	-22	0	3	170	1	-13	3	171	-41	-12	4	172	-26	-18	-1	173	-24	-16	0	174	-18	-15	0
175	-14	-12	0	176	-10	-10	0	177	-7	-7	0	178	-5	-5	0	179	-3	-3	0	180	-1	-1	0
181	-10	-6	10	182	-8	-28	10	183	-26	-36	9	184	-23	-44	5	185	-19	-41	4	186	-15	-35	4
187	-12	-29	3	188	-9	-22	3	189	-6	-16	2	190	-4	-11	2	191	-2	-6	2	192	-1	-2	1
193	-3	0	-9	194	-6	-11	-9	195	-13	-8	-8	196	-13	-13	-2	197	-10	-14	-1	198	-8	-13	-1
199	-6	-12	-1	200	-5	-9	0	201	-3	-7	0	202	-2	-5	0	203	-1	-3	-1	204	0	-1	-1
205	7	2	-9	206	19	-3	-9	207	30	3	-7	208	33	0	-3	209	30	-2	-1	210	24	-3	-1
211	19	-3	-1	212	14	-3	-1	213	10	-2	-1	214	7	-1	-1	215	4	-1	-1	216	1	0	-1
217	-24	20	13	218	1	0	12	219	-43	39	16	220	-27	24	-2	221	-25	21	1	222	-19	14	1
223	-15	10	1	224	-11	7	1	225	-8	5	0	226	-5	3	0	227	-3	2	0	228	-1	1	0
229	-13	19	4	230	-11	17	5	231	-35	57	6	232	-31	50	-2	233	-26	38	0	234	-20	28	0
235	-15	20	0	236	-11	14	0	237	-8	10	0	238	-5	6	0	239	-3	3	0	240	-1	1	0
241	-4	9	-2	242	-5	1	-1	243	-14	21	-1	244	-13	15	0	245	-9	8	1	246	-7	5	1
247	-5	2	1	248	-3	1	1	249	-2	0	0	250	-1	0	0	251	-1	0	0	252	0	0	0
253	8	5	-3	254	24	-4	-3	255	36	8	-2	256	39	3	-1	257	36	0	0	258	29	-2	0
259	22	-2	0	260	17	-2	0	261	12	-2	0	262	8	-1	0	263	5	-1	0	264	2	0	0
265	-13	8	4	266	-26	-3	5	267	-52	16	7	268	-54	9	-2	269	-43	3	1	270	-34	0	1
271	-26	-1	1	272	-19	-1	1	273	-13	-1	1	274	-9	-1	1	275	-5	-1	0	276	-2	0	0
277	9	7	-1	278	28	-3	0	279	41	13	1	280	46	6	-1	281	41	2	[illegible]	282	33	0	1
[illegible]	25	-1	0	284	19	-1	0	285	14	-1	0	286	9	-1	0	287	5	0	0	288	2	0	0
289	-22	7	5	290	1	-20	5	291	-40	-3	6	292	-26	-16	0	293	-23	-16	1	294	-18	-15	0
295	-13	-13	0	[illegible]	-10	-10	0	297	-7	-7	0	298	-5	-5	0	299	-3	-3	0	300	-1	-1	0
301	-12	2	6	302	-8	-26	7	303	-30	-16	6	304	-26	-28	1	305	-22	-30	1	306	-17	-27	1
307	-13	-22	1	308	-10	-17	1	309	-7	-13	1	310	-5	-8	1	311	-3	-5	0	312	-1	-2	0

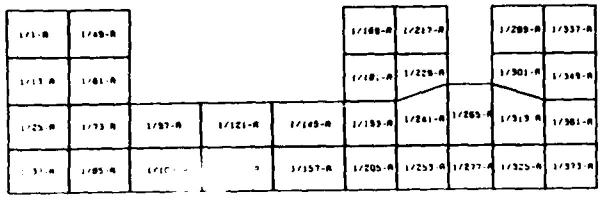
Figure D11. (Sheet 4 of 5)

SHEAR STRESSES FOR LOAD CASE 11 (PSI)

ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
313	-4	8	-4	314	-2	-6	-4	315	-10	14	-3	316	-9	6	-3	317	-6	-1	-2	318	-5	-3	-1
319	-4	-4	-1	320	-3	-3	-1	321	-2	-3	-1	322	-1	-2	-1	323	-1	-1	-1	324	0	0	-1
325	3	9	-2	326	25	-2	-2	327	37	18	-1	328	41	11	-1	329	37	5	-1	330	29	3	-1
331	22	1	-1	332	17	0	-1	333	12	0	0	334	8	0	0	335	5	0	0	336	2	0	0
337	-22	22	11	338	1	-3	10	339	-40	42	14	340	-26	26	-2	341	-22	19	1	342	-18	13	0
343	-13	9	0	344	-10	6	0	345	-7	4	0	346	-5	3	0	347	-3	1	0	343	-1	0	0
349	-9	23	4	350	4	13	4	351	-15	63	5	352	-7	52	-1	353	-6	37	0	354	-5	27	0
355	-4	19	0	356	-3	13	0	357	-2	9	0	358	-1	6	0	359	-1	3	0	360	0	1	0
361	-2	20	-2	362	4	17	-2	363	-1	62	-2	364	2	54	-1	365	3	33	-1	366	2	28	-1
367	2	20	-1	368	1	14	-1	369	1	10	-1	370	1	6	-1	371	0	3	-1	372	0	1	-1
373	5	15	-2	374	14	6	-2	375	22	33	-2	376	25	30	0	377	21	21	-1	378	17	15	-1
379	13	10	0	380	10	7	0	381	7	5	0	382	5	3	0	383	3	2	0	384	1	1	0

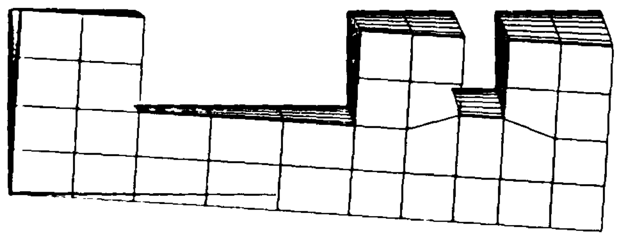
	ELEM	VXY	ELEM	VYZ	ELEM	VZX
MIN.	263	-54	184	-44	193	-9
MAX.	280	46	351	63	219	16

Figure D11. (Sheet 5 of 5)

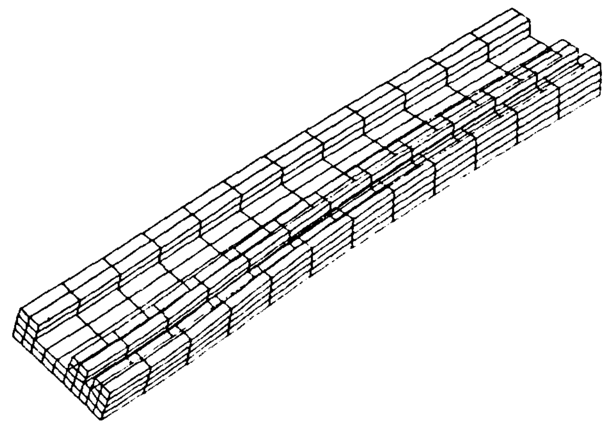


FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE, AUG 82
UNDEFORMED GRID
SNORT STRUCTURE(756 NODES,384 ELEMENTS)

FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE, AUG 82
LOAD CASE NO-12



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE, AUG 82
LOAD CASE NO-12
SNORT STRUCTURE(756 NODES 384 ELEMENTS)



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE, AUG 82
LOAD CASE NO-12

Figure D12. Finite-element analysis for load case 12 with K = 175 $lb/in.^3$ (Sheet 1 of 5)

NORMAL STRESSES FOR LOAD CASE 12 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
1	1	-173	-5	2	1	-137	-4	3	1	-72	-2	4	1	0	0	5	0	53	1	6	0	76	1
7	0	75	1	8	0	63	1	9	-1	46	1	10	-1	32	0	11	-1	21	0	12	-1	16	0
13	8	-125	-17	14	7	-102	-15	15	4	-61	-9	16	1	-13	-1	17	-1	24	3	18	-2	43	5
19	-2	48	5	20	-2	46	4	21	-1	41	3	22	-1	36	3	23	-1	32	2	24	-1	29	2
25	4	-73	-17	26	3	-65	-14	27	2	-47	-8	28	0	-25	-1	29	-1	-5	4	30	-1	10	5
31	-1	20	6	32	-1	28	5	33	0	34	4	34	0	33	4	35	0	41	3	36	0	42	3
37	-12	-26	-4	38	-10	-31	-3	39	-7	-36	-1	40	-2	-37	2	41	2	-32	3	42	3	-21	4
43	3	-5	4	44	3	13	4	45	3	29	3	46	2	42	2	47	2	51	2	48	2	55	2
49	-2	-111	3	50	-2	-86	3	51	-1	-42	1	52	0	4	0	53	1	39	-2	54	1	55	-2
55	1	53	-2	56	0	42	-2	57	0	27	-1	58	0	14	-1	59	0	4	-1	60	0	-1	-1
61	31	-62	18	62	27	-50	15	63	17	-30	7	64	4	-8	-3	65	-4	11	-8	66	-6	23	-9
67	-6	27	-8	68	-6	26	-6	69	-5	22	-5	70	-4	18	-5	71	-4	15	-4	72	-3	13	-4
73	26	-26	3	74	23	-25	2	75	15	-23	-1	76	3	-20	-3	77	-4	-13	-5	78	-5	-5	-4
79	-4	5	-3	80	-4	13	-2	81	-3	19	-2	82	-3	24	-1	83	-2	27	-1	84	-2	28	-1
85	-50	8	-3	86	-42	-2	-3	87	-27	-19	-2	88	-8	-34	-2	89	4	-40	-1	90	9	-34	0
91	10	-19	0	92	10	-1	1	93	9	16	1	94	8	29	1	95	7	38	0	96	6	43	0
97	86	11	12	98	76	6	10	99	52	-1	4	100	18	-10	-2	101	-2	-13	-5	102	-7	-10	-6
103	-8	-4	-5	104	-8	3	-4	105	-7	8	-3	106	-6	13	-3	107	-6	16	-3	108	-5	17	-2
109	-71	49	-3	110	-61	32	-3	111	-44	1	-3	112	-20	-33	-4	113	-5	-50	-4	114	3	-49	-3
115	7	-36	-2	116	8	-17	-1	117	8	0	-1	118	7	14	0	119	7	24	0	120	6	29	-1
121	78	19	-3	122	71	14	-2	123	56	7	-1	124	30	-1	-2	125	15	-6	-1	126	9	-7	-1
127	6	-4	0	128	4	0	0	129	2	3	0	130	1	7	0	131	1	9	0	132	1	10	0
133	-57	94	-11	134	-50	69	-10	135	-44	24	-8	136	-32	-33	-7	137	-24	-62	-5	138	-14	-65	-3
139	-8	-53	-1	140	-4	-35	-1	141	-2	-16	0	142	-1	-2	0	143	0	9	0	144	0	14	0
145	43	24	-18	146	44	19	-17	147	40	13	-13	148	37	5	2	149	29	-1	4	150	25	-5	5
151	20	-5	5	152	16	-3	4	153	12	-1	4	154	10	1	3	155	8	3	3	156	7	4	2
157	-18	147	-21	158	-18	111	-20	159	-25	54	-15	160	-37	-35	-10	161	-37	-76	-6	162	-30	-83	-3
163	-23	-71	-1	164	-17	-52	0	165	-12	-33	0	166	-9	-17	0	167	-7	-6	0	168	-7	-1	0
169	-9	-330	-55	170	-10	-260	-55	171	-15	-151	-76	172	7	62	20	173	0	137	-3	174	1	150	3
175	0	129	1	176	0	96	1	177	0	64	1	178	0	37	1	179	0	19	0	180	0	10	0
181	4	-144	-59	182	11	-115	-59	183	18	-59	-63	184	16	28	10	185	19	67	4	186	16	69	7
187	14	59	7	188	11	43	6	189	8	28	5	190	7	16	4	191	6	7	3	192	5	3	3
193	13	36	-45	194	15	27	-41	195	16	18	-40	196	13	-2	-7	197	12	-11	-6	198	10	-15	-3
199	9	-15	-1	200	7	-13	0	201	6	-11	0	202	5	-8	0	203	4	-7	0	204	4	-6	0
205	17	199	-30	206	9	154	-29	207	-2	84	-24	208	-32	-38	-16	209	-36	-90	-11	210	-32	-99	-7
211	-25	-83	-4	212	-20	-68	-3	213	-15	-48	-2	214	-12	-31	-1	215	-10	-20	-1	216	-9	-14	-1
217	-16	-281	-100	218	-16	-216	-50	219	-22	-117	-85	220	9	57	20	221	1	120	-7	222	2	129	-1
223	1	108	-2	224	1	77	-2	225	1	46	-2	226	0	21	-1	227	0	4	-1	228	0	-4	-1
229	-8	-124	-85	230	6	-93	-51	231	13	-43	-75	232	11	26	2	233	15	58	-15	234	13	53	-11
235	11	47	-9	236	9	31	-7	237	7	16	-6	238	6	3	-5	239	5	-5	-4	240	4	-9	-4
241	6	51	-48	242	7	41	-36	243	10	29	-43	244	7	-1	-11	245	7	-15	-16	246	7	-21	-12
247	6	-22	-9	248	5	-21	-7	249	4	-19	-5	250	3	-17	-4	251	3	-16	-4	252	3	-16	-3
253	29	247	-35	254	14	192	-31	255	5	110	-26	256	-24	-40	-20	257	-28	-101	-15	258	-25	-114	-10
259	-21	-103	-7	260	-16	-82	-5	261	-12	-61	-4	262	-10	-44	-3	263	-8	-31	-3	264	-7	-25	-2
265	-13	52	-52	266	1	46	-30	267	6	35	-32	268	14	8	-4	269	14	-8	-5	270	15	-16	-2
271	12	-19	0	272	10	-21	0	273	8	-21	0	274	7	-21	0	275	6	-21	0	276	5	-21	0
277	32	291	-38	278	10	228	-33	279	1	134	-26	280	-23	-41	-21	281	-26	-114	-14	282	-24	-129	-10
283	-20	-118	-7	284	-16	-96	-4	285	-12	-74	-3	286	-10	-56	-3	287	-8	-43	-2	288	-7	-36	-2
289	-12	-357	-98	290	-12	-280	-46	291	-18	-158	-78	292	9	83	21	293	1	160	-3	294	2	167	3
295	1	138	1	296	1	99	1	297	0	61	1	298	0	31	0	299	0	10	0	300	0	0	0
301	-3	-136	-89	302	12	-102	-51	303	20	-46	-62	304	7	40	5	305	12	74	-2	306	11	71	2
307	9	55	3	308	7	34	2	309	6	16	2	310	5	1	2	311	4	-9	1	312	4	-14	1

Figure D12.   (Sheet 2 of 5)

NORMAL STRESSES FOR LOAD CASE 12 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
313	4	96	-51	314	4	80	-36	315	6	56	-35	316	1	2	-10	317	1	-23	-8	318	2	-33	-4
319	1	-37	-2	320	1	-36	-1	321	1	-35	-1	322	1	-33	0	323	1	-32	0	324	1	-31	0
325	20	330	-41	326	5	263	-37	327	1	158	-29	328	-16	-41	-24	329	-17	-124	-16	330	-16	-142	-11
331	-13	-131	-7	332	-11	-109	-5	333	-8	-86	-4	334	-7	-67	-3	335	-5	-54	-3	336	-5	-47	-2
337	-19	-295	-57	338	-18	-229	-59	339	-27	-125	-82	340	11	75	18	341	1	142	-6	342	3	146	-1
343	1	117	-2	344	1	80	-2	345	1	44	-2	346	0	15	-1	347	0	-4	-1	348	0	-14	-1
349	6	-62	-52	350	11	-46	-58	351	17	-9	-70	352	-2	28	-2	353	4	49	-13	354	2	42	-9
355	2	27	-7	356	1	10	-6	357	1	-5	-5	358	1	-17	-4	359	1	-25	-3	360	1	-29	-3
361	1	150	-50	362	1	123	-52	363	4	82	-55	364	-3	-4	-17	365	-1	-41	-18	366	-1	-56	-13
367	0	-58	-10	368	0	-56	-7	369	0	-52	-6	370	0	-48	-5	371	0	-45	-4	372	0	-43	-4
373	7	363	-45	374	1	293	-44	375	3	178	-37	376	-10	-41	-29	377	-7	-132	-20	378	-7	-153	-15
379	-5	-143	-10	380	-4	-121	-7	381	-3	-98	-6	382	-2	-78	-4	383	-2	-64	-4	384	-2	-57	-4

