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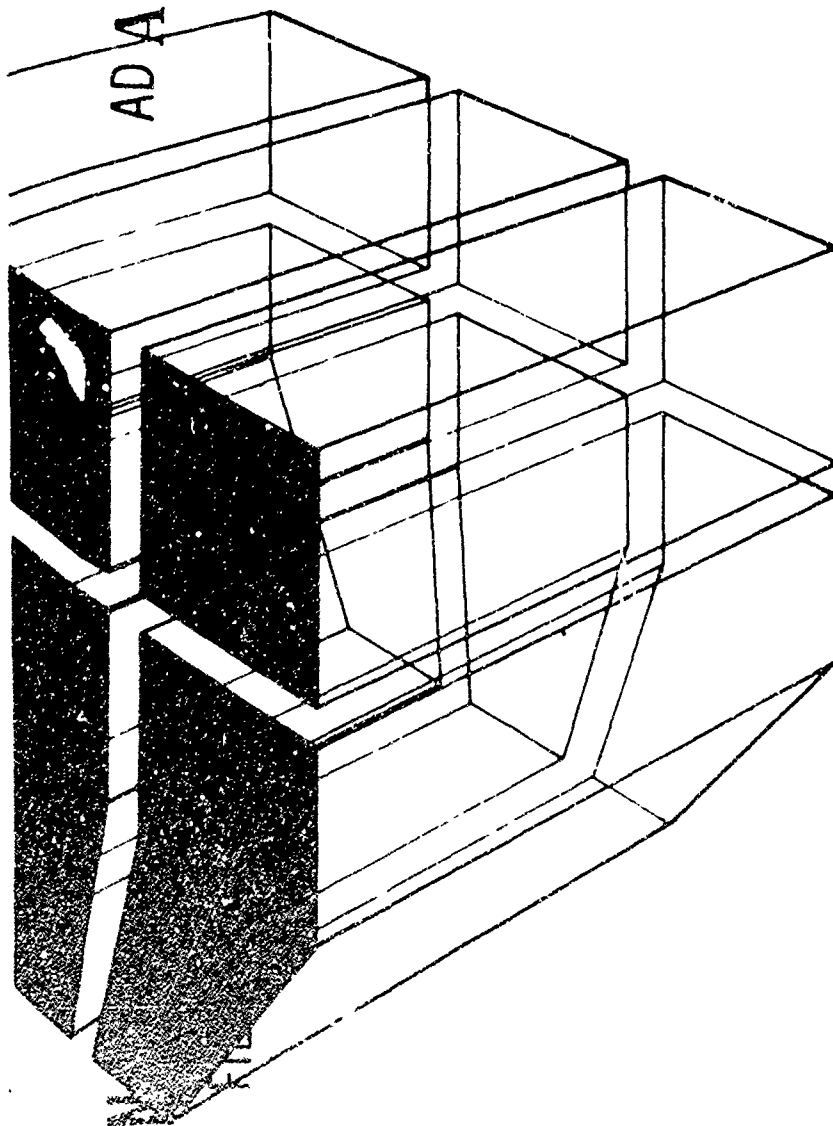
February 1974

Effect of Gear Pattern of Airfield Pavement Performance

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THE EFFECTS OF GEAR PATTERN ON PAVEMENT
SYSTEMS PERFORMANCE



by
J. L. Rice
J. J. Pannik
J. J. Hooley



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FOREWORD

This investigation was sponsored by the Office of the Chief of Engineers (OCE), Washington, D.C. as part of RDT&E Program 6.47.17.D, Project 4A664717D895 "Military Construction Systems Development," Task 04 "Military Airfield Facilities," Work Unit 003 "Effect of Gear Pattern of Airfield Pavement Performance," with Mr. A. Muller as Technical Monitor.

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CONTENTS

DD FORM 1473	1
FOREWORD	3
LIST OF FIGURES AND TABLES	5
1 INTRODUCTION	7
Problem	
Background	
Scope and Objective	
Previous Attempts to Solve	
Theoretical Considerations	
2 BASIS OF ANALYSIS	8
3 WHEEL LOADING PATTERNS	8
4 PAVEMENT LOADING HISTOGRAMS	9
MWHGL Test Track Data	
5 MIXED TRAFFIC	19
6 ANALYSIS AND DISCUSSIONS	23
7 CONCLUSIONS AND RECOMMENDATIONS	23
Conclusions	
Recommendations	
APPENDIX A: Slab 30E—A Computer Program for Airfield Slab Analysis	25
APPENDIX B: Guide for Data Input	40
REFERENCES	127
DISTRIBUTION	

FIGURES

Number	Page
1 Deflection Contours for 37,000 Wheel Loading Lockbourne Test Slab	10
2 Instrumentation Layout for 12-Wheel Traffic, Rigid Pavement Test Section	11
2a Instrumentation Layouts for the Twin-Tandem Assembly, Rigid Pavement Test Section	12
3 Traffic Patterns for the C-5A Wheel Assembly, Rigid Pavement Test Section	12
4 Traffic Patterns for Twin-Tandem Wheel Assembly, Rigid Pavement Test Section	14
5 Typical Strain Trace Under 12-Wheel Traffic Showing Strain Profile for One Pass	15
6 Histograms for Strain Excursions Under 12-Wheel Traffic, Item 1, Rigid Pavement Test Section	16
7 Histograms for Strain Excursions Under 12-Wheel Traffic, Item 2, Rigid Pavement Test Section	17
8 Histograms for Strain Excursions Under 12-Wheel Traffic, Item 3, Rigid Pavement Test Section	18
9 Histograms for Strain Excursions Under Twin-Tandem Traffic, Item 3, Rigid Pavement Test Section	20
10 Wander Pattern for Runway Loading	21
A1 Approximate Storage Requirements for SLAB 30E	26
A2 Data Coordinate Numbering System	29
A3 Sample Data Input	30
A4 Typical Special Load Pattern	32
A5 Bridge Approach Slab—Problem 601M	36
A6 Runway Slab with C-5A and B-747—Sample Problems JRS and Jkb	37
B1 Checklist for Input Tables	44

TABLES

Number	Page
1 Weighted Areas for the 12 Wheel MWHGL Traffic Histograms H_1	13
2 Weighted Areas for Twin-Tandem MWHGL Traffic Histograms	19
3 Weighted Strain Histogram Areas H_M for 1000 Passes	21
4 Report of Selected Aircraft Traffic Data	22
B1 Control Data	41
B2 Constants	41
B3 Specified Areas for Selected Output	41
B4 Stiffness and Load Data	41
B5 Axial Thrust Data	42
B6 Special Load Patterns	42
B7 Placements of Table B6 Load Patterns	42

THE EFFECTS OF GEAR PATTERN ON SYSTEMS PERFORMANCE

1 INTRODUCTION

Problem. A major problem in airfield pavement evaluation and design is assessing the damage which will be caused by new landing gear loads and complex geometries. In addition, a need exists to determine the design life and life remaining in an existing airfield pavement. This problem is compounded due to the effects of mixed traffic and the lack of a suitable rationale for handling mixed traffic.

Background. The two new jumbo jet aircraft now in operation, the C-5A and the Boeing 747, may require a new trend in development of future aircraft pavement. Sufficient ground flotation or load distribution in the landing gear design was required for the C-5A so that the aircraft could operate from a medium load pavement as defined in TM 5-824-3.¹ The Federal Aviation Administration (FAA), prior to the introduction of the 747, placed a requirement on aircraft designers which limited the pavement flexural stress to that which was developed by the stretched version of the DC-8 aircraft. If this trend is continued in the future, pavement requirements for new aircraft may level off at some bounding limit. If these requirements do approach a bounding limit, the pavement engineer will no longer have the luxury of designing for the heaviest aircraft and ignoring the lighter traffic because many aircraft types will have nearly the same pavement requirements. As aircraft continue to grow in size and weight, an economic breaking point is certain to be reached where it will be more economical to upgrade the pavements than to provide more flotation on the aircraft. In order to provide the necessary flotation, aircraft designers will probably introduce radically different geometries and varying wheel loads all of which will require a more precise method of analysis.

Scope and Objective. The objective of this study is to identify a technique which will permit OCF to provide an improved method for specifying the relative effects of traffic loads on rigid pavements to reflect variations in gear patterns, with particular emphasis on multiwheel aircraft including the C-5A

and 747 aircraft. The scope of this study is limited to provide the necessary methodology to satisfy that objective.

Previous Attempts to Solve. Other investigators² have approached this problem in different ways. Attempts have been based on an equivalence in stress developed in the pavement. The relative severity of two landing gear systems is judged by comparing the critical flexural stresses generated in the pavement slab. Fatigue effects are accounted for through the use of Miner's hypothesis which assumes that damage is relative and linearly proportional to the ratio of actual traffic to traffic at failure for each wheel load configuration. The new multiwheel landing gear systems, in addition to developing critical stress, also distort pavements over large areas at stresses below the critical stress. Previous methods have ignored the subcritical stresses and have some limited success because the subcritical stresses were substantially smaller than the critical.

Theoretical Considerations. Pavement response to static loading can be predicted with reasonable accuracy using the Westergaard algorithm. Using the same assumptions, Westergaard, Stelzer and Hudson³ have developed a finite element representation of a loaded pavement slab which allows a more flexible modeling of boundary conditions. Such a finite element analysis has been adapted to the use of complex gear patterns as a part of this study (Appendix A). It is possible to construct influence lines for a point on the pavement which can be used to approximate the stress, strain, and/or deflection history for the point produced by a load at other points on the pavement. The stress history at a point in a rigid pavement which results from the movement of a multiple wheel landing gear system is likely to contain a number of stress excursions of varying magnitude.

Various investigators have had success in describing fatigue failure by performing a weighted summation of the excursions of stress, strain, or deflection which a specimen encounters. The excursions have to be weighted as to severity for obvious reasons. For

¹A Method for Estimating the Life of Rigid Pavements (ORDL Technical Report No. 423) (1962).

²C. F. Stelzer and W. R. Hudson, A Direct Computer Solution for Plates and Pavement Slabs, Research Report 56-9 (Center for Highway Research, University of Texas, 1967).

³Rigid Pavements for Airfields Other than Army, TM 5-824-3 (1970).

example, a specimen may be capable of sustaining a strain excursion of 40 micro inches per in. only 10 times, but it can sustain 3000 excursions of 50 micro inches per in. If a strain cycle relationship expressed as 200 micro inches per inch $\times$ 10 cycles = 2000 strain cycles were to be used, as a basis of performance, the pavement could sustain 50 micro inches per inch at 3000 $\div$ 50 = 40 cycles instead of the 3000 cycles measured. Obviously a weighting technique must be applied to the magnitude of the excursion. This is accomplished by assuming that damage is proportional to some function of the number of operations. For the purpose of this study a log function has been selected. It should be emphasized however that this relationship requires further study as additional data become available.

2 BASIS OF ANALYSIS

A number of factors must be considered in an analysis of complex loading history. Generally speaking only two response parameters are available from existing analytical procedures used in the evaluation of pavements: deflection and bending moment. The single most important factor to be considered for pavements loaded near the center of the slab is gear configuration, i.e., single wheel, twin tandem, or multi-wheeled landing gears.

The two pavement response parameters, deflection and bending moment, provide a basis for determining the amount or degree of distortion introduced in a pavement by a particular gear loading. From an analysis viewpoint, bending moment is of more value than deflection because a pavement can conceivably be subjected to large deflection with a small bending moment and vice versa. Bending moment can be converted into stresses and strain assuming linearly elastic component behavior. Current design procedures are based on flexural stress considerations which are directly obtained from bending moment utilizing elastic plate bending theory.

Performance data for pavements subjected to various gear configuration loadings are rather difficult to obtain. Several controlled traffic tests have been performed by the Corps of Engineers in past years. These tests are of the test track type where aircraft loading is simulated by a loading apparatus trafficking a series of test slabs in which several

parameters are varied such as slab thickness, subgrade strength, etc. These tests have been conducted at low speed and typically the loading apparatus is capable of simulating one main gear of the aircraft. Performance of the test items is assessed in accordance with current Corps of Engineers performance criteria. Three degrees of failure have been established by the Corps of Engineers as follows:

1 *Initial Failure*—That point when a crack develops in a pavement and extends through the entire thickness of the pavement as a result of traffic loading. The crack must be due to an externally applied loading and not to shrinkage or other non-traffic effects.

2 *Shattered Slab*—That point where traffic induced cracking has subdivided the pavement slab into six visible pieces. As with the initial failure criterion, the cracks must be due to externally applied loading and must extend through the full depth of the pavement slab.

3 *Complete Failure*—That point where the pavement slab has been cracked into about 35 pieces, each piece having an area of 15 to 20 square feet. At this point, the pavement would be considered non-operational due to excessive roughness and the likelihood of debris formation.

Due to the inherent assumptions associated with the available pavement analysis procedures, primary emphasis has been placed on the initial failure condition. The shattered slab and complete failure conditions represent situations too unwieldy for analytical modeling at this time.

Actual in-service pavements are subjected to a mixture of traffic. Air Force bases which are dedicated to bomber wings will experience not only bomber traffic but also support type traffic such as tankers, cargo aircraft, etc. Some data are available on traffic operations at selected Air Force bases. These data should be analyzed to determine probable traffic mixtures for selected Air Force bases.

3 WHEEL LOADING PATTERNS

The footprint produced by a complex landing gear can be examined by either deflection contours or strain contours. The detail of the contour pattern

will depend on the pavement thickness, subgrade modulus, the elastic properties of the concrete pavement slab, wheel loads and spacing, in addition to the slab geometry in relation to the wheel loads.

It is possible therefore to define the cyclic strain or deflection history on a pavement by using the footprint as an influence diagram in which the wheel loading paths relative to a point in the pavement are traced on the contour.

The basis for this technique is outlined as follows. A plot of either pavement deflection or strain response in the form of contours can be used to predict pavement response due to traffic loading. Since the concrete and foundation materials are assumed to behave elastically, superposition can be used to determine response histories for each of the traffic lanes. The contour plot moves along the pavement coincident with the wheel gear system. Therefore, the deflection or strain history at a point in the pavement can be constructed from the contour plot simply by tracing the location of the point in the pavement on the contour as the wheel gear passes over.

An example of the use of such an approach follows: Figure 1 is a contour plot of deflection for a single wheel loading on a Lockbourne test slab. It represents the deflection history of a test pavement subjected to a 37,000 pound wheel loading resulting from traffic by an A-3 Tournapull with a Model NU scraper. The traffic lines are designated on the contour plot and represent the path followed by each of the loading wheels. These plots were used to develop response histories. The deflection history of the pavement at the transverse joint shown on Figure 1 produced by single wheels traversing each of the traffic lines would then be computed as follows:

Lane 1 Front Wheel - .023 in.
Rear Wheel - .033 in.
Lane 2 Front Wheel - .007 in.
Rear Wheel - .013 in.

Initial failure occurred after 90 operations. The area of the histogram representing the deflection history is

$$.033 \ln 90 + .023 \ln 90 + .007 \ln 90 + .013 \ln 90 = .342$$

The procedure described in the above example was applied to other test pavements subjected to single, twin tandem, and 12-wheel assembly loading.

Pertinent physical properties from test items trafficked in the Lockbourne and Multiple Wheel Heavy Gear Load (MWHGL) tests were used in a finite element computer program for pavement analysis developed by Austin Research Engineers, Inc. This program computes both deflection and principle stress or moment at each nodal point (Appendix A). Thus, a single run of the program provides a rather complete picture of the response of an entire pavement slab. Weighted histogram areas were calculated for the initial crack failure condition. The summation of the weighted area histogram is indicative of the distortion of the slab under load. Histograms were produced for single, twin tandem, and 12-wheel landing gear arrays with 30,000 lb wheel loads. The average values for the weighted areas were .318 for single wheel, .526 for twin tandem and 1.43 for 12-wheel assemblies. Using the single wheel loading as a datum, this would indicate that twin tandem assemblies distort the slab 1.66 times as much as single wheel. These values are indicative of the strain relief and reversals occurring between loading wheels.

4 PAVEMENT LOADING HISTOGRAMS

Previous test track data were analyzed in view of the strain-deflection history approach. The current Corps of Engineers design method is based on critical flexural stresses generated at a jointed edge. An attempt to produce strain-deflection histories was based on conditions which exist at a jointed edge. This initial attempt was performed using data collected from the Lockbourne⁴ and MWHGL⁵ test tracks.

The analysis of data from these tests presented problems due to jointed edge behavior. For design purposes, a jointed edge is assumed to transfer 25 percent of the load across the joint over the design life.⁶ The 25 percent load transfer factor was established based on performance data from many experimental and in-service pavements. While the load transfer value is probably valid as an average, some

⁴Lockbourne No. 1 Test Track, Final Report (U S Army Ohio River Division Laboratories, 1946)

⁵Multiple Wheel Heavy Gear Load Pavement Tests, WES-TR-571-17, Vol I-IV (Waterways Experiment Station, 1971)

⁶R. L. Hutchinson, Basis for Rigid Pavement Design for Military Airfields, Miscellaneous Paper No. 5-7 (Waterways Experiment Station, 1966)

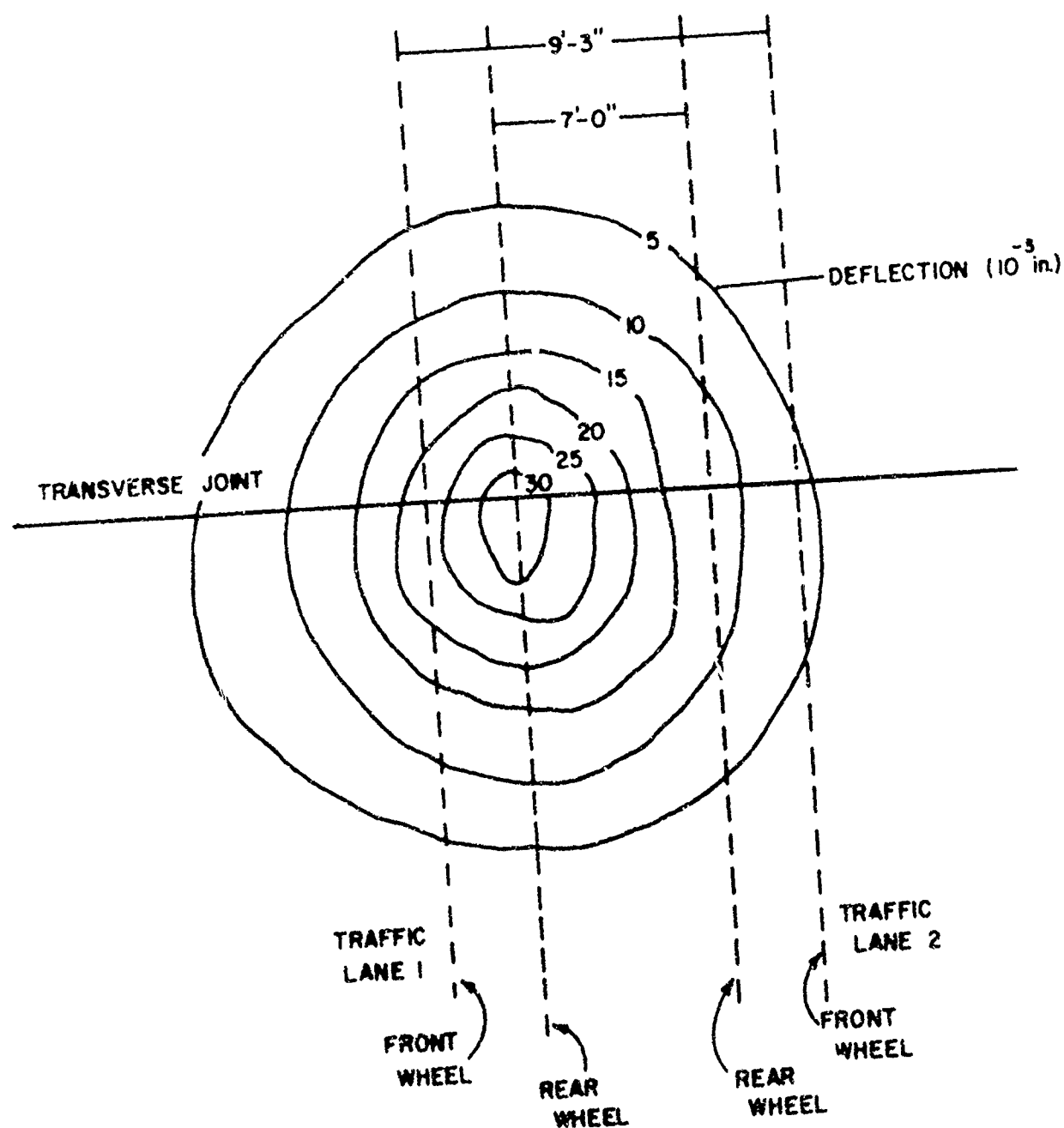


Figure 1. Deflection contours for 37,500 wheel loading Lockbourne test slab.

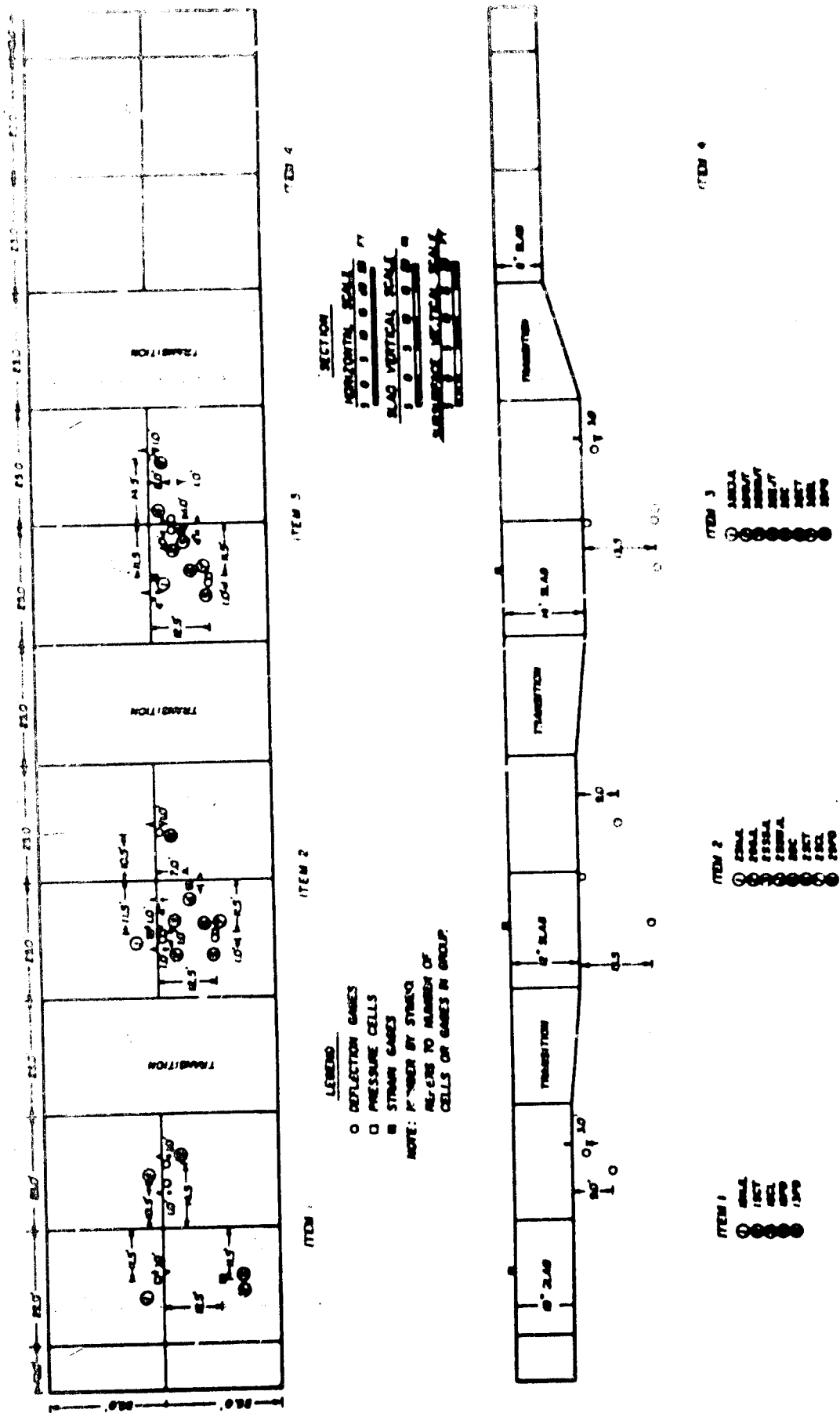


Figure 2. Instrumentation layout for 12 wheel traffic, rigid pavement test section

variations undoubtedly occur during the course of the design life. These variations have a rather decided impact on a strain or deflection history analysis.

MWHGL Test Track Data. The data collected from test tracks were analyzed using the strain history approach. Because detailed strain history data for rigid pavement performance are available from the MWHGL test reports, extensive use was made of this data. Figure 2 shows a layout of the MWHGL test track and locations of instrumentation. Traffic was applied to the test track pavement in five lines as shown in Figure 3 in order to simulate the wander of typical operational C-5A aircraft. A

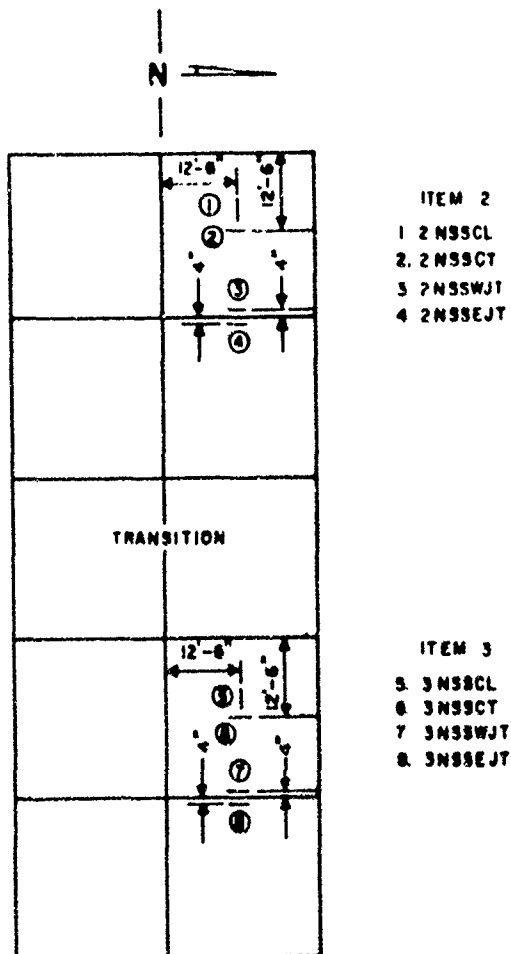


Figure 2a. Instrumentation layouts for the twin tandem assembly, rigid pavement test section.