	ELEM	SX	ELEM	SY	ELEM	SZ	
MIN.	109	-71	289	-357	217	-100	(COMPRESSIVE)
MAX.	97	86	373	363	292	21	(TENSILE)

Figure D12. (Sheet 3 of 5)

SHEAR STRESSES FOR LOAD CASE 12 (PSI)

ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
1	-20	-10	-5	2	-57	-28	-4	3	-83	-42	-2	4	-91	-49	0	5	-81	-49	1	6	-65	-45	2
7	-51	-38	1	8	-38	-30	1	9	-27	-22	1	10	-18	-15	1	11	-10	-9	1	12	-3	-3	1
13	-5	-22	1	14	-16	-60	1	15	-23	-88	1	16	-24	-101	1	17	-19	-99	1	18	-14	-88	1
19	-10	-73	0	20	-7	-58	0	21	-5	-43	0	22	-3	-29	0	23	-2	-17	0	24	-1	-6	0
25	3	-21	14	26	7	-58	12	27	10	-87	8	28	12	-99	3	29	14	-97	-1	30	13	-86	-2
31	11	-72	-2	32	9	-56	-2	33	7	-42	-2	34	4	-29	-2	35	3	-17	-2	36	1	-5	-1
37	15	-11	13	38	49	-29	11	39	72	-44	7	40	79	-51	2	41	76	-50	-1	42	65	-45	-2
43	51	-38	-2	44	39	-30	-2	45	28	-23	-2	46	19	-15	-1	47	11	-9	-1	48	4	-3	-1
49	-20	16	-3	50	-57	45	-2	51	-82	63	-1	52	-90	68	0	53	-80	58	1	54	-65	45	2
55	-50	32	1	56	-37	22	1	57	-27	15	1	58	-18	10	1	59	-10	5	1	60	-3	2	1
61	-12	31	-17	62	-36	88	-15	63	-53	126	-8	64	-56	134	0	65	-48	118	5	66	-37	91	6
67	-27	66	5	68	-19	47	5	69	-14	32	4	70	-9	21	3	71	-5	12	3	72	-2	4	3
73	-3	11	21	74	-12	32	19	75	-17	44	14	76	-17	46	7	77	-11	37	2	78	-5	26	0
79	-2	16	-1	80	0	10	-1	81	0	6	-1	82	1	3	-1	83	0	2	-1	84	0	1	-1
85	27	3	23	86	74	9	20	87	107	12	15	88	119	11	7	89	113	7	2	90	97	2	0
91	75	-1	-1	92	59	-2	-1	93	43	-2	-1	94	29	-2	-1	95	17	-1	-1	96	5	0	-1
97	-29	11	-10	98	-84	31	-7	99	-123	44	0	100	-133	46	8	101	-115	37	13	102	-91	27	12
103	-68	18	10	104	-49	12	8	105	-34	8	7	106	-22	5	5	107	-13	3	5	108	-4	1	4
109	21	5	2	110	54	13	3	111	81	19	6	112	88	18	9	113	82	12	10	114	70	7	9
115	56	3	8	116	43	1	6	117	31	0	5	118	21	0	4	119	12	0	3	120	4	0	3
121	-25	6	-14	122	-70	4	-11	123	-105	15	-4	124	-114	10	5	125	-99	3	10	126	-80	-1	10
127	-61	-3	9	128	-45	-4	7	129	-32	-3	6	130	-21	-2	5	131	-12	-1	4	132	-4	0	4
133	22	7	-17	134	49	5	-14	135	77	16	-5	136	80	11	6	137	70	3	12	138	56	-1	12
139	43	-4	11	140	32	-4	9	141	23	-4	7	142	16	-3	6	143	9	-2	5	144	3	-1	5
145	-27	11	-33	146	-75	-25	-27	147	-113	-2	-18	148	-125	-21	5	149	-114	-32	11	150	-95	-32	12
151	-75	-28	11	152	-57	-23	10	153	-41	-17	8	154	-27	-12	7	155	-15	-7	6	156	-5	-2	5
157	31	15	-29	158	65	-8	-24	159	106	20	-17	160	108	5	0	161	91	-6	5	162	71	-10	7
163	53	-11	7	164	39	-10	6	165	27	-8	5	166	18	-6	4	167	10	-3	4	168	3	-1	3
169	-44	40	-16	170	-39	-73	-20	171	-101	3	-27	172	-91	-54	7	173	-77	-51	-1	174	-61	-52	1
175	-46	-44	1	176	-34	-35	1	177	-24	-26	0	178	-16	-18	0	179	-9	-10	0	180	-3	-3	0
181	-17	12	-17	182	-34	-105	-10	183	-60	-69	-11	184	-63	-119	13	185	-54	-127	10	186	-45	-115	11
187	-35	-96	9	188	-26	-75	7	189	-19	-55	6	190	-12	-37	5	191	-7	-21	4	192	-2	-7	4
193	-1	25	-27	194	-5	-37	-17	195	-11	9	-16	196	-13	-23	-5	197	-13	-41	-3	198	-13	-43	-1
199	-12	-39	0	200	-9	-32	0	201	-7	-24	0	202	-5	-17	0	203	-3	-10	0	204	-1	-3	0
205	40	23	-21	206	92	-13	-15	207	142	34	-13	208	149	11	-6	209	129	-4	-4	210	102	-10	-2
211	77	-11	-1	212	56	-11	-1	213	39	-8	0	214	26	-6	0	215	15	-4	0	216	5	-1	0
217	-46	95	25	218	-42	0	32	219	-107	139	44	220	-94	86	-9	221	-80	71	5	222	-63	46	2
223	-48	32	2	224	-35	21	2	225	-25	14	1	226	-16	8	1	227	-9	5	1	228	-3	1	1
229	-31	93	11	230	-45	66	15	231	-96	204	19	232	-92	172	-5	233	-77	128	1	234	-61	92	0
235	-46	64	0	236	-34	43	0	237	-24	29	0	238	-16	18	0	239	-9	10	0	240	-3	3	0
241	-5	54	-10	242	-6	7	-1	243	-19	91	2	244	-18	59	0	245	-13	30	2	246	-11	14	2
247	-9	5	2	248	-6	0	2	249	-5	-1	2	250	-3	-2	1	251	-2	-1	1	252	-1	0	1
253	40	37	-10	254	102	-13	-4	255	152	47	-2	256	163	18	-2	257	143	1	0	258	113	-6	1
259	86	-9	1	260	63	-9	1	261	44	-7	1	262	29	-5	1	263	17	-3	1	264	5	-1	1
265	-34	54	-4	266	-83	-5	-2	267	-136	77	4	268	-145	42	-2	269	-126	14	3	270	-103	1	4
271	-77	-5	4	272	-59	-7	4	273	-42	-7	3	274	-28	-5	3	275	-16	-3	2	276	-5	-1	2
277	39	43	-3	278	109	-9	-2	279	163	59	0	280	176	29	-1	281	155	9	1	282	124	0	1
283	94	-5	1	284	69	-6	1	285	49	-5	1	286	32	-4	1	287	18	-2	1	288	6	-1	1
289	-33	65	-13	290	-30	-80	-20	291	-100	18	-26	292	-86	-45	8	293	-74	-49	0	294	-59	-51	2
295	-45	-44	1	296	-33	-35	1	297	-23	-26	1	298	-15	-18	1	299	-9	-10	1	300	-3	-3	1
301	-22	42	-7	302	-39	-83	-9	303	-75	-15	-10	304	-75	-70	6	305	-67	-91	2	306	-54	-87	4
307	-42	-74	3	308	-31	-59	3	309	-22	-44	2	310	-15	-30	2	311	-8	-17	2	312	-3	-6	2

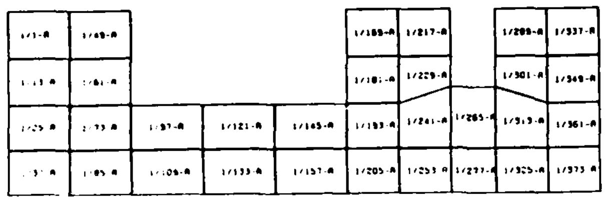
Figure D12. (Sheet 4 of 5)

SHEAR STRESSES FOR LOAD CASE 12 (PSI)

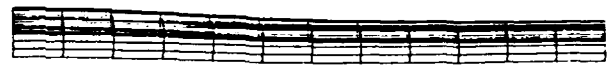
ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
313	-6	52	2	314	-3	-12	-5	315	-12	74	-7	316	-11	36	-4	317	-10	4	-5	318	-9	-8	-4
319	-8	-13	-3	320	-6	-13	-3	321	-4	-11	-2	322	-3	-8	-2	323	-2	-5	-1	324	-1	-2	-1
325	32	48	4	326	94	-3	-1	327	143	77	-2	328	155	45	-3	329	135	21	-3	330	108	9	-3
331	82	2	-2	332	60	-1	-2	333	43	-2	-1	334	28	-2	-1	335	16	-1	-1	336	5	0	-1
337	-33	91	25	338	-31	-6	30	339	-102	156	42	340	-86	90	-9	341	-74	69	4	342	-58	44	1
343	-44	29	1	344	-32	18	1	345	-23	12	1	346	-15	7	1	347	-8	4	1	348	-3	1	1
349	-19	94	14	350	0	58	10	351	-34	228	14	352	-21	183	-3	353	-18	130	0	354	-14	92	0
355	-10	63	0	356	-8	43	0	357	-5	28	0	358	-3	18	0	359	-2	10	0	360	-1	3	0
361	-3	86	9	362	13	73	1	363	8	224	-1	364	14	191	-2	365	12	134	-4	366	10	96	-4
367	8	66	-3	368	6	45	-3	369	4	30	-2	370	3	19	-2	371	2	10	-1	372	0	3	-1
373	17	63	3	374	53	29	-1	375	82	139	-3	376	88	107	-1	377	77	73	-2	378	61	50	-2
379	47	33	-2	380	34	22	-2	381	24	14	-1	382	16	9	-1	383	9	5	-1	384	3	2	-1

	ELEM	VXY	ELEM	VYZ	ELEM	VZX
MIN.	268	-145	185	-127	145	-33
MAX.	280	176	351	228	219	44

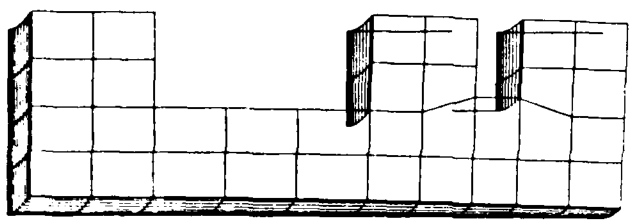
Figure D12. (Sheet 5 of 5)



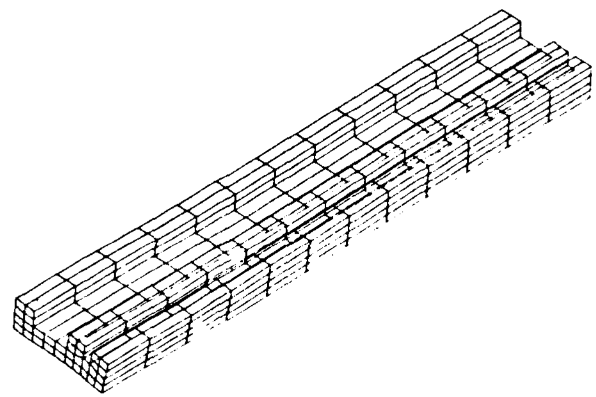
FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
UNDEFORMED GRID



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
LOAD CASE NO-13



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
LOAD CASE NO-13



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
LOAD CASE NO-13

Figure D13. Finite element analysis for load case 13 with $K = 175$ lb/in.^{3} (Sheet 1 of 5)