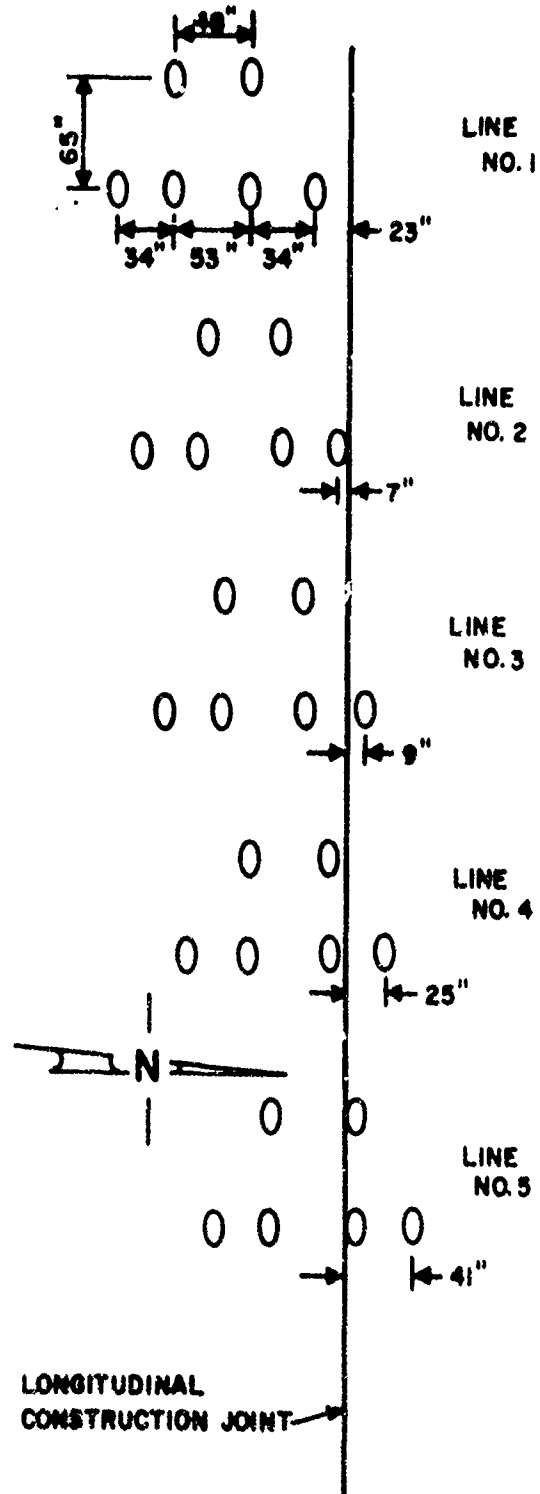


Figure 3. Traffic patterns for the C-5A wheel assembly, rigid pavement test section.

similar series of traffic tests was applied to the test items to simulate 747 traffic. The traffic lines for these loadings are shown in Figure 4.

The response data for each test slab were collated in strain history format. In order to utilize this data, a procedure for weighting the strain excursions was necessary. Several weighting functions were examined during the initial phases of the study. The method chosen to weight the magnitude of strain excursions which are measured from maxima to minima was based on Saint Venent's maximum strain theory of failure. The maximum strain theory assumes that failure occurs simultaneously as the elastic limit of the material is reached. This failure theory is primarily applicable to materials which fail by brittle fracture such as concrete. The maximum strain for conventional paving quality concrete is on the order of 200 micro inches per inch. Thus, strain excursions were divided by 200 micro inches per inch to provide a ratio of the magnitude of each excursion to the maximum strain which can be tolerated by the concrete. A somewhat similar technique was employed to weight the magnitude of the deflection excursions. Some limited data were collected to determine an approximate value of elastic deflection normally associated with initial failure of rigid air-field pavements over a normal design life. The value selected as typical was 0.05 inches. It should be noted that the selection of a base deflection or datum value can be rather arbitrary as the value is merely used to establish a relative weighting index. All excursions are expressed as a ratio of the datum deflection.

The relative merits of using a strain or deflection history were examined. More meaningful results were obtained using the strain history approach as compared to deflection because of the large number of factors affecting deflection. This would appear reasonable as pavement design and analysis procedures are predicted on stress rather than deflection. Another consideration which tends to favor the strain history approach is the fact that equal deflections can be vastly different in damaging effects due to difference in radius of curvature. Deflections are less sensitive to interaction between wheels and gears.

Measurement of strain in the MWHGL pavement tests was accomplished at the center and edges of Test Items 1, 2 and 3 in the longitudinal and trans-

verse directions for the total test program. An example of a typical strain history for lane 2 is shown in Figure 5. Histograms were prepared showing the number of strain excursions per pattern versus the magnitude of the excursion. The interval for the histogram is 5 micro inches per inch. Histograms for strain measured in test items 1 to 3 are shown in Figures 6 through 8. Each strain excursion was weighted by dividing by 200 micro inches per inch and the number of occurrences of this weighted strain was considered by multiplying the quotient by the natural logarithmic of the number of occurrences. This calculation was performed for each interval of the histogram and summed. Table 1 shows the value of each of the weighted histograms for the C-5A test program. It should be noted that these weighted histogram areas must be evaluated in light of the performance of the MWHGL test items. Item 1 had a crack prior to the application of traffic. Test item 3 experienced a first crack prematurely due to a subgrade pumping failure. Test item 2 performed in a normal manner and can be used as a basis for normalization of the data.

Table 1
Weighted Areas for the 12-Wheel MWHGL
Traffic Histograms - H_T

Test Item No.	Gage No.	At First Crack	For Total Traffic
1	1 SNJL	1.90	22.88
	1 SCL	5.72	39.59
	1 SCT	1.63	32.13
2	2 SWCT	50.23	55.76
	2 SSJL	69.84	77.47
	2 SCL	55.15	61.24
	2 SCT	14.27	15.82
3	3 SWJT	21.56	48.99
	3 SCL	4.55	10.33
	3 SCT	13.96	32.81

The use of jointed edge histories was later abandoned due to difficulties in correlation brought on by mathematically modeling the jointed edge. The assignment of a value for load transfer at a jointed edge is at best a tenuous estimate. Joint efficiency changes with time and increased traffic volume and has a large impact on strain and deflection history computations. For design purposes a load transfer value of 25 percent is assumed for the entire design life of a pavement. The 25 percent

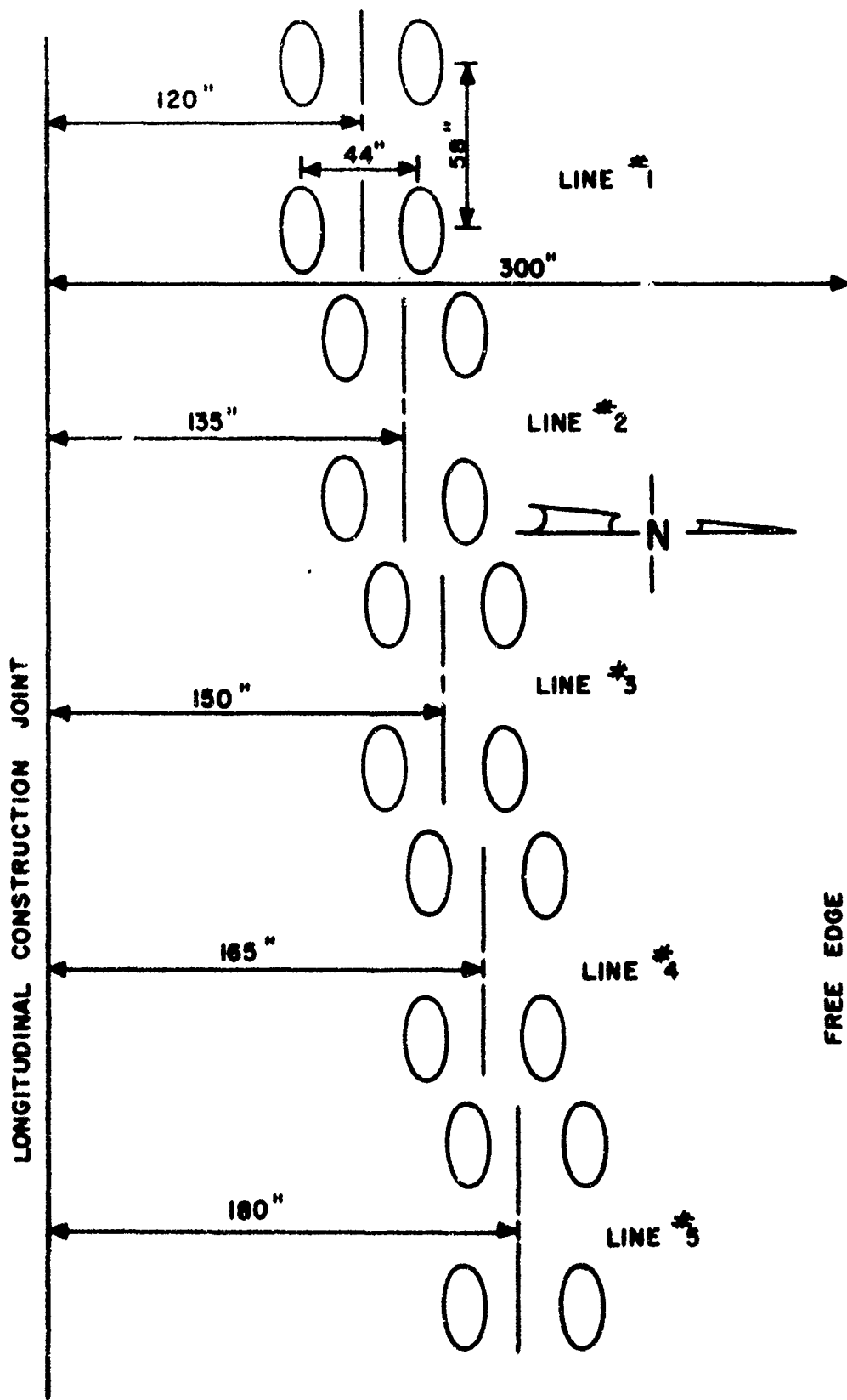


Figure 4. Traffic patterns for twin-tandem wheel assembly, rigid pavement test section.

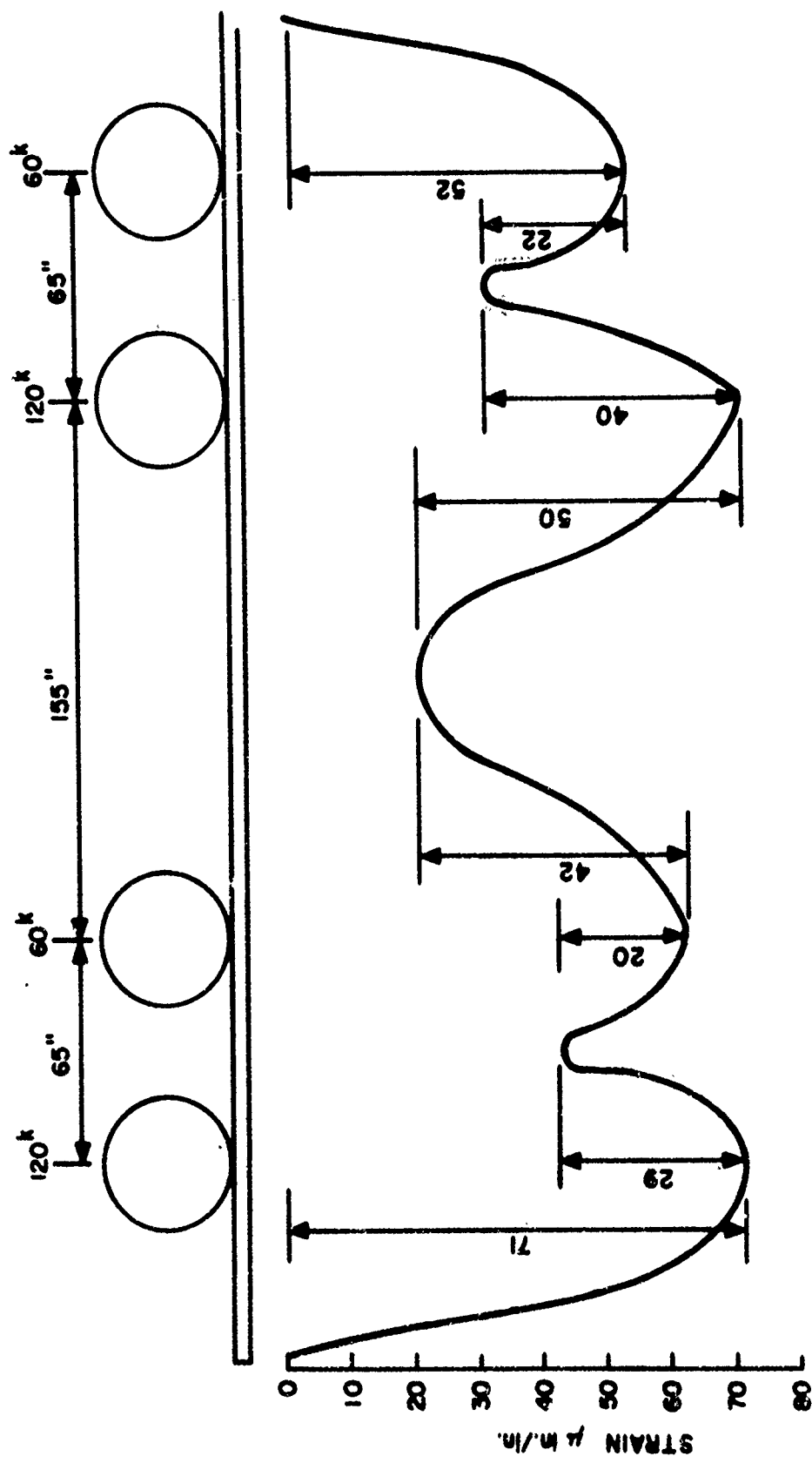


Figure 5. Typical strain trace under 12-wheel traffic showing strain profile for one pass. Note: gage 2SCCL, test item 2; surface strain gage; longitudinal direction; gear on traffic line 2; pavement thickness = 12.1 in.; subgrade modulus $k = 78$ pci; concrete flexural strength = 800 psi. Outside wheel of gear is passing gage at a distance of 16 ft.

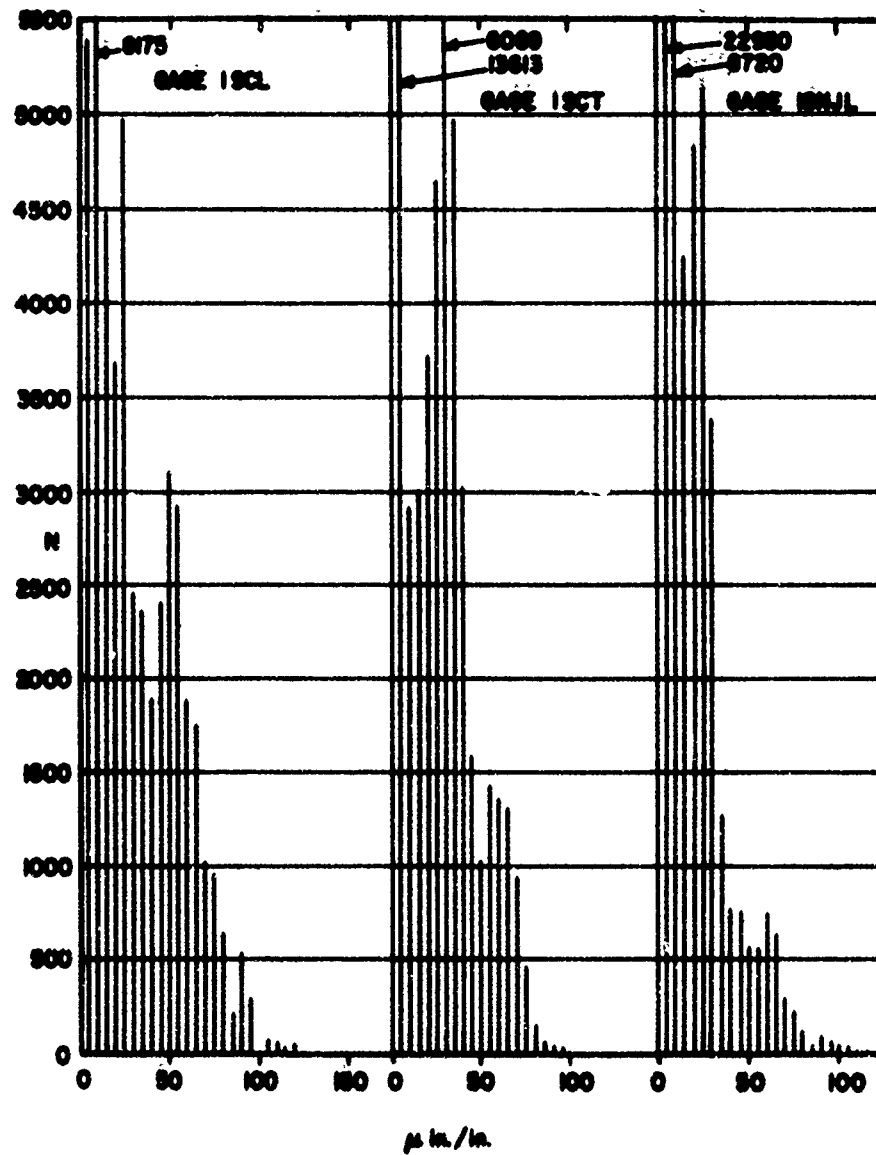


Figure 6. Histograms for strain excursions under 12-wheel traffic, Item 1, rigid pavement test section.

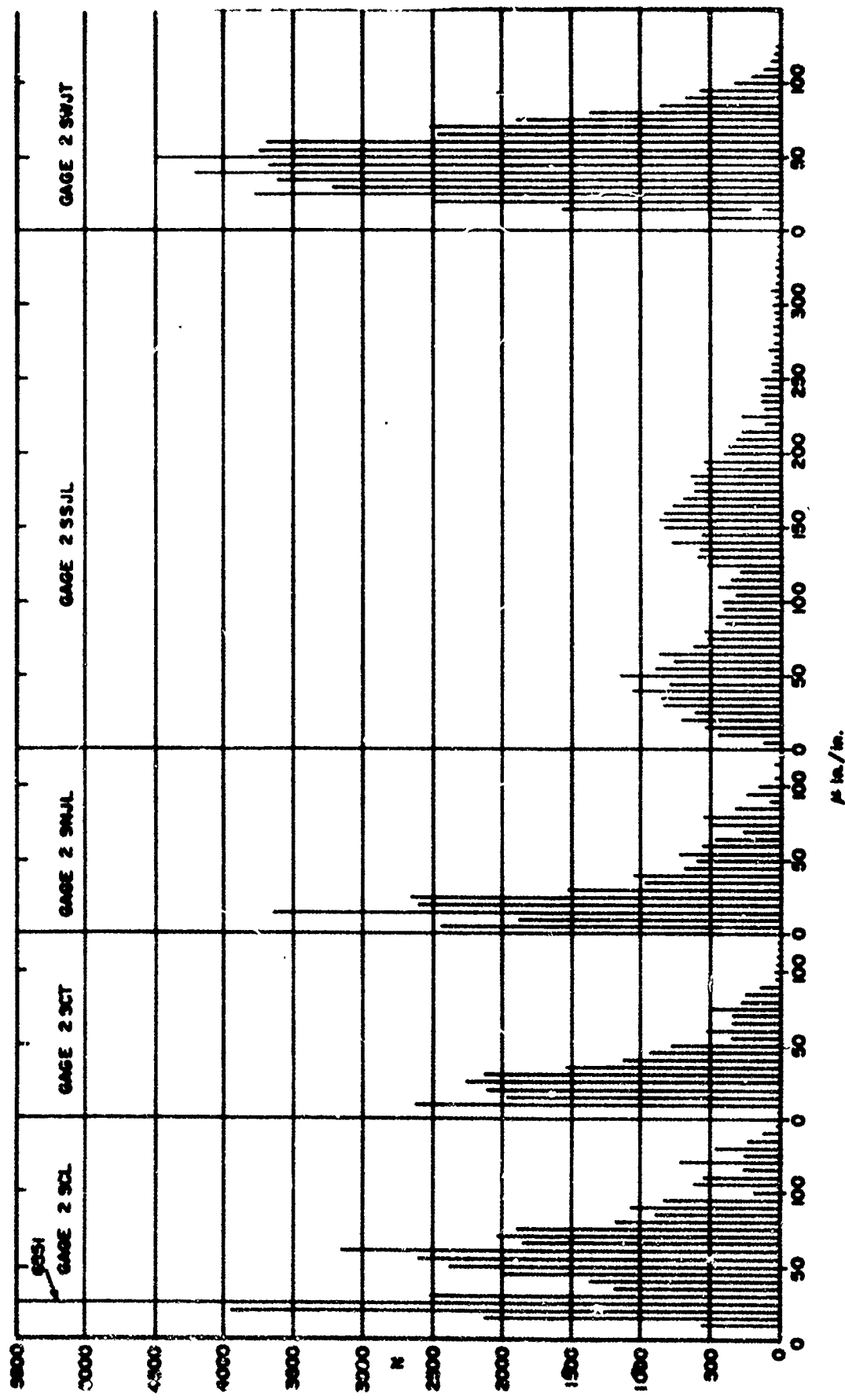


Figure 7. Histograms for strain excursions under 12-wheel traffic, item 2, rigid pavement test section.

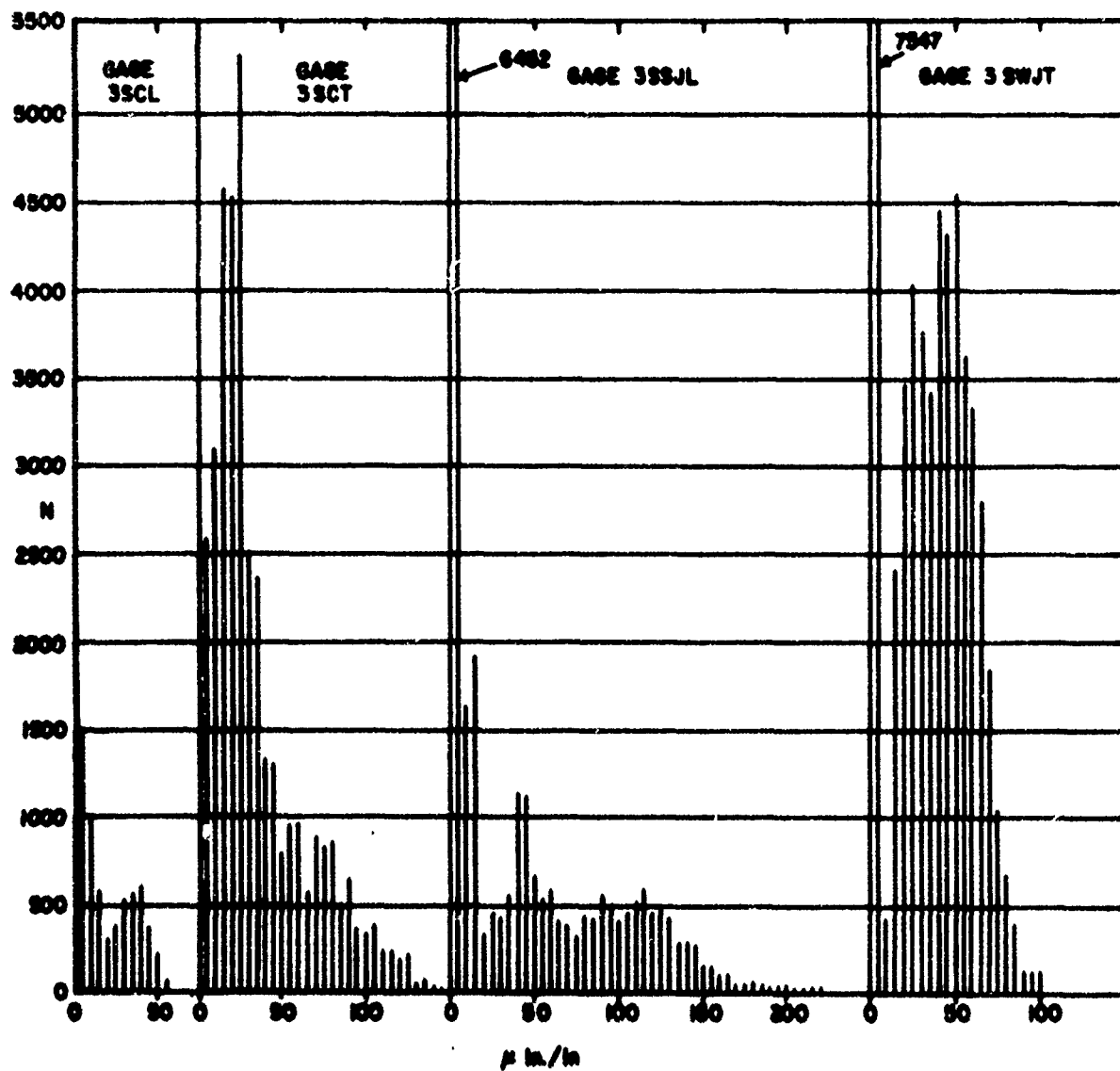


Figure 8. Histograms for strain excursions under 12-wheel traffic, Item 2, rigid pavement test section.

assumption has been demonstrated to be reasonable for design purposes through test track experiments and inspections of in-service pavements. The strain history approach is much too sensitive to the load transfer value to use an average value for the life of the pavement. Emphasis was shifted from the use of a jointed edge loading to an interior loading condition. The use of an interior loading condition eliminates a number of boundary conditions which are difficult to represent mathematically.

The twin tandem 747 traffic which was applied to the test items provides a mechanism for evaluating the interior slab loading technique in as much as this traffic was applied at the center of the slabs as shown in Figure 4. Histograms for the strain excursions in Test Item 2 produced by this traffic are shown in Figure 9. Table 2 shows the weighted areas for these histograms for test items 2 and 3. The areas were adjusted to the initial failure condition and 15 traffic patterns for test items 2 and 3, respectively.

Table 2
Weighted Areas for Twin-Tandem MWHGL
Traffic Histograms

Test Item No.	Gage No.	At First Crack	For Total Traffic
2	2 NSCL	5.75	97.74
3	3 NSCL	71.41*	(36.73) Gage Failure

*Reconstructed from histogram of traffic up to gage failure.

5 MIXED TRAFFIC

Chapter 3 discussed a procedure for generating load histories from gear pattern contours for particular aircraft configurations and pavement designs. Chapter 4 presented a hypothesis which establishes a total weighted area traffic histogram, H_T , which is a unique characteristic of the fatigue life of each pavement system.

In order to examine the relative severity of mixed traffic loading for which test track is not available, a series of calculations can be made using the program described in Appendix A to calculate weighted histogram areas. The wander pattern for traffic on a taxi-

way is as shown in Figure 10. Traffic distribution which is typically contained in the central 40 inches of the taxiway wander pattern accounts for 75 percent of all traffic.⁷

The technique for generating histograms is based on the calculated stress distribution. The weighted area histogram (H_S) is obtained as follows:

$$H_S = \sum_{j=1}^M \left[\frac{\Delta \sigma_j}{E_c \epsilon_f} \ln A_j \right] \quad [\text{Eq 1}]$$

where $\Delta \sigma_j$ = sum of stress excursions in lane j
 E_c = Young's modulus for the concrete pavement
 ϵ_f = maximum strain at failure
 A_j = proportional area of the wander pattern in lane j
 M = the number of lanes in the distribution pattern.

H_S represents the area of the weighted histogram for a single pass. For multiple passes represented by the wander distribution A_j the traffic histogram H_M is obtained from:

$$H_M = \sum \left[\frac{\Delta \sigma_j}{E_c \epsilon_f} \ln A_j N_p \right] \quad [\text{Eq 2}]$$

If we wish to compare complex traffic patterns, we must solve equation 2 for N_p .

$$N_p = e^{\frac{E_c \epsilon_f H_M - \sum (\Delta \sigma_j \ln A_j)}{\sum \Delta \sigma_j}} \quad [\text{Eq 3}]$$

Equation 3 can be used to estimate the impact of a complex mix of traffic simply by summing the individual distribution patterns as follows:

$$N_p = e^{\frac{E_c \epsilon_f H_T - \sum \sum (\Delta \sigma_{ij} \ln A_{ij} N_i)}{\sum \sum \Delta \sigma_{ij}}} \quad [\text{Eq 4}]$$

where H_T = the design weighted histogram area for the life of the pavement
 σ_{ij} = the stress excursion for aircraft i in lane j
 N_i = ratio of i type aircraft operations to total aircraft operations occurring on a periodic basis.

⁷Robert F. Baker, *Report of Photogrammetric Methods for Measuring Lateral Placement of Aircraft*, Lockbourne AFB (Ohio State University, 1966).

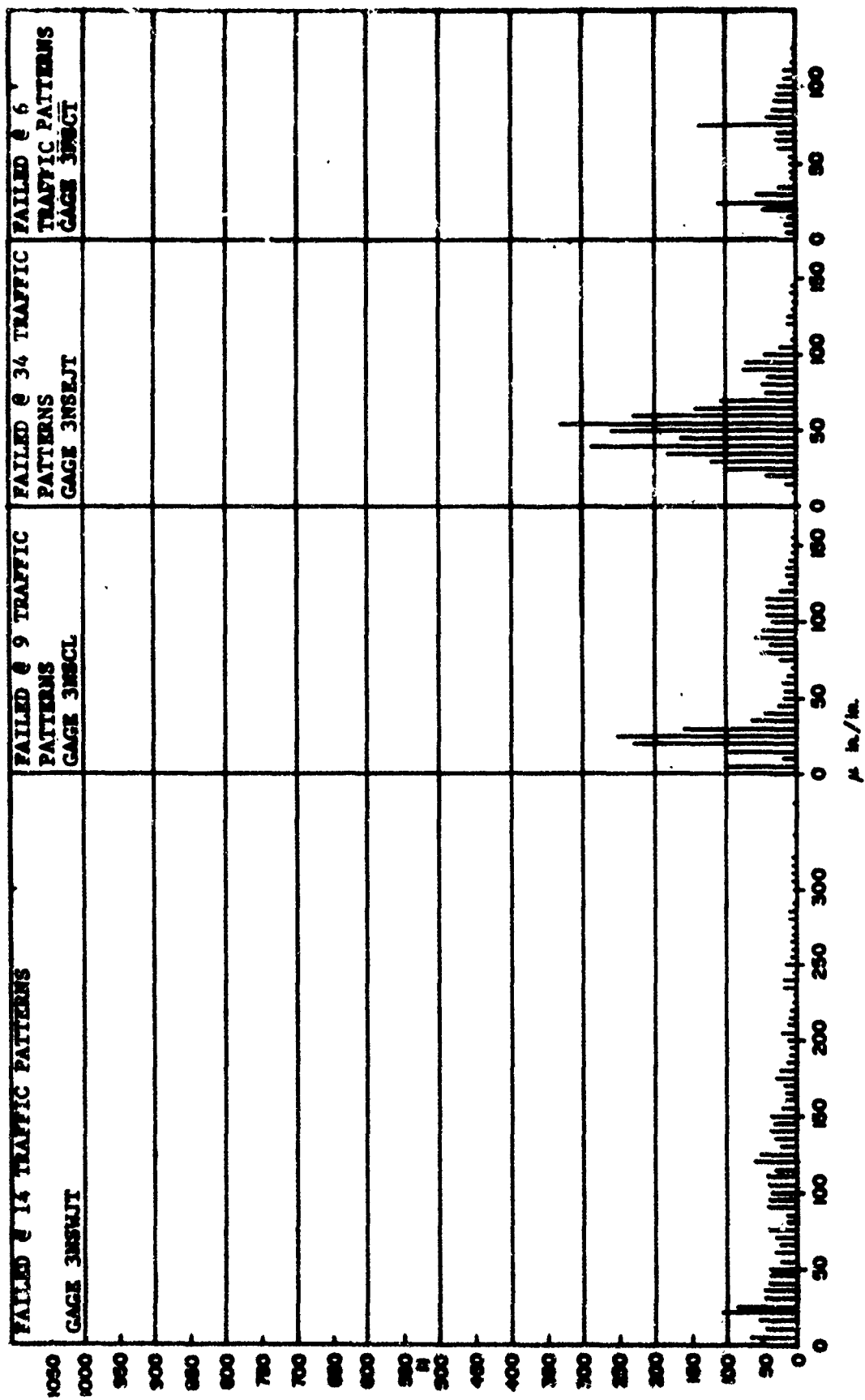


Figure 9. Histograms for strain excursions under twin-tandem traffic, item 3, rigid pavement test section.

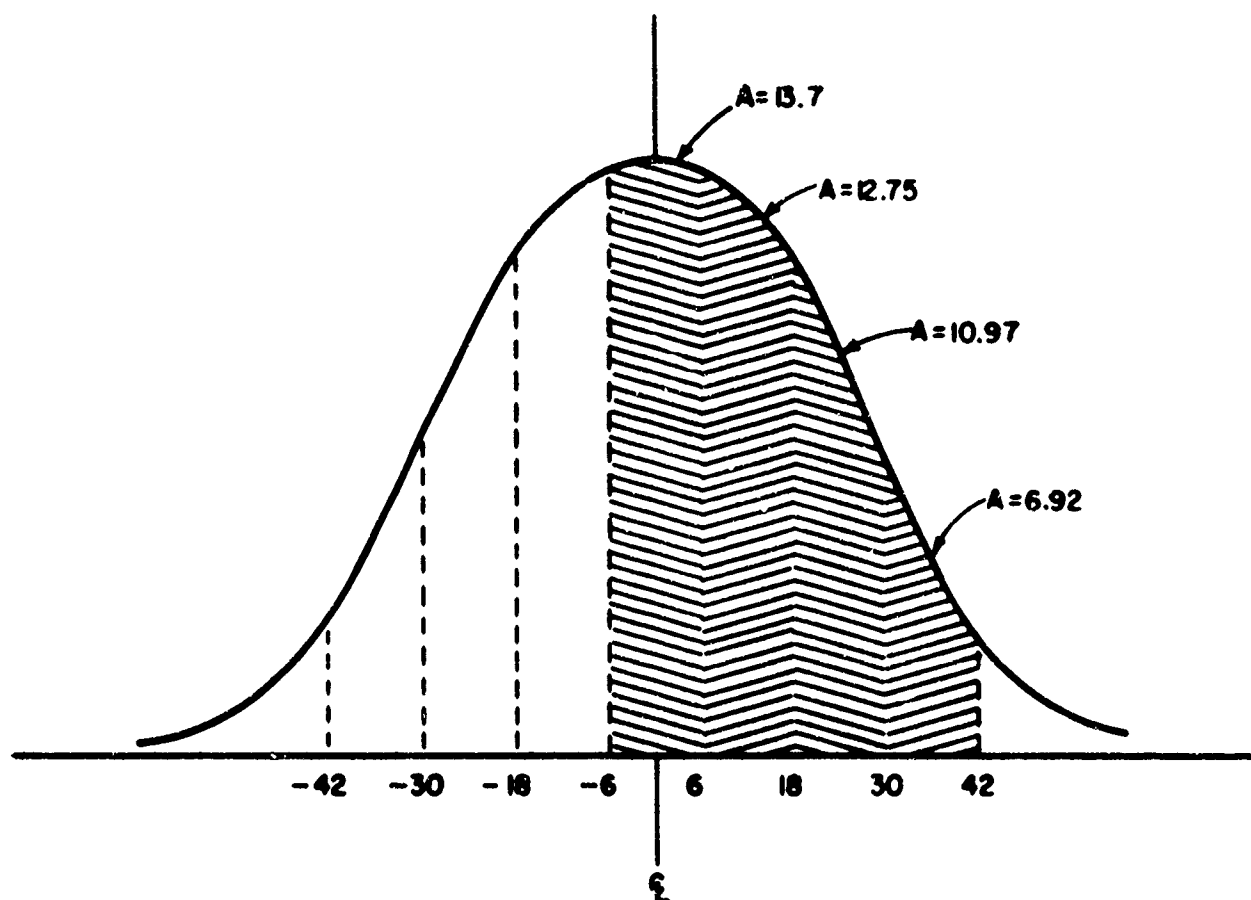


Figure 10. Wander pattern for runway loading.

Table 3
Weighted Strain Histogram Areas H_M for 1,000 Passes

Gear Configuration	Total Area
25,000 # Single Wheel	3.52
B-52	57.49
C-141	27.98
B-47	24.78
KC 135	31.27

Table 3 shows accumulated stress excursion levels for the 25,000 lb single wheel load, the B-52, B-47, KC-135 and C-141 aircraft systems. The pavement is a 12-inch thick slab with a radius of relative stiffness of 50 in. Weighted histograms were then developed by summing the individual stress excursions along traffic lanes spaced for each 12-inch segment of the wander pattern which represents the appropriate traffic density.

Table 4 is a report of aircraft traffic compiled by base operations of a typical heavy load Air Force base selected at random. Data of this type have been compiled for some 24 heavy load Air Force bases

over a four-year time period. On the average, the typical heavy load Air Force base experienced 100 cycles of B-52 traffic per month and 95 cycles of KC 135 traffic. A considerable amount of variation occurred in the traffic operations, however, as the standard deviation for B-52 traffic was 64 and for KC 135 the standard deviation was 51.

Some of the variation is probably due to differences in the numbers of aircraft stationed at a base. In some instances different numbers of squadrons, groups or wings are stationed at different Air Force bases. Variations in numbers of aircraft are reflected in the above standard deviations.

The distribution of aircraft traffic on taxiway and runways has been studied to a limited extent⁸ and has been shown to be approximately normally distributed. These studies indicated that 75 percent of aircraft traffic is concentrated with a wander of 7.5 feet on primary taxiways and 37.5 feet on runways at

⁸Robert F. Baker, *Report of Photogrammetric Methods for Measuring Lateral Placement of Aircraft*, Lockbourne AFB (Ohio State University, 1966).

Table 4
Report of Selected Aircraft Traffic Data

Month of Report Period	CYCLES OF OPERATION*												
	TYPE AIRCRAFT												
	Heavy Bomber			Medium Bomber			Tanker			Cargo			All Other Aircraft
	A	B	C	D	E	F	G	H	I	J	K	L	
First JUL	259			298			8	77	624	1034			
Second AUG	301			347	4		8	116	675	1297			
Third SEP	259			351	2		15	102	722	1176			
Fourth OCT	216			317	1		14	113	593	1457			
Fifth NOV	258			343			9	105	637	1467			
Sixth DEC	200			260			12	77	525	1048			
Totals	1493			1919	7		66	550	3776	7479			
AVG. TAKEOFF Wt. (Kips)	400M			235M	175M		323M	185M					
AVG. LANDING Wt. (Kips)	200M			125M	104M		257M	168M					
AVG. WEIGHT Range (Kips)													

*A cycle of operation is composed of one takeoff and one landing of the aircraft.

about the runway midpoint. The Corps of Engineers design method for pavements is based on 75 percent of the traffic occurring within the limits of the traffic area width. The data generated above from past operational records would indicate that over a 20-year design life at an average heavy load base, 24,000 cycles of B-52 and 22,800 cycles of KC 135 traffic will be encountered. Applying the 75 percent adjustment for traffic design yields—18,000 cycles of B-52 and 17,100 cycles of KC 135 traffic. Using the existing Corps of Engineers method for describing traffic, the above traffic volumes would be converted to 9000 coverages of B-52 traffic for taxiways and 4500 coverages for runways. These figures agree well with 10,000 coverages and 5000 coverages used for design. In the present design method for heavy load pavements the KC 135 traffic would be ignored. This is in contrast to the relative strain history areas shown in Table 3 which indicate that the KC 135 traffic is 54 percent as severe as the B-52 traffic. Thus, the total traffic would be computed as $9000 + 17.1/18 \times .54 \times 9000 = 13,617$ coverages for the taxiways and implies that the traffic volume used in the design of taxiways and runways is understated by 36 percent.

6 ANALYSIS AND DISCUSSION

Several problems arose during the course of this study which tend to limit the degree of validation which is possible. No data are available on the behavior of pavements under mixed traffic loadings under ideal test conditions. Data from various test tracks with similar properties and performance records were compared. A prime consideration in studying the effects of wheel interaction is the radius of relative stiffness which controls wheel interaction. Thus past test track data had to be analyzed on approximately the same basis to achieve meaningful comparisons. This requirement limited the data available for comparative analysis.

Computer analysis of pavement response is essential when using the strain history approach. No convenient manual method could be devised which would yield meaningful results. The output required to produce a significant strain history is too detailed for manual computation except for single wheel loadings. Wheel interactions on multi-wheeled gears are too complex to produce without the aid of a digital computer.

It has been necessary to make a number of implicit assumptions relative to the hypothesis advanced in this study which defines a weighted area histogram as a unique characteristic of each pavement systems. These assumptions are listed below:

1. A lower threshold for fatigue failure produced by strain excursions in a pavement does not limit the level at which a significant portion of the strain excursions are accumulated during the pavement life.
2. The relative severity of strain excursions is a function of the log of the number of loading cycles.
3. The weighted histogram area, H_T , at which fatigue failure occurs is a function of the strain excursion history only and is unique for each pavement system design.

The strain history technique yields reasonable results and can provide a basis for designing airfield pavements for a given level of mixed traffic. The method provides a much more realistic assessment of traffic on rigid pavements than the coverage concept as wheel interaction is taken into consideration. The coverage concept merely considers surface geometry; interactive effects are left to judgment and experience.

7 CONCLUSIONS AND RECOMMENDATIONS

Conclusions. Based on the results of the study reported herein, several conclusions can be drawn concerning the strain history method of assessing field traffic loadings.

The strain history approach appears to be a viable technique to assess multi-wheeled aircraft traffic effects on pavements.

The strain history approach should be based on interior loading conditions due to the difficulties encountered in modeling jointed edge boundary conditions. If sufficient assumptions are made concerning the jointed edge boundary conditions to permit a comparative analysis from the same reference, the analysis may as well be performed using interior loading conditions. The analysis is intended to

demonstrate relative effects rather than absolute values.

The deflection history approach was abandoned early in the study as the deflection approach was not sensitive enough to wheel interaction to provide meaningful data.

The strain history approach is a reasonable technique for analyzing the effects of mixed traffic on airfield pavement performance. The weighting functions applied to strains and repetitions will permit mixed traffic to be assessed from a common basis. Insufficient data is available to verify the nature of the Fatigue-Cyclic Excursions (F-N) Curve for concrete pavements. The assumption that the relationship is a log function needs to be verified. An assumption that fatigue strain is linearly proportional to the ratio of the strain excursion experienced to that at failure is undoubtedly an oversimplification. The relationship is probably influenced by the strain level beyond that purely linear position of

the stress-strain diagram with a minor influence up to that point.

Recommendations.

1. The Corps of Engineers rigid pavement design criteria should be based on histograms of strain distribution rather than coverage concept for describing traffic volume.

2. Lateral positioning of aircraft on taxiways and runways during normal operations should be investigated. Previous studies are rather old and should be updated to reflect changes in aircraft and operational characteristics which may affect aircraft placement during normal operations.

3. The nature of the weighting factor to be applied to strain excursions should be verified by either model tests or traffic data.

4. A program for the collection and analysis of field data for correlation should be undertaken particularly for new pavements.

APPENDIX A: SLAB 30E—A COMPUTER PROGRAM FOR AIRFIELD SLAB ANALYSIS

This appendix presents the documentation of a computer program developed by Austin Research Engineers Inc. for the U.S. Army Construction Engineering Research Laboratory (CERL), Champaign, Illinois. The work was conducted under Contract No. DACA 23-70-C-0076 by Mr. John J. Panak. Mr. Frank L. Endres was the programmer who made the revisions to the original program and performed the checkout work on the CERL input facility.

The FORTRAN Program. Program SLAB 30E is an extensive u-date and revision of a program called SLAB 30 which is reported by Stelzer and Hudson.⁹ It has features which allow it to work more efficiently than SLAB 30, and in addition, includes three significant new developments which are:

1. Addition of a printer plot routine to allow a visual display of selected lines of output values of deflection, bending moments and principal stresses.
2. Addition of a feature which will allow a particular wheel load pattern, such as that associated with the C-5A, to be simply input to the computer model by reference to a single input coordinate.
3. Addition of a data input generation routine which will allow much simpler definition of the pavement slab in terms with which the investigator is accustomed.

The program is written to operate on any Control Data Corporation Model 206 remote user terminal which can access a CDC 6600 computer. All programming is in ASA FORTRAN and therefore is compatible with other computers such as IBM 360 and UNIVAC 1108 systems.

Storage Requirements. The storage requirements are variable, depending upon the size of the problem to be run. Cards which must be changed for different sized problems are specified at the beginning of the

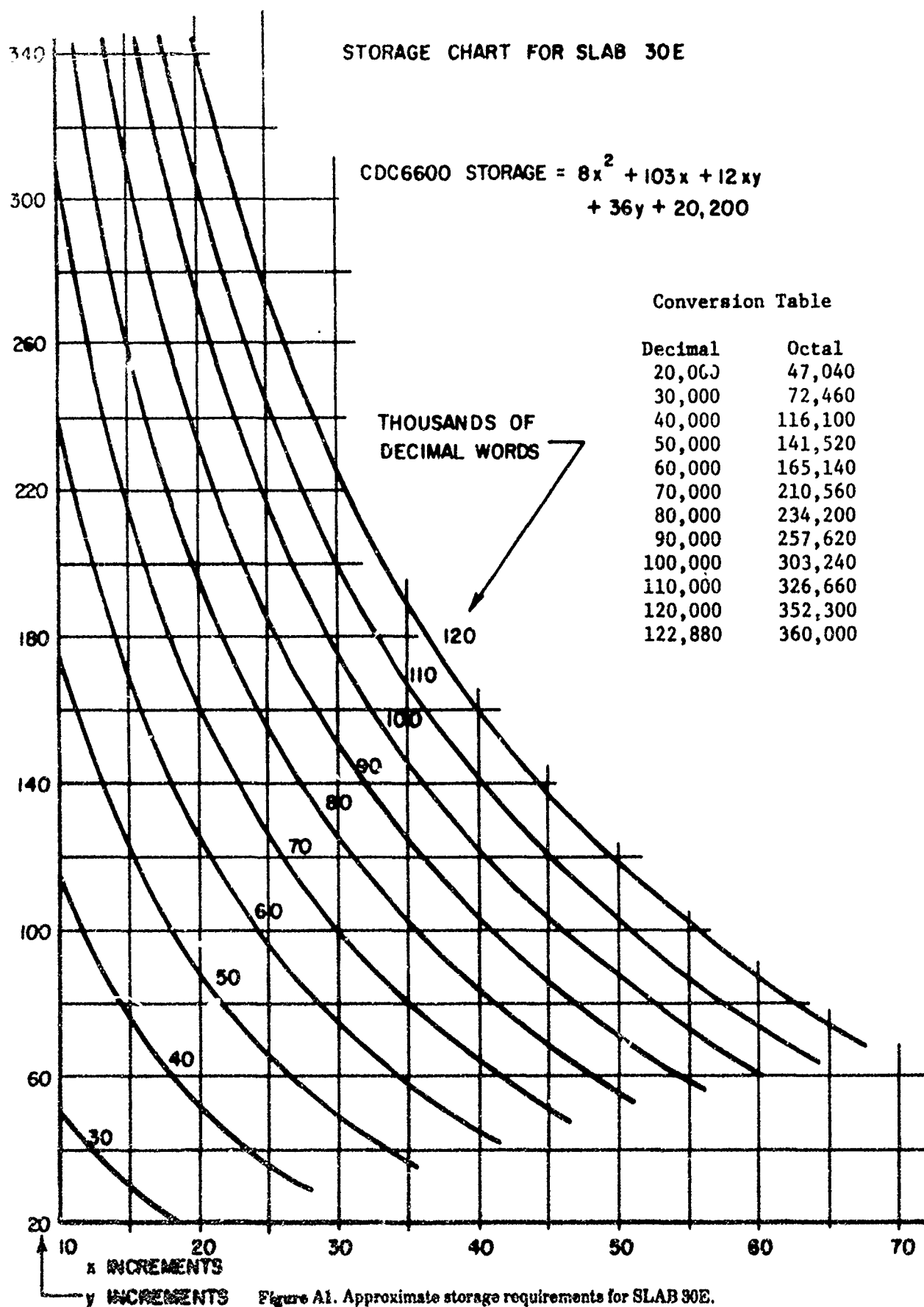
program and only include the dimension statements and two variables which define the number of increments in both directions. It is not necessary to match exactly the dimensioned storage to the problem, any size larger is also acceptable. It is recommended that several dimension packages be made of those cards with RE-DIMEN in columns 73 through 80 of the main driving program (refer to program listing). These packages can be of multiples of width and length of 10 or 20 stations up to the maximum acceptable for the particular computer being used. A plot of the CDC 6600 storage requirement is shown in Figure A1. If necessary to gain more storage space, certain variables could be placed in common. In addition, others may be set equal to each other in storage by an equivalence declaration. Common and equivalence statements have not been added in the program for normal operation, to avoid initial confusion when converting to other computer systems. All subroutines in the program are variably dimensioned as functions of the short (X) and long (Y) lengths, which are specified in the main driving program.

Input of Problems. The procedures that are followed in input of problems are outlined in the Guide for Data Input. A parallel study of the guide will help to understand the following discussion. Any number of problems may be run at the same time.

The first two cards of a problem series are for identification purposes. Any alphanumeric descriptive information desired can be entered. It is suggested that the date of the run and the user's name always be entered within these two cards. The next card is the problem number card with a brief description of the particular problem. The problem number itself may contain alphabetical characters if desired. The problem series terminates when a blank problem number is encountered.

Tables of Data Input. Table B1 is used to input the problem control data and is composed of a single data card that specifies the multiple load option and the number of cards in the following data Tables B2 through B7. The Multiple Load Option in column 7 of Table B1 is left blank if each successive problem is independent of the preceding problem. If a following problem is for the same slab but only the load pattern and placement are to change, the first problem in the loading series is specified with a +1 for the option. This will be the "parent" problem. Each

⁹C. F. Stelzer and W. R. Hudson, *A Direct Computer Solution for Plates and Pavement Slabs*, Research Report 56-9 (Center for Highway Research, University of Texas, 1967).



successive loading must have a -1 for the option and these will be termed "offspring" problems. When a blank option or another +1 is encountered, that problem is then another independent problem or a new parent problem.

The optional stiffness input switches in columns 55, 60, and 65 may be used to automatically compute conventional slab or plate stiffness values by entering a one for the options selected. Appropriate values must then be made available in Table B2. If D^x or D^y or C are to be computed, then there must be real values available for E and t in Table B2. If a uniform value of S is to be computed, then a subgrade modulus k must be available. The stiffness options must be left blank for offspring problems.

Two Output Options may be specified in columns 75 and 80. All of the detailed output of Table B8 may be omitted if desired. The user is cautioned when using this option that he could omit what might later be desirable information. Deletion of output reduces central computer time only a small amount. It may, however, decrease turn-around time due to reductions in peripheral processor time and printer time. If the output is suppressed, a single reference station is printed which is at or near the center of the slab. The other output option is exercised if the user desires the printout of principal stresses in place of principal moments. If the stress option is exercised, an appropriate value of slab thickness must then be available in Table B2. The principal moment is converted to a stress having the same sign by multiplication of the moment by the plate section modulus which is internally computed on the assumption of a uniform thickness of plate. The use of the stress option is only appropriate for plates of a constant thickness. At specified discontinuities in the slab, such as a crack or joint which might be modeled by means of a reduced bending stiffness, the output value of "stress" at that location may be misleading. A better estimate of stress at discontinuities, may be obtained by inspecting the variation in computed stress at several stations adjacent to the crack while incrementally moving the concentrated loads away from the crack.

Table B2 is used to specify the constants for the problem. These are the number of increments in the X and Y directions, the increment lengths in both directions, and Poisson's ratio. For efficient solution of the program, the number of Y increments must be

equal to or greater than the number of X increments. Table B2 is omitted for offspring problems since the constants must be the same as in the parent problem. The constants specified for the parent are retained and used by all successive offspring problems.

Data for optional stiffness constants are also input in Table B2. The Modulus of Elasticity E and the slab thickness t must be specified if D^x , D^y , or C are to be internally computed by the options in Table B1. A uniform subgrade modulus k must be specified if S is to be computed. All of these three constants may be input if desired and thus printed for reference without the options exercised in Table B1. The options cause the computation of the equivalent data which could be input in Table B4 based on these customary plate stiffness relationships:

$$\begin{aligned} D^x = D^y &= \frac{Et^3}{12(1-\nu^2)} \\ C &= \frac{Et^3}{12(1+\nu)} \\ S &= kh_x h_y \end{aligned} \quad [\text{Eq A1}]$$

The computed stiffnesses are constant over the X by Y area of the slab and appropriate quarter and half-values are generated at corners and edges. They are printed as an extension to Table B4, and thus any additional stiffness values entered in Table B4 are superimposed algebraically. By the addition of appropriate reduced lines of stiffness in Table B4, any degree of discontinuity may be modeled. Multi-valued subgrade moduli, or foundations with voids may also be modeled by entering the appropriate additive spring stiffnesses in Table B4.

Table B3 is used to define the lines or areas of selected output for deflection, bending moments in the X and Y directions, and either the maximum principal moment or stress depending on the print option in Table B1. The number of cards are as specified in Table B1 and may include up to a maximum of 10 cards. Each card may encompass up to a maximum of 300 points. That is, coordinates from 10, 10 through 20, 40 or from 0, 0 through 12, 25 could be specified. If a larger area is required, another card covering the adjacent area could be added.

The major advantage of Table B3 is that a crude printer plot display is also obtained for each area specified. This feature will be discussed more completely under the heading Computed Results. Table B3 is especially useful when studying the deflection and moment variations along a line or over a local area. Table B3 may be omitted if desired, since all selected output values are duplicated in the complete printout of results in Table B8. The selected output is controlled by the same input joint coordinate system described below for Table B4. The user is cautioned when omitting Table B3, since he may have elected to suppress the complete printout of results by the option in Table B1. It is thus possible to use a significant amount of computer time and print no results.

Table B4 has the number of cards as specified in Table B1. Card counts should be carefully checked. It is recommended that a listing of the data cards be checked by the user prior to submission of the program for a run.