NORMAL STRESSES FOR LOAD CASE 13 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
1	0	-14	0	2	0	-13	0	3	0	-12	0	4	0	-9	0	5	0	-6	0	6	0	-2	0
7	0	2	0	8	0	6	0	9	0	9	0	10	0	11	0	11	0	13	0	12	0	13	0
13	0	-22	-1	14	0	-20	-1	15	0	-15	-1	16	0	-9	-1	17	0	-3	-1	18	0	2	-1
19	0	6	-1	20	0	9	-1	21	0	11	-1	22	0	12	-1	23	0	13	-1	24	0	14	-1
25	0	-29	-2	26	0	-26	-2	27	0	-18	-2	28	0	-9	-2	29	0	0	-1	30	0	5	-1
31	0	9	-1	32	0	11	-2	33	0	12	-2	34	0	13	-2	35	0	14	-2	36	0	14	-2
37	0	-36	-1	38	0	-31	-1	39	0	-21	-1	40	0	-8	-1	41	0	2	-1	42	0	9	-2
43	0	12	-2	44	0	13	-2	45	0	14	-2	46	0	14	-2	47	0	14	-2	48	0	14	-2
49	0	-7	0	50	0	-7	0	51	0	-7	0	52	0	-7	0	53	0	-6	0	54	0	-3	0
55	0	0	0	56	0	3	0	57	0	6	0	58	0	8	0	59	0	9	0	60	0	10	0
61	2	-14	-1	62	1	-13	-1	63	1	-11	-1	64	1	-7	-1	65	1	-3	-1	66	0	0	-1
67	0	3	-1	68	0	6	-1	69	0	8	-1	70	0	9	-1	71	0	10	-1	72	0	10	-1
73	2	-22	-1	74	2	-19	-2	75	2	-14	-1	76	1	-7	-1	77	1	0	-1	78	1	4	-1
79	0	7	-1	80	0	9	-2	81	0	10	-2	82	1	10	-2	83	1	11	-2	84	1	11	-2
85	-2	-30	-1	86	-1	-26	-1	87	-1	-17	-1	88	-1	-7	-1	89	-1	2	-1	90	-1	7	-2
91	-1	10	-2	92	-1	11	-2	93	-1	11	-2	94	-1	11	-2	95	-1	11	-2	96	-1	11	-2
97	10	-13	0	98	9	-12	0	99	7	-8	0	100	5	-4	0	101	3	0	0	102	2	3	-1
103	2	5	-1	104	2	6	-1	105	2	7	-1	106	2	8	-1	107	2	8	-1	108	2	8	-1
109	-5	-23	-1	110	-4	-21	-1	111	-4	-14	-1	112	-4	-5	-1	113	-3	2	-1	114	-2	6	-1
115	-2	7	-2	116	-2	8	-2	117	-2	8	-2	118	-2	7	-2	119	-2	7	-2	120	-2	7	-2
121	17	-6	-1	122	16	-5	-1	123	13	-3	-1	124	7	-1	0	125	4	1	0	126	3	3	0
127	3	4	0	128	3	4	0	129	3	4	0	130	3	4	0	131	3	4	0	132	3	4	0
133	-10	-17	-1	134	-9	-16	-1	135	-7	-11	-1	136	-6	-2	-1	137	-4	3	-1	138	-4	4	-1
139	-3	5	-2	140	-3	5	-2	141	-4	4	-2	142	-4	4	-2	143	-4	3	-2	144	-4	3	-2
145	25	4	5	146	24	4	5	147	20	3	5	148	9	2	0	149	4	2	0	150	4	2	0
151	3	2	0	152	3	1	0	153	3	1	0	154	3	1	0	155	3	1	0	156	3	1	-1
157	-15	-11	1	158	-14	-11	0	159	-11	-8	0	160	-7	1	-1	161	-5	3	-1	162	-4	3	-1
163	-4	3	-2	164	-4	2	-2	165	-4	1	-2	166	-3	0	-2	167	-3	0	-2	168	-3	-1	-2
169	3	16	5	170	2	14	5	171	4	9	6	172	-1	0	-1	173	0	-4	0	174	0	-6	0
175	0	-6	0	176	0	-5	0	177	0	-4	0	178	0	-4	0	179	0	-3	0	180	0	-3	0
181	12	13	10	182	12	12	10	183	9	8	10	184	4	3	-1	185	2	-1	0	186	2	-2	-1
187	1	-3	-1	188	1	-3	-1	189	1	-3	-1	190	1	-3	-1	191	1	-3	-1	192	1	-3	-1
193	12	6	1	194	12	5	1	195	9	4	2	196	4	3	-2	197	1	2	-1	198	1	0	-1
199	1	-1	-2	200	1	-2	-2	201	1	-2	-2	202	1	-3	-2	203	1	-3	-2	204	1	-3	-2
205	-15	-5	-1	206	-14	-6	-1	207	-12	-4	-1	208	-7	3	-2	209	-5	4	-2	210	-3	2	-2
211	-3	1	-2	212	-3	-1	-2	213	-3	-2	-2	214	-3	-3	-2	215	-2	-4	-2	216	-2	-4	-2
217	0	21	1	218	0	19	1	219	1	14	2	220	0	-1	-2	221	0	-5	0	222	0	-7	-1
223	0	-8	0	224	0	-8	0	225	0	-7	0	226	0	-6	0	227	0	-6	0	228	0	-6	0
229	8	16	-5	230	8	14	-5	231	5	10	-5	232	4	2	-2	233	2	-2	-1	234	1	-4	-1
235	1	-5	-1	236	1	-6	-1	237	1	-6	-1	238	1	-6	-1	239	1	-6	-1	240	1	-6	-1
241	8	10	-5	242	8	8	-5	243	6	6	-5	244	2	4	-2	245	0	1	-2	246	0	-1	-2
247	0	-3	-2	248	0	-4	-2	249	0	-5	-2	250	0	-5	-2	251	0	-6	-2	252	0	-6	-2
253	-11	1	-2	254	-10	0	-2	255	-8	0	-2	256	-5	4	-2	257	-4	4	-2	258	-3	1	-2
259	-2	-1	-2	260	-2	-3	-2	261	-2	-4	-2	262	-2	-5	-2	263	-2	-6	-2	264	-2	-6	-2
265	13	18	3	266	12	16	3	267	10	12	3	268	4	6	0	269	1	1	-1	270	1	-2	-1
271	1	-4	-1	272	1	-6	-1	273	1	-7	-1	274	1	-8	-1	275	1	-8	-1	276	1	-8	-1
277	-12	6	-1	278	-11	5	-1	279	-9	4	-1	280	-5	6	-2	281	-3	3	-2	282	-2	1	-2
283	-2	-2	-2	284	-2	-5	-2	285	-2	-6	-2	286	-1	-8	-2	287	-1	-9	-2	288	-1	-9	-2
289	2	30	7	290	2	26	6	291	2	17	8	292	0	6	-2	293	0	-3	0	294	0	-8	0
295	0	-10	0	296	0	-11	0	297	0	-11	0	298	0	-11	0	299	0	-10	0	300	0	-10	0
301	9	27	8	302	9	24	8	303	8	17	9	304	2	7	-2	305	1	-1	-1	306	1	-5	-1
307	0	-8	-1	308	0	-9	-1	309	0	-10	-1	310	0	-10	-1	311	0	-11	-1	312	0	-11	-1

Figure D13. (Sheet 2 of 5)

NORMAL STRESSES FOR LOAD CASE 13 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
313	3	20	3	314	3	18	3	315	2	13	4	316	1	7	-2	317	0	1	-1	318	0	-3	-1
319	0	-6	-1	320	0	-8	-1	321	0	-9	-1	322	0	-10	-1	323	0	-11	-1	324	0	-11	-1
325	-8	12	-1	326	-7	11	-1	327	-7	8	-1	328	-3	7	-2	329	-2	3	-2	330	-2	0	-2
331	-1	-4	-2	332	-1	-7	-2	333	-1	-9	-2	334	-1	-10	-2	335	-1	-11	-2	336	-1	-11	-2
337	-1	34	-1	338	-1	30	-1	339	-2	22	0	340	1	5	-1	341	0	-4	0	342	0	-9	0
343	0	-12	0	344	0	-13	0	345	0	-14	0	346	0	-13	0	347	0	-13	0	348	0	-13	0
349	2	29	-6	350	2	26	-6	351	2	19	-5	352	0	6	-2	353	0	-2	-1	354	0	-7	-1
355	0	-10	-1	356	0	-12	-1	357	0	-13	-1	358	0	-13	-1	359	0	-13	-1	360	0	-13	-1
361	0	24	-5	362	0	21	-5	363	0	16	-5	364	0	7	-2	365	0	0	-2	366	0	-4	-2
367	0	-8	-2	368	0	-10	-2	369	0	-12	-2	370	0	-13	-2	371	0	-14	-2	372	0	-14	-2
373	-3	19	-2	374	-3	17	-3	375	-3	13	-2	376	-2	8	-2	377	-1	2	-2	378	-1	-2	-2
379	-1	-6	-2	380	-1	-9	-2	381	0	-11	-2	382	0	-13	-2	383	0	-14	-2	384	0	-14	-2

	ELEM	SX	ELEM	SY	ELEM	SZ	
MIN.	157	-15	37	-36	349	-6	(COMPRESSIVE)
MAX.	145	25	337	34	183	10	(TENSILE)

Figure D13. (Sheet 3 of 5)

SHEAR STRESSES FOR LOAD CASE 13 (PSI)

ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
1	0	0	0	2	-1	-1	0	3	-1	-1	0	4	-1	-1	0	5	-1	-1	0	6	-1	0	0
7	-1	0	0	8	-1	0	0	9	-1	0	0	10	0	0	0	11	0	0	0	12	0	0	0
13	0	0	0	14	-1	-1	0	15	-1	-1	0	16	-1	-1	0	17	-1	-1	0	18	-1	-1	0
19	-1	0	0	20	0	0	0	21	0	0	0	22	0	0	0	23	0	0	0	24	0	0	0
25	0	0	1	26	-1	-1	1	27	-1	-1	1	28	-1	-1	1	29	-1	-1	0	30	-1	-1	0
31	0	0	0	32	0	0	0	33	0	0	0	34	0	0	0	35	0	0	0	36	0	0	0
37	0	0	1	38	-1	-1	1	39	-2	-1	1	40	-2	-1	1	41	-1	-1	1	42	0	0	0
43	0	0	0	44	0	0	0	45	0	0	0	46	0	0	0	47	0	0	0	48	0	0	0
49	0	0	0	50	-1	0	0	51	-1	-1	0	52	-1	-1	0	53	-1	0	0	54	-1	1	0
55	-1	1	0	56	-1	1	0	57	-1	1	0	58	0	1	0	59	0	0	0	60	0	0	0
61	0	0	0	62	-1	0	0	63	-2	0	0	64	-2	1	0	65	-2	2	0	66	-2	3	0
67	-1	3	0	68	-1	2	0	69	-1	2	0	70	0	1	0	71	0	1	0	72	0	0	0
73	-1	0	2	74	-2	0	2	75	-4	0	2	76	-4	0	1	77	-3	1	1	78	-2	1	1
79	-2	1	1	80	-1	1	1	81	-1	1	1	82	0	1	1	83	0	0	1	84	0	0	1
85	-1	0	3	86	-2	0	2	87	-5	-1	2	88	-4	-1	2	89	-3	0	1	90	-1	0	1
91	0	0	1	92	0	0	1	93	0	0	1	94	0	0	1	95	0	0	1	96	0	0	1
97	-2	0	3	98	-4	0	3	99	-7	-1	2	100	-8	0	1	101	-7	0	1	102	-5	1	1
103	-4	1	1	104	-3	1	1	105	-2	1	1	106	-1	0	1	107	-1	0	1	108	0	0	1
109	-1	0	3	110	-3	0	3	111	-7	-1	3	112	-7	-1	2	113	-5	0	1	114	-3	0	1
115	-2	0	1	116	-1	0	1	117	-1	0	1	118	0	0	1	119	0	0	1	120	0	0	1
121	-2	-1	3	122	-5	0	3	123	-9	-2	2	124	-9	-1	1	125	-8	0	0	126	-6	0	0
127	-4	0	0	128	-3	0	0	129	-2	0	0	130	-1	0	0	131	-1	0	0	132	0	0	0
133	-2	-1	4	134	-4	0	4	135	-9	-2	3	136	-9	-1	1	137	-6	0	1	138	-4	0	1
139	-2	0	1	140	-1	0	1	141	-1	0	0	142	0	0	0	143	0	0	0	144	0	0	0
145	-3	-2	6	146	-6	1	6	147	-12	-6	5	148	-12	-4	1	149	-9	-2	0	150	-6	-1	0
151	-4	-1	0	152	-3	0	0	153	-2	0	0	154	-1	0	0	155	-1	0	0	156	0	0	0
157	-2	-2	2	158	-3	1	2	159	-8	-4	2	160	-8	-2	0	161	-5	-1	0	162	-3	0	0
163	-2	0	0	164	-1	0	0	165	-1	0	0	166	0	0	0	167	0	0	-1	168	0	0	-1
169	-8	-6	4	170	6	4	4	171	-9	-8	6	172	-2	-3	-1	173	-2	-2	0	174	-1	-1	0
175	-1	-1	0	176	-1	0	0	177	-1	0	0	178	0	0	0	179	0	0	0	180	0	0	0
181	-4	-5	9	182	0	0	9	183	-7	-12	8	184	-4	-9	2	185	-3	-5	1	186	-2	-3	1
187	-2	-2	1	188	-1	-1	1	189	-1	-1	1	190	0	-1	0	191	0	0	0	192	0	0	0
193	-2	-3	-2	194	-3	0	-2	195	-7	-7	-2	196	-7	-5	-1	197	-5	-2	-1	198	-3	-1	-1
199	-2	-1	-1	200	-1	0	-1	201	-1	0	-1	202	0	0	-1	203	0	0	-1	204	0	0	-1
205	-1	-2	-3	206	-2	1	-3	207	-5	-6	-2	208	-4	-2	-1	209	-3	-1	-1	210	-2	0	-1
211	-1	0	-1	212	0	0	-1	213	0	0	-1	214	0	0	-1	215	0	0	-1	216	0	0	-1
217	-8	-1	4	218	6	2	4	219	-9	-1	5	220	-2	1	0	221	-2	1	0	222	-2	1	0
223	-1	1	0	224	-1	1	0	225	-1	1	0	226	0	0	0	227	0	0	0	228	0	0	0
229	-4	-1	1	230	0	3	1	231	-7	1	2	232	-5	3	-1	233	-4	3	0	234	-3	2	0
235	-2	2	0	236	-1	2	0	237	-1	1	0	238	-1	1	0	239	0	1	0	240	0	0	0
241	-2	-2	0	242	-2	1	0	243	-6	-3	0	244	-6	-1	0	245	-4	0	0	246	-3	0	0
247	-2	1	0	248	-1	1	0	249	-1	0	0	250	0	0	0	251	0	0	0	252	0	0	0
253	-1	-2	-1	254	-1	1	0	255	-3	-4	0	256	-2	-2	0	257	-2	0	0	258	-1	0	0
259	0	0	0	260	0	0	0	261	0	0	0	262	0	0	0	263	0	0	0	264	0	0	0
265	-3	-2	3	266	-4	1	3	267	-11	-4	4	268	-11	-2	-1	269	-7	-1	0	270	-5	0	0
271	-3	0	0	272	-2	0	0	273	-2	0	0	274	-1	0	0	275	-1	0	0	276	0	0	0
277	-1	-2	0	278	0	1	0	279	-1	-3	0	280	0	-1	0	281	0	0	0	282	0	0	0
283	0	0	0	284	0	0	0	285	0	0	0	286	0	0	0	287	0	0	0	288	0	0	0
289	-9	-5	5	290	8	3	5	291	-11	-8	7	292	-2	-3	-1	293	-2	-2	0	294	-1	-1	0
295	-1	-1	0	296	-1	0	0	297	-1	0	0	298	0	0	0	299	0	0	0	300	0	0	0
301	-4	-4	5	302	1	0	5	303	-7	-10	5	304	-4	-7	0	305	-3	-4	0	306	-2	-3	0
307	-1	-2	0	308	-1	-1	0	309	-1	-1	0	310	0	0	0	311	0	0	0	312	0	0	0

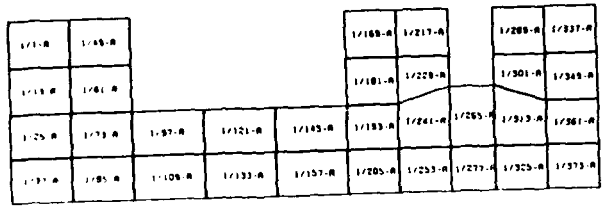
Figure D13. (Sheet 4 of 5)

SHEAR STRESSES FOR LOAD CASE 13 (PSI)

ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
313	-2	-2	-3	314	-1	0	-3	315	-5	-5	-2	316	-4	-3	-1	317	-2	-1	-1	318	-2	-1	0
319	-1	0	0	320	-1	0	0	321	0	0	0	322	0	0	0	323	0	0	0	324	0	0	0
325	0	-1	-2	326	0	1	-2	327	1	-2	-2	328	1	-1	-1	329	1	0	0	330	0	0	0
331	0	0	0	332	0	0	0	333	0	0	0	334	0	0	0	335	0	0	0	336	0	0	0
337	-9	1	3	338	7	-1	3	339	-11	2	4	340	-2	1	0	341	-2	0	0	342	-1	1	0
343	-1	1	0	344	-1	1	0	345	-1	1	0	346	0	0	0	347	0	0	0	348	0	0	0
349	-3	1	1	350	2	0	1	351	-4	3	1	352	-1	3	0	353	-1	1	0	354	-1	1	0
355	0	1	0	356	0	1	0	357	0	1	0	358	0	1	0	359	0	0	0	360	0	0	0
361	-1	0	-3	362	0	1	-3	363	-2	2	-2	364	-1	3	-1	365	0	2	0	366	0	1	0
367	0	1	0	368	0	1	0	369	0	1	0	370	0	1	0	371	0	0	0	372	0	0	0
373	0	0	-2	374	0	0	-2	375	1	1	-2	376	1	1	0	377	1	1	0	378	0	1	0
379	0	1	0	380	0	1	0	381	0	1	0	382	0	0	0	383	0	0	0	384	0	0	0

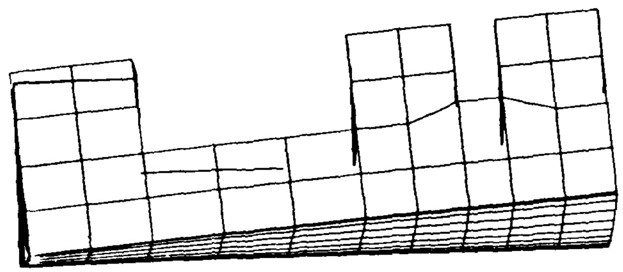
	ELEM	VXY	ELEM	VYZ	ELEM	VZX
MIN.	148	-12	183	-12	313	-3
MAX.	290	8	170	4	181	9

Figure D13. (Sheet 5 of 5)