Stiffness and load data are entered by a coordinate system notation. The coordinates refer to the discrete-element model of the slab. A joint is defined as occurring at the intersection of the station lines in each x and y-direction. A mesh is defined as that area surrounded by four joints. A bar is defined as the discrete-element length between adjacent joints. Figure A2 of the Guide for Data Input summarizes this notation. Note that mesh data cannot have either a zero x or zero y-coordinate; x-bar data cannot have a zero x-coordinate, and, similarly, the y-bar cannot have a zero y-coordinate. If the data occur only at one location (such as a concentrated load), the From and Through coordinate is simply repeated. If the data occur along a line, the coordinates will reflect this by having either both x or both y-coordinates the same. Data distributed over a rectangular area are specified by entering the lower left and upper right coordinates of the area.

Values of stiffness entered in Table B4 are added algebraically to the automatically created optional stiffnesses computed by Tables B1 and B2. Thus, the user has the ability to freely model any discontinuities that might exist in the actual pavement.

The orthogonal bending stiffnesses D^x and D^y are entered in each direction and are specified on a per unit width basis. If the edge of the slab coincides

with a station line, a half-value of stiffness should be input for both D^x and D^y along the edge. If the edge of the real slab is not on a station line, a proportionate value of full stiffness is entered. This is demonstrated by a sample input in Figure A3 of the Guide for Data Input. The stiffness proportionment may be thought of as a direct function of the plan area of real slab surrounding each joint.

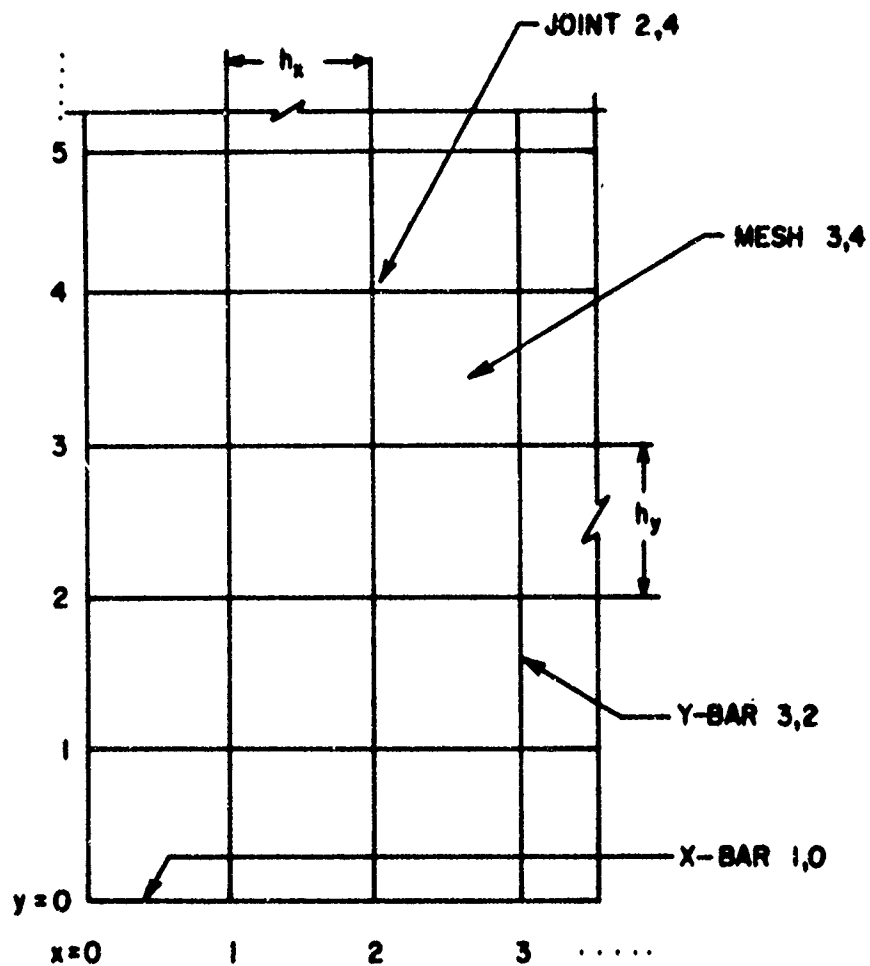
Load Q is concentrated on a per joint basis and may be apportioned at each joint by the contributory area loaded around each joint. Positive loads act upward. Loads that occur between joints may be fractionally proportioned to the adjacent joints. Support springs S are concentrated values input and apportioned exactly like loads. A rigid support may be specified by introducing a large value of support spring. A maximum value of 1×10^{25} is suggested to avoid computational difficulties for some computers. Loads may also be applied to the pavement by means of specified load pattern in Tables B6 and B7 discussed below.

The twisting stiffness C is input on a per unit width basis for each mesh surrounded by four joints. When the geometric edges of the actual slab do not fall on a station line, proportionate values of unit twisting stiffness may be input similar to bending stiffness proportionment. Computations of twisting stiffnesses for slabs or plates are at best still approximate procedures. This is due to uncertainty in the defining of the shearing modulus of rigidity. The best procedure is to ascertain the twisting stiffness experimentally as outlined by Reference 10. The formulas shown above in the Table B2 discussion are correct for uniformly thick isotropic plates. An approximate value of twisting stiffness for orthotropic slabs or stiffened plates may be obtained by using procedures outlined by Huffington¹¹ or computations summarized by Troitsky in a recent publication.¹² Fortunately, precise values of twisting stiffness are unnecessary to model a slab. The main load

¹⁰W. R. Hudson and Hudson Matlock, *Discontinuous Orthotropic Plates and Pavement Slabs*, Research Report 56-6 (Center of Highway Research, University of Texas, 1966).

¹¹N. J. Huffington, Jr., *Theoretical Determination of Rigidity Properties of Orthogonally Stiffened Plates* (Applied Mechanics Division, ASME, 1965).

¹²S. Timoshenko and S. Woinowsky-Krieger, *Theory of Plates and Shells*, Engineering Society Monographs, 2nd Ed. (McGraw-Hill, 1959).



JOINT DATA: D^x, D^y, Q, S

(D^x AND D^y ARE PER UNIT WIDTH, Q AND S ARE CONCENTRATED)

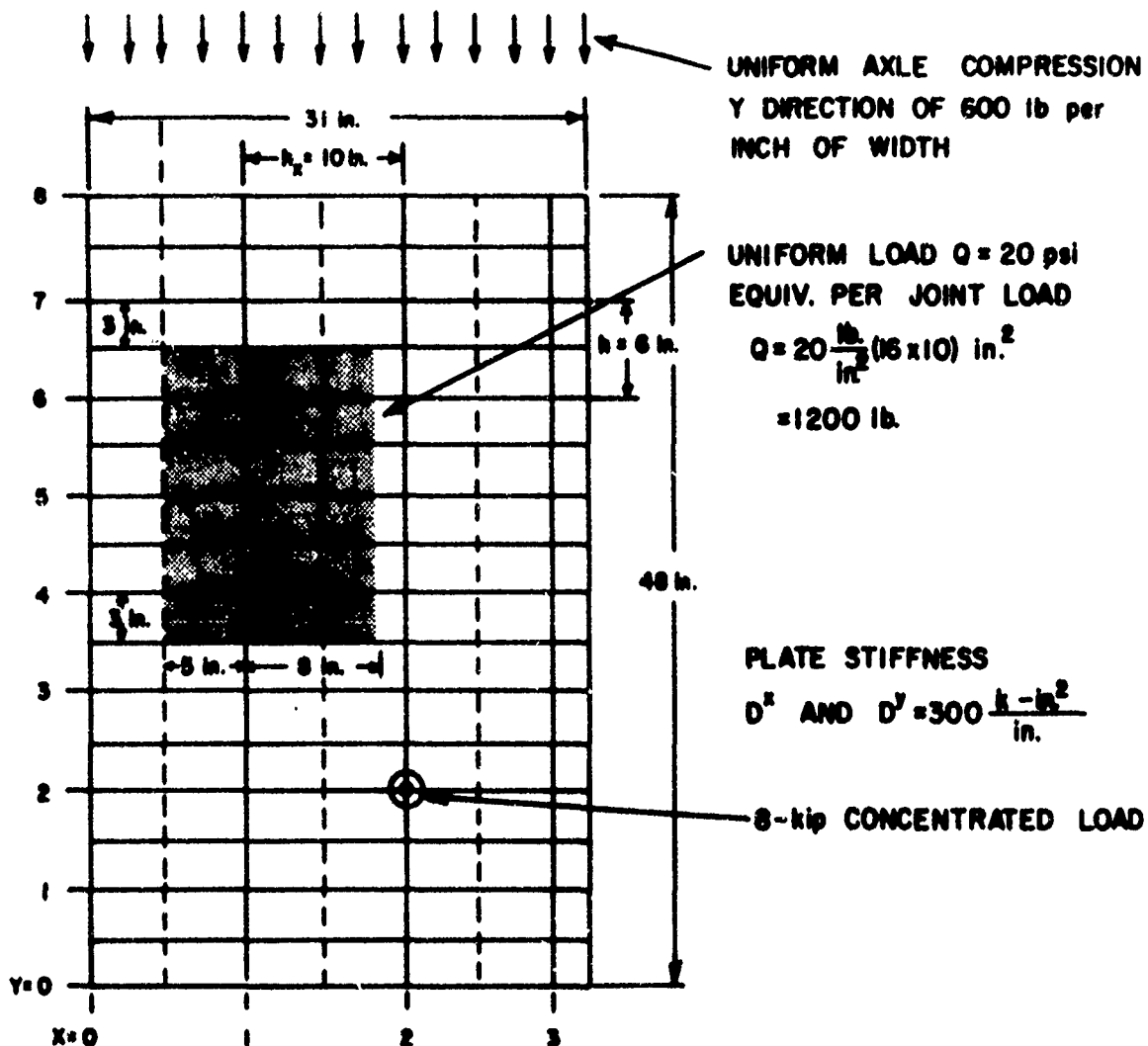
MESH DATA: C

(C IS PER UNIT WIDTH)

BAR DATA: P^x, P^y

(P^x AND P^y ARE CONCENTRATED)

Figure A2. Data coordinate numbering system.



FROM		THROUGH		$D^x \text{ AND } D^y$	Q	p^y
X	Y	X	Y			
0	0	2	8	7.500E+04		
0	1	2	7	7.500E+04		
1	1	2	7	1.500E+05		
3	0	3	8	9.000E+04		
3	1	3	7	9.000E+04		
1	4	1	6		-1.200E+03	
2	4	2	6		-3.600E+02	
2	2	2	2		-8.000E+03	
0	1	0	8			-3.000E+03
1	1	2	8			-6.000E+03
3	1	3	8			-3.600E+03

data incomplete for this sample

Figure A3. Sample data input.

carrying capabilities of a slab are due to its bending stiffness which is more accurately definable.

By using a zero value of twisting stiffness and zero Poisson's ratio, a simple grid system may be modeled. Each beam would be modeled by an appropriate D^x or D^y term which would then be the per unit width stiffness. The beam stiffnesses entered should therefore be divided by the increment width.

Table B5 is for input of in-plane axial tensions P^x or P^y if present. These might be generated due to temperature differentials or traffic braking and acceleration forces. There is no provision in the program for automatic distribution of applied axial forces since no in-plane supports are used which would restrain them. The user must specify the distribution of the axial tensions (+) and compressions (-) in each x-bar and y-bar of the model. Since these are bar forces, no data should be input which would represent forces outside the boundaries of the actual slab. A brief sample of data input is given in Figure A3 in the Guide for Data Input.

All data in Tables B4 and B5 are algebraically accumulated and values therefore may be added or subtracted regardless of other values specified.

Table B6 is for input of special load patterns such as are found on the C-5A or Boeing 747 aircraft. This table allows the user to specify one pattern which can then be repeated or placed several times on the same pavement. By this means, the placement of wheel load patterns by individual load inputs in Table B4 is unnecessary.

A maximum of nine different patterns may be specified with a maximum of 12 loads in each pattern. Each pattern requires two input data cards. The first card specifies the pattern number designation, the number of loads in the pattern, and the pattern coordinates. The pattern has its own local coordinate system, the only restriction being that the increment spacing is the same as for the complete pavement described by Table B2. The second card of the pattern is for the entry of the individual pattern load magnitudes. For loads between stations, a geometric apportionment of load could be used. The first pattern coordinate and load entered in columns 9 through 14 is the reference load for the pattern and is the load which is placed by Table B7. It may have

any coordinate including negative values and may also have a zero magnitude of load which is sometimes convenient. A typical pattern and Table B6 input is shown in Figure A4 of the Guide for Data Input.

For a problem series in which the effects of several load patterns may be studied, all patterns could be entered in Table 6 of the first problem. The selected pattern numbers are then applied to the slab by the Table B7 of each problem. The series can be parent and offspring problems, or individual problems in which stiffness might be changed from problem to problem. New patterns can be entered at any problem in the series and are then available for subsequent problems. If the same pattern number is used as was previously used, then the new pattern replaces the old pattern.

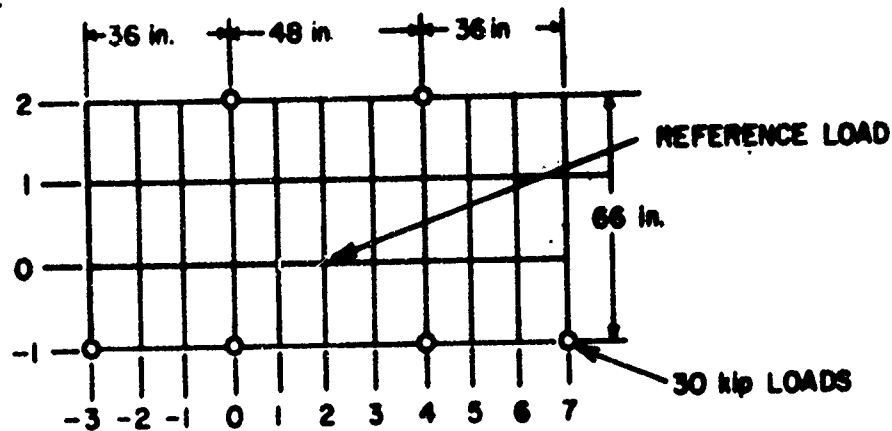
Table B7 is for the placement of any or all of the load patterns defined by Table B6. Any number of pattern-placement cards may be used. Placements of the reference load are by coordinates which are related to the overall system defined by Table B2. Placements outside the boundaries of the actual slab are permissible. Any loads of the pattern that thus fall off the slab are not included in the solution. The same pattern number may be repeated on several cards if desired. They need not be in numerical ascending sequence.

For offspring problems, only Table B1 and Table B4 with added loads are required. Any loads entered in the offspring Table B4 replace all other previous Table B4 loads. Offspring problems may also be run with only Table B1 and new load pattern placements in Table B7. Table B2, stiffnesses in Table B4, and Table B5 cannot be used in offspring problems. Tables B3, B6 and B7 may be used as desired.

Input Checklist. An input checklist is provided in Table A1 of the Guide for Data Input. A listing of the input data prior to problem submission will also aid in detecting coding and keypunch errors.

Data Errors. All data are checked for compatibility with the geometry of the specified slab and consistency of coordinate input. A count of the number of data errors is made and if any errors are encountered, the problem is terminated and a message showing the number of data errors made is printed. Typical errors are: 1. misuse of the multiple-load

PATTERN NO.



$$h_x = 12 \text{ in.} \quad h_y = 22 \text{ in.}$$

Table B6 input for this pattern:

Pattern Num	Num of Loads in Pattern	x	y	x	y	x	y	x	y	x	y	x	y	x	y
2	7	2	0	0	2	4	2	-3	-1	0	-1	4	-1	7	-1
		0		-30000		-30000		-30000		-30000		-30000		-30000	

Figure A4. Typical special load pattern.

option, such as a -1 following a 0 in the preceding problem; 2. the number of increments in the x-direction exceeding those in the y-direction (if this were allowed, an inefficient and time consuming computer solution would result); 3. a negative or zero increment length specified; 4. a negative Poisson's ratio or thickness input; 5. the "Through" x or y-coordinate in a data specification numerically less than the "From" coordinate; 6. data specified outside the geometric limits of the slab (exceptions are Table B6 and B7 which allow load patterns to be outside slab boundaries); 7. a zero x or y-coordinate specified for a twisting stiffness; 8. a zero x-coordinate used for x-bar axial tensions or a zero y-coordinate for y-bar tensions; 9. the number of increments specified are greater than the dimensioned storage the program can operate with; and 10. misuse of the selected output option.

Computer Results. All input data cards are reflected in the printout of results exactly as they were input. It is good practice to again check these data for possible errors prior to inspection of the remainder of the results. The importance of using descriptive alphanumeric information for the problem series header cards and for each problem number card cannot be over-emphasized. This will avoid confusion when running a large number of problems.

A continuation of Table B4 is printed after the normal Table B4 input which reflects the computed optional pavement stiffness constants. Appropriate quarter, half, and full values are generated for bending stiffnesses and the subgrade spring equivalent. Full values of twisting stiffness are computed for all the mesh areas of the slab. Reference to Figure A2 in the Guide for Data Input explains the different data types and their associated numbering systems.

Immediately after the echo print of load placements in Table B7, a summary of the applied load patterns is printed. This should be inspected to see if the total number of wheel loads and their algebraic sum are of the intended amounts. The number of pattern wheels which fall outside the slab boundaries and their algebraic sum are also printed for information.

Table B8 gives the complete printout of final results. If the option to delete Table B8 is exercised in Table B1, then only a single reference station is

printed at or near the center of the slab. Again, the user is cautioned to use this option with discretion to avoid deleting significant results. Table B8 is arranged to give the x and y-joint coordinate, the transverse deflection at each joint (upward deflections are positive), the bending and twisting moments, the support reaction, the principal moment or stress and its direction. The tabulations are arranged in groups for each y-station. Output values of bending and twisting moments are given on a per unit width basis. Bending moments are positive for compression in the top of the plate or slab. The x-bending moments act in the x-direction and y-bending moments in the y-direction.

The per unit width x twisting moment is tabulated and is exactly equal to the y twisting moment with opposite sign. The x-twisting moment acts in the x-direction and is about the y-axis. Even though the input values of twisting stiffness were specified at each mesh, the output value of twisting moment is the average of four adjacent mesh areas and is therefore given at the joint. The user is cautioned that the output values of twisting moment along the edges or other discontinuities of a slab or plate reflect the average and therefore may be a one-quarter, one-half, or some other proportionate value of twisting moment.

The support reaction is the concentrated value of resistance to displacement offered by any support springs if present. A subgrade modulus spring will reflect the concentrated value of pressure under the slab. The value of support reaction is different than the similar value tabulated in prior versions of DSLAB and SLAB computer programs. In those programs, the value might have been better labeled Net Reaction, or Net Force, since it was the summation of the applied load and support reaction.

Internally in the program, a Mohr's circle analysis is made at each joint using the orthogonal bending moments and the twisting moments to yield the larger numeric value (positive or negative) of principal moment per unit width and the angle from the x-axis of the coordinate system to the acting direction of this larger value. Counterclockwise angles are positive. If the stress option is specified in Table B1, the values are converted to the larger numeric value of principal stress instead of moment. A positive stress indicates tension in the bottom of the slab. The input value of thickness is properly

used only for slabs of constant thickness. For slabs of variable stiffness and thickness, a direct conversion can be made for principal stress from the principal moment.

As both a check on the internal computer solution and a check on the input of the load system to a problem, a statics check is printed at the end of Table B8 which is the algebraic sum of all the reaction values and should be equal to the sum of all the applied loads from Tables B4 and B7. This check should always be inspected to verify that the desired load system was specified and that the problem was properly solved.

Table B9 has been found to be the most immediately useful type of output in the SLAB 30E program. It lists the output parameters which were specified as selected output in Table B3. Each area of Table B3 is treated as a separate output array for each of the four desired output values of deflection, bending moments in the X and Y directions, and principal moment or stress depending on the Table B1 stress option.

The coordinate references are printed in consecutive groups associated with the largest number of increments in the rectangular area. For instance, if an area were desired from 10, 15 to 12, 20 then there would be three groups of values each with five values. If the area is square, then the groups are for each Y value included which is the same as the normal arrangement of Table B8 output. Adjacent to the coordinate is the numerical value of the deflection, moment, etc. To the right of the output values is a series of asterisks which have a relative placement to one another which are proportional to the numerical output value. Thus, a crude plot of the output values is obtained. The plot has a width of 20 printer characters and a length equal to the number of nodes encompassed by the area specified. The plot has no scale and no zero, the values are relative to one another, increasing positively to the right. The 20 character width is based on the minimum and maximum value in the area to be plotted. The user is cautioned to not misinterpret apparent changes in plot curvatures which might have been generated due to very slight numerical change.

The plots have been found to be especially valuable in understanding slab behavior in areas adjacent to concentrated wheel loads. All deflection

areas are printed first followed by bending moment areas which are printed adjacent to each other if both x and y-moments were desired in the same area. The final selected output is for the principal moments or stresses. Plots of principal stresses along slab lines are somewhat misleading since the direction of the stress usually varies along the line. It is valuable, however, in pointing out maximum values of stress which might be overlooked when inspecting a mass of numbers in the normal Table B8 output.

The final printed output is of the computer time which has been used for the problem plus another time which is the total elapsed time. The user should record his problem run times for parent and offspring problems for each different problem size he runs. By this means, an estimate of required run times can be made for future problems. For small problems, the offspring times will be from 20 to 50 percent of the parent problem times. Fortunately, the offspring problem time decreases to a very small proportion of the parent problem time as the problem size becomes large. A time as low as four percent is possible. For this reason, the user should, for computer economy, run as many offspring problems for each parent problem as he thinks he might need.

Computer Time Requirements. The computer time required for running problems with program SLAB 30E cannot be as precisely defined as the storage requirements indicated in Figure A1. As previously stated, it would be good practice for the user to record run times as he uses the program to be able to make better run time predictions.

Based on a small sample of run times using SLAB 30E and similar programs, the following time expressions were derived:

For parent and independent problems,

$$T_p = \frac{2XY}{1000} \left(1 + \frac{X}{50}\right) \quad [\text{Eq A2}]$$

Where T_p is the predicted central processor time in seconds, and X and Y are the number of slab increments.

For offspring problems,

$$T_o = T_p \left(\frac{60 - X}{100}\right) \quad [\text{Eq A3}]$$

where T_0 is the offspring time and T_p is the above parent problem time. A minimum of four percent of T_p should be reserved for T_0 times for large problems.

In both parent and offspring problems, a very rough estimate of input-output time required may be found by this expression:

$$T_{I/O} = \frac{XY}{5} \quad [\text{Eq A4}]$$

where $T_{I/O}$ is the estimate of input-output time in seconds.

The above time estimates should be reasonably accurate for problems with X less than 30. For larger problems, the estimated times will probably be somewhat conservative.

The program compile time must be added to the estimated problem run times. The complete program deck will compile in approximately ten seconds. If stored on tape in a re-locatable form, the compile time will be nominal.

Sample Problems.

Bridge Approach Slab-Problem 601M. This problem is the same as example problem 601 of Stelzer and Hudson's report¹³ and similar to problem 601 of Hudson and Matlock's report.¹⁴ It is discussed here to demonstrate the use of Program SLAB 30E and to give a reference solution for program checkout when necessary.

The problem is illustrated in Figure A5. A 10-inch-thick, reinforced-concrete bridge approach slab is used. It is supported on one end by the bridge abutment; the other end rests on the embankment. Because of poor compaction, which often results when there is backfill, the soil has settled under the interior of the slab and left a section unsupported. The slab has a center-line joint and a crack which

developed from a combination of shrinkage and previous overstress. For a non-uniformly supported slab such as this, the dead weight of the slab must be considered when evaluating moment and stresses. This weight acts as a uniform load of 600 lb per station. Two 10-kip wheel loads were considered in this example. An axial load of 5000 lb per in. has been induced by the expansion of the adjoining pavement.

The problem is modeled by a 12 by 16 increment slab. The slab stiffness options are exercised in Table B1. The subgrade is introduced in Table B4 over the proper area from stations 0, 7 to 12, 15. The crack and joint are modeled by subtracting the full bending stiffness along their lines from 0, 7 to 12, 7 and 6, 0 to 6, 16. The abutment support is simulated by a double line of rigid supports along that edge from 0, 0 to 12, 1. The loads are introduced by Tables B6 and B7 to demonstrate their use, although they could have been coded in Table B4. It will be noted that there are two load patterns in Table B6 which simulate a truck and trailer. The load placement in Table B7 is such that only two of the trailer wheels fall on the approach slab in the same position as shown on Figure A5.

The reader will note that the computed results are slightly different than Stelzer indicates. This is due to a coding error in his problem. The illustration of Figure A5 shows an axial compression of 5000 lb/in. in the y-direction of the slab, but the problem as coded in the Stelzer report has this axial compression in the x-direction. The thrust is slight and has little effect on the results in either case however.

The results for problem 601M are also somewhat misleading near the face of the abutment. A double line of rigid supports was used to represent the abutment support which effectively fixes the slab against rotation at that end. A more realistic modeling would have been achieved by a single line of supports at the abutment edge, thus allowing rotation to occur. The amount of nominal anchorage that is usually placed between slab and abutment is not nearly enough to preclude rotation.

Taxiway Slab with C-5A—Problem JR5. This and the next problem show how the application of Tables B6 and B7 can be used to conveniently code complex load patterns and their placements. The problem is illustrated in Figure A6 with the heavy crosses indicating the C-5A wheel loads, and the

¹³C. F. Stelzer and W. R. Hudson, *A Direct Computer Solution for Plates and Pavement Slabs*, Research Report 56-9 (Center for Highway Research, University of Texas, 1967).

¹⁴W. R. Hudson and Hudson Matlock, *Discontinuous Orthotropic Plates and Pavement Slabs*, Research Report 56-6 (Center of Highway Research, University of Texas, 1966).

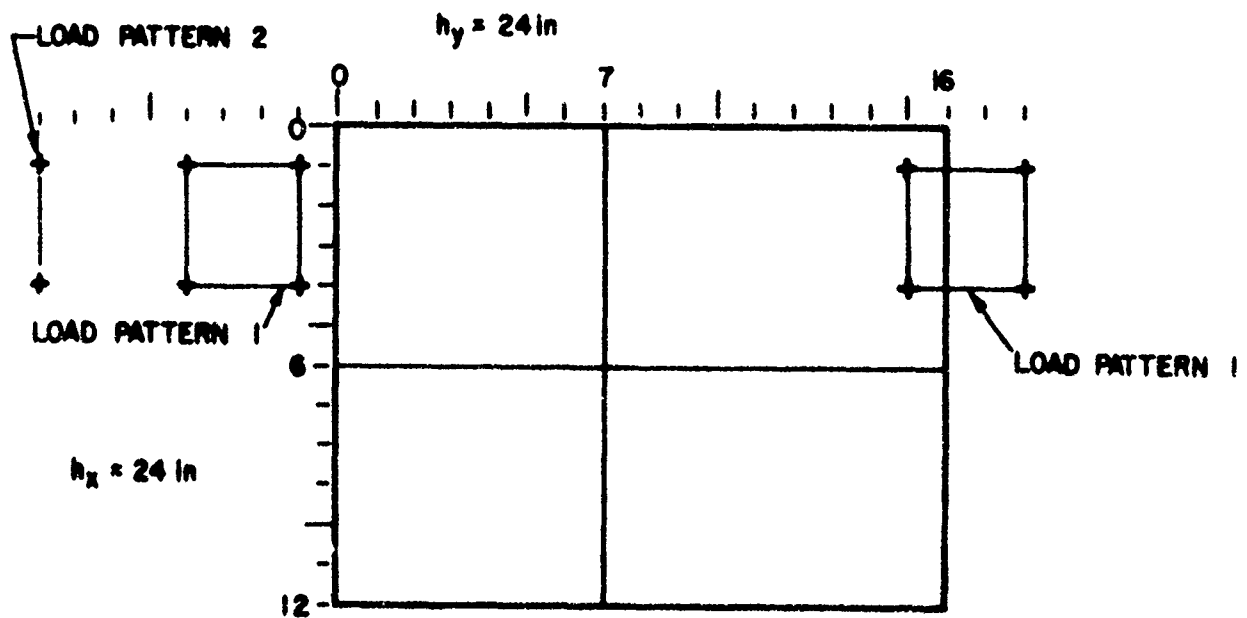
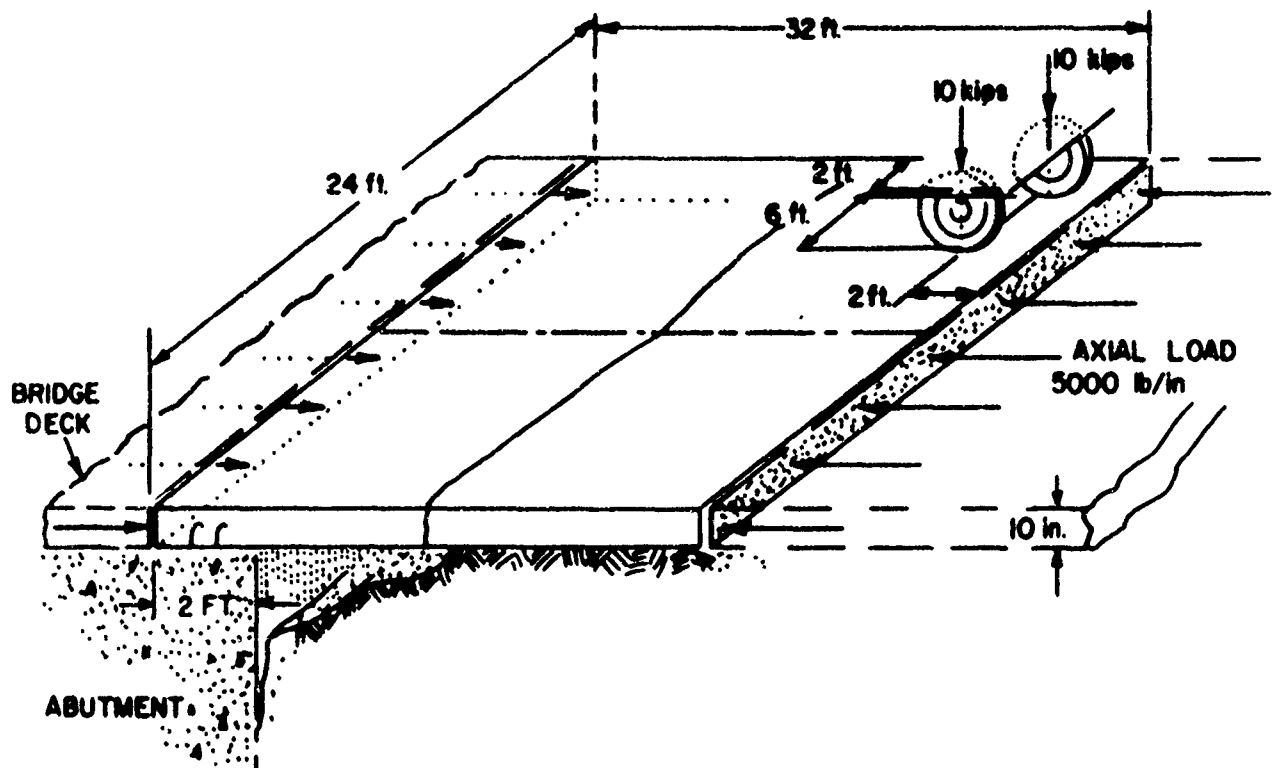
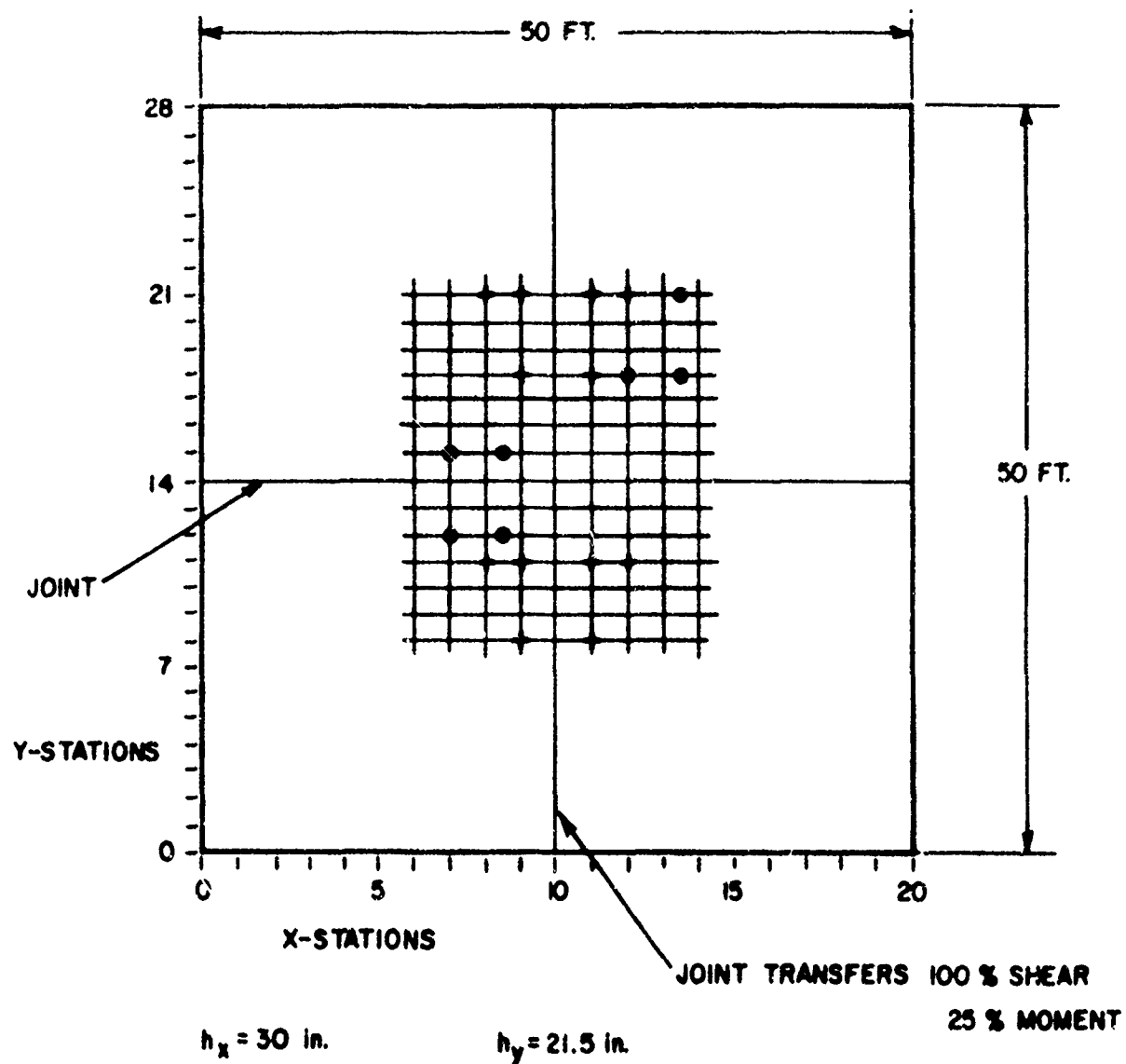


Figure A5. Bridge approach slab - problem 001M.



+ C-5A wheel load at 30,000 lbs (Prob JR5)

o 747 wheel load at 42,500 lbs (Prob JR6)

Thickness $t = 12$ in.

Subgrade $k = 125$ pci

Concrete $E = 5 \times 10^6$ psi

Concrete $\nu = 0.2$

Figure A6. Runway slab with C-5A and B-747—sample problems JR5 and JR6.

darkened circles the Boeing 747 loads which are used in the following problem.

The slab area under study has four 25-foot square panels with cracks between the panels that have 25 percent flexural stiffness remaining. The slab is 12 inches thick, the subgrade modulus is 125 lbs per cubic in., and the concrete modulus of elasticity is five million lbs per square in. with a Poisson's ratio of 0.2.

The selected increment lengths of 30 in. and 21.5 in. are coarse for a problem of this type, and the user would probably use more increments to effectively model his problem. However, a coarse solution when inspected would allow the user to then possibly delete, for additional finer mesh problems, areas of the slab which obviously do not affect the area under study.

All the input and output options are specified in Table B1. A selected output area which includes the loaded area of the slab is specified in Table B3. In addition, three lines of selected output are specified in the x and y-directions. Seventy-five percent of the slab bending stiffness is removed by Table B4 input along the lines of the joint. It is noted that this is accomplished by removing 37.5 percent along the complete line and the remaining 37.5 percent at the interior stations along the joint. By this means, the removed stiffness at the edges is compatible with the automatically generated half-values at the edges. One six-wheel gear group of the C-5A is described in Table B6 with an additional reference wheel at the center of the pattern with a zero load value. This pattern is then placed twice by Table B7 to create the total load pattern as shown on Figure A6.

The output of Table B8 has been omitted. The output of Table B9 indicates that the maximum deflection occurs at station 10, 10 and the maximum stress occurred at station 9, 11. The large slab area specified in Table B3 from 3, 8 to 17, 21 allows these maximums to be immediately discerned by the relative plot values adjacent to the tabulated values. Three additional lines of selected output were specified by Table B3 which coincide with some of the wheel loads as shown on Figure A6. These lines are valuable for comparing deflection and moment variations in specific directions or areas. It may be noted that the plotted output from areas can be thought of as plots of contiguous strips with the relative values

of each line in proper proportion to adjacent lines. Variations of deflection, stress, or bending moment may thus be studied in one direction along consecutive strips taken in the other direction, but still allow the maximums to be emphasized by the plots.

Taxiway Slab with B-747—Problem JR6. This problem is the same slab shown in Figure A3 which was used for Problem JR5. A different load pattern is used which represents two gear groups of the Boeing 747 aircraft. Due to the modeling coarseness of this demonstration example, two wheels of each group are split to adjacent node points, thus forming a six-wheel group for each pattern. This apportionment must be taken into consideration when interpreting the results.

This problem is run as an offspring problem to the previous problem. Only Tables B1, B3, B6 and B7 were input. The pattern could have been described as pattern No. 2 in the previous problem and then simply placed by the Table B7 of this problem. The computer efficiency of multiple loadings via offspring problems may be seen by comparison of the run time of 23 seconds in Problem JR5 to 7 seconds in this problem which is 30 percent of the parent problem time. For extremely large problems (which might be a maximum of 68 by 68 or 20 by 342 as seen in Figure A1) the offspring time might be as little as 3 to 4 percent of the parent problem's time. A procedure for estimating computer times was given in the discussion of the program.

The output for this problem may be compared to that of Problem JR5. The major bending moments with the B-747 loads, even though the individual wheels are of almost 50 percent greater magnitude, are not 50 percent greater. When the stresses (or principal moments) are compared, however, the B-747 maximum is significantly higher than the stress induced by the C-5A. This is due to the much higher twisting moments present which are evidently caused by the influence of the two gear patterns on each other. The two C-5A patterns are orthogonal to the major slab directions, but the two B-747 patterns are oriented almost at 45 degrees to each other in relation to the major slab directions, thus causing a significant twisting effect.

Simply Supported Plate—Problem SAC1. This problem is added for reference and to roughly demonstrate the accuracy of the program. The prob-

lem is a simply supported isotropic plate 48 inches square, 0.9788 inches thick, with a concentrated load of 10^5 pounds at the center. The optional stiffness input was not used, although it could have been. The stiffnesses entered in Table B4 are computed from the above plate thickness for a modulus of elasticity of 3.0×10^7 lbs/in², and a Poisson's ratio of 0.25. The simple supports are created by very stiff support springs around all edges.

The results indicate a maximum deflection at the center of 1.138 inches. Even though this is a coarse

mesh of only 8 by 8 increments, the deflection is seen to agree closely with a closed-form solution of 1.07 inches given by Timoshenko.

This problem is recommended to be run for quick program checkout whenever it becomes necessary. An 8 by 8 driver for the program will only require approximately 24,000 (56,000 octal) words of storage and the problem will run in about 12 (14 octal) seconds which includes 10 seconds for a complete recompilation.

APPENDIX B GUIDE FOR DATA INPUT

SLAB WE GUIDE FOR DATA INPUT CARD FORMS

IDENTIFICATION OF RUN (two alphanumeric cards per run)

										80
										80

IDENTIFICATION OF PROBLEM (one card for each problem; program stops if PROB NUM is left blank)

PROB NUM		Description of problem (alphanumeric)								80
1	5	11								

Table B1. CONTROL DATA (one card for each problem).

Multiple Load Option + 1 for Parent prob 1 for Offsprings		Number of Cards for Table					Optional Stiffness Input Constants Enter 1 to compute D ^x & D ^y C S			Options (1 Yes) Delete Print Detailed Principal Output Stress	
2	3	4	5	6	7	D ^x & D ^y	C	S	Delete	Print	
5	20	25	30	35	40	45	55	60	65	75	80

Table B2. CONSTANTS (one card, omit for offspring problems).

Num Iners		Increment Lengths		Poisson's Ratio ν	Data for Optional Stiffness Constant		
X	Y	X-Direction h_x	Y-Direction h_y		Modulus of Elasticity E	Slab Thickness t	Subgrade Modulus k
5	10	20	30	40	50	60	70
		L	L		F/L ²	L	F/L ³

F = Force Units, L = Length Units. All units must be consistent

Table B3. SPECIFIED AREAS FOR SELECTED OUTPUT (number of cards as shown in Table B1 10 maximum)

From		Through		PRINT and SPLIT (1 Yes)			
X	Y	X	Y	DEFL	X-MOM Y-MOM PRIN STRESS/MOMENT		
5	10	15	20	25	30	35	40

Table B4. STIFFNESS AND LOAD DATA (number of cards as shown in Table B1 enter only load for offspring problems)

From		Through		Bending Stiffness		Load	Spring	Twisting Stiffness
X	Y	X	Y	D ^x	D ^y	Q	S	C
5	10	15	20	30	40	50	60	70

*For offspring problems Tables B2 and B5 must be omitted, and only load may be entered in Table B4. Tables B3, B6 and B7 may be used as desired.

**Optional Stiffness Switches must be blank for offspring problems

Table B5. AXIAL THRUST DATA (number of cards as shown in Table B1 omit for offspring problems).

From		Through		Axial Thrust	
X	Y	X	Y	p_x	p_y
5	10	15	20	61	70
					80

Table B6. SPECIAL LOAD PATTERNS (number of cards as shown in Table B1 up to 9 patterns may be used).

Pat tern Num	Num of Loads in Pattern	Reference Load		These coordinates refer to the load pattern																									
		x	y	x	y	x	y	x	y	x	y	x	y	x	y	x	y	x	y	x	y	x	y	x	y	x	y	x	y
2	6	11	14	17	20	23	26	29	32	35	38	41	44	47	50	53	56	59	62	65	68	71	74	77	80				
		Magnitude of Loads																											
		14	20	26	32	38	44	50	56	62	68	74	80																

Special Patterns are placed as specified in Table B7. Up to 9 different patterns (18 cards) may be used. The first load of each pattern is the reference for Table B7. It may have a zero load magnitude. Negative pattern coordinates are permissible.

Table B7. PLACEMENTS OF TABLE B6 LOAD PATTERNS (number of cards as shown in Table B1).

Pattern Num	Num of Place ments	X		Y		X		Y		X		Y		X		Y		X		Y		X		Y		X		Y	
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80													

These coordinates refer to the coordinate system defined by Table B2. Negative coordinate placements are permissible.

GENERAL PROGRAM NOTES

The data cards must be assembled in proper order for the program to run.

A consistent system of units must be used for all input data, for example, kips and feet.

All 2 to 5-space words are understood to be right-justified integers

All 10-space words are floating-point numbers (E10.3)

All 6-space words are floating-point numbers (F6.0)

+4321

-4.321E+03

-30.0

Table B1. CONTROL DATA.

The multiple load option is exercised for problem series in which only the load positions and magnitudes of Tables B4 or B6 and B7 will vary. The first problem in a series is the Parent and is specified by entering +1, successive loadings are the Offspring and are specified by entering -1. If the option is left blank, the problem is complete within itself.

The number of cards input for Table B2 through Table B7 should be carefully checked after coding is completed. A checklist for allowable Tables and numbers of cards for each Table is given in Table A1.

Conventional plate or slab input stiffness may be selected by entering 1 for those to be computed. Appropriate values must then be made available in Table B2.

Output options may also be selected if desired. All detailed output of Table B8 may be suppressed except a single reference location at the center of the slab. The user may also print principal bending stresses computed from a constant thickness t in place of principal moment. The stress has the same sign as the principal moment. A value of thickness must then be available in Table B2.

Table B2. CONSTANTS.

Variables	h_x	h_y	ν	E	t	k
Typical Input Units:	in.	in.	none	lbs/in ³	in.	lbs/in ³

Only one card is needed for Parent or Independent problems. This table is omitted for Offspring problems.

Poisson's ratio will be taken as zero unless specified (always positive).

Data for computation of optional stiffnesses need be entered only if the options are exercised in Table B1. However, they may be entered and thus printed for reference if desired. The stiffnesses are computed from these customary relationships:

$$D^x = D^y = \frac{Et^3}{12(1-\nu^2)} \quad C = \frac{Et^3}{12(1+\nu)} \quad S = kh_xh_y$$

The computed stiffnesses are constant over the X by Y area of the slab and appropriate quarter and half-values are generated at corners and edges. They are printed as an extension to Table B2 and thus any additional stiffness values entered in Table B4 are superimposed algebraically.

Table B3. SPECIFIED AREAS FOR SELECTED OUTPUT.

A maximum of ten cards may be used, with a maximum of 300 points specified by each card.

The selected results are printed if any of the four print options are exercised.

Table B3 may be omitted if desired since all selected output values are duplicated in the complete printout of the results. The user is cautioned, however, that the complete printout may have been suppressed by the option in Table B1.

The selected output is controlled by the same joint coordinate system shown in Fig A2 and described below for Table B4.

Table B4. STIFFNESS AND LOAD DATA.

Variables:	D^x	D^y	Q	S	C
Typical Input Units:	$\frac{\text{lb-in}^2}{\text{in.}}$	$\frac{\text{lb-in}^2}{\text{in.}}$	lb	$\frac{\text{lb}}{\text{in.}}$	$\frac{\text{lb-in}^2}{\text{in./rad}}$

All data are described with a coordinate system notation which is related to the discrete-element model of the slab. This is shown in Figure A2.

To distribute data over a rectangular area, the lower left-hand and the upper right-hand coordinates must be specified. Figure A3 illustrates a sample data input.

All data entered in this table are algebraically added to the optional stiffness values generated from Tables B1 and B2.

To specify data at a single location, the same coordinates must be specified in both the "From" and "Through" columns.

The "Through" coordinates must always be equal to or numerically greater than the "From" coordinates.

The user may input values on the edges of the slab and the corners to represent the proportionate area desired as illustrated in Figure A3.

There are no restrictions on the order of cards in Table B4. Cumulative input is used, with full values at each coordinate.

Unit stiffness values D^x and D^y are input at all joints. The values are reduced proportionately for edges.

Load values, Q, and support springs S for any joint are determined by multiplying the unit load or unit support value by the appropriate area of the real slab assigned to that joint. Hinged supports are provided by using large S values. Concentrated loads that occur between joints can be proportioned geometrically to adjacent joints.

Unit twisting stiffness C is defined for the mesh of the plate or slab surrounded by four rigid bars and four joints. The mesh is numbered according to the joint number at the upper right corner of the mesh as shown in Figure A2.

Table B5. AXIAL THRUST DATA.

Variables	P^x	P^y
Typical Input Units	lb	lb

All data in this table are concentrated. Distributed data must be summed over the width of the increment involved. Proportionate values can be used along edges.

Axial tension (+) or compression (—) values P are specified for each x -bar or y -bar. There is no mechanism in the program to automatically distribute the internal effects of any externally applied axial loads.

The axial thrust P^x refers to the force in the x -bar in the x -direction. Since it is a bar value, no coordinate should be used which would specify a P^x value in a bar outside the real plate or slab. The bars are numbered according to the joint number as shown in Figure A2.

Table B6. SPECIAL LOAD PATTERNS.

A maximum of 9 different patterns (18 cards) may be used with up to 12 loads in each pattern.

The first load entered in columns 9 through 14 is designated as the reference load for placement of the pattern by Table B7. It may have a zero value for convenience if desired.

The coordinates entered in this table refer to the relative positions of the loads within the pattern. This is illustrated by Fig A4. Coordinates may also have negative values if desired.

Special Load patterns need not be entered if they are the same as those in previous problems, however, additional patterns may be used. Any new patterns entered replace those with the same pattern number. All load patterns defined in previous problems, including previous Parent and Independent problems, are retained, and may then be used by specifying their placement in Table B7.

Table B7. PLACEMENTS OF TABLE B6 LOAD PATTERNS.

Each pattern defined by Table B6 may be placed at a number of different locations on the slab. Any patterns specified in previous problems may be also placed by this table; they need not be re-entered in this problem's Table B6. Pattern numbers must be unique throughout the series, however.

Placements of the reference load are by coordinates which are related to the overall system defined by Table B2. Placements outside the boundaries of the actual slab are permissible. Any loads of the pattern that thus fall off the slab are not included in the solution. For reference, however, a summation of all loads placed on and off the slab is given in the output of Table B7.

If only new patterns and placements are specified, and no stiffness data is changed in Tables B2, B4, or B5, then this problem is an off-spring problem.

Table No.	Maximum No. of Cards	Parent or Independent Problems		Offspring Problems		
		Required	Optional	Required	Optional	Disallowed
B1	1	X		X		
B2	1	X				X
B3	10		X		X	
B4	no limit		X		X*	
B5	no limit		X			X
B6	18		X		X	
B7	no limit		X		X	

*Load Only

The user should also ensure that if Optional Stiffness Options are exercised in Table B1, that appropriate data is available in Table B2. He should also verify that if the Option to Delete Detailed Output is used, that sufficient output will be printed for areas specified in Table B3.

Figure B1. Checklist for input tables.

GLOSSARY OF NOTATION

NOTATION FOR SLAB 3CE			
C			
C			
C	A(,1)	RECURSION COEFFICIENT	17N09
C	AA(,1)	COEFF IN STIFFNESS MATRIX	19APR
C	ALF	ANGLE ON MOHR'S CIRCLE	17N09
C	AM1(,1)	RECURSION COEFFICIENT A(,1) AT J-1	12N09
C	AM2(,1)	RECURSION COEFFICIENT A(,1) AT J-2	12N09
C	AN1(,) AN2(,)	IDENTIFICATION AND REMARKS (ALPHA - NUP)	28DE7
C	AT(,)	TEMP STORAGE FOR A(,1) RECURSION COEFF	12N09
C	B(,)	RECURSION COEFFICIENT	12N09
C	BB(,3)	COEFFS IN STIFFNESS MATRIX	03JAN
C	BETA	HALF THETA (COUNTER CLOCKWISE IS +)	17N09
C	BMA	AVERAGE OF X AND Y BENDING MOMENTS	28DE7
C	BMO	FIRST PRINCIPAL BENDING MOMENT	03JAN
C	BMP	BMX - BMA	28DE7
C	BMR	RADIUS OF MOHR'S CIRCLE	28DE7
C	BMT	SECOND PRINCIPAL BENDING MOMENT	03JAN
C	BMX(,)	BENDING MOMENT IN THE X DIRECTION	03JAN
C	BMY(,)	BENDING MOMENT IN THE Y DIRECTION	03JAN
C	BM1(,)	RECURSION COEFFICIENT B(,) AT J-1	12N09
C	BM2(,)	RECURSION COEFFICIENT B(,) AT J-2	12N09
C	CI(,)	RECURSION COEFFICIENT	12N09
C	CC(,5)	COEFFS IN STIFFNESS MATRIX	03JAN
C	CH(,)	TWISTING STIFFNESS PER UNIT WIDTH	03JAN
C	CHN	INPUT VALUE OF TWISTING STIFFNESS	03JAN
C	CH1(,)	RECURSION COEFFICIENT CI(,) AT J-1	12N09
C	CH2(,)	RECURSION COEFFICIENT CI(,) AT J-2	12N09
C	CRD(,)	CROSS BENDING STIFFNESS FOR PR EFFECTS	30JLR
C	DI(,)	RECURSION MULTIPLIER	12N09
C	UDI(,3)	COEFFS IN STIFFNESS MATRIX	03JAN
C	DX(,) , DY(,)	BENDING STIFFNESSES PER UNIT WIDTH	28DE7
C	DXN , DYN	INPUT VALUES OF BENDING STIFFNESSES	03JAN
C	EI(,)	RECURSION MULTIPLIER	12N09
C	EE(,)	COEFF IN STIFFNESS MATRIX	03JAN
C	ER	A TEST TO ELIMINATE REMNANT REACTIONS	28DE7
C	FF(,)	COEFF IN LOAD VECTOR	03JAN
C	HX	INCREMENT LENGTH IN X DIRECTION	03JAN
C	HXDHY	HX DIVIDED BY HY	28DF7
C	HXDHY3	HX DIVIDED BY HY CUBED	28DE7
C	HY	INCREMENT LENGTH IN Y DIRECTION	28DE7
C	HYDHX	HY DIVIDED BY HX	28DE7
C	HYDHX3	HY DIVIDED BY HX CUBED	28DE7
C	I	STATION NUMBER IN X DIRECTION	28DE7
C	IN1	INITIAL EXTERNAL X COORDINATE	03JAN
C	IN2	FINAL EXTERNAL X COORDINATE	28DE7
C	IN13(,)	INITIAL EXTERNAL X COORDINATE IN TABLE 3	12N09
C	IN23(,)	FINAL EXTERNAL X COORDINATE IN TABLE 3	12N09
C	IOPC	TWISTING STIFFNESS(OPTIONAL) SWITCH	07SEC
C	IOPD	BENDING STIFFNESS(OPTIONAL) SWITCH	07SEC
C	IOPPS	OPTION FOR PRIN STRESS INSTEAD OF MOM	07SEC
C	IOPS	SUBGRADE MODULAS (OPTIONAL) SWITCH	07SEC
C	IOPB	OPTION TO SUPPRESS DETAILED OUTPUT (TAB 8)	07SEC
C	IOPP	INTERNAL PLOT OPTION SWITCH	07SEC
C	ISTA	EXTERNAL X COORDINATE NUMBER	12N09
C	ITEST(,)	ALPHANUMERIC BLANKS, USED TO TERMINATE THE PROGRAM	12N09
C			12N09