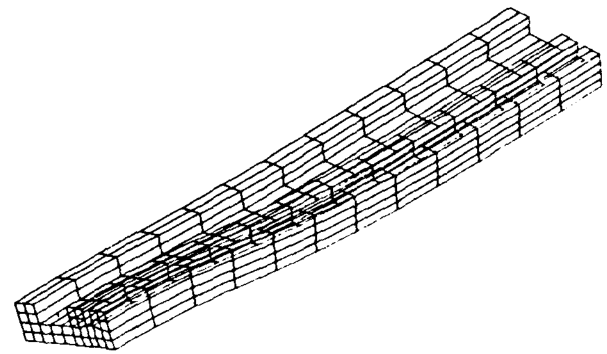


FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE, AUG 82
UNDEFORMED GRID
SNORT STRUCTURE(758 NODES,384 ELEMENTS)

FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE, AUG 82
LOAD CASE NO-14



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE, AUG 82
LOAD CASE NO-14
SNORT STRUCTURE(758 NODES,384 ELEMENTS)



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE, AUG 82
LOAD CASE NO-14

Figure D14. Finite-element analysis for load case 14 with $K = 175$ lb/in.^{3} (Sheet 1 of 5)

NORMAL STRESSES FOR LOAD CASE 14 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
1	0	12	0	2	0	7	0	3	0	-2	0	4	0	-12	0	5	0	-18	-1	6	0	-17	-1
7	0	-11	-1	8	0	-3	-1	9	0	4	-1	10	0	10	0	11	0	14	0	12	0	15	0
13	-1	-7	1	14	-1	-8	1	15	-1	-9	0	16	0	-10	-1	17	0	-9	-2	18	0	-6	-2
19	0	-1	-2	20	0	3	-2	21	0	7	-2	22	0	10	-2	23	0	12	-2	24	0	13	-2
25	0	-26	1	26	0	-23	1	27	0	-16	0	28	0	-7	-2	29	0	0	-2	30	0	5	-3
31	0	8	-3	32	0	10	-3	33	0	11	-3	34	0	11	-3	35	0	11	-2	36	0	11	-2
37	2	-44	-1	38	2	-37	-1	39	1	-23	-1	40	0	-5	-2	41	0	9	-2	42	0	16	-3
43	-1	17	-3	44	-1	16	-3	45	-1	14	-3	46	-1	12	-3	47	-1	10	-3	48	-1	9	-3
49	0	10	-1	50	0	6	-1	51	0	-2	-1	52	0	-10	0	53	0	-15	0	54	0	-15	0
55	0	-10	0	56	0	-3	0	57	0	3	0	58	0	9	0	59	0	12	0	60	0	14	0
61	-3	-9	-4	62	-3	-9	-4	63	-2	-9	-3	64	0	-8	-1	65	2	-6	1	66	2	-4	0
67	2	0	0	68	1	3	0	69	1	7	0	70	1	9	-1	71	1	11	-1	72	1	12	-1
73	-2	-25	-2	74	-2	-22	-2	75	-1	-15	-2	76	1	-5	-1	77	2	2	0	78	2	6	-1
79	1	9	-1	80	1	9	-1	81	1	10	-2	82	1	10	-2	83	1	10	-2	84	1	9	-2
85	7	-41	0	86	6	-34	-1	87	4	-20	-1	88	0	-3	-1	89	-2	10	-1	90	-2	16	-2
91	-3	17	-2	92	-3	15	-2	93	-3	12	-2	94	-2	10	-2	95	-2	8	-2	96	-2	7	-2
97	-3	-20	-2	98	-3	-17	-2	99	-1	-11	-1	100	3	-3	0	101	4	3	1	102	4	6	0
103	4	8	0	104	4	8	0	105	4	8	0	106	4	8	0	107	4	8	0	108	4	7	0
109	6	-40	0	110	6	-34	-1	111	4	-20	-1	112	-1	-1	0	113	-2	12	-1	114	-3	17	-1
115	-4	17	-2	116	-4	14	-2	117	-4	11	-2	118	-4	8	-2	119	-4	5	-2	120	-4	4	-2
121	8	-11	-1	122	8	-9	-1	123	6	-6	-1	124	4	-1	0	125	3	2	0	126	2	5	0
127	3	6	0	128	3	6	0	129	4	5	0	130	4	5	0	131	4	4	0	132	4	4	0
133	-2	-40	2	134	-2	-34	1	135	-1	-20	0	136	-2	3	0	137	-1	15	-1	138	-1	18	-1
139	-2	17	-2	140	-3	13	-2	141	-4	9	-2	142	-4	6	-2	143	-4	3	-2	144	-4	2	-2
145	25	0	10	146	24	1	10	147	19	2	9	148	5	2	1	149	0	3	-1	150	0	3	-1
151	0	3	-1	152	1	3	-1	153	2	2	-1	154	2	1	-1	155	2	1	-1	156	3	0	-1
157	-16	-41	5	158	-15	-36	4	159	-11	-22	3	160	-3	7	1	161	0	18	0	162	1	20	-1
163	0	17	-2	164	-1	13	-2	165	-2	8	-2	166	-2	4	-2	167	-3	1	-2	168	-3	-1	-2
169	5	78	16	170	5	68	15	171	7	43	20	172	-3	-9	-5	173	0	-31	0	174	0	-36	-1
175	0	-32	-1	176	0	-25	-1	177	0	-18	-1	178	0	-12	-1	179	0	-8	0	180	0	-6	0
181	15	42	24	182	15	38	23	183	10	23	24	184	3	0	-3	185	-1	-14	-1	186	-1	-16	-2
187	-1	-15	-2	188	0	-13	-2	189	0	-10	-2	190	0	-7	-2	191	0	-5	-2	192	0	-4	-2
193	13	1	10	194	13	2	9	195	10	2	10	196	2	5	-1	197	-1	4	0	198	-1	3	-1
199	0	2	-2	200	0	0	-2	201	0	-1	-2	202	0	-2	-2	203	0	-3	-2	204	1	-3	-2
205	-22	-42	5	206	-21	-37	4	207	-16	-23	3	208	-4	10	1	209	1	21	0	210	2	22	-1
211	1	18	-1	212	0	12	-2	213	0	7	-2	214	-1	2	-2	215	-1	-1	-2	216	-1	-2	-2
217	3	76	17	218	3	67	15	219	4	46	24	220	-2	-10	-7	221	0	-29	1	222	0	-34	-1
223	0	-31	0	224	0	-25	0	225	0	-19	0	226	0	-13	0	227	0	-9	0	228	0	-7	0
229	12	42	7	230	12	37	7	231	8	24	11	232	3	-1	-3	233	-1	-13	1	234	-1	-17	0
235	-1	-16	0	236	0	-14	0	237	0	-11	-1	238	0	-9	-1	239	0	-7	-1	240	0	-6	-1
241	9	4	2	242	9	4	2	243	7	3	3	244	2	6	-1	245	-1	4	1	246	-1	2	0
247	-1	0	0	248	0	-1	-1	249	0	-3	-1	250	0	-4	-1	251	0	-5	-1	252	0	-5	-1
253	-19	-42	4	254	-18	-37	4	255	-14	-23	3	256	-3	13	2	257	0	24	0	258	1	24	0
259	1	19	-1	260	1	12	-2	261	0	6	-2	262	0	1	-2	263	0	-2	-2	264	-1	-4	-2
265	17	15	14	266	19	13	13	267	14	10	13	268	3	7	1	269	-1	3	0	270	-2	0	-1
271	-1	-2	-1	272	-1	-4	-1	273	-1	-5	-1	274	0	-6	-1	275	0	-7	-1	276	0	-7	-1
277	-21	-42	6	278	-20	-38	6	279	-16	-23	4	280	-3	14	2	281	0	26	1	282	1	25	0
283	1	19	-1	284	1	12	-2	285	0	5	-2	286	0	0	-2	287	0	-3	-2	288	0	-5	-2
289	4	131	24	290	4	88	22	291	6	57	31	292	-2	-5	-7	293	0	-33	1	294	0	-42	-1
295	0	-40	-1	296	0	-34	-1	297	0	-27	-1	298	0	-21	-1	299	0	-16	0	300	0	-14	0
301	13	60	26	302	13	53	24	303	10	34	28	304	2	3	-4	305	-2	-15	0	306	-1	-20	-1
307	-1	-21	-2	308	-1	-19	-2	309	-1	-17	-2	310	0	-14	-1	311	0	-13	-1	312	0	-12	-1

Figure D14. (Sheet 2 of 5)

NORMAL STRESSES FOR LOAD CASE 14 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
313	3	10	14	314	3	10	13	315	2	8	14	316	1	9	0	317	-1	6	0	318	0	2	-1
319	0	-1	-1	320	0	-4	-1	321	0	-6	-2	322	0	-8	-2	323	0	-9	-2	324	0	-9	-2
325	-14	-41	7	326	-13	-36	6	327	-11	-21	5	328	-1	16	3	329	0	27	1	330	1	26	0
331	1	29	-1	332	1	12	-2	333	0	5	-2	334	0	-1	-2	335	0	-5	-2	336	0	-7	-2
337	1	96	9	338	1	84	8	339	2	56	13	340	-1	-6	-5	341	0	-31	1	342	0	-40	0
343	0	-39	0	344	0	-34	0	345	0	-27	0	346	0	-22	0	347	0	-17	0	348	0	-15	0
349	2	49	1	350	2	43	1	351	1	29	4	352	0	3	-2	353	-1	-11	1	354	0	-17	0
355	0	-19	0	356	0	-18	0	357	0	-17	-1	358	0	-15	-1	359	0	-14	-1	360	0	-13	-1
361	0	6	2	362	1	5	2	363	0	5	3	364	0	10	1	365	0	8	2	366	0	5	1
367	0	1	0	368	0	-3	-1	369	0	-7	-1	370	0	-9	-1	371	0	-10	-1	372	0	-11	-1
373	-5	-38	5	374	-5	-33	5	375	-5	-18	4	376	0	17	3	377	0	28	2	378	0	26	0
379	0	19	-1	380	0	11	-1	381	0	3	-2	382	0	-3	-2	383	0	-7	-2	384	0	-8	-2

	ELEM	SX	ELEM	SY	ELEM	SZ	
MIN.	205	-22	37	-44	292	-7	(COMPRESSIVE)
MAX.	145	25	289	101	291	31	(TENSILE)

Figure D14. (Sheet 3 of 5)

SHEAR STRESSES FOR LOAD CASE 14 (PSI)

ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
1	3	2	1	2	9	4	1	3	14	7	0	4	16	8	0	5	14	8	0	6	11	8	0
7	8	7	0	8	6	6	0	9	4	4	0	10	3	3	0	11	2	2	0	12	1	1	0
13	0	4	0	14	2	10	0	15	3	15	0	16	3	18	0	17	2	17	0	18	2	16	0
19	1	13	0	20	1	11	0	21	1	8	0	22	0	5	0	23	0	3	0	24	0	1	0
25	-1	4	-1	26	-2	10	-1	27	-4	15	-1	28	-4	17	0	29	-4	17	1	30	-3	15	1
31	-3	13	1	32	-2	10	1	33	-1	8	1	34	-1	5	1	35	-1	3	1	36	0	1	1
37	-4	2	-1	38	-10	4	-1	39	-16	7	-1	40	-17	8	0	41	-15	8	1	42	-12	8	1
43	-10	7	1	44	-7	6	1	45	-5	4	1	46	-3	3	1	47	-2	2	1	48	-1	1	0
49	3	-3	1	50	9	-8	1	51	14	-13	0	52	16	-13	0	53	14	-11	0	54	11	-7	0
55	8	-5	0	56	6	-3	0	57	4	-2	0	58	3	-1	0	59	2	-1	0	60	1	0	0
61	1	-5	2	62	5	-15	2	63	7	-23	1	64	8	-24	0	65	6	-20	-1	66	5	-14	-1
67	3	-9	-1	68	2	-6	-1	69	2	-4	-1	70	1	-2	-1	71	1	-1	-1	72	0	0	0
73	-1	-2	-1	74	-1	-6	-1	75	-2	-8	0	76	-2	-9	1	77	-2	-6	1	78	-2	-3	1
79	-2	-1	1	80	-1	0	1	81	-1	0	1	82	-1	0	1	83	0	0	1	84	0	0	1
85	-6	-1	-1	86	-16	-2	-1	87	-26	-3	0	88	-28	-3	1	89	-25	-2	1	90	-20	0	1
91	-15	1	1	92	-12	1	1	93	-8	1	1	94	-5	1	1	95	-3	0	1	96	-1	0	1
97	3	-2	5	98	9	-5	5	99	13	-9	3	100	14	-9	1	101	12	-6	-1	102	10	-4	-1
103	7	-2	-1	104	5	-1	0	105	4	-1	0	106	2	0	0	107	1	0	0	108	0	0	0
109	-6	-1	4	110	-14	-3	4	111	-25	-5	3	112	-26	-5	1	113	-22	-3	0	114	-17	-1	0
115	-13	0	0	116	-10	0	0	117	-7	0	0	118	-4	0	1	119	-3	0	1	120	-1	0	1
121	2	-2	6	122	5	0	6	123	8	-5	4	124	9	-4	1	125	8	-1	-1	126	7	0	-1
127	6	1	-1	128	5	1	-1	129	3	1	-1	130	2	1	-1	131	1	0	0	132	0	0	0
133	-6	-2	8	134	-13	0	8	135	-26	-6	6	136	-27	-4	1	137	-21	-1	-1	138	-16	0	-1
139	-12	1	-1	140	-8	1	-1	141	-6	1	-1	142	-4	1	-1	143	-2	0	-1	144	-1	0	0
145	1	-5	14	146	5	6	13	147	5	-7	11	148	7	-1	1	149	9	3	-1	150	9	5	-2
151	8	5	-2	152	7	4	-2	153	5	3	-2	154	4	2	-1	155	2	1	-1	156	1	0	-1
157	-7	-5	8	158	-15	3	7	159	-30	-9	6	160	-31	-4	0	161	-24	0	-1	162	-18	2	-1
163	-13	2	-1	164	-9	2	-1	165	-6	2	-1	166	-4	1	-1	167	-2	1	-1	168	-1	0	-1
169	-3	-14	9	170	13	19	8	171	7	-11	11	172	14	6	-3	173	12	7	0	174	9	8	0
175	7	7	0	176	5	6	0	177	4	5	0	178	2	3	0	179	1	2	0	180	0	1	0
181	-2	-8	15	182	6	20	15	183	2	-4	14	184	6	10	0	185	6	17	-1	186	5	17	-1
187	4	15	-1	188	3	12	-1	189	3	9	0	190	2	6	0	191	1	4	0	192	0	1	0
193	-2	-8	2	194	-3	9	2	195	-8	-12	2	196	-7	-3	-1	197	-4	4	0	198	-2	6	-1
199	-1	6	-1	200	0	5	-1	201	0	4	-1	202	0	3	-1	203	0	2	-1	204	0	1	-1
205	-8	-7	0	206	-18	5	0	207	-33	-13	0	208	-34	-5	0	209	-28	0	0	210	-22	1	0
211	-16	2	0	212	-11	2	-1	213	-8	2	-1	214	-5	1	-1	215	-3	1	-1	216	-1	0	-1
217	-3	-18	1	218	13	5	1	219	8	-29	0	220	15	-14	1	221	12	-12	0	222	10	-7	0
223	7	-5	0	224	5	-3	0	225	4	-2	0	226	3	-1	0	227	1	0	0	228	0	0	0
229	0	-16	-1	230	8	-5	-1	231	8	-38	-1	232	11	-29	-1	233	9	-21	-1	234	8	-14	0
235	6	-9	0	236	5	-6	0	237	3	-4	0	238	2	-2	0	239	1	-1	0	240	0	0	0
241	-2	-11	2	242	-1	3	2	243	-5	-22	2	244	-4	-13	0	245	-3	-6	0	246	-2	-2	0
247	-1	0	0	248	0	1	0	249	0	1	0	250	0	1	0	251	0	0	0	252	0	0	0
253	-8	-8	1	254	-19	6	1	255	-32	-14	1	256	-34	-6	0	257	-29	-1	0	258	-23	1	0
259	-17	2	0	260	-12	2	0	261	-8	2	0	262	-5	1	0	263	-3	1	0	264	-1	0	0
265	2	-11	5	266	10	5	5	267	10	-21	5	268	12	-11	-1	269	14	-4	-1	270	13	0	-1
271	10	1	-1	272	8	2	-1	273	6	2	-1	274	4	1	-1	275	2	1	-1	276	1	0	-1
277	-7	-9	1	278	-19	5	1	279	-31	-16	1	280	-33	-7	0	281	-29	-2	0	282	-24	0	0
283	-18	1	0	284	-13	1	0	285	-9	1	0	286	-6	1	0	287	-3	1	0	288	-1	0	0
289	-7	-18	10	290	17	21	9	291	2	-17	12	292	13	4	-2	293	11	6	0	294	9	8	0
295	7	7	0	296	5	6	0	297	4	5	0	298	2	3	0	299	1	2	0	300	0	1	0
301	-2	-12	9	302	9	17	9	303	4	-13	8	304	8	2	0	305	9	11	0	306	7	13	0
307	6	12	0	308	5	10	0	309	3	7	0	310	2	5	0	311	1	3	0	312	0	1	0