C	11 , 12	IN1 AND IN2 PLUS 2	28DE7
C	J	STATION NUMBER IN Y DIRECTION	28DE7
C	JJ	J FOR SUBROUTINE MATRIX	28DE7
C	JN1	INITIAL EXTERNAL Y COORDINATE	28DF7
C	JN2	FINAL EXTERNAL Y COORDINATE	28DE7
C	JN13()	INITIAL EXTERNAL Y COORDINATE IN TABLE 3	12NO9
C	JN23()	FINAL EXTERNAL Y COORDINATE IN TABLE 3	12NO9
C	JSTA	EXTERNAL Y COORDINATE NUMBER	12NO9
C	J1 , J2	JN1 AND JN2 PLUS 2	28DE7
C	K	DO LOOP INDEX USED INSTEAD OF I	03JAB
C	KASEX()	OPTION FOR SELECTED PRINT OF BMX	12NO9
C	KASEY()	OPTION FOR SELECTED PRINT OF BMY	12NO9
C	KLONG	MAXIMUM REAL Y DIMENSION SIZE	01AGR
C	KSHORT	MAXIMUM REAL X DIMENSION SIZE	01AGR
C	KML	KEEP MULTIPLE LOADING FOR ERROR CHECKS	28DE7
C	KPRUB()	PROBLEM NUMBER FROM PARENT	12NO9
C	LL	DO LOOP INDEX FOR REVERSED J	03JAB
C	L2	KLONG+3, USED FOR VARIABLE DIMENSIONING	19APR
C	L1	KSHORT+3, USED FOR VARIABLE DIMENSIONING	19APR
C	HL	MULTIPLE LOADING SWITCH	03JAB
C	MX	NUMBER OF INCREMENTS IN X DIRECTION	28DE7
C	HXP1 THRU HXP5	MX + 1 THRU MX + 5	01AGR
C	MY	NUMBER OF INCREMENTS IN Y DIRECTION	28DE7
C	HYP1 THRU HYP5	MY + 1 THRU MY + 5	01AGR
C	N	INDEX FOR READING CARDS	03JAB
C	NCT2	NUMBER OF CARDS IN TABLE 2	03JAB
C	NCT3	NUMBER OF CARDS IN TABLE 3	01AGR
C	NDE	NUMBER OF DATA ERRORS	03JAB
C	APRUB()	PROBLEM NUMBER (PROG STOPS IF BLANK)	12NO9
C	ODHX	ONE DIVIDED BY HX	28DE7
C	UDHXHY	ONE DIVIDED BY HX TIMES HY	28DE7
C	UDHX2	ONE DIVIDED BY HX SQUARED	03JAB
C	UDHY	ONE DIVIDED BY HY	28DE7
C	UDHY2	ONE DIVIDED BY HY SQUARED	03JAB
C	PDHXHY	POISSONS RATIO DIVIDED BY HX TIMES HY	28DE7
C	PHMAX	LARGEST PRINCIPAL MOMENT	03JAB
C	PR	POISSONS RATIO	28DE7
C	PSIGO	PLOTTING ARRAY FOR PRIN STRESS OR MOMENTS	07SEC
C	PXI ,) , PY(,)	AXIAL TENSIONS IN X AND Y DIRECTIONS	01AGR
C	PXN , PYN	INPUT VALUES OF X AND Y AXIAL TENSIONS	01AGR
C	Q1 ,)	TRANSVERSE LOAD PER JOINT	01AGR
C	QBMX , QBY	LOAD ABSORBED IN BENDING	01AGR
C	UN	INPUT VALUE OF TRANSVERSE LOAD	03JAB
C	QPX , QPY	LOAD ABSORBED DUE TO AXIAL TENSIONS	01AGR
C	QTMX , QTM	LOAD ABSORBED IN TWISTING	01AGR
C	REACT	SUPPORT REACTION PER JOINT	01AGR
C	S1 ,)	SPRING SUPPORT, VALUE PER JOINT	01AGR
C	SDT2	MOMENT MULTIPLIER FOR PLATE STRESS	03JAB
C	SIGU	LARGEST PRINCIPAL MOMENT OR STRESS	03JAB
C	SKK	SUBGRADE MODULUS	07SEC
C	SN	INPUT VALUE OF SUPPORT SPRINGS	28DE7
C	SOM	VARIABLE LABEL (=STRESS OR =MOMENT)	07SEC
C	SUMR	SUMMATION OF REACTIONS FOR STATICS CHECK	03JAB
C	THETA	MOMENTS CIRCLE ANGLE BETWEEN X AND	17NO9
C		PRINCIPAL MOMENT	17NO9
C	THK	THICKNESS OF SLAB FOR STRESS CALCULATIONS	03JAB

C	TGMX, TGMV	TEMP STORAGE ARRAYS FOR PLOT ROUTINE	07SEC
C	XX	INDEPENDENT VARIABLE FOR PLOT ROUTINE	07SEC
C			75EC
C	NOTATION FOR SUBROUTINE SPLOT 3 AND 4		07SEC
C			75EC
C	BETA	SCALED DATA (FLT PT)	07SEC
C	I	GENERAL INDEX	07SEC
C	IOTA	FIXED BETA	07SEC
C	IR	POINT POSITIONER FOR PLOTTING STRING	07SEC
C	IS	INDEX OVER X-STA TO BE PLOTTED	07SEC
C	ISKP	LENGTH OF SPACE ARRAY TO BE USED	07SEC
C	JS	INDEX OVER J-STA TO BE PLOTTED	07SEC
C	L	INDEX OVER ISKP	07SEC
C	OMEGA	MAXIMUM VALUE IN X ARRAY	07SEC
C	SIGMA	SCALER	07SEC
C	SPACE	INITIAL PART OF PLOTTING STRING	07SEC
C	SYMB()	LAST 4 CHARACTERS OF PLOTTING STRING	07SEC
C	SYMD	SYMB(IR) - TEMP	07SEC
C	THETA	MINIMUM VALUE IN X ARRAY	07SEC
C	WIDTH	WIDTH OF PLOT IN CHARACTERS (COLUMNS)	07SEC
C	X	ARRAY TO BE PLOTTED	07SEC

LISTING OF PROGRAM DECK

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PROGRAM SLAB30C( INPUT, OUTPUT, TAPE1, TAPE2 )
C-----THIS PROGRAM IS A VERSION EXTENDED FROM SLAB 30 FOR CERL BY
C AUSTIN RESEARCH ENGINEERS INC. IT HAS THE ADDED CAPABILITIES
C SELECTED PLOT OUTPUT, PAVEMENT ORIENTED INPUT, AND THE
C ABILITY TO INPUT A SPECIFIED PATTERN OF LOADS AT ANY DESIRED
C LOCATION .
C
C-----FOR DIFFERENT SIZED PROBLEMS ONLY THE DIMENSION CARDS OF THIS
C DRIVLR NEED BE CHANGED. FOR EXAMPLE, AA(5+3,1) , BB(5+3,3) ,
C ALSO CHANGE KSHORT AND KLONG TO EQUAL THE REAL X AND Y STATIONS.
C
C CC(5+3,5) , B(5+3,5+3) , BMX(5+3,L+3) WHERE S AND L REFER
C TO THE SHORT AND LONG LENGTHS OF THE REAL PROBLEM.
C-----THIS PROGRAM IS NOW DIMENSIONED TO SOLVE A 20 BY 40 GRID.
C
C-----THIS PROGRAM WILL OPERATE ON EITHER CDC6600 OR IBM360/50 SYSTEMS.
C THOSE CARDS NEEDED TO OPERATE ON THE IBM360/50 ARE INCLUDED AS
C FOLLOWING COMPANION CARDS TO THE CDC CARDS AND HAVE A C IN COLUMN
C ONE AND THE SYMBOLS IBM IN COLUMNS 78 THRU 80. OTHER ADDITIONAL
C CARDS SUCH AS THE SELECTIVE DOUBLE PRECISION STATEMENTS ARE ALSO
C TAGGED WITH IBM AND NULLED WITH A C. WHEN CONVERTING TO THE
C IBM360/50 SYSTEM, THE COMPANION CDC6600 CARDS SHOULD BE RETAINED
C AND NULLED WITH AN ADDED C.
C
C DOUBLE PRECISION AA, BB, CC, DD, EE, FF, W, 26SE91PM
C 1 A, AM1, AM2, B, BM1, BM2, WP1, 26SF91PM
C 2 C, CM1, CM2, D, E, AT, WP2, 26SE91PM
C 3 ALF, BETA, BMA, BMO, BMP, BMR, BMT, 26SE91PM
C 4 CRD, ER, HX, HXDHY, 26SE91PM
C 5 HXDHY3, HY, HYDHY, HYDHY3, ODHX, ODHXHY, ODHX2, 26SE91PM
C 6 PDHXHY, PI, PMMAX, PR, QBMX, 26SE91PM
C 7 QBMX, REACT, SDT2, SIGO, SUMR, THETA, 26SE91PM
C 8 THK, TMA, TMX, TMY, WSUM1, WSUM2, WSUM3, 26SE91PM
C 9 OPX, QPY, QTMX, QTHY 26SE91PM
C
C DIMENSION
C 1 FF( 23 , 1 ), AA( 23 , 1 ), EE( 23 , 1 ), RE-DIMEN
C 2 AM2( 23 , 1 ), AM1( 23 , 1 ), 26JEN
C 3 BB( 23 , 3 ), DD( 23 , 3 ), 26JEN
C 4 CC( 23 , 5 ), 26JEN
C 5 B( 23 , 23 ), BM1( 23 , 23 ), BM2( 23 , 23 ), RE-DIMEN
C 6 C( 23 , 23 ), CM1( 23 , 23 ), CM2( 23 , 23 ), RE-DIMEN
C 7 D( 23 , 23 ), E( 23 , 23 ), RE-DIMEN
C 8 BMX( 23 , 43 ), BMY( 23 , 43 ), O( 23 , 43 ), RE-DIMEN
C 9 S( 23 , 43 ), CH( 23 , 43 ), RE-DIMEN
C A DX( 23 , 43 ), DY( 23 , 43 ), PX( 23 , 43 ), RE-DIMEN
C B PY( 23 , 43 ), W( 23 , 43 ), AT( 23 , 43 ), RE-DIMEN
C
C DIMENSION PSIGO (23,43)
C KSHORT = 20
C KLONG = 40
C L1 = KSHORT + 3
C L2 = KLONG + 3
C
C CALL SB30ES ( AA, BB, CC, DD, EE, FF, A, AT, AM1, 26JEN
C 1 AM2, B, BM1, BM2, C, CM1, CM2, D, E, 05JAB
C 2 WP1, WP2, BMX, BMY, CH, PSIGO, DX, DY, O, 23JFO
C 3 S, PX, PY, W, L1, L2 ) 19APR
C
C END

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SUBROUTINE SB3CES ( AA, BB, CC, DD, EE, FF, A, AT, AM1, 26JFC
1 AM2, B, BM1, BM2, C, CM1, CM2, D, E, C5JAB
2 WP1, WP2, BMX, BMY, CH, PSIGO, DX, DY, Q, 23JFQ
3 S, PX, PY, W, L1, L2 1 19APB

C
1 FORMAT ( 52H PROGRAM SLAB3OE CERL SPECIAL DECK-ARE-JJP, FLE 26JEO
1 28H REVISION DATE 07 SEP 70 ) REVISD

C
C DOUBLE PRECISION AA, BB, CC, DD, EE, FF, W, 26SE91BM
C 1 A, AM1, AM2, B, BM1, BM2, WP1, 26SE91BM
C 2 C, CM1, CM2, D, E, AT, WP2, 26SE91BM
C 3 ALF, BETA, BMA, BMO, BMP, BMR, BMT, 26SE91BM
C 4 CRD, ER, HX, HXDHY, 26SE91BM
C 5 HXDHY3, HY, HYDHY, HYDHY3, ODHX, ODHXHY, ODHX2, 26SE91BM
C 6 PDHXHY, PI, PMMAX, PR, QBMX, 26SE91BM
C 7 QBMX, REACT, SDT2, SIGO, SUMR, THETA, 26SE91BM
C 8 THK, TMA, TMX, TMY, WSUM1, WSUM2, WSUM3, 26SE91BM
C 9 QPX, QPY, QTMX, QTMY 26SE91BM

C
C DIMENSION
1 FF( L1, 1 ), AA( L1, 1 ), EE( L1, 1 ), 05JAB
2 AM2( L1, 1 ), A( L1, 1 ), AM1( L1, 1 ), 05JAB
3 BB( L1, 3 ), WP1( L1, 1 ), WP2( L1, 1 ), 05JAB
4 CC( L1, 5 ), DD( L1, 3 ), 05JAB
5 B( L1, L1 ), BM1( L1, L1 ), BM2( L1, L1 ), 19APB
6 C( L1, L1 ), CM1( L1, L1 ), CM2( L1, L1 ), 19APB
7 D( L1, L1 ), E( L1, L1 ), 19APB
8 BMX( L1, L2 ), BMY( L1, L2 ), Q( L1, L2 ), 19APB
9 S( L1, L2 ), CH( L1, L2 ), 07MYB
A DX( L1, L2 ), DY( L1, L2 ), PX( L1, L2 ), 19APB
B PY( L1, L2 ), W( L1, L2 ), AT( L1, L2 ), 31OC9

C
C DIMENSION
1 IN23( 10 ), JN23( 10 ), JN13( 10 ), 03NO9
2 KASEY( 10 ), NPROB( 2 ), KPROB( 2 ), 03NO9
3 ITEST( 2 ), AN1( 40 ), AN2( 18 ), 03NO9
4 CRD( 5 ) 03NO9

C
C DIMENSION PSIGO ( L1, L2 ) 26JEOFN
COMMON / SPLT / MX, MY, THK, NCT3, NDE, PR, SOM 31AGO
COMMON / CUPS / EM, SKK, IOPD, IOPC, IOPS, HX, HY 17AGO
6 FORMAT ( ) 4MY3
10 FORMAT ( 5H , 80X, 10H1-----TRIM ) 03FE4
11 FORMAT ( 5H1 , 80X, 10H1-----TRIM ) 03FE4
12 FORMAT ( 20A4 ) 17OC9
13 FORMAT ( 5X, 20A4 ) 17OC9
14 FORMAT ( A1, A4, 5X, 17A4, A2 ) 17OC9
15 FORMAT ( ///10H PROB , /5X, A1, A4, 5X, 17A4, A2 ) 17OC9
16 FORMAT ( ///17H PROB (CONTD), /5X, A1, A4, 5X, 17A4, A2 ) 17OC9
19 FORMAT ( 61/, 44H ***THIS SERIES OF PROBLEMS WAS RUN USING A 18AGO
1 40H PROGRAM DEVELOPED FOR THE 31AGO
2 / 5X 52HTRANSPORTATION FACILITIES BRANCH, 31AGO
3 / 5X 52HDEPARTMENT OF THE ARMY, 31AGO
4 / 5X 52HCONSTRUCTION ENGINEERING RESEARCH LABORATORY, 31AGO
5 / 5X 52HCHAMPAIGN, ILLINOIS 31AGO
6 //10X 10HBY // 07SEN
7 / 5X 26HAUSTIN RESEARCH ENGINEERS, 31AGO
8 / 5X 20H AUSTIN, TEXAS ) 31AGO

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46 FORMAT (5X, 2(1X,12,1X,13),22X,E11.3)
C 46 FORMAT (5X, 2(1X,12,1X,13),22X,1PE11.3 )
47 FORMAT ( 5X, 12, 1X, 13, 6E11.3, F6.1 )
C 47 FORMAT ( 5X, 12, 1X, 13, 1PE11.3, OPF6.1 )
48 FORMAT( 52H X MOMENT AND X TWISTING MOMENT ACT IN
1 32H THE X DIRECTION (ABOUT Y AXIS), ,/
2 50H Y TWISTING MOMENT = -X TWISTING MOM
3 35HENT, COUNTERCLOCKWISE BETA ANGLES ,/
4 50H ARE POSITIVE FROM X AXIS TO THE DIR
5 28HSECTION OF LARGEST PRINCIPAL , A6 )
49 FORMAT (///50H *** THE DETAILED OUTPUT HAS BEEN DELETED BY T
1 21HHE OPTION IN TABLE 1.
2 /, 9X 50HA SINGLE SET OF VALUES IS PRINTED AT OR NEAR THE S
3 25HLAB CENTER FOR REFERENCE // )
50 FORMAT (///50H STATICS CHECK. SUMMATION OF REACTION,
1 6HS = , E10.3 )
C 1 6HS = , 1PE10.3 )
55 FORMAT ( //44H TABLE 3. SPECIFIED AREAS FOR SELECTED
1 15HPLOTTED OUTPUT ,//
2 45H PLOT (1=YES)
3 / 45H FROM THRU DEFL X-MOMENT
4 1X 18H Y-MOMENT PRIN , A6 )
60 FORMAT ( //35H TABLE 6. SPECIAL LOAD PATTERNS// )
63 FORMAT ( //40H TABLE 9. SELECTED OUTPUT
64 FORMAT ( //47H TABLE 9. SELECTED OUTPUT -- USING
1 32HSTIFFNESS DATA FROM PARENT PROB , A1, A4 )
74 FORMAT ( //50H TABLE 7. PLACEMENTS OF SPECIAL LOAD PATTERNS // )
91 FORMAT (///30H **** PROBLEM TERMINATED , 14 ,
1 20H DATA ERRORS **** )
92 FORMAT ( //51H **** CAUTION. MULTIPLE LOADING OPTION MISUSED
1 35H FOR THIS OR PRIOR PROBLEM **** )
93 FORMAT (///38H **** PROBLEM WILL BE TERMINATED.
1 40HTHE DIMENSION STORAGE IS TOO SMALL **** )
94 FORMAT ( (///47H *** NO CARDS ALLOWED IN TAB 2 OR 5 FOR ML=-1
95 FORMAT ( ///50H *** PRIOR PROBLEM IS NOT A PARENT ***
96 FORMAT ( ///50H *** MY SHOULD NOT BE LESS THAN MX ***
97 FORMAT ( 60X50H ***ILLEGAL DATA INPUT ATTEMPTED IN OFFSPRING PROB
98 FORMAT (///40H **** UNDESIGNATED ERROR STOP **** )
C
C-----PROGRAM AND PROBLEM IDENTIFICATION
C
3TEST(1) = 1H
3TEST(2) = 4H
KML = 0
READ 12, ( AN1(N), N = 1, 40 )
CALL TIC TUC (1)
1010 READ 14, NPROB, ( AN2(N), N = 1, 18 )
IF ( NPROB(1) - 1TEST(1) ) 1020, 1015, 1020
1015 IF ( NPROB(2) - 1TEST(2) ) 1020, 9990, 1020
1020 PRINT 11
1021 PRINT 1
PRINT 13, ( AN1(N), N = 1, 40 )
PRINT 15, NPROB, ( AN2(N), N = 1, 18 )
REWIND 1
REWIND 2
NDE = 0

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```

C
C----- INPUTTABLE 1
C
  READ 20, ML, NCT2, NCT3, NCT4, NCT5, NCT6, NCT7, IOPD, IOPC, 02JLO
  1 IOPS, IOPB, IOPPS 17AGO
  PRINT 30, ML, NCT2, NCT3, NCT4, NCT5, NCT6, NCT7, IOPD, IOPC, 02JLO
  1 IOPS, IOPB, IOPPS 17AGO
    IF ( ML ) 62, 61, 61 07OC9

C
C----- INPUTTABLE 2
C
  61 READ 21, MX, MY, HX, MY, PR, EM, THK, SKK 17AGO
  62 PRINT 22, MX, MY, HX, MY, PR, EM, THK, SKK 17AGO
    IF ( ML.NE.-1 ) GO TO 69 17AGO
    IF ( NCT2 + NCT5 .NE. 0 ) PRINT 94 17AGO
    IF ( NCT2 + NCT5 .NE. 0 ) NDE = NDE + 1 17AGO
  69 IF ( KML ) 75, 70, 72 17AGO
  70 IF ( ML ) 71, 75, 75 15DE7
  71 NDE = NDE + 1 18DE7
    PRINT 95 17AGO
    GO TO 75 15DE7
  72 IF ( ML ) 75, 73, 73 15DE7
  73 PRINT 92 15DE7
  75 KML = ML 15DE7
    IF ( L1-3-MX ) 76, 77, 77 29OC9
  76 PRINT 93 29OC9
    NDE = NDE + 1 29OC9
  77 IF ( L2-3-MY ) 78, 79, 79 29OC9
  78 PRINT 93 29OC9
    NDE = NDE + 1 29OC9
  79 IF ( MX - MY ) 81, 81, 80 29OC9
  80 NDE = NDE + 1 18DE7
    PRINT 96 17AGO
  81 IF ( HX * MY ) 82, 82, 83 29N07
  82 NDE = NDE + 1 18DE7
  83 IF ( PR + THK ) 84, 85, 85 29N07
  84 NDE = NDE + 1 18DE7
  85 CONTINUE 29N07

C
C----- COMPUTE FOR CONVENIENCE
C
    IF ( ML ) 136, 100, 100 29N07
  100 MXP1 = MX + 1 29N07
    MYP1 = MY + 1 29N07
    MXP2 = MX + 2 08DE7
    MYP2 = MY + 2 29N07
    MXP3 = MX + 3 08DE7
    MYP3 = MY + 3 08DE7
    MXP4 = MX + 4 08DE7
    MYP4 = MY + 4 08DE7
    MXP5 = MX + 5 08DE7
    MYP5 = MY + 5 08DE7
    ODHX = 1.0 / HX 14SF6
    ODHY = 1.0 / MY 14SE6
    ODHXHY = ODHX * ODHY 14N07
    PDHXHY = PR * ODHXHY 14N07

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ODHY2 = ODHY * ODHY	14N07
ODHX2 = OCHX * ODHX	14N07
HXDHY = HX * ODHY	14N07
HYDHX = HY * ODHX	14N07
HYDHX3 = HYDHX * ODHX2	14N07
HXDHY3 = HXDHY * ODHY2	14N07
KPROB(1) = IPROB(1)	17OC9
KPROB(2) = NPROB(2)	17OC9
DO 105 J = 1, MYP3	29N07
DO 103 I = 1, MXP3	29N07
DX(I,J) = 0.0	01N06
DY(I,J) = 0.0	01N06
O(I,J) = 0.0	01N06
S(I,J) = 0.0	01N06
CH(I,J) = 0.0	07MY8
PX(I,J) = 0.0	23JE7
PY(I,J) = 0.0	23JE7
BMX(I,J) = 0.0	29N07
BMY(I,J) = 0.0	29N07
103 CONTINUE	29N07
105 CONTINUE	23JE7
DO 135 K = 1, MXP3	29N07
DO 130 I = 1, MXP3	29N07
B(I,K) = 0.0	29N07
BM1(I,K) = 0.0	21DF7
C(I,K) = 0.0	29N07
CM1(I,K) = 0.0	21DE7
130 CONTINUE	16AG7
135 CONTINUE	16AG7
136 DO 138 K = 1, MXP3	29N07
A(K,1) = 0.0	21DE7
AM1(K,1) = 0.0	29N07
W(K,MYP3) = 0.0	28DE7
WP1(K,1) = 0.0	29N07
WP2(K,1) = 0.0	28DE7
138 CONTINUE	29N07
C	
C----- INPUT TABLE 3	
C	
SOM = 6HSTRESS	17AG0
IF (IOPPS.NE.1) SOM = 6HMOMENT	17AG0
PRINT 55 , SOM	17AG0
IF (NCT3) 9980, 180, 150	24SE9
150 IPOP = 0	26JE0
CALL SLPLT (W, BMX, BMY, PSIGO, L1, L2, IPOP, 0)	26JE0
GO TO 181	24SE9
180 PRINT 36	24SE9
181 CONTINUE	24SE9
C	
C----- INPUT TABLE 4	
C	
190 IF (ML) 200, 320, 320	15DF7
200 PRINT 34, KPROB	15DE7
DO 220 J = 1, MYP3	15DF7
DO 210 I = 1, MXP3	29N07
W(I,J) = 0.0	24OC7

	Q(I,J) = 0.0	240C7
210	CONTINUE	240C7
220	CONTINUE	240C7
	IF (NCT4) 9980, 224, 225	075F0
224	PRINT 38	75F0
	GO TO 362	075F0
225	DO 260 N = 1, NCT4	025E0
	READ 26, IN1, JN1, IN2, JN2, ON	200C7
	PRINT 46, IN1, JN1, IN2, JN2, ON	200C7
	I1 = IN1 + 2	29N07
	J1 = JN1 + 2	29N07
	I2 = IN2 + 2	29N07
	J2 = JN2 + 2	29N07
	IF (IN1 - IN2) 232, 232, 231	29N07
231	NDE = NDE + 1	18DE7
232	IF (JN1 - JN2) 234, 234, 233	29N07
233	NDE = NDE + 1	18DE7
234	IF (IN2 - MX) 236, 236, 235	29N07
235	NDE = NDE + 1	18DF7
236	IF (JN2 - MY) 238, 238, 237	29N07
237	NDE = NDE + 1	18DF7
238	DO 255 I = I1, I2	29N07
	DO 250 J = J1, J2	200C7
	Q(I,J) = Q(I,J) + ON	200C7
250	CONTINUE	200C7
255	CONTINUE	200C7
260	CONTINUE	200C7
	GO TO 386	19DE7
320	PRINT 33	15DE7
	IF (NCT4) 9980, 323, 325	025E0
323	PRINT 38	25E0
	GO TO 362	025F0
325	DO 360 N = 1, NCT4	025E0
	READ 23, IN1, JN1, IN2, JN2, DXN, DYN, ON, SN, CHN	07MY8
	PRINT 43, IN1, JN1, IN2, JN2, DXN, DYN, ON, SN, CHN	07MY8
	IF (CHN) 331, 335, 331	07MY8
331	IF (IN1 - IN2) 331, 335, 335	18DE7
333	NDE = NDE + 1	18DE7
335	I1 = IN1 + 2	15DE7
	J1 = JN1 + 2	29N07
	I2 = IN2 + 2	29N07
	J2 = JN2 + 2	29N07
	IF (IN1 - IN2) 342, 342, 341	29N07
341	NDE = NDE + 1	18DF7
342	IF (JN1 - JN2) 344, 344, 343	29N07
343	NDE = NDE + 1	18DE7
344	IF (IN2 - MX) 346, 346, 345	29N07
345	NDE = NDE + 1	18DF7
346	IF (JN2 - MY) 348, 348, 347	29N07
347	NDE = NDE + 1	18DF7
348	DO 355 I = I1, I2	29N07
	DO 350 J = J1, J2	01DE7
	DX(I,J) = DX(I,J) + DXN	45E64
	DY(I,J) = DY(I,J) + DYN	45E64
	Q(I,J) = Q(I,J) + ON	13AP3
	S(I,J) = S(I,J) + SN	13AP3

	CH(I,J) = CH(I,J) + CHN	07MY8
350	CONTINUE	13AP3
355	CONTINUE	22JE7
360	CONTINUE	13AP3
C	GENERATE EXTENDED TABLE 4	
362	IF (IOPD+IOPC+IOPS .EQ. 0) GO TO 363	26JF0
	IF (ML.EQ.-1) PRINT 97	31AG0
	IF (ML.EQ.-1) GO TO 363	31AG0
	CALL COPS (CH, DX, DY, S, L1, L2)	26JE0
363	CONTINUE	26JE0
C		
C-----	INPUT TABLE 5	
C		
	PRINT 37	22AP5
	IF (NCT5) 9980, 385, 364	24SE9
364	DO 382 N = 1, NCT5	24SE9
	READ 24, IN1, JN1, IN2, JN2, PXN, PYN	11DE7
	PRINT 44, IN1, JN1, IN2, JN2, PXN, PYN	11DE7
	IF (PXN) 365, 367, 365	18DE7
365	IF (IN1 * IN2) 9980, 366, 367	18DE7
366	NDE = NDE + 1	18DE7
367	IF (PYN) 368, 370, 368	18DE7
368	IF (JN1 * JN2) 9980, 369, 370	18DE7
369	NDE = NDE + 1	18DE7
370	I1 = IN1 + 2	18DE7
	J1 = JN1 + 2	29M07
	I2 = IN2 + 2	29M07
	J2 = JN2 + 2	29M07
	IF (IN1 - IN2) 372, 372, 371	29M07
	NDE = NDE + 1	18DE7
371	IF (JN1 - JN2) 374, 374, 373	29M07
372	NDE = NDE + 1	18DE7
373	NDE = NDE + 1	18DE7
374	IF (IN2 - MX) 376, 376, 375	29M07
375	NDE = NDE + 1	18DE7
376	IF (JN2 - MY) 378, 378, 377	29M07
377	NDE = NDE + 1	18DE7
378	DO 380 I = I1, I2	12DE7
	DO 379 J = J1, J2	12DE7
	PX(I,J) = PX(I,J) + PXN	20AP5
	PY(I,J) = PY(I,J) + PYN	20AP5
379	CONTINUE	29M07
380	CONTINUE	12DE7
382	CONTINUE	12DE7
	GO TO 386	19DE7
385	PRINT 38	19DE7
C		
C-----	INPUT TABLES 6 AND 7	
C		
386	PRINT 60	26JE0
	IF (NCT7) 9980, 389, 388	31AG0
388	CALL PLUP (C, L1, L2, NCT6, NCT7, MX, MY)	26JE0
	GO TO 400	26JEC
389	PRINT 38	17AG0
	IF (NCT7) 9980, 392, 400	17AG0
392	PRINT 74	17AG0
	PRINT 38	17AG0

400	IF (NDE) 9980, 401, 397	26JEO
397	PRINT 91, NDE	26JEO
	GO TO 9990	29N07
C		
C	-----FORM SUB-MATRICES	
C		
C	-----A SPRING IS PLACED AT PTS BEYOND BOUNDARIES OF THE REAL SLAB	
C	TO MAKE SOLUTION OF NON-RECTANGULAR SLABS OR SLABS WITH	
C	HOLES POSSIBLE. THIS IS DONE BY TESTING ON THE CC(I,3)	
C	TERMS, AND IF ZERO, SET EQUAL TO 1.0	
C		
C	-----Q(I,J) IS THE INPUT LOAD FOR THIS PROBLEM, OTHER PRIOR PROBLEM	
C	LOADS ARE DISCARDED	
C		
401	DO 600 J = 1, MYP3	29N07
	DO 404 I = 1, MXP3	08DE7
	FF(I,1) = Q(I,J)	300C9
	IF (J-1) 9980, 402, 403	08DE7
402	AA(I,1) = 0.0	03JAB
	GO TO 404	08DE7
403	AA(I,1) = DY(I,J-1) * HXDHY3	03JAB
404	CONTINUE	08DE7
	IF (ML) 501, 405, 405	08DE7
405	DO 500 I = 1, MXP3	08DE7
	IF (J-1) 9980, 410, 407	13DE7
407	IF (MYP3-J) 9980, 438, 420	05N09
C	-----COEFFICIENTS COMPUTED AT J = 1	
410	IF (I-1) 9980, 411, 412	08DE7
411	BB(I,2) = 0.0	08DE7
	BB(I,3) = 0.0	08DE7
	CC(I,3) = 1.0	170C9
	CC(I,4) = 0.0	08DE7
	CC(I,5) = 0.0	08DE7
	DD(I,2) = 0.0	08DE7
	DD(I,3) = 0.0	08DE7
	EE(I,1) = 0.0	03JAB
	GO TO 500	08DE7
412	IF (MXP3-I) 9980, 419, 413	13DF7
413	CRD(5) = AMIN1 (DX(I, J+1), DY(I, J+1))	29JL8
	BD(I,1) = 0.0	29JL8
	BB(I,2) = 0.0	08DE7
	BB(I,3) = 0.0	08DE7
	CC(I,2) = 0.0	08DE7
	CC(I,3) = HXDHY3 * DY(I,J+1)	08DE7
	+ ODHY * PY(I,J+1)	11DE7
1		14DE7
	IF (CC(I,3)) 415, 414, 415	170C9
414	CC(I,3) = 1.0	13DF7
415	CC(I,4) = 0.0	29JL8
	DD(I,1) = PDHXHY * CRD(5)	08DE7
	DD(I,2) = -2.0 * (HXDHY3 * DY(I,J+1) -	29JL8
	+ PDHXHY * CRD(5))	08DE7
1		29JL8
2		03JAB
	DD(I,3) = PDHXHY * CRD(5)	13DE7
	EE(I,1) = HXDHY3 * DY(I,J+1)	13DE7
	IF (I-2) 9980, 417, 416	
416	CC(I,1) = 0.0	

417	IF (MXP2-1) 9980, 500, 418	13DF7
418	CC(I,5) = 0.0	13DF7
	GO TO 500	08DE7
419	BB(I,1) = 0.0	13DF7
	BB(I,2) = 0.0	08DE7
	CC(I,1) = 0.0	08DE7
	CC(I,3) = 1.0	17OC9
	CC(I,2) = 0.0	08DE7
	DD(I,2) = 0.0	08DE7
	DD(I,1) = 0.0	08DE7
	EE(I,1) = 0.0	08DE7
	GO TO 500	08DE7
	C-----COEFFICIENTS COMPUTED FROM J = 2 TO MYP2	
420	IF (I-1) 9980, 421, 424	05N09
421	CRD(3) = AMIN1 (DX(I+1,J) , DY(I+1,J))	29JL8
	BB(I,2) = 0.0	29JL8
	BB(I,3) = PDHXHY * CRD(3)	29JL8
	CC(I,3) = HYDHX3 * DX(I+1,J)	08DE7
	+ ODHX * PX(I+1,J)	08DE7
1	IF (CC(I,3)) 441, 422, 423	05N09
422	CC(I,3) = 1.0	05N09
423	CC(I,4) = -2.0 * (HYDHX3 * DX(I+1,J)	05N09
1	+ PDHXHY * CRD(3))	29JL8
2	- ODHX * PX(I+1,J)	08DE7
	CC(I,5) = HYDHX3 * DX(I+1,J)	11DE7
	DD(I,2) = 0.0	08DE7
	DD(I,3) = PDHXHY * CRD(3)	29JL8
	EE(I,1) = 0.0	03JAB
	GO TO 500	08DE7
424	IF (MXP3-1) 9980, 431, 425	05N09
425	CRD(1) = AMIN1 (DX(I-1,J) , DY(I-1,J))	05N09
	CRD(2) = AMIN1 (DX(I ,J) , DY(I ,J))	29JL8
	CRD(3) = AMIN1 (DX(I+1,J) , DY(I+1,J))	29JL8
	CRD(4) = AMIN1 (DX(I ,J-1) , DY(I ,J-1))	29JL8
	CRD(5) = AMIN1 (DX(I ,J+1) , DY(I ,J+1))	29JL8
	BB(I,1) = PDHXHY * (CRD(1) + CRD(4)) +	30JL8
	ODHXHY * (CH(I,J) + CH(I,J))	07MY8
1	BB(I,2) = -2.0 * (PDHXHY * (CRD(2) + CRD(4))	29JL8
1	+ HXDHY3 * (DY(I,J-1) + DY(I,J)))	14SE6
2	+ ODHXHY * (- CH(I,J) - CH(I+1,J)	07MY8
3	- CH(I,J) - CH(I+1,J)) - ODHY * PY(I,J)	07MY8
	BB(I,3) = PDHXHY * (CRD(3) + CRD(4))	29JL8
1	+ ODHXHY * (CH(I+1,J) + CH(I+1,J))	07MY8
	CC(I,2) = -2.0 * (HYDHX3 * (DX(I-1,J) + DX(I,J))	29N07
1	+ PDHXHY * (CRD(1) + CRD(2)))	29JL8
2	+ ODHXHY * (- CH(I,J) - CH(I,J+1)	07MY8
3	- CH(I,J) - CH(I,J+1)) - ODHX * PX(I,J)	07MY8
	CC(I,3) = HYDHX3 * (DX(I-1,J) + 4.0 * DX(I,J)	29N07
1	+ DX(I+1,J)) + HXDHY3 * (DY(I,J-1) + 4.0	14SE6
2	* DY(I,J) + DY(I,J+1)) + PDHXHY * 4.0	14SE6
3	* (CRD(2) + CRD(2)) + ODHXHY	29JL8
4	* (CH(I,J) + CH(I,J+1) - CH(I+1,J)	09MY8
5	+ CH(I+1,J+1) + CH(I,J) + CH(I+1,J)	07MY8
6	+ CH(I,J+1) + CH(I+1,J+1)) + ODHX	07MY8
7	* (PX(I,J) + PX(I+1,J)) + ODHY	14SE6
8	* (PY(I,J) + PY(I,J+1)) + S(I,J)	14SE6

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      IF ( CC(I,3) ) 427, 426, 427      05N09
426      CC(I,3) = 1.0                  05N09
427      CC(I,4) = -2.0 * ( HYDMX3 * ( DX(I,J) + DX(I+1,J) ) 05N09
1          + PDHXHY * ( CRD(3) + CRD(2) ) ) 29JL8
2          + ODMXHY * ( - CH(I+1,J) - CH(I+1,J+1) ) 07MY8
3          - CH(I+1,J) - CH(I+1,J+1) ) - ODMX 07MY8
4          * PX(I+1,J) 14SE6
      DD(I,1) = PDHXHY * ( CRD(1) + CRD(5) ) 29JL8
1          + ODMXHY * ( CH(I,J+1) + CH(I,J+1) ) 09MY8
      DD(I,2) = -2.0 * ( HXDHY3 * ( DY(I,J) + DY(I,J+1) ) 29N07
1          + PDHXHY * ( CRD(2) + CRD(5) ) ) 29JL8
2          + ODMXHY * ( - CH(I,J+1) - CH(I+1,J+1) ) 07MY8
3          - CH(I,J+1) - CH(I+1,J+1) ) - ODMY 07MY8
4          * PY(I,J+1) 14SE6
      DD(I,3) = PDHXHY * ( CRD(3) + CRD(5) ) 29JL8
1          + ODMXHY * ( CH(I+1,J+1) + CH(I+1,J+1) ) 07MY8
      EE(I,1) = HXDHY3 * DY(I,J+1) 03JAR
      IF (I-2) 9980, 429, 428 05N09
428      CC(I,1) = DX(I-1,J) * HYDMX3 05N09
429      IF (MXP2 - 1) 9980, 500, 430 05N09
430      CC(I,5) = HYDMX3 * DX(I+1,J) 05N09
      GO TO 500 08DE7
431      CRD(1) = AMIN1 ( DX(I-1,J) , DY(I-1,J) ) 05N09
      BU(I,1) = CRD(1) * PDHXHY 29JL8
      BB(I,2) = 0.0 08DE7
      CC(I,1) = DX(I-1,J) * HYDMX3 08DE7
      CC(I,2) = -2.0 * ( HYDMX3 * DX(I-1,J) 08DE7
1          + PDHXHY * CRD(1) ) 29JL8
      CC(I,3) = HYDMX3 * DX(I-1,J) 08DE7
      IF ( CC(I,3) ) 436, 435, 436 05N09
435      CC(I,3) = 1.0 05N09
436      DD(I,1) = PDHXHY * CRD(1) 05N09
      DD(I,2) = 0.0 08DE7
      EE(I,1) = 0.0 03JAR
      GO TO 500 08DE7
C-----COEFFICIENTS COMPUTED AT J = MYP3
438      IF (I-1) 9980, 439, 440 05N09
439      BU(I,2) = 0.0 05N09
      BB(I,3) = 0.0 08DE7
      CC(I,3) = 1.0 17OC9
      CC(I,4) = 0.0 08DE7
      CC(I,5) = 0.0 08DE7
      DD(I,2) = 0.0 08DE7
      DD(I,3) = 0.0 08DF7
      EE(I,1) = 0.0 03JAR
      GO TO 500 08DE7
440      IF (MXP3-1) 9980, 447, 441 05N09
441      CRD(4) = AMIN1 ( DX(I ,J-1) , DY(I ,J-1) ) 05N09
      BB(I,1) = CRD(4) * PDHXHY 29JL8
      BB(I,2) = -2.0 * ( PDHXHY * CRD(4) 29JL8
1          + HXDHY3 * DY(I,J-1) ) 08DE7
      BB(I,3) = PDHXHY * CRD(4) 29JL8
      CC(I,2) = 0.0 08DE7
      CC(I,3) = HXDHY3 * DY(I,J-1) 08DE7
      IF ( CC(I,3) ) 9980, 442, 443 05N09
442      CC(I,3) = 1.0 05N09

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443	CC(1,4) = 0.0	05N09
	DD(1,1) = 0.0	08DE7
	DD(1,2) = 0.0	08DE7
	DD(1,3) = 0.0	08DE7
	EE(1,1) = 0.0	03JAB
	IF (1-2) 9980, 445, 444	05N09
444	CC(1,1) = 0.0	05N09
445	IF (MXP2-1) 9980, 500, 446	05N09
446	CC(1,5) = 0.0	05N09
	GO TO 500	08DF7
447	BB(1,1) = 0.0	05N09
	BD(1,2) = 0.0	08DE7
	CC(1,1) = 0.0	08DE7
	CC(1,2) = 0.0	08DE7
	CC(1,3) = 1.0	17OC9
	DD(1,1) = 0.0	08DE7
	DD(1,2) = 0.0	08DE7
	EE(1,1) = 0.0	03JAB
500	CONTINUE	04MY7
C		
C-----	BEGIN MAIN SOLUTION	
501	DO 515 I = 1, MXP3	29N07
C-----	RETAIN RECURSION COEFFICIENTS TO USE AT NEXT J STEP	
	AM2(1,1) = AM1(1,1)	21DE7
	AM1(1,1) = A(1,1)	21DE7
504	IF (ML) 515, 505, 505	29N07
505	DO 510 K = 1, MXP3	20OC7
	BM2(1,K) = BM1(1,K)	21DE7
	BM1(1,K) = B(1,K)	21DE7
	CM2(1,K) = CM1(1,K)	21DE7
	CM1(1,K) = C(1,K)	21DE7
510	CONTINUE	04MY7
515	CONTINUE	30JE7
C-----	SOLVE FOR ALL RECURSION COEFFICIENTS AND RETAIN THE A(1,1)	
C	COEFFICIENT AT THIS J STEP IN THE AT(1,J) ARRAY	
	JJ = J	08AG7
	CALL MATRIX (L1,JJ,MXP3,MY,AA,BB,CC,DD,EE,FF,A,AM1,	29N07
	1 AM2,B,BM1,BM2,C,CM1,CM2,D,E,ML)	19AP8
	DO 520 I = 1, MXP3	20OC7
	AT(1,J) = A(1,1)	29N07
520	CONTINUE	20OC7
C		
C-----	TEST FOR MULTIPLE LOADING --	
C	IF ZERO, RETAIN B AND C COEFFICIENTS ON TAPE 1.	
C	IF PARENT, ALSO RETAIN D AND E MULTIPLIERS ON TAPE 2.	
C	IF OFFSPRING, MOVE TAPE 1 COMPLETELY FORWARD IN STEPS.	
C		
	IF (ML) 522, 530, 525	25OC7
522	READ (1)	25OC7
	GO TO 600	31AGC
525	WRITE (2) ((D(1,K),E(1,K), I=1,MXP3), K=1,MXP3)	20OC7
530	WRITE (1) ((B(1,K), C(1,K), I=1,MXP3), K=1,MXP3)	29N07
600	CONTINUE	4MY7
C		
C-----	COMPUTE AND PRINT RESULTS	
C		

DO 650 LL = 1, MYP3	29NO7
J = MYP4 - LL	29NO7
C-----POSITION TAPE 1 FOR READING AND RETRIEVE THE A RECURSION COEFF	
BACKSPACE 1	16AG7
DO 625 I = 1, MXP3	21JL7
A(I,1) = AT(I,J)	28DE7
625 CONTINUE	22JE7
C-----RETRIEVE B AND C RECURSION COEFFICIENTS AT THIS J STEP	
READ (1) ((B(I,K), C(I,K), I=1, MXP3), K=1, MXP3)	29NO7
C-----REPOSITION TAPE	
BACKSPACE 1	16AG7
C	
C-----COMPUTE DEFLECTIONS	
C	
AM1 AND AM2 ARE NOW TEMPS USED TO REPRESENT B*WP1 AND C*WP2	
CALL MATMPY (L1, MXP3, 1, B, WP1, AM1)	26JAR
CALL MATMPY (L1, MXP3, 1, C, WP2, AM2)	26JAR
DO 630 I = 1, MXP3	21JL7
W(I,J) = A(I,1) + AM1(I,1) + AM2(I,1)	29NO7
WP2(I,1) = WP1(I,1)	28DE7
WP1(I,1) = W(I,J)	28DE7
630 CONTINUE	4MY7
650 CONTINUE	04MY7
C-----SET DEFLECTIONS AT CORNER STATIONS OUTSIDE THE BOUNDARIES	
W(1,1) = 2.0 * W(1,2) - W(1,3)	29NO7
W(MXP3,1) = 2.0 * W(MXP3,2) - W(MXP3,3)	29NO7
W(1,MYP3) = 2.0 * W(1,MYP2) - W(1,MYP1)	29NO7
W(MXP3,MYP3) = 2.0 * W(MXP3,MYP2) - W(MXP3,MYP1)	29NO7
C	
C-----COMPUTE BENDING MOMENTS, REACTIONS AND TWISTING MOMENTS	
C	
DO 730 J = 2, MYP2	24SF9
DO 720 I = 2, MXP2	29NO7
CRD(2) = AMIN1 (DX(I, J), DY(I, J))	29JLA
WSUM1 = ODHX2 * (W(I-1,J) - 2.0 * W(I,J) + W(I+1,J))	06NO7
WSUM2 = ODHY2 * (W(I,J-1) - 2.0 * W(I,J) + W(I,J+1))	06NO7
BMX(I,J) = DX(I,J) * WSUM1 + CRD(2) * PR * WSUM2	29JLA
BMY(I,J) = DY(I,J) * WSUM2 + CRD(2) * PR * WSUM1	29JLA
720 CONTINUE	08SE7
730 CONTINUE	08SE7
C	
C-----OUTPUT TABLES	
C	
PRINT 11	15SE6
PRINT 1	21JL7
PRINT 13, (AN1(N), N = 1, 40)	17OC9
PRINT 16, HPROB, (AN2(N), N = 1, 18)	17OC9
IF (ML) 888, 887, 887	06NO9
887 PRINT 39	6NO9
PRINT 48, SOM	18AG0
GO TO 889	06NO9
888 PRINT 42, KPROB	06NO9
PRINT 48, SOM	18AGC
889 IF (IOPPS) 9980, 892, 891	17AG0
891 SDT2 = 6.0 / (THK * THK)	17AGC
GO TO 895	06NO9

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892          SDT2 = 1.0                                17AG0
895 PRINT 40, SUMR                                     17AG0
          IF ( IOPB.EQ.1 )                             17AG0
*PRINT 49                                             17AG0
          ER = 1.0E-12                                21N07
          SUMR = 0.0                                   12DE7
          DO 960 J = 2, MYP2                           29N07
          IF ( IOPB.NE.1 ) PRINT 6                    7AG0
C-----COMPUTE ABSORBED LOADS
          JSTA = J - 2                                29N07
          DO 955 I = 2, MXP2                           29N07
          ISTA = I - 2                                29N07
          OBMX = ( BMX(I-1,J) - 2.0 * BMX(I,J) + BMX(I+1,J) ) 02N06CNC
          OBMX = ( BMX(I-1,J)*1.0D0 - 2.0D0 * BMX(I,J) + BMX(I+1,J) ) 30OC91P"
          * HYDHX                                       06N07CNC
          * 1.0D0 ) * HYDHX                             30OC91P"
          OBMX = ( BMX(I-1,J) - 2.0 * BMX(I,J) + BMX(I+1,J) ) 02N06CNC
          OBMX = ( BMX(I-1,J)*1.0D0 - 2.0D0 * BMX(I,J) + BMX(I+1,J) ) 30OC91P"
          * HXDHY                                       06N07CNC
          * 1.0D0 ) * HXDHY                             30OC91P"
          OTMX = ( W(I-1,J-1) * CH(I,J) - W(I-1,J) * ( CH(I,J)
          + CH(I,J+1) ) + W(I-1,J+1) * CH(I,J+1) ) 07MY8
          - W(I,J-1) * ( CH(I,J) + CH(I+1,J) ) + W(I,J) * 07MY8
          * ( CH(I,J) + CH(I,J+1) + CH(I+1,J) + CH(I+1,J
          +1) ) - W(I,J+1) * ( CH(I,J+1) + CH(I+1,J+1) ) 07MY8
          + W(I+1,J-1) * CH(I+1,J) - W(I+1,J) * ( CH(I
          +1,J) + CH(I+1,J+1) ) + W(I+1,J+1) * CH(I+1,J 07MY8
          +1) ) * ODHXHY                                06N07
          OTMY = OTMX                                  07MY8
          OPX = ODHX * ( PX(I,J) * W(I-1,J) - ( PX(I,J)
          + PX(I+1,J) ) * W(I,J) + PX(I+1,J) * W(I+1,J) ) 06N07
          + 0.0D0 + PX(I+1,J) ) * W(I,J) + PX(I+1,J) * W(I+1,J) ) 102N06CNC
          OPY = ODHY * ( PY(I,J) * W(I,J-1) - ( PY(I,J)
          + PY(I,J+1) ) * W(I,J) + PY(I,J+1) * W(I,J+1) ) 06N07
          + 0.0D0 + PY(I,J+1) ) * W(I,J) + PY(I,J+1) * W(I,J+1) ) 102N06CNC
          + 0.0D0 + PY(I,J+1) ) * W(I,J) + PY(I,J+1) * W(I,J+1) ) 30OC91P"
C-----COMPUTE TWISTING MOMENTS
          WSUM3 = ( W(I-1,J-1) - W(I-1,J+1) - W(I+1,J-1) +
          W(I+1,J+1) ) * 0.0625 * ODHXHY 14DE7
          TMX = ( CH(I,J) + CH(I,J+1) + CH(I+1,J) + 07MY8CNC
          TMX = ( CH(I,J) + CH(I,J+1) + CH(I+1,J) + 0.0D0 + 30OC91P"
          CH(I+1,J+1) ) * WSUM3 07MY8
C-----SUBTRACT APPLIED LOAD FROM SUM OF ABSORBED LOADS TO GET REACT
          REACT = OBMX + OBMX + OTMX + OTMY - OPX - OPY - Q(I,J) 06N07
C-----SUMMATION OF REACTIONS FOR STATICS CHECK
          SUMR = SUMR + REACT 17JA8
          IF ( REACT * REACT - ER ) 905, 905, 906 10N07
          905 REACT = 0.0 10N07
C
C-----COMPUTE PRINCIPAL MOMENTS OR STRESSES
          906 BMA = ( BMX(I,J) + BMY(I,J) ) * 0.50 17JA8
          C BMX IS BENDING MOMENT IN X DIRECTION (COMPRESSION IN TOP IS + )
          C TMX IS TWISTING MOMENT IN X DIRECTION (ABOUT Y AXIS)
          C SIGO IS THE MAXIMUM NUMERIC VALUE OF PRINCIPAL MOMENT ( + OR - ) .
          C IF THICKNESS SWITCH IS INPUT IT IS THE PLATE STRESS AND IS +
          C FOR TENSION IN BOTTOM OF PLATE

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C      COUNTER CLOCKWISE BETA ANGLES ARE POSITIVE AND ARE MEASURED FROM
C      THE X AXIS TO THE DIRECTION OF THE LARGEST PRINCIPAL STRESS
C      OR MOMENT (POSITIVE OR NEGATIVE)
      TMY = -TMX
      BMP = BMX(I,J) - BMA
      BMR = SORT ( BMP * BMP + TMY * TMY )
      BMO = DSORT ( BMP * BMP + TMY * TMY )
      BMO = BMA + BMR
      BMT = BMA - BMR
C-----TEST TO PRINT ONLY THE MAXIMUM VALUE
      IF ( BMA ) 916, 918, 918
916      PMMAX = BMT
      IF ( BMP ) 940, 930, 920
918      PMMAX = BMO
      IF ( BMP ) 920, 930, 940
920      ALF = TMY / BMP
      ALF = ATAN ( ALF ) * 57.29578
      ALF = DATAN ( ALF ) * 57.29578
C      IF ( ALF ) 922, 924, 924
922      THETA = -ALF - 180.0
      GO TO 945
924      THETA = + 180.0 - ALF
      GO TO 945
930      IF ( TMY ) 932, 934, 936
932      THETA = + 90.0
      GO TO 945
934      THETA = 0.0
      GO TO 945
936      THETA = - 90.0
      GO TO 945
940      ALF = TMY / BMP
      ALF = ATAN ( ALF ) * 57.29578
      ALF = DATAN ( ALF ) * 57.29578
C      THETA = -ALF
C-----CLOCKWISE ANGLES ARE NEGATIVE
945      BETA = 0.5 * THETA
      SIGO = PMMAX * SDT2
      PSIGO(I,J) = SIGO
      IF ( IOP8.NE.1 ) GO TO 948
      IF ( ISTA.EQ.(MX/2) .A. JSTA.EQ.(MY/2) ) GO TO 948
      GO TO 955
948 PRINT 47, ISTA, JSTA, W(I,J), BMX(I,J), BMY(I,J), TMX, REACT,
1      SIGO, BETA
955 CONTINUE
960 CONTINUE
      PRINT 6
      PRINT 40, SOM
      PRINT 50, SUMR
      IF ( NCT3 ) 9980, 985, 970
970 CONTINUE
C-----OUTPUTTABLE
C      PRINT 11
      PRINT 1
      PRINT 13, ( ANI(I), I=1, 40 )