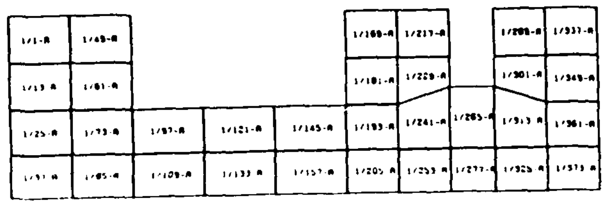
Figure D14. (Sheet 4 of 5)

SHEAR STRESSES FOR LOAD CASE 14 (PSI)

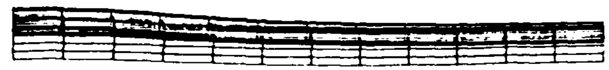
ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
313	-1	-11	-5	314	-1	5	-4	315	-4	-21	-3	316	-3	-11	-1	317	-1	-3	0	318	-1	0	0
319	0	2	0	320	0	3	0	321	0	2	0	322	0	2	0	323	0	1	0	324	0	0	0
325	-6	-9	-4	326	-17	3	-4	327	-25	-17	-3	328	-28	-10	0	329	-25	-4	0	330	-20	-2	1
331	-15	0	0	332	-11	1	0	333	-7	1	0	334	-5	1	0	335	-3	0	0	336	-1	0	0
337	-6	-14	0	338	17	1	0	339	3	-26	-1	340	13	-15	1	341	11	-13	0	342	9	-7	0
343	7	-5	0	344	5	-3	0	345	4	-1	0	346	2	-1	0	347	1	0	0	348	0	0	0
349	-1	-15	-2	350	3	-9	-1	351	1	-38	-2	352	2	-31	0	353	2	-23	0	354	2	-16	0
355	1	-10	0	356	1	-6	0	357	1	-4	0	358	0	-2	0	359	0	-1	0	360	0	0	0
361	-1	-14	-5	362	-2	-11	-5	363	-3	-38	-4	364	-4	-32	0	365	-3	-23	0	366	-3	-16	1
367	-2	-11	0	368	-1	-7	0	369	-1	-4	0	370	-1	-2	0	371	0	-1	0	372	0	0	0
373	-3	-10	-3	374	-9	-3	-3	375	-13	-24	-2	376	-15	-18	0	377	-13	-13	0	378	-11	-8	0
379	-8	5	0	380	-6	-3	0	381	-4	-2	0	382	-3	-1	0	333	-1	-1	0	384	0	0	0

	ELEM	VXY	ELEM	VYZ	ELEM	VZX
MIN.	208	-34	363	-38	361	-5
MAX.	290	17	290	21	181	15

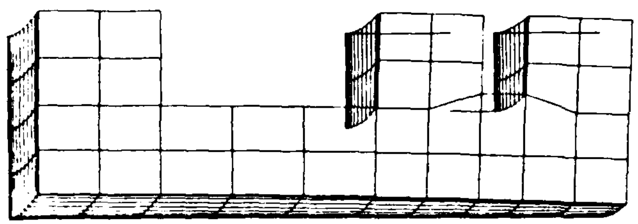
Figure D14. (Sheet 5 of 5)



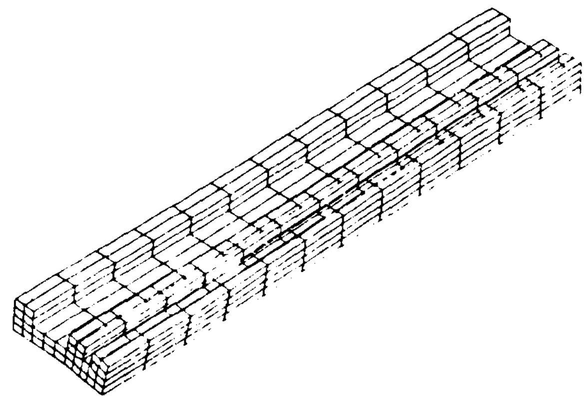
FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
UNDEFORMED GRID
SNORT STRUCTURE(756 NODES,394 ELEMENTS)



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
LOAD CASE NO-15



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
LOAD CASE NO-15
SNORT STRUCTURE(756 NODES,394 ELEMENTS)



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
LOAD CASE NO-15

Figure D15. Finite-element analysis for load case 15 with K = 175 lb/in.^{3} (Sheet 1 of 5)

NORMAL STRESSES FOR LOAD CASE 15 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
1	0	-29	-1	2	0	-27	0	3	0	-23	0	4	0	-19	0	5	0	-12	0	6	0	-4	0
7	0	5	0	8	0	13	0	9	0	19	0	10	0	23	0	11	0	26	0	12	0	27	0
13	1	-44	-2	14	0	-39	-1	15	0	-30	-1	16	0	-18	-1	17	0	-6	-1	18	0	4	-1
19	0	12	-1	20	0	18	-1	21	0	22	-1	22	0	25	-1	23	0	27	-1	24	0	27	-1
25	0	-58	-2	26	0	-51	-2	27	0	-36	-1	28	0	-17	-1	29	0	-1	-1	30	0	11	-1
31	0	18	-1	32	0	23	-1	33	0	25	-2	34	0	27	-2	35	0	28	-2	36	0	28	-2
37	0	-72	0	38	0	-62	-1	39	0	-42	-1	40	0	-16	-1	41	0	5	-1	42	0	18	-1
43	0	24	-2	44	0	27	-2	45	0	28	-2	46	0	29	-2	47	0	29	-2	48	0	28	-2
49	0	-14	0	50	0	-14	0	51	0	-15	0	52	0	-14	0	53	0	-12	0	54	0	-7	0
55	0	0	0	56	0	7	0	57	0	12	0	58	0	16	0	59	0	19	0	60	0	20	0
61	3	-29	-1	62	2	-26	-1	63	2	-21	-1	64	1	-13	-1	65	1	-6	0	66	0	1	-1
67	0	7	-1	68	0	12	-1	69	0	16	-1	70	0	18	-1	71	0	20	-1	72	0	21	-1
73	4	-44	-1	74	3	-38	-2	75	3	-27	-1	76	2	-13	-1	77	1	0	-1	78	1	8	-1
79	0	14	-1	80	0	17	-2	81	0	19	-2	82	0	21	-2	83	0	21	-2	84	0	22	-2
85	-2	-58	0	86	-1	-51	0	87	-1	-34	-1	88	-2	-12	-1	89	-1	5	-1	90	0	15	-1
91	0	20	-2	92	0	22	-2	93	0	22	-2	94	-1	22	-2	95	-1	22	-2	96	-1	22	-2
97	17	-27	0	98	15	-24	0	99	12	-17	0	100	7	-7	0	101	4	1	0	102	2	6	-1
103	2	10	-1	104	2	12	-1	105	2	14	-1	106	2	15	-1	107	2	15	-1	108	2	15	-1
109	-8	-46	0	110	-6	-40	0	111	-5	-27	-1	112	-5	-8	0	113	-3	5	-1	114	-2	12	-1
115	-2	15	-1	116	-2	16	-2	117	-2	16	-2	118	-2	15	-2	119	-2	15	-2	120	-2	15	-2
121	30	-12	-2	122	28	-10	-2	123	22	-7	-2	124	11	-2	0	125	5	2	0	126	4	5	0
127	3	6	0	128	3	8	0	129	3	8	0	130	4	8	0	131	4	8	0	132	4	8	0
133	-16	-34	0	134	-14	-30	0	135	-11	-20	0	136	-9	-3	0	137	-5	6	-1	138	-4	10	-1
139	-3	11	-1	140	-3	10	-2	141	-4	9	-2	142	-4	8	-2	143	-4	7	-2	144	-4	7	-2
145	46	7	11	146	45	7	11	147	36	6	10	148	14	4	2	149	5	3	0	150	4	3	0
151	4	3	0	152	4	2	0	153	4	2	0	154	4	2	0	155	4	1	0	156	4	1	0
157	-27	-22	3	158	-24	-20	3	159	-20	-14	2	160	-12	2	0	161	-7	7	-1	162	-5	8	-1
163	-4	6	-1	164	-4	5	-2	165	-4	3	-2	166	-4	1	-2	167	-4	0	-2	168	-4	-1	-2
169	5	32	10	170	5	28	10	171	8	18	12	172	-2	1	-2	173	0	-9	0	174	0	-12	0
175	0	-12	0	176	0	-10	0	177	0	-9	0	178	0	-7	0	179	0	-6	0	180	0	-5	0
181	23	26	21	182	22	24	20	183	17	16	22	184	8	6	-1	185	2	-2	0	186	2	-5	0
187	2	-6	-1	188	2	-6	-1	189	2	-6	-1	190	1	-6	-1	191	1	-6	-1	192	1	-5	-1
193	22	12	4	194	22	11	4	195	18	8	5	196	6	7	-2	197	1	3	-1	198	1	1	-1
199	1	-1	-1	200	1	-3	-2	201	1	-4	-2	202	1	-5	-2	203	1	-6	-2	204	1	-6	-2
205	-28	-10	0	206	-25	-10	0	207	-21	-7	0	208	-12	6	-1	209	-7	8	-2	210	-5	6	-2
211	-4	3	-2	212	-4	0	-2	213	-3	-3	-2	214	-3	-5	-2	215	-3	-6	-2	216	-3	-7	-2
217	1	42	3	218	1	38	2	219	1	29	5	220	0	-1	-3	221	0	-10	0	222	0	-15	-1
223	0	-16	0	224	0	-15	0	225	0	-14	0	226	0	-13	0	227	0	-12	0	228	0	-11	0
229	16	32	-9	230	15	28	-9	231	10	20	-8	232	7	5	-3	233	2	-4	-2	234	1	-8	-2
235	1	-11	-2	236	1	-12	-2	237	1	-12	-2	238	1	-12	-1	239	1	-11	-1	240	1	-11	-1
241	15	20	-8	242	15	17	-8	243	12	12	-8	244	3	8	-2	245	0	2	-2	246	0	-2	-2
247	0	-5	-2	248	0	-8	-2	249	0	-10	-2	250	0	-11	-2	251	0	-11	-2	252	0	-12	-2
253	-20	2	-2	254	-19	1	-2	255	-15	1	-2	256	-10	10	-1	257	-6	8	-2	258	-4	4	-2
259	-3	[illegible]	-2	260	-3	-4	-2	261	-2	-8	-2	262	-2	-10	-2	263	-2	-12	-2	264	-2	-12	-2
265	25	35	8	266	24	32	7	267	19	23	7	268	7	12	1	269	1	3	0	270	1	-4	-1
271	1	-9	-1	272	1	-12	-1	273	1	-14	-1	274	1	-15	-1	275	1	-16	-1	276	1	-16	-1
277	-23	12	0	278	-21	10	0	279	-18	8	0	280	-9	12	-1	281	-6	7	-2	282	-4	2	-2
283	-3	-4	-2	284	-3	-9	-2	285	-2	-12	-2	286	-2	-15	-2	287	-2	-17	-2	288	-2	-17	-2
289	3	59	14	290	3	51	13	291	4	34	16	292	-1	13	-3	293	0	-5	0	294	0	-16	0
295	0	-20	0	296	0	-22	0	297	0	-22	0	298	0	-21	0	299	0	-21	0	300	0	-20	0
301	18	54	17	302	18	48	17	303	15	34	20	304	4	14	-3	305	1	-2	0	306	1	-11	-1
307	1	-16	-1	308	1	-19	-1	309	1	-20	-1	310	1	-21	-1	311	0	-21	-1	312	0	-21	-1

Figure D15. (Sheet 2 of 5)

NORMAL STRESSES FOR LOAD CASE 15 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
313	5	41	8	314	6	37	8	315	4	27	9	316	1	14	-2	317	-1	2	-1	318	0	-6	-1
319	0	-12	-1	320	0	-16	-1	321	0	-19	-1	322	0	-20	-1	323	0	-21	-2	324	0	-22	-2
325	-15	25	1	326	-14	22	1	327	-13	17	0	328	-6	14	-1	329	-4	6	-2	330	-3	0	-2
331	-2	-7	-2	332	-2	-13	-2	333	-1	-17	-2	334	-1	-20	-2	335	-1	-22	-2	336	-1	-22	-2
337	-3	69	-1	338	-2	60	-1	339	-4	44	1	340	1	9	-2	341	0	-7	0	342	0	-19	-1
343	0	-25	0	344	0	-27	0	345	0	-27	0	346	0	-27	0	347	0	-26	0	348	0	-26	0
349	4	58	-10	350	4	51	-10	351	4	38	-9	352	0	12	-3	353	0	-3	-1	354	0	-13	-1
355	0	-20	-1	356	0	-23	-1	357	0	-25	-1	358	0	-26	-1	359	0	-27	-1	360	0	-27	-1
361	1	47	-8	362	1	43	-8	363	1	32	-7	364	0	14	-2	365	-1	1	-2	366	0	-8	-2
367	0	-15	-2	368	0	-20	-2	369	0	-24	-2	370	0	-26	-2	371	0	-27	-2	372	0	-27	-2
373	-6	37	-3	374	-6	35	-3	375	-5	27	-3	376	-3	16	-2	377	-2	5	-2	378	-2	-3	-2
379	-1	-11	-2	380	-1	-17	-2	381	-1	-22	-2	382	-1	-25	-2	383	0	-27	-2	384	0	-28	-2

	ELEM	SX	ELEM	SY	ELEM	SZ	
MIN.	205	-28	37	-72	349	-10	(COMPRESSIVE)
MAX.	145	46	337	69	183	22	(TENSILE)

Figure D15. (Sheet 3 of 5)

SHEAR STRESSES FOR LOAD CASE 15 (PSI)

ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
1	-1	0	0	2	-1	-1	0	3	-1	-1	0	4	-2	-2	0	5	-2	-1	0	6	-3	-1	0
7	-2	0	0	8	-2	0	0	9	-1	0	0	10	-1	0	0	11	0	0	0	12	0	0	0
13	-1	0	0	14	-1	-1	0	15	-2	-2	0	16	-2	-2	0	17	-2	-2	0	18	-2	-1	0
19	-1	-1	0	20	-1	0	0	21	-1	0	0	22	0	0	0	23	0	0	0	24	0	0	0
25	-1	0	1	26	-1	-1	1	27	-3	-1	1	28	-3	-2	1	29	-2	-2	1	30	-1	-1	0
31	-1	-1	0	32	0	0	0	33	0	0	0	34	0	0	0	35	0	0	0	36	0	0	0
37	-1	0	2	38	-2	-1	1	39	-4	-2	1	40	-4	-2	1	41	-1	-1	1	42	0	-1	1
43	0	-1	0	44	0	0	0	45	0	0	0	46	0	0	0	47	0	0	0	48	0	0	0
49	-1	0	0	50	-1	-1	0	51	-1	-1	0	52	-2	-1	0	53	-2	1	0	54	-3	2	0
55	-2	2	0	56	-2	2	0	57	-1	2	0	58	-1	1	0	59	0	1	0	60	0	0	0
61	-1	1	-1	62	-2	1	0	63	-4	0	0	64	-4	1	0	65	-4	4	0	66	-3	5	0
67	-3	5	0	68	-2	4	0	69	-1	3	0	70	-1	2	0	71	0	1	0	72	0	0	0
73	-2	0	4	74	-4	0	3	75	-7	-1	3	76	-8	0	2	77	-6	1	1	78	-4	2	1
79	-3	3	1	80	-2	2	1	81	-1	2	1	82	-1	1	1	83	0	1	1	84	0	0	1
85	-2	0	5	86	-4	-1	4	87	-9	-2	3	88	-9	-2	3	89	-5	0	2	90	-2	0	1
91	-1	1	1	92	0	1	1	93	0	1	1	94	0	0	1	95	0	0	1	96	0	0	1
97	-3	0	5	98	-9	0	5	99	-14	-2	4	100	-15	-1	2	101	-14	1	1	102	-11	2	1
103	-8	2	1	104	-6	2	1	105	-4	1	1	106	-3	1	1	107	-1	1	1	108	0	0	1
109	-3	0	6	110	-7	-1	6	111	-14	-2	5	112	-14	-2	3	113	-9	0	2	114	-6	1	2
115	-4	1	1	116	-2	1	1	117	-1	1	1	118	-1	0	1	119	0	0	1	120	0	0	1
121	-4	-1	6	122	-10	1	6	123	-17	-4	5	124	-18	-2	2	125	-15	0	1	126	-11	0	1
127	-8	0	1	128	-6	0	1	129	-4	0	1	130	-2	0	0	131	-1	0	0	132	0	0	0
133	-4	-2	8	134	-8	1	8	135	-17	-4	7	136	-17	-3	3	137	-11	-1	1	138	-7	0	1
139	-5	0	1	140	-3	0	1	141	-2	0	1	142	-1	0	1	143	0	0	1	144	0	0	0
145	-5	-5	12	146	-12	1	12	147	-24	-11	11	148	-24	-8	2	149	-18	-3	1	150	-13	-2	1
151	-9	-1	0	152	-6	-1	0	153	-4	0	0	154	-2	0	0	155	-1	0	0	156	0	0	0
157	-4	-4	4	158	-6	2	4	159	-16	-8	4	160	-15	-4	1	161	-10	-1	0	162	-6	-1	0
163	-4	0	0	164	-2	0	0	165	-1	0	0	166	-1	0	0	167	0	0	0	168	0	0	0
169	-16	-11	9	170	11	8	8	171	-18	-16	12	172	-4	-5	-3	173	-4	-4	0	174	-3	-2	0
175	-2	-1	0	176	-2	-1	0	177	-1	0	0	178	-1	0	0	179	0	0	0	180	0	0	0
181	-7	-10	18	182	1	0	18	183	-14	-24	17	184	-9	-17	3	185	-7	-10	2	186	-5	-7	1
187	-3	-4	1	188	-2	-3	1	189	-1	-2	1	190	-1	-1	1	191	0	-1	1	192	0	0	1
193	-4	-6	-4	194	-6	1	-3	195	-14	-15	-3	196	-14	-10	-1	197	-10	-5	-1	198	-7	-3	-1
199	-4	-2	-1	200	-3	-1	-1	201	-2	0	-1	202	-1	0	-1	203	0	0	-1	204	0	0	-1
205	-3	-5	-5	206	-4	3	-5	207	-10	-8	-4	208	-9	-4	-1	209	-6	-1	-1	210	-4	-1	0
211	-2	0	0	212	-1	0	-1	213	0	0	-1	214	0	0	-1	215	0	0	-1	216	0	0	-1
217	-16	-3	9	218	12	4	8	219	-19	-1	10	220	-4	3	-1	221	-5	2	0	222	-3	2	0
223	-2	2	0	224	-2	2	0	225	-1	1	0	226	-1	1	0	227	0	1	0	228	0	0	0
229	-7	-2	2	230	0	6	2	231	-14	2	3	232	-10	6	-1	233	-7	5	-1	234	-5	5	0
235	-4	4	0	236	-3	3	0	237	-2	2	0	238	-1	2	0	239	-1	1	0	240	0	0	0
241	-4	-4	1	242	-4	3	1	243	-13	-6	1	244	-11	-2	0	245	-8	0	0	246	-5	1	0
247	-4	1	0	248	-2	1	0	249	-1	1	0	250	-1	1	0	251	0	0	0	252	0	0	0
253	-2	-4	-1	254	-2	3	-1	255	-6	-7	0	256	-5	-3	0	257	-3	-1	0	258	-2	0	0
259	-1	0	0	260	0	0	0	261	0	0	0	262	0	0	0	263	0	0	0	264	0	0	0
265	-6	-4	7	266	-7	2	7	267	-22	-8	9	268	-21	-4	-2	269	-13	-1	0	270	-10	0	0
271	-7	0	0	272	-5	1	0	273	-3	1	0	274	-2	0	0	275	-1	0	0	276	0	0	0
277	-1	-3	0	278	0	2	0	279	-1	-6	1	280	-1	-2	0	281	0	-1	0	282	0	0	0
283	0	0	0	284	1	1	0	285	1	0	0	286	1	0	0	287	1	0	0	288	0	0	0
289	-19	-11	11	290	15	6	10	291	-22	-16	13	292	-4	-6	-2	293	-4	-5	1	294	-3	-2	0
295	-2	-1	0	296	-2	-1	0	297	-1	0	0	298	-1	0	0	299	0	0	0	300	0	0	0
301	-8	-8	11	302	3	-1	11	303	-14	-21	11	304	-8	-15	1	305	-6	-9	0	306	-4	-5	0
307	-3	-3	0	308	-2	-2	0	309	-1	-1	0	310	-1	-1	0	311	0	0	0	312	0	0	0

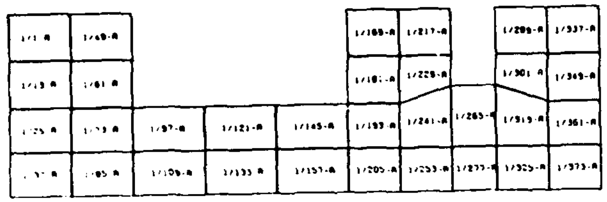
Figure D15. (Sheet 4 of 5)

SHEAR STRESSES FOR LOAD CASE 15 (PSI)

ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
313	-3	-4	-6	314	-2	1	-5	315	-9	-9	-4	316	-8	-6	-2	317	-5	-3	-1	318	-4	-1	0
319	-2	0	-1	320	-1	0	0	321	-1	0	-1	322	0	0	-1	323	0	0	0	324	0	0	0
325	0	-2	-4	326	1	1	-4	327	1	-4	-3	328	1	-1	-1	329	1	0	0	330	0	0	0
331	1	1	0	332	1	1	0	333	1	1	0	334	1	0	0	335	1	0	0	336	0	0	0
337	-18	1	7	338	14	-1	6	339	-21	3	7	340	-4	3	-1	341	-4	1	0	342	-3	1	0
343	-2	1	0	344	-2	1	0	345	-1	1	0	346	-1	1	0	347	0	1	0	348	0	0	0
349	-7	1	1	350	5	0	2	351	-8	6	1	352	-2	5	0	353	-2	3	0	354	-1	3	0
355	-1	3	0	356	-1	3	0	357	0	2	0	358	0	2	0	359	0	1	0	360	0	0	0
361	-2	1	-5	362	1	1	-5	363	-3	5	-5	364	-2	5	-1	365	-1	3	-1	366	-1	3	0
367	0	3	0	368	0	3	0	369	0	2	0	370	0	2	0	371	0	1	0	372	0	0	0
373	1	0	-4	374	1	1	-3	375	2	2	-3	376	2	3	0	377	2	2	0	378	1	2	0
379	1	2	0	380	1	2	0	381	1	1	0	382	1	1	0	383	0	1	0	384	0	0	0

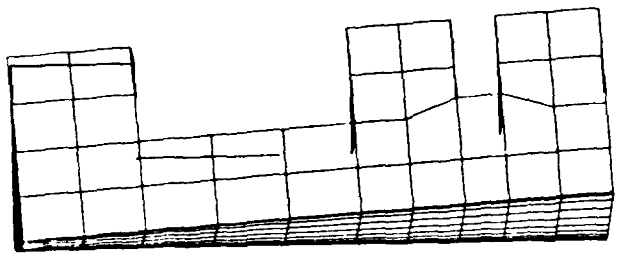
	ELEM	VXY	ELEM	VYZ	ELEM	VZX
MIN.	148	-24	183	-24	313	-6
MAX.	290	15	170	8	181	18

Figure D15. (Sheet 5 of 5)

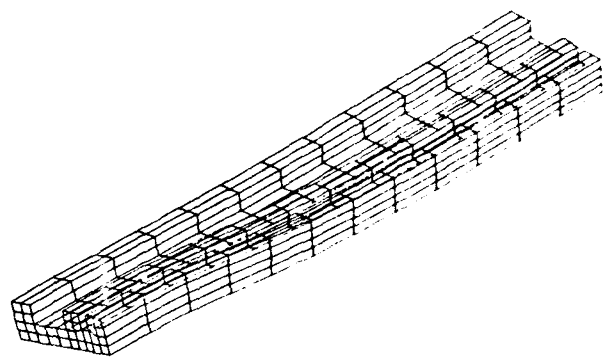


FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
UNDEFORMED GRID
SNORT STRUCTURE(756 NODES,394 ELEMENTS)

FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
LOAD CASE NO-16



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
LOAD CASE NO-16
SNORT STRUCTURE(756 NODES 394 ELEMENTS)



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
LOAD CASE NO 16

Figure D16. Finite-element analysis for load case 16 with $K = 175\ lb/in.^3$ (Sheet 1 of 5)

NORMAL STRESSES FOR LOAD CASE 16 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
1	0	23	1	2	0	14	1	3	0	-4	0	4	0	-24	-1	5	0	-35	-1	6	0	-33	-1
7	0	-21	-1	8	0	-6	-1	9	0	8	-1	10	0	19	-1	11	0	27	-1	12	0	31	-1
13	-2	-15	4	14	-2	-15	3	15	-1	-18	2	16	0	-19	-1	17	1	-17	-3	18	1	-11	-3
19	1	-2	-3	20	1	7	-3	21	1	15	-3	22	1	21	-2	23	1	25	-2	24	1	27	-2
25	-1	-52	4	26	-1	-45	3	27	0	-32	1	28	0	-14	-2	29	1	1	-3	30	0	11	-4
31	0	17	-4	32	0	20	-4	33	0	22	-4	34	0	23	-3	35	0	23	-3	36	0	23	-3
37	4	-88	1	38	4	-73	0	39	3	-45	-1	40	1	-9	-2	41	0	18	-3	42	-1	32	-3
43	-1	35	-4	44	-1	33	-4	45	-1	28	-4	46	-1	24	-3	47	-1	21	-3	48	-1	19	-3
49	1	20	-2	50	1	12	-2	51	0	-4	-1	52	0	-20	0	53	-1	-30	0	54	0	-29	0
55	0	-20	0	56	0	-6	0	57	0	7	0	58	0	17	0	59	0	24	0	60	0	28	0
61	-7	-17	-7	62	-7	-18	-7	63	-4	-18	-4	64	0	-15	0	65	3	-12	2	66	3	-7	2
67	3	0	1	68	2	7	1	69	2	14	0	70	2	19	0	71	2	22	0	72	2	24	0
73	-4	-50	-3	74	-4	-43	-3	75	-2	-29	-2	76	1	-11	0	77	3	4	1	78	3	13	0
79	2	17	-1	80	2	19	-1	81	2	20	-1	82	2	19	-2	83	2	19	-2	84	1	19	-2
85	14	-82	1	86	14	-68	0	87	10	-40	0	88	1	-5	0	89	-3	21	-1	90	-4	33	-2
91	-4	34	-2	92	-4	31	-3	93	-4	25	-3	94	-4	20	-3	95	-4	16	-3	96	-4	14	-3
97	-8	-41	-4	98	-8	-35	-4	99	-5	-23	-2	100	3	-7	0	101	6	5	2	102	6	12	1
103	6	15	1	104	6	16	0	105	6	16	0	106	5	16	0	107	5	15	0	108	5	15	0
109	15	-80	1	110	14	-67	1	111	11	-38	0	112	1	0	1	113	-2	26	0	114	-4	35	-1
115	-5	34	-1	116	-5	29	-2	117	-6	22	-2	118	-6	16	-2	119	-6	12	-2	120	-6	10	-2
121	13	-23	-1	122	12	-19	-1	123	9	-12	-2	124	4	-3	0	125	2	4	0	126	1	9	0
127	2	11	0	128	3	11	0	129	4	10	-1	130	4	9	-1	131	5	8	-1	132	5	8	-1
133	-1	-79	5	134	0	-67	4	135	2	-39	2	136	0	6	2	137	1	31	1	138	0	38	-1
139	-2	35	-1	140	-3	27	-2	141	-4	19	-2	142	-5	12	-2	143	-5	7	-2	144	-5	5	-2
145	47	0	21	146	45	1	20	147	35	3	18	148	6	4	2	149	-3	5	-1	150	-4	6	-2
151	-3	6	-2	152	-1	5	-2	153	0	3	-2	154	1	2	-2	155	2	1	-2	156	2	0	-1
157	-29	-80	12	158	-26	-70	11	159	-18	-42	8	160	-3	14	4	161	4	38	1	162	5	41	-1
163	3	36	-2	164	1	26	-2	165	-1	16	-2	166	-2	8	-2	167	-2	3	-2	168	-3	0	-2
169	10	155	32	170	9	136	30	171	15	87	41	172	-6	-19	-10	173	0	-62	1	174	-1	-72	-1
175	0	-65	-1	176	0	-51	-1	177	0	-36	-1	178	0	-24	-1	179	0	-16	-1	180	0	-11	-1
181	29	84	48	182	28	75	46	183	19	47	49	184	5	-1	-4	185	-4	-27	-1	186	-3	-32	-3
187	-3	-30	-3	188	-2	-25	-3	189	-1	-19	-3	190	-1	-14	-3	191	0	-11	-2	192	0	-9	-2
193	26	3	22	194	25	3	20	195	19	3	22	196	4	10	0	197	-2	9	1	198	-2	7	-1
199	-2	4	-2	200	-1	1	-2	201	-1	-2	-2	202	0	-4	-2	203	0	-5	-2	204	0	-6	-2
205	-43	-83	12	206	-39	-73	11	207	-30	-46	9	208	-5	21	5	209	4	44	2	210	6	45	0
211	4	37	-1	212	3	26	-2	213	1	14	-2	214	0	5	-2	215	0	-1	-2	216	-1	-4	-2
217	6	153	35	218	6	133	31	219	9	91	48	220	-3	-20	-13	221	0	-57	3	222	-1	-69	-1
223	0	-63	0	224	0	-50	0	225	0	-37	0	226	0	-26	0	227	0	-18	0	228	0	-14	0
229	24	85	16	230	23	75	14	231	14	48	24	232	6	-1	-6	233	-3	-26	3	234	-3	-33	2
235	-2	-32	1	236	-2	-28	1	237	-1	-22	0	238	-1	-17	0	239	0	-14	0	240	0	-12	-1
241	18	8	5	242	18	7	5	243	13	6	8	244	3	12	0	245	-2	9	3	246	-2	5	2
247	-2	1	1	248	-1	-3	0	249	-1	-6	0	250	-1	-8	-1	251	0	-9	-1	252	0	-10	-1
253	-38	-83	11	254	-35	-74	10	255	-27	-46	8	256	-5	26	6	257	2	48	3	258	4	48	1
259	4	38	0	260	2	25	-1	261	1	13	-2	262	1	3	-2	263	0	-4	-2	264	0	-7	-2
265	38	29	28	266	37	27	27	267	28	20	26	268	5	15	2	269	-3	7	2	270	-4	0	0
271	-3	-4	-1	272	-3	-8	-1	273	-2	-11	-1	274	-1	-13	-1	275	-1	-14	-1	276	-1	-14	-1
277	-42	-84	15	278	-39	-75	14	279	-31	-46	11	280	-5	29	7	281	2	52	3	282	4	50	1
283	3	39	0	284	2	25	-1	285	2	11	-2	286	1	1	-2	287	1	-6	-2	288	1	-10	-2
289	8	202	49	290	8	176	45	291	11	114	62	292	-4	-9	-14	293	-1	-65	2	294	-1	-84	-2
295	0	-80	-1	296	0	-68	-1	297	0	-53	-1	298	0	-41	-1	299	0	-33	-1	300	0	-28	-1
301	26	120	52	302	26	106	50	303	19	69	58	304	4	7	-7	305	-3	-29	1	306	-3	-41	-2
307	-3	-42	-2	308	-2	-39	-2	309	-1	-34	-2	310	-1	-29	-2	311	-1	-25	-2	312	-1	-23	-2

Figure D16. (Sheet 2 of 5)

NORMAL STRESSES FOR LOAD CASE 16 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
313	6	21	29	314	7	19	27	315	3	15	28	316	2	18	1	317	-2	12	2	318	-1	5	0
319	-1	-2	-1	320	-1	-8	-2	321	0	-12	-2	322	0	-15	-2	323	0	-17	-2	324	0	-18	-2
325	-27	-31	16	326	-26	-71	15	327	-22	-42	12	328	-3	32	7	329	1	55	4	330	2	53	1
331	2	40	0	332	1	24	-1	333	1	10	-2	334	1	-2	-2	335	1	-9	-2	336	1	-13	-2
337	3	192	18	338	3	168	16	339	4	113	27	340	-2	-12	-9	341	-1	-62	2	342	-1	-80	0
343	-1	-78	0	344	0	-67	0	345	0	-54	0	346	0	-43	0	347	0	-35	0	348	0	-31	0
349	3	98	4	350	4	87	3	351	1	57	9	352	1	7	-3	353	-1	-22	3	354	-1	-33	2
355	-1	-37	1	356	0	-36	0	357	0	-33	0	358	0	-30	0	359	0	-27	0	360	0	-26	-1
361	1	11	7	362	1	11	6	363	0	11	8	364	1	21	3	365	-1	17	5	366	0	10	3
367	0	1	1	368	0	-7	0	369	0	-13	0	370	0	-17	-1	371	0	-20	-1	372	0	-21	-1
373	-11	-75	13	374	-10	-65	12	375	-10	-36	9	376	-1	34	8	377	-1	56	5	378	0	53	3
379	0	39	1	380	0	23	0	381	0	7	-1	382	0	-5	-2	383	0	-13	-2	384	0	-17	-2

	ELEM	SX	ELEM	SY	ELEM	SZ	
MIN.	205	-43	37	-88	292	-14	(COMPRESSIVE)
MAX.	145	47	289	202	291	62	(TENSILE)

Figure D16. (Sheet 3 of 5)

SHEAR STRESSES FOR LOAD CASE 16 (PSI)

ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
1	6	3	1	2	19	9	1	3	29	14	1	4	32	16	0	5	27	17	-1	6	21	16	-1
7	16	14	-1	8	12	11	0	9	9	9	0	10	6	6	0	11	3	3	0	12	1	1	0
13	1	7	0	14	4	20	0	15	6	30	0	16	6	35	0	17	5	35	0	18	3	31	0
19	2	27	0	20	2	21	0	21	1	16	0	22	1	11	0	23	0	6	0	24	0	2	0
25	-2	7	-3	26	-5	19	-3	27	-8	30	-2	28	-8	35	0	29	-8	34	1	30	-7	31	1
31	-5	26	1	32	-4	21	1	33	-3	16	1	34	-2	11	1	35	-1	6	1	36	0	2	1
37	-7	3	-2	38	-20	9	-2	39	-32	14	-1	40	-35	17	1	41	-31	17	1	42	-25	16	1
43	-19	14	1	44	-14	11	1	45	-10	8	1	46	-7	6	1	47	-4	3	1	48	-1	1	1
49	6	-5	1	50	19	-17	1	51	29	-25	1	52	32	-27	0	53	27	-21	-1	54	21	-14	-1
55	16	-9	0	56	12	-6	0	57	8	-4	0	58	6	-2	0	59	3	-1	0	60	1	0	0
61	3	-10	5	62	9	-30	5	63	14	-45	3	64	16	-48	0	65	13	-39	-2	66	9	-27	-2
67	7	-13	-2	68	5	-12	-1	69	3	-8	-1	70	2	-5	-1	71	1	-3	-1	72	0	-1	-1
73	-1	-3	-3	74	-2	-11	-2	75	-4	-17	-2	76	-4	-17	0	77	-4	-12	1	78	-4	-7	1
79	-4	-3	1	80	-3	-1	2	81	-2	0	2	82	-1	0	2	83	-1	0	2	84	0	0	2
85	-12	-1	-2	86	-32	-4	-2	87	-52	-6	-1	88	-57	-6	1	89	-50	-3	2	90	-40	0	2
91	-31	1	2	92	-23	2	2	93	-16	2	2	94	-11	1	2	95	-6	1	2	96	-2	0	2
97	6	-4	10	98	18	-11	10	99	26	-18	6	100	29	-19	0	101	25	-13	-3	102	19	-8	-3
103	14	-4	-2	104	10	-2	-1	105	7	-1	-1	106	5	-1	-1	107	3	0	0	108	1	0	0
109	-11	-2	8	110	-28	-5	7	111	-49	-10	4	112	-53	-10	1	113	-44	-5	-1	114	-34	-2	-1
115	-26	0	-1	116	-19	1	0	117	-14	1	0	118	-9	1	0	119	-5	0	0	120	-2	0	0
121	3	-4	13	122	11	0	12	123	15	-11	8	124	18	-7	1	125	17	-2	-2	126	15	1	-3
127	12	2	-2	128	9	2	-2	129	7	2	-2	130	5	1	-1	131	3	1	-1	132	1	0	-1
133	-12	-4	17	134	-27	0	16	135	-52	-12	12	136	-54	-8	2	137	-42	-2	-2	138	-31	1	-3
139	-23	2	-3	140	-16	2	-2	141	-11	2	-2	142	-7	1	-1	143	-4	1	-1	144	-1	0	-1
145	2	-9	28	146	11	12	26	147	9	-15	22	148	14	-3	2	149	19	7	-3	150	19	9	-4
151	16	9	-4	152	13	8	-3	153	10	6	-3	154	7	4	-2	155	4	3	-2	156	1	1	-2
157	-15	-10	16	158	-31	7	15	159	-61	-18	13	160	-62	-8	1	161	-48	0	-1	162	-36	3	-2
163	-26	4	-2	164	-18	4	-2	165	-12	3	-2	166	-8	2	-2	167	-4	1	-2	168	-1	0	-2
169	-6	-28	18	170	26	37	16	171	15	-22	23	172	29	12	-6	173	23	14	1	174	19	17	-1
175	14	15	0	176	11	12	0	177	7	9	0	178	5	6	0	179	3	4	0	180	1	1	0
181	-4	-16	30	182	12	39	29	183	4	-8	28	184	11	20	0	185	11	34	-1	186	10	34	-2
187	9	30	-2	188	7	25	-2	189	5	18	-1	190	3	13	-1	191	2	7	-1	192	1	2	-1
193	-4	-16	5	194	-5	17	5	195	-16	-25	5	196	-14	-6	0	197	-8	9	0	198	-4	12	0
199	-2	12	-1	200	0	11	-1	201	0	9	-1	202	0	6	-1	203	0	4	-1	204	0	1	-1
205	-16	-15	0	206	-37	11	0	207	-66	-25	1	208	-69	-10	0	209	-57	0	1	210	-44	3	0
211	-32	4	0	212	-23	4	0	213	-15	3	-1	214	-10	3	-1	215	-5	2	-1	216	-2	1	-1
217	-6	-36	2	218	27	11	3	219	16	-58	1	220	29	-28	1	221	24	-25	-1	222	20	-15	0
223	15	-10	-1	224	11	-6	0	225	8	-3	0	226	5	-2	0	227	3	-1	0	228	1	0	0
229	1	-32	-2	230	16	-10	-1	231	16	-76	-1	232	21	-57	-1	233	19	-41	-1	234	16	-29	0
235	12	-19	0	236	9	-12	0	237	7	-8	0	238		-5	0	239	3	-2	0	240	1	-1	0
241	-4	-21	4	242	-3	6	4	243	-10	-44	3	244		-25	1	245	-6	-11	-1	246	-3	-4	0
247	-2	0	-1	248	-1	1	-1	249	0	2	-1	250	[illegible]	2	-1	251	0	1	-1	252	0	0	-1
253	-16	-17	3	254	-38	11	3	255	-64	-29	2	256	-68	-12	1	257	-58	-2	0	258	-46	2	0
259	-34	3	0	260	-24	4	0	261	-17	3	-1	262	-11	2	-1	263	-6	1	-1	264	-2	0	-1
265	4	-22	11	266	20	10	11	267	19	-42	11	268	25	-22	-2	269	29	-7	-1	270	25	-1	-1
271	21	2	-2	272	16	3	-1	273	12	3	-1	274	8	2	-1	275	4	2	-1	276	1	1	-1
277	-15	-18	1	278	-39	10	1	279	-62	-32	2	280	-67	-15	0	281	-59	-4	0	282	-47	0	0
283	-36	2	0	284	-25	3	0	285	-17	3	0	286	-11	2	0	287	-6	1	0	288	-2	0	0
289	-14	-36	20	290	35	42	18	291	5	-33	24	292	27	8	-5	293	23	11	1	294	19	16	-1
295	14	14	0	296	10	12	0	297	7	9	0	298	5	6	0	299	3	4	0	300	1	1	0
301	-3	-23	17	302	18	35	17	303	8	-27	17	304	17	4	-1	305	17	22	-1	306	15	25	-1
307	12	24	-1	308	9	20	-1	309	7	15	-1	310	4	10	-1	311	3	6	-1	312	1	2	0

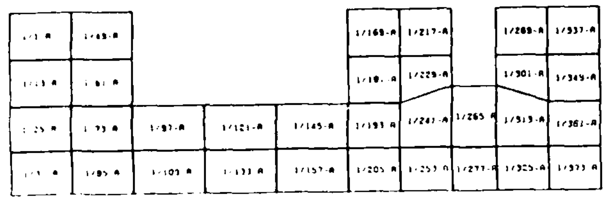
Figure D16. (Sheet 4 of 5)

SHEAR STRESSES FOR LOAD CASE 16 (PSI)

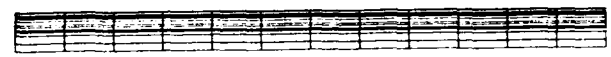
ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
313	-2	-21	-9	314	-1	10	-8	315	-8	-42	-6	316	-6	-22	-2	317	-3	-6	0	318	-1	1	1
319	0	4	1	320	0	5	0	321	0	5	0	322	0	3	0	323	0	2	0	324	0	1	0
325	-12	-18	-7	326	-33	6	-7	327	-50	-35	-5	328	-55	-19	0	329	-50	-9	1	330	-40	-3	1
331	-30	0	1	332	-22	1	1	333	-15	1	0	334	-10	1	0	335	-5	1	0	336	-2	0	0
337	-13	-29	0	338	33	2	1	339	6	-52	-2	340	26	-31	2	341	23	-25	-1	342	18	-15	0
343	14	-9	0	344	10	-5	0	345	7	-3	0	346	5	-2	0	347	3	-1	0	348	1	0	0
349	-3	-29	-3	350	7	-18	-2	351	1	-76	-4	352	5	-62	1	353	5	-46	-1	354	3	-31	0
355	3	-20	0	356	2	-13	0	357	1	-8	0	358	1	-5	0	359	1	-2	0	360	0	-1	0
361	-1	-27	-10	362	-4	-21	-10	363	-6	-76	-9	364	-7	-65	-1	365	-6	-47	1	366	-5	-33	1
367	-4	-21	1	368	-3	-13	1	369	-2	-8	1	370	-1	-5	0	371	-1	-3	0	372	0	-1	0
373	-5	-20	-6	374	-19	-7	-6	375	-26	-49	-5	376	-30	-37	0	377	-27	-25	1	378	-22	-17	1
379	-17	-10	1	380	-12	-6	1	381	-8	-4	0	382	-5	-2	0	383	-3	-1	0	384	-1	0	0

	ELEM	VXY	ELEM	VYZ	ELEM	VZX
MIN.	208	-69	363	-76	361	-10
MAX.	290	35	290	42	181	30

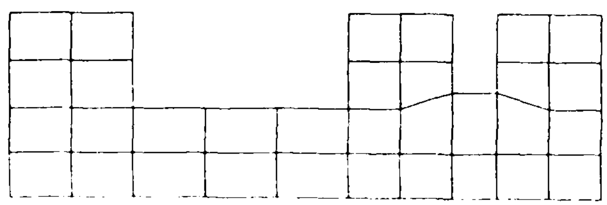
Figure D16. (Sheet 5 of 5)



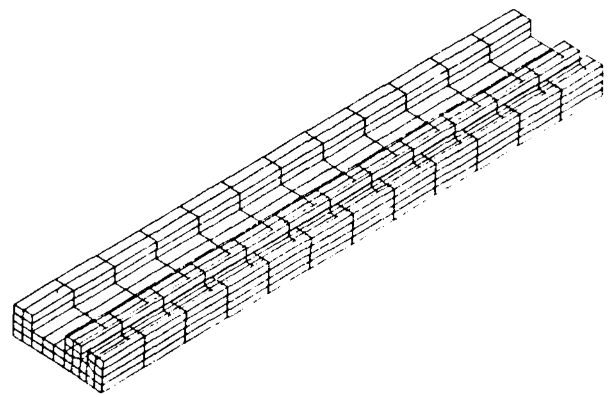
FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
UNDEFORMED GRID



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
LOAD CASE NO-17



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
LOAD CASE NO-17



FINITE-ELEMENT ANALYSIS OF PROPOSED 'SNORT' STRUCTURE. AUG 82
LOAD CASE NO-17

Figure D17. Finite-element analysis for load case 17 with $K = 175$ lb/in.^{3} (Sheet 1 of 5)

NORMAL STRESSES FOR LOAD CASE 17 (PSI)

ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ	ELEM	SX	SY	SZ
1	0	0	0	2	0	0	0	3	0	0	0	4	0	0	0	5	0	0	0	6	0	0	0
7	0	0	0	8	0	0	0	9	0	0	0	10	0	0	0	11	0	0	0	12	0	0	0
13	0	0	-1	14	0	0	-1	15	0	0	-1	16	0	0	-1	17	0	0	-1	18	0	0	-1
19	0	0	-1	20	0	0	-1	21	0	0	-1	22	0	0	-1	23	0	0	-1	24	0	0	-1
25	0	0	-2	26	0	0	-2	27	0	0	-2	28	0	0	-2	29	0	0	-2	30	0	0	-2
31	0	0	-2	32	0	0	-2	33	0	0	-2	34	0	0	-2	35	0	0	-2	36	0	0	-2
37	0	0	-2	38	0	0	-2	39	0	0	-2	40	0	0	-2	41	0	0	-2	42	0	0	-2
43	0	0	-2	44	0	0	-2	45	0	0	-2	46	0	0	-2	47	0	0	-2	48	0	0	-2
49	0	0	0	50	0	0	0	51	0	0	0	52	0	0	0	53	0	0	0	54	0	0	0
55	0	0	0	56	0	0	0	57	0	0	0	58	0	0	0	59	0	0	0	60	0	0	0
61	1	0	-1	62	1	0	-1	63	1	0	-1	64	1	0	-1	65	1	0	-1	66	1	0	-1
67	1	0	-1	68	1	0	-1	69	1	0	-1	70	1	0	-1	71	1	0	-1	72	1	0	-1
73	1	0	-2	74	1	0	-2	75	1	0	-2	76	1	0	-2	77	1	0	-2	78	1	0	-2
79	1	0	-2	80	1	0	-2	81	1	0	-2	82	1	0	-2	83	1	0	-2	84	1	0	-2
85	-1	-1	-2	86	-1	-1	-2	87	-1	-1	-2	88	-1	-1	-2	89	-1	-1	-2	90	-1	-1	-2
91	-1	-1	-2	92	-1	-1	-2	93	-1	-1	-2	94	-1	-1	-2	95	-1	-1	-2	96	-1	-1	-2
97	3	0	-1	98	3	0	-1	99	3	0	-1	100	3	0	-1	101	3	0	-1	102	3	0	-1
103	3	0	-1	104	3	0	-1	105	3	0	-1	106	3	0	1	107	3	0	-1	108	3	0	-1
109	-3	-1	-2	110	-3	-1	-2	111	-3	-1	-2	112	-3	-1	-2	113	-3	-1	-2	114	-3	-1	-2
115	-3	-1	-2	116	-3	-1	-2	117	-3	-1	-2	118	-3	-1	2	119	-3	-1	-2	120	-3	-1	-2
121	3	1	0	122	3	1	0	123	3	1	0	124	3	1	0	125	3	1	0	126	3	1	0
127	3	1	0	128	3	1	0	129	3	1	0	130	3	1	0	131	3	1	0	132	3	1	0
133	-3	-1	-2	134	-3	-1	-2	135	-3	-1	-2	136	-3	-1	-2	137	-3	-1	-2	138	-3	-1	-2
139	-3	-1	-2	140	-3	-1	-2	141	-3	-1	-2	142	-3	-1	-2	143	-3	-1	-2	144	-3	-1	-2
145	3	0	-1	146	3	0	-1	147	3	0	-1	148	3	0	-1	149	3	0	-1	150	3	0	-1
151	3	0	-1	152	3	0	-1	153	3	0	-1	154	3	0	-1	155	3	0	-1	156	3	0	-1
157	-3	-1	-2	158	-3	-1	-2	159	-3	-1	-2	160	-3	-1	-2	161	-3	-1	-2	162	-3	-1	-2
163	-3	-1	-2	164	-3	-1	-2	165	-3	-1	-2	166	-3	-1	-2	167	-3	-1	-2	168	-3	-1	-2
169	0	0	0	170	0	0	0	171	0	0	0	172	0	0	0	173	0	0	0	174	0	0	0
175	0	0	0	176	0	0	0	177	0	0	0	178	0	0	0	179	0	0	0	180	0	0	0
181	1	0	-1	182	1	0	-1	183	1	0	-1	184	1	0	-1	185	1	0	-1	186	1	0	-1
187	1	0	-1	188	1	0	-1	189	1	0	-1	190	1	0	-1	191	1	0	-1	192	1	0	-1
193	1	0	-2	194	1	0	-2	195	1	0	-2	196	1	0	-2	197	1	0	-2	198	1	0	-2
199	1	0	-2	200	1	0	-2	201	1	0	-2	202	1	0	-2	203	1	0	-2	204	1	0	-2
205	-2	-1	-2	206	-2	-1	-2	207	-2	-1	-2	208	-2	-1	-2	209	-2	-1	-2	210	-2	-1	-2
211	-2	-1	-2	212	-2	-1	-2	213	-2	-1	-2	214	-2	-1	-2	215	-2	-1	-2	216	-2	-1	-2
217	0	0	0	218	0	0	0	219	0	0	0	220	0	0	0	221	0	0	0	222	0	0	0
223	0	0	0	224	0	0	0	225	0	0	0	226	0	0	0	227	0	0	0	228	0	0	0
229	1	0	-1	230	1	0	-1	231	1	0	-1	232	1	0	-1	233	1	0	-1	234	1	0	-1
235	1	0	-1	236	1	0	-1	237	1	0	-1	238	1	0	-1	239	1	0	1	240	1	0	1
241	0	0	-2	242	0	0	-2	243	0	0	-2	244	0	0	-2	245	0	0	2	246	0	0	2
247	0	0	-2	248	0	0	-2	249	0	0	-2	250	0	0	2	251	0	0	2	252	0	0	-2
253	1	-1	2	254	-1	-1	-2	255	-1	-1	-2	256	-1	1	-2	257	-1	1	2	258	-1	1	-2
259	-1	-1	-2	260	-1	-1	-2	261	-1	-1	-2	262	-1	-1	-2	263	-1	-1	2	264	-1	1	2
265	1	0	-1	266	1	0	-1	267	1	0	-1	268	1	0	-1	269	1	0	-1	270	1	0	1
271	1	0	-1	272	1	0	-1	273	1	0	-1	274	1	0	1	275	1	0	1	276	1	0	1
277	-1	-1	-2	278	-1	-1	-2	279	-1	-1	-2	280	-1	-1	-2	281	1	1	[illegible]	282	1	1	2
283	-1	-1	-2	284	-1	-1	-2	285	-1	-1	-2	286	-1	1	2	287	1	1	[illegible]	288	1	1	2
289	0	0	0	290	0	0	0	291	0	0	0	292	0	0	0	293	0	0	0	294	0	0	0
295	0	0	0	296	0	0	0	297	0	0	0	298	0	0	0	299	0	0	0	300	0	0	0
301	0	0	-1	302	0	0	-1	303	0	0	-1	304	0	0	1	305	0	0	1	306	0	0	1
307	0	0	-1	308	0	0	-1	309	0	0	-1	310	0	0	1	311	[illegible]	[illegible]	[illegible]	312	0	0	1

Figure D17. (Sheet 2 of 5)

SHEAR STRESSES FOR LOAD CASE 17 (PSI)

ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
313	0	0	0	314	0	0	0	315	0	0	0	316	0	0	0	317	0	0	0	318	0	0	0
319	0	0	0	320	0	0	0	321	0	0	0	322	0	0	0	323	0	0	0	324	0	0	0
325	0	0	0	326	0	0	0	327	0	0	0	328	0	0	0	329	0	0	0	330	0	0	0
331	0	0	0	332	0	0	0	333	0	0	0	334	0	0	0	335	0	0	0	336	0	0	0
337	0	0	0	338	0	0	0	339	0	0	0	340	0	0	0	341	0	0	0	342	0	0	0
343	0	0	0	344	0	0	0	345	0	0	0	346	0	0	0	347	0	0	0	348	0	0	0
349	0	0	0	350	0	0	0	351	0	0	0	352	0	0	0	353	0	0	0	354	0	0	0
355	0	0	0	356	0	0	0	357	0	0	0	358	0	0	0	359	0	0	0	360	0	0	0
361	0	0	0	362	0	0	0	363	0	0	0	364	0	0	0	365	0	0	0	366	0	0	0
367	0	0	0	368	0	0	0	369	0	0	0	370	0	0	0	371	0	0	0	372	0	0	0
373	0	0	0	374	0	0	0	375	0	0	0	376	0	0	0	377	0	0	0	378	0	0	0
379	0	0	0	380	0	0	0	381	0	0	0	382	0	0	0	383	0	0	0	384	0	0	0

	ELEM	VXY	ELEM	VYZ	ELEM	VZX
MIN.	107	0	193	0	204	-1
MAX.	98	0	204	0	84	1

Figure D17. (Sheet 3 of 5)

SHEAR STRESSES FOR LOAD CASE 17 (PSI)

ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
1	0	0	0	2	0	0	0	3	0	0	0	4	0	0	0	5	0	0	0	6	0	0	0
7	0	0	0	8	0	0	0	9	0	0	0	10	0	0	0	11	0	0	0	12	0	0	0
13	0	0	0	14	0	0	0	15	0	0	0	16	0	0	0	17	0	0	0	18	0	0	0
19	0	0	0	20	0	0	0	21	0	0	0	22	0	0	0	23	0	0	0	24	0	0	0
25	0	0	0	26	0	0	0	27	0	0	0	28	0	0	0	29	0	0	0	30	0	0	0
31	0	0	0	32	0	0	0	33	0	0	0	34	0	0	0	35	0	0	0	36	0	0	0
37	0	0	0	38	0	0	0	39	0	0	0	40	0	0	0	41	0	0	0	42	0	0	0
43	0	0	0	44	0	0	0	45	0	0	0	46	0	0	0	47	0	0	0	48	0	0	0
49	0	0	0	50	0	0	0	51	0	0	0	52	0	0	0	53	0	0	0	54	0	0	0
55	0	0	0	56	0	0	0	57	0	0	0	58	0	0	0	59	0	0	0	60	0	0	0
61	0	0	0	62	0	0	0	63	0	0	0	64	0	0	0	65	0	0	0	66	0	0	0
67	0	0	0	68	0	0	0	69	0	0	0	70	0	0	0	71	0	0	0	72	0	0	0
73	0	0	1	74	0	0	1	75	0	0	1	76	0	0	1	77	0	0	1	78	0	0	1
79	0	0	1	80	0	0	1	81	0	0	1	82	0	0	1	83	0	0	1	84	0	0	1
85	0	0	1	86	0	0	1	87	0	0	1	88	0	0	1	89	0	0	1	90	0	0	1
91	0	0	1	92	0	0	1	93	0	0	1	94	0	0	1	95	0	0	1	96	0	0	1
97	0	0	1	98	0	0	1	99	0	0	1	100	0	0	1	101	0	0	1	102	0	0	1
103	0	0	1	104	0	0	1	105	0	0	1	106	0	0	1	107	0	0	1	108	0	0	1
109	0	0	1	110	0	0	1	111	0	0	1	112	0	0	1	113	0	0	1	114	0	0	1
115	0	0	1	116	0	0	1	117	0	0	1	118	0	0	1	119	0	0	1	120	0	0	1
121	0	0	0	122	0	0	0	123	0	0	0	124	0	0	0	125	0	0	0	126	0	0	0
127	0	0	0	128	0	0	0	129	0	0	0	130	0	0	0	131	0	0	0	132	0	0	0
133	0	0	0	134	0	0	0	135	0	0	0	136	0	0	0	137	0	0	0	138	0	0	0
139	0	0	0	140	0	0	0	141	0	0	0	142	0	0	0	143	0	0	0	144	0	0	0
145	0	0	0	146	0	0	0	147	0	0	0	148	0	0	0	149	0	0	0	150	0	0	0
151	0	0	0	152	0	0	0	153	0	0	0	154	0	0	0	155	0	0	0	156	0	0	0
157	0	0	-1	158	0	0	-1	159	0	0	-1	160	0	0	-1	161	0	0	-1	162	0	0	-1
163	0	0	-1	164	0	0	-1	165	0	0	-1	166	0	0	-1	167	0	0	-1	168	0	0	-1
169	0	0	0	170	0	0	0	171	0	0	0	172	0	0	0	173	0	0	0	174	0	0	0
175	0	0	0	176	0	0	0	177	0	0	0	178	0	0	0	179	0	0	0	180	0	0	0
181	0	0	0	182	0	0	0	183	0	0	0	184	0	0	0	185	0	0	0	186	0	0	0
187	0	0	0	188	0	0	0	189	0	0	0	190	0	0	0	191	0	0	0	192	0	0	0
193	0	0	-1	194	0	0	-1	195	0	0	-1	196	0	0	-1	197	0	0	-1	198	0	0	-1
199	0	0	-1	200	0	0	-1	201	0	0	-1	202	0	0	-1	203	0	0	-1	204	0	0	-1
205	0	0	-1	206	0	0	-1	207	0	0	-1	208	0	0	-1	209	0	0	-1	210	0	0	-1
211	0	0	-1	212	0	0	-1	213	0	0	-1	214	0	0	-1	215	0	0	-1	216	0	0	-1
217	0	0	0	218	0	0	0	219	0	0	0	220	0	0	0	221	0	0	0	222	0	0	0
223	0	0	0	224	0	0	0	225	0	0	0	226	0	0	0	227	0	0	0	228	0	0	0
229	0	0	0	230	0	0	0	231	0	0	0	232	0	0	0	233	0	0	0	234	0	0	0
235	0	0	0	236	0	0	0	237	0	0	0	238	0	0	0	239	0	0	0	240	0	0	0
241	0	0	0	242	0	0	0	243	0	0	0	244	0	0	0	245	0	0	0	246	0	0	0
247	0	0	0	248	0	0	0	249	0	0	0	250	0	0	0	251	0	0	0	252	0	0	0
253	0	0	0	254	0	0	0	255	0	0	0	256	0	0	0	257	0	0	0	258	0	0	0
259	0	0	0	260	0	0	0	261	0	0	0	262	0	0	0	263	0	0	0	264	0	0	0
265	0	0	0	266	0	0	0	267	0	0	0	268	0	0	0	269	0	0	0	270	0	0	0
271	0	0	0	272	0	0	0	273	0	0	0	274	0	0	0	275	0	0	0	276	0	0	0
277	0	0	0	278	0	0	0	279	0	0	0	280	0	0	0	281	0	0	0	282	0	0	0
283	0	0	0	284	0	0	0	285	0	0	0	286	0	0	0	287	0	0	0	288	0	0	0
289	0	0	0	290	0	0	0	291	0	0	0	292	0	0	0	293	0	0	0	294	0	0	0
295	0	0	0	296	0	0	0	297	0	0	0	298	0	0	0	299	0	0	0	300	0	0	0
301	0	0	0	302	0	0	0	303	0	0	0	304	0	0	0	305	0	0	0	306	0	0	0
307	0	0	0	308	0	0	0	309	0	0	0	310	0	0	0	311	0	0	0	312	0	0	0

Figure D17. (Sheet 4 of 5)

SHEAR STRESSES FOR LOAD CASE 17 (PSI)

ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX	ELEM	VXY	VYZ	VZX
313	0	0	0	314	0	0	0	315	0	0	0	316	0	0	0	317	0	0	0	318	0	0	0
319	0	0	0	320	0	0	0	321	0	0	0	322	0	0	0	323	0	0	0	324	0	0	0
325	0	0	0	326	0	0	0	327	0	0	0	328	0	0	0	329	0	0	0	330	0	0	0
331	0	0	0	332	0	0	0	333	0	0	0	334	0	0	0	335	0	0	0	336	0	0	0
337	0	0	0	338	0	0	0	339	0	0	0	340	0	0	0	341	0	0	0	342	0	0	0
343	0	0	0	344	0	0	0	345	0	0	0	346	0	0	0	347	0	0	0	348	0	0	0
349	0	0	0	350	0	0	0	351	0	0	0	352	0	0	0	353	0	0	0	354	0	0	0
355	0	0	0	356	0	0	0	357	0	0	0	358	0	0	0	359	0	0	0	360	0	0	0
361	0	0	0	362	0	0	0	363	0	0	0	364	0	0	0	365	0	0	0	366	0	0	0
367	0	0	0	368	0	0	0	369	0	0	0	370	0	0	0	371	0	0	0	372	0	0	0
373	0	0	0	374	0	0	0	375	0	0	0	376	0	0	0	377	0	0	0	378	0	0	0
379	0	0	0	380	0	0	0	381	0	0	0	382	0	0	0	383	0	0	0	384	0	0	0

	ELEM	VXY	ELEM	VYZ	ELEM	VZX
MIN.	107	0	193	0	204	-1
MAX.	98	0	204	0	84	1

Figure D17. (Sheet 5 of 5)

END

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