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10SE9
15DF7
10SE9CNC
310C91PM
15DE7
15DE7
15DE7
10SE9
10SE9CNC
170C91PM
10SE9
10SE9
15DE7
10SE9
15DE7
10SE9
10SE9
15DE7
15DE7
10SE9
15DE7
10SE9
10SE9
15DE7
10SE9
10SE9CNC
170C91PM
10SE9
15DE7
15DE7
26JEO
17AGO
17AGO
17AGO
08DE7
14DE7
11SE7
09AG7
17AGO
17AGO
12DE7
26JEO
26JEO
24SE9
24SF9
170C9

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      PRINT 16, NPROB, ( AN2(I), I = 1, 10 )
      IF ( ML ) 972, 971, 971
971 PRINT 63
      PRINT 45
      GO TO 973
972 PRINT 64, KPROB
      PRINT 45
973 CONTINUE
      CALL SLPLT ( W, BMX, BMY, PSIGO, L1, L2, IPOP, 1 )
985 CONTINUE
      CALL TIC TOC (4)
      GO TO 1010
9980 PRINT 98
9990 CONTINUE
9999 CONTINUE
      PRINT 11
      PRINT 1
      PRINT 13, ( AN1(N), N = 1, 40 )
      CALL TIC TOC (2)
      PRINT 19
      END

```

```

170C9
26JEO
26JEO
04N09
26JFO
26JEO
4N09
26JEO
26JEO
26JFO
25SE6
26AG3
29N07
19MR5
04MY3
8MY3
31JL7
170C9
26SE6
26AG3

```

```

SUBROUTINE MATRIX ( L1,JJ,MXP3,MY,AA,BB,CC,DD,EE,FF,A,AM1,      79N07
1      AM2,B,BM1,BM2,C,CM1,CM2,D,E,ML )      19AP8
C DOUBLE PRECISION AA, BB, CC, DD, EE, FF, A, AM1, AM2, B, BM1, BM2, 160C91
C 1      C, CM1, CM2, D, E      160C91
C DIMENSION      AA (L1,1) ,      BB (L1,3) ,      CC (L1,5) , 03JA9
2      DD (L1,3) ,      EE (L1,1) ,      FF (L1,1) , 19AP8
3      A (L1,1) ,      AM1(L1,1) ,      AM2(L1,1) , 29N07
4      B (L1,L1) ,      BM1(L1,L1) ,      BM2(L1,L1) , 29N07
5      C (L1,L1) ,      CM1(L1,L1) ,      CM2(L1,L1) , 29N07
6      D(L1,L1) ,      E(L1,L1)      26JA8

C
C-----TEST FOR MULTIPLE LOADING, IF OFFSPRING, RETRIEVE D AND E
C RECURSION MULTIPLIERS FROM TAPE 2
C
      IF( ML ) 500, 520, 520      200C7
500 READ (2) (( D(I,K) , E(I,K) , I= 1,MXP3) , K= 1,MXP3 )      200C7
      GO TO 550      200C7
C
C-----COMPUTE RECURSION MULTIPLIER E
520 CALL MATMY1 (L1 , MXP3 , MXP3 , AA , BM2 , E)      29N07
      CALL MATA1 (L1 , MXP3 , C , BB , E)      29N07
C
C-----COMPUTE RECURSION MULTIPLIER -1/D, C USED AS A TEMPORARY
      CALL MATMPY (L1 , MXP3 , MXP3 , E , BM1 , D)      29N07
      CALL MATMY1 (L1 , MXP3 , MXP3 , AA , CM2 , C )      29N07
      DO 535 K = 1, MXP3      21JL7
      DO 530 I = 1, MXP3      21JL7
          D(I,K) = - D(I,K) - C(I,K)      01DE7
530 CONTINUE      4MY7
535 CONTINUE      22JE7
      CALL MATS2 (L1, MXP3, D, CC, D )      29N07
C
C-----COMPUTE RECURSION MULTIPLIER D
      CALL INVR5 ( D, L1, MXP3, JJ )      19AP8
C-----COMPUTE RECURSION COEFFICIENT C
      CALL MATM2 (L1 , MXP3 , D , EE , C )      29N07
C-----COMPUTE RECURSION COEFFICIENT B, NOW USING BM2 AS A TEMPORARY
      CALL MATMPY (L1 , MXP3 , MXP3 , E , CM1 , B )      29N07
      CALL MATA1 (L1 , MXP3 , B , DD , BM2)      21DE7
      CALL MATMPY (L1 , MXP3 , MXP3 , D , BM2 , B )      21DE7
C-----COMPUTE RECURSION COEFFICIENT A, EE USED AS A TEMPORARY
550 CALL MATMPY (L1 , MXP3 , 1 , E , AM1 , A )      29N07
      CALL MATMY1 (L1 , MXP3 , 1 , AA , AM2, EE )      02JAB
      DO 560 I = 1, MXP3      21JL7
          EE(I,1) = A(I,1) + EE (I,1) - FF(I,1)      300C9
560 CONTINUE      04MY7
      CALL MATMPY (L1 , MXP3 , 1 , D , EE , A )      02JAB
      RETURN      8AG7
      END      8AG7

```

C	SUBROUTINE MATMY1 (M1 , L2 , L , X , Y , Z) DOUBLE PRECISION X, Y, Z DIMENSION X(M1,1) , Z(M1,L) , Y(M1,L) DO 200 I = 1 , L2 DO 100 J = 1 , L Z(I,J) = X(I,1) * Y(I,J) 100 CONTINUE 200 CONTINUE RETURN END	25JL7 160C91 03JAN 19APR 13JL7 03JAN 13JL7 19APR 13JL7 13JL7
---	--	---

C	SUBROUTINE MATA1 (M1 , L2 , Z , X3 , Y) DOUBLE PRECISION X3, Z, Y DIMENSION X3(M1,3) , Z(M1,M1) , Y(M1,M1) MM1 = L2 - 1 DO 60 I = 1 , L2 DO 50 J = 1 , L2 Y(I,J) = Z(I,J) 50 CONTINUE 60 CONTINUE DO 100 I = 2 , MM1 Y(I,I-1) = Y(I,I-1) + X3(I,1) Y(I,I) = Y(I,I) + X3(I,2) Y(I,I+1) = Y(I,I+1) + X3(I,3) 100 CONTINUE Y(1,1) = Y(1,1) + X3(1,2) Y(1,2) = Y(1,2) + X3(1,3) Y(L2,L2-1) = Y(L2,L2-1) + X3(L2,1) Y(L2,L2) = Y(L2,L2) + X3(L2,2) RETURN END	25JL7 160C91 13JL7 25JL7 19APR 25JL7 13JL7 13JL7 19APR 13JL7 13JL7 13JL7 13JL7 13JL7 25JL7 25JL7 13JL7 13JL7
---	---	---

C	SUBROUTINE MATMPY (M1 , L2 , L , X , Y , Z) DOUBLE PRECISION X, Y, Z DIMENSION X(M1,M1) , Y(M1,L) , Z(M1,L) DO 300 I = 1 , L2 DO 200 M = 1 , L Z(I,M) = 0.0 DO 100 K = 1 , L2 Z(I,M) = X(I,K) * Y(K,M) + Z(I,M) 100 CONTINUE 200 CONTINUE 300 CONTINUE RETURN END	25JL7 160C91 27JF7 19APR 19APR 27JF7 25JL7 27JF7 27JF7 19APR 19APR 27JF7 27JF7
---	---	--

```

SUBROUTINE MATS2 (L1 , M1 , Z , X3 , Y)
DOUBLE PRECISION Z, X3, Y
DIMENSION X3(L1,5) , Z(L1,L1) , Y(L1,L1)
      MM2 = M1 - 2
      DO 100 I = 3, MM2
        Y(I,I-2) = Z(I,I-2) - X3(I,1)
        Y(I,I-1) = Z(I,I-1) - X3(I,2)
        Y(I,I) = Z(I,I) - X3(I,3)
        Y(I,I+1) = Z(I,I+1) - X3(I,4)
        Y(I,I+2) = Z(I,I+2) - X3(I,5)
100    CONTINUE
      Y(1,1) = Z(1,1) - X3(1,3)
      Y(1,2) = Z(1,2) - X3(1,4)
      Y(1,3) = Z(1,3) - X3(1,5)
      Y(2,1) = Z(2,1) - X3(2,2)
      Y(2,2) = Z(2,2) - X3(2,3)
      Y(2,3) = Z(2,3) - X3(2,4)
      Y(2,4) = Z(2,4) - X3(2,5)
      Y(M1-1,M1-3) = Z(M1-1,M1-3) - X3(M1-1,1)
      Y(M1-1,M1-2) = Z(M1-1,M1-2) - X3(M1-1,2)
      Y(M1-1,M1-1) = Z(M1-1,M1-1) - X3(M1-1,3)
      Y(M1-1,M1) = Z(M1-1,M1) - X3(M1-1,4)
      Y(M1,M1-2) = Z(M1,M1-2) - X3(M1,1)
      Y(M1,M1-1) = Z(M1,M1-1) - X3(M1,2)
      Y(M1,M1) = Z(M1,M1) - X3(M1,3)
      RETURN
      END

```

	SUBROUTINE INVR5 (A, L1, L2, JJ)	19AP8
C	DOUBLE PRECISION A, S, S2	160C91PM
	DIMENSION A(L1,L1)	25JA8
20	FORMAT (///28H NO INVERSE EXISTS JJ=, I5, 10H A(I,J) =)	30OC9
30	FORMAT (1X,10E10.3)	10OC7
31	FORMAT (// 50H NOTE: THIS IS USUALLY DUE TO AN ILL-DEFINED OR	31AG0
1	/ 52H INSTABLE STRUCTURE - CHECK YOUR INPUT FOR	31AG0
2	/ 52H ERRORS. (BEWARE WHEN MODELING CRACKS THAT	31AG0
3	/ 52H THE STIFFNESS AT THE CRACK IS GREATER THAN	31AG0
4	/ 52H ZERO) - ALSO THIS WILL HAPPEN IF THE SLAB	31AG0
5	/ 51H HAS BUCKLED DUE TO EXCESSIVE AXIAL THRUST	31AG0
	EP = 1.0E-10	21DE7
	DO 185 I = 1, L2	20OC7
	KK = 1 + 1	20OC7
	IF (ABS(A(I,1)) - EP) 990, 990, 150	19AP8COC
C	IF (DABS(A(I,1)) - EP) 990, 990, 150	30OC91PM
150	S = 1 / A(I,1)	20OC7
	DO 160 J = 1, L2	25JA8
	A(I,J) = A(I,J) * S	20OC7
160	CONTINUE	20OC7
	A(I,1) = S	25JA8
	DO 180 J = 1, L2	20OC7
	IF (J-1) 170, 180, 170	20OC7
170	S2 = A(J,1)	20OC7

```

      A(J,I) = 0.0
      DO 175 K = 1, L2
        A(J,K) = A(J,K) - S2 * A(I,K)
175    CONTINUE
180    CONTINUE
185    CONTINUE
      RETURN
990  PRINT 20, JJ
      PRINT 30, (( A(I,J), J=1,L2) , I=1, L2 )
      PRINT 31
      END

```

29JAN
 29JAN
 200C7
 200C7
 200C7
 200C7
 200C7
 200C7
 10JAN
 25JAN
 31AGO
 200C7

```

C  SUBROUTINE MATM2 (M1 , L2 , Y , X , Z)
    DOUBLE PRECISION X, Y, Z
    DIMENSION X(M1,1) , Z(M1,M1) , Y(M1, M1)
      DO 200 I = 1 , L2
        DO 100 J = 1 , L2
          Z(I,J) = X(J,1) * Y(I,J)
100    CONTINUE
200    CONTINUE
      RETURN
      END

```

25JUL7
 160C91AM
 03JAN
 19APR
 25JUL7
 03JAN
 19JUL7
 19APR
 19JUL7
 19JUL7

SUBROUTINE TIC TOC (J)		240C6
C		
C-----	THIS ROUTINE IS SPECIFICALLY FOR THE CDC6600. WHEN USING THE	
C	IBM360/50 SYSTEM THE INDICATED IBM CARDS WILL CALL THE SUBROUTINE	
C	PRTIME TO PRINTOUT THE REQUIRED TIME.	
C		
C-----	TIC TOC (1) = COMPILE TIME	20DE7
C	TIC TOC (2) = ELAPSED TM TIME	300C9
C	TIC TOC (3) = TIME FOR THIS PROBLEM	20DE7
C	TIC TOC (4) = TIME FOR THIS PROBLEM AND ELAPSED TM TIME	300C9
10	FORMAT(///30X19)ELAPSED TIME = 15.8H MINUTESF9.3,8H SECONDS)	31AGC
11	FORMAT(///3.15HCOMPILE TIME = 15.8H MINUTESF9.3,8H SECONDS)	25SE6
12	FORMAT(///30X24)TIME FOR THIS PROBLEM = 15.8H MINUTESF9.3,	25SE6
1	8H SECONDS)	25SE6
	I = J - 2	21JY7
	IF (I-1) 40, 30, 30	21JY7
30	F14 = F	25SF6
40	CALL SECOND (F)	25SE6CNC
C	40 CALL PRTIME	300C91PV
C	GO TO 990	300C91PV
	I11 = F	25SE6
	I1 = I11 / 60	25SE6
	F12 = F - I1*60	25SE6
	IF (I) 50, 70, 60	24JL7
50	PRINT I1, I1, F12	21JY7
	GO TO 990	25SE6
60	F13 = F - F14	25SE6
	I2 = F13 / 60	25SE6
	F13 = F13 - I2*60	25SF6
	PRINT I2, I2, F13	25SE6
	IF (I-1) 990, 990, 70	21JY7
70	PRINT I1, I1, F12	21JY7
990	CONTINUE	06SE7
	RETURN	25SF6
	END	25SE6

```

SUBROUTINE PLOP ( U, L1, L2, NCT6, NCT7, MX, MY )
C - - - THIS SUBROUTINE ACCEPTS SPECIAL LOAD PATTERNS AND THEIR
C PLACEMENTS, AND GENERATES THE APPROPRIATE LOAD VALUES FOR
C SOLUTION BY THE MAIN PROGRAM.
      DIMENSION IN16( 9,12), JN16( 9,12), OP( 9,12), NO(9), Q(L1,L2),
      1 IN17( 7), JN17( 7)
      DATA OP / 108 * 0.0 /
      60 FORMAT ( 12,2X 12, 2X 2413 )
      61 FORMAT ( 8X 12F6.0 )
      64 FORMAT ( 5X50H PATTERN: NUM OF PATTERN COORDINATES AND
      1 30H CONCENTRATED LOADS
      2 /, 5X 50H NUM LOADS X Y X Y X Y X
      3 30H Y X Y X Y
      4 / 26X 10HREFERENCE )
      65 FORMAT ( /5X15, 5X 14, 4X 6( 15, 14 ) )
      66 FORMAT ( 23X 6( 3X F6.0 ) )
      67 FORMAT ( 26X 6( 13,1X,13 ) )
      70 FORMAT ( //50H TABLE 7. PLACEMENTS OF SPECIAL LOAD PATTERNS /)
      71 FORMAT ( 1615 )
      72 FORMAT ( 2110, 1X 7( 15,14 ) )
      74 FORMAT ( 50H PATTERN NUM OF LOCATION OF REFE
      1 30HRENCE LOAD (SLAB COORDINATES) /
      2 50H NUM PLACEMENTS X Y X Y X Y
      3 35H X Y X Y X Y X Y / )
      80 FORMAT ( ///50H NUM OF WHEEL LOADS APPLIED TO THE SLAB =
      1 110, / 50H SUM OF WHEEL LOADS APPLIED TO THE SLAB =
      2 E10.3, / 50H -NUM OF WHEEL LOADS PLACED OUTSIDE SLAB =
      3 110, / 50H SUM OF WHEEL LOADS PLACED OUTSIDE SLAB =
      4 E10.3 )
      PRINT 64
      IF ( NCT6.EQ.0 ) GO TO 115
      NCT6D2 = NCT6 / 2
      DO 110 N = 1, NCT6D2
      READ 60, NP, NL, ( IN16(NP,J), JN16(NP,J), J = 1, NL )
      NO(NP) = NL
      READ 61, ( OP(NP,I), I = 1, NL )
      IF ( NL .GE. 12 ) GO TO 110
      NLP1 = NL + 1
      DO 100 I = NLP1, 12
      100 OP(NP,I) = 0.0
      110 CONTINUE
      115 DO 150 NP = 1, 9
      DO 120 I = 1, 12
      IF ( OP(NP,I) .EQ. 0. ) GO TO 120
      NL = NO(NP)
      GO TO 122
      120 CONTINUE
      GO TO 150
      122 IF ( NL.GT.6 ) GO TO 140
      PRINT 65, NP, NL, ( IN16(NP,J), JN16(NP,J), J = 1, NL )
      PRINT 66, ( OP(NP,I), I = 1, NL )
      GO TO 150
      140 PRINT 65, NP, NL, ( IN16(NP,J), JN16(NP,J), J = 1, 6 )
      PRINT 66, ( OP(NP,I), I = 1, 6 )
      PRINT 67, ( IN16(NP,J), JN16(NP,J), J = 7, NL )
      PRINT 66, ( OP(NP,I), I = 7, NL )

```

150	CONTINUE	26JEO
155	QPSUM = 0.0	31AGO
	QPOSUM = 0.0	26JEO
	LOP = 0	26JEO
	LOPO = 0	26JEO
	PRINT 70	26JEO
	PRINT 74	26JEO
	DO 300 N = 1, NCT7	26JEO
	READ 71, NP, NSP, (IN17(I), JN17(I), I = 1, NSP)	26JEO
	PRINT 72, NP, NSP, (IN17(I), JN17(I), I = 1, NSP)	26JEO
	NL = NQ(NP)	26JEO
	DO 290 IP = 1, NSP	29JEO
	DO 280 IL = 1, NL	29JEO
	I = IN16(NP, IL) + IN17(IP)	18AGO
	J = JN16(NP, IL) + JN17(IP)	18AGO
	IF (I.LT.0 .OR. I.GT.MX .OR. J.LT.0 .OR. J.GT.MY) GO TO 260	29JEO
	I = I + 2	18AGO
	J = J + 2	18AGO
	QPSUM = QPSUM + QP(NP, IL)	29JEO
	LOP = LOP + 1	26JEO
	Q(I, J) = Q(I, J) + QP(NP, IL)	29JEO
	GO TO 280	26JEO
260	QPOSUM = QPOSUM + QP(NP, IL)	29JEO
	LOPO = LOPO + 1	26JEO
280	CONTINUE	26JEO
290	CONTINUE	26JEO
300	CONTINUE	26JEO
	PRINT 80, LOP, QPSUM, LOPO, QPOSUM	26JEO
	RETURN	26JEO
	END	26JEO

```

SUBROUTINE CUPS ( CH, DX, DY, S, L1, L2 )
COMMON / CUPS / EM, SKK, IOPD, IOPC, IOPS, MX, MY
C - - - THIS SUBROUTINE GENERATES THE OPTIONAL PAVEMENT STIFFNESS
C          CONSTANTS. APPROPRIATE QUARTER AND HALF VALUES ARE
C          GENERATED AT THE EDGES.
COMMON / SPLT / MX, MY, THK, NCT3, NDE, PR
DIMENSION DX(L1,L2), DY(L1,L2), CH(L1,L2), S(L1,L2)
40 FORMAT ( / 50H      TABLE 4. ( CONTD ) COMPUTED OPTIONAL PAVEMENT
1      15H STIFFNESSES
2      //      37H      FROM      THRU      DX      DY
3      10X      25H      S      C
4      // 7X      5H1      1 13.14, 2X2H0.9X2H0.2CX2H0.8XF1C.3,
5      / 7X      5H0      0 13.14, 2E11.3, 11X E11.3, 4H 0.
6      / 7X      5H1      0 13.14, 2E11.3, 11X E11.3, 4H 0.
7      / 7X      5H0      1 13.14, 2E11.3, 11X E11.3, 4H 0.
8      / 7X      5H1      1 13.14, 2E11.3, 11X E11.3, 4H 0. )
      DXG04 = 0.0
      SGO4 = 0.0
      CHGEN = 0.0
      MYP1 = MY + 1
      MYP2 = MY + 2
      MXP2 = MX + 2
      MXP1 = MX + 1
      MXM1 = MX - 1
      MYM1 = MY - 1
      IF ( IOPD.NE.1 ) GO TO 110
      DXGEN = ( EM * THK**3 ) / ( 12. * ( 1. - PR*PR ) )
      DXG04 = DXGEN * .25
100      IF ( IOPC.NE.1 ) GO TO 110
      CHGEN = DXGEN * ( 1. - PR )
110      IF ( IOPS.NE.1 ) GO TO 200
      SGO4 = SKK * MX * MY * .25
200      PRINT 40, MX, MY, CHGEN, MX, MY, DXG04, DXG04, SGO4
1      , MXM1, MY, DXG04, DXG04, SGO4
2      , MX, MYM1, DXG04, DXG04, SGO4
3      , MXM1, MYM1, DXG04, DXG04, SGO4
      IF ( IOPC.NE.1 ) GO TO 300
      DO 250 I = 3, MXP2
      DO 250 J = 3, MYP2
      CH(I,J) = CH(I,J) + CHGEN
250      CONTINUE
300      DO 310 I = 2, MXP2
      DO 310 J = 2, MYP2
      DX(I,J) = DX(I,J) + DXG04
      DY(I,J) = DY(I,J) + DXG04
310      S(I,J) = S(I,J) + SGO4
      DO 320 I = 3, MXP1
      DO 320 J = 2, MYP2
      DX(I,J) = DX(I,J) + DXG04
      DY(I,J) = DY(I,J) + DXG04
320      S(I,J) = S(I,J) + SGO4
      DO 340 I = 2, MXP2
      DO 340 J = 3, MYP1
      DX(I,J) = DX(I,J) + DXG04
      DY(I,J) = DY(I,J) + DXG04
340      S(I,J) = S(I,J) + SGO4

```

```

DO 350 I = 3, MXP1
DO 350 J = 3, MYP1
  DX(I,J) = DX(I,J) + DXGO4
  DY(I,J) = DY(I,J) + DYGO4
  S(I,J) = S(I,J) + SGO4
350 RETURN
END

```

```

26JEO
26JEO
26JEO
26JEO
26JEO
26JEO
26JEO

```

```

SUBROUTINE ZOT1 ( XX, YY, NEND, ID )
C - - - THIS ROUTINE ( WHEN ACTIVATED ) DRIVES A CALCOMP 763
C IF YOU HAVE A 763 AND DESIRE THE USE OF THIS ROUTINE
C CONTACT FRANK L ENDRES , AUSTIN RESEARCH ENGINEERS INC.
C 3128 MANOR RD. AUSTIN, TEX 78723
RETURN
END

```

```

28JEO

```

```

SUBROUTINE SPLTD2 ( KEY, NEND, X, DUM )
DIMENSION X(NEND), DUM(1)
COMMON /PLOT/ I1, I2, J1, J2
  IF ( KEY.EQ.1 ) CALL SPLOT3 ( X, NEND, DUM )
  IF ( KEY.EQ.2 ) CALL SPLOT4 ( X, DUM, NEND )
RETURN
END

```

```

02JEO
02JEO
25NO9
18NO9
18NO9
15OC9
15OC9

```

```

SUBROUTINE SPLT ( W, BMX, BMY, SIGO, L1, L2, IPOD, IC )
COMMON / ZUT / LOP, MC, IPOLL, MOP
COMMON / SPLT / MX, MY, THK, NCT3, NDE, PR, SOM
COMMON / PLOT / I1, I2, J1, J2
DIMENSION IN13( 10 ), IN23( 10 ), JN13( 10 ), JN23( 10 ),
1 KASEW(10), KASEX(10), KASEY(10), KASEP(10),
2 TEMX (400), TEMY (300), XX(300),
3 W(L1,L2), BMX(L1,L2), BMY(L1,L2), SIGO(L1,L2)
DATA ID1, ID2, ID3, ID4 /10HDEFLECTION, 10HBEND MOM X,
1 10HBEND MOM Y, 10H SIGO /
46 FORMAT (5X, 2(1X,12,1X,13),22X,E11.3)
56 FORMAT ( 4( 2X, 13 ), 4( 4X, 11 ) )
57 FORMAT ( 5X, 2( 1X, 12, 1X, 13 ), 6X, 12, 11X, 12, 2(11X,12) )
65 FORMAT (///,15X,26HX MOMENTS ONLY, BETWEEN ( ,13,1H,,13,
1 8H ) AND ( ,13, 1H,,13,2H ) , ///,
2 30H X , Y X MOMENT , / )
66 FORMAT ( 15X, 12, 1X, 13, 10X, E10.3 )
C 66 FORMAT ( 15X, 12, 1X, 13, 10X, 1PE10.3 )
67 FORMAT (///,15X,26HY MOMENTS ONLY, BETWEEN ( ,13,1H,,13,
1 8H ) AND ( ,13, 1H,,13,2H ) , ///,
2 30H X , Y Y MOMENT , / )
68 FORMAT ( 15X, 12, 1X, 13, 10X, E10.3 )
C 68 FORMAT ( 15X, 12, 1X, 13, 10X, 1PE10.3 )
69 FORMAT (///,15X,32HBOTH X AND Y MOMENTS, BETWEEN ( ,13,
1 1H,,13, 8H ) AND ( ,13, 1H,,13, 2H ) , ///,
2 22H X , Y X MOMENT , 28X, 10H Y MOMENT , / )
74 FORMAT ( 15X, 12, 1X, 13, 10X, E10.3, 3X, E10.3 )
C 74 FORMAT ( 15X, 12, 1X, 13, 10X, 1PE10.3, 3X, 1PE10.3 )
86 FORMAT (///,15X,26HDEFLECTIONS, BETWEEN ( ,13,1H,,13,
1 8H ) AND ( ,13, 1H,,13,2H ) , ///,
2 30H X , Y DEFLECTION , / )
87 FORMAT (///,15X,10HPRINCIPAL A6,16HES, BETWEEN ( ,13,
1 1H,,13, 8H ) AND ( ,13, 1H,,13, 2H ) , ///,
2 13H X , Y A6 , / )
90 FORMAT (// 45H *** CAUTION. TOTAL NUMBER OF SPECIFIED
1 10H POINTS IS , 15, /,
2 40H SHOULD NOT BE GREATER THAN 300 ,//)
IF ( IC.NE.0 ) GO TO 800
DO 100 I = 1, 300
XX(I) = I - 1
100 CONTINUE
LOP = -1
MC = 10
IPOLL = 1
MOP = 0
C
C----- INPUT TABLE 3
C
DO 175 N = 1, NCT3
READ 56, IN13(N), JN13(N), IN23(N), JN23(N), KASEW(N), KASEX(N),
1 KASEY(N), KASEP(N)
PRINT 57, IN13(N), JN13(N), IN23(N), JN23(N), KASEW(N), KASEX(N),
1 KASEY(N), KASEP(N)
NEND = (IN23(N)-IN13(N)+1)*(JN23(N)-JN13(N)+1)
IF ( IN13(N) - IN23(N) ) 154, 154, 153
153 NDE = NDE + 1

```

```

02JEO
15JEOCDC
31AGO
24MYO
19MYO
124YC
15JEO
18MYO
15JEOCDC
15JEOCDC
23OC7CDC
20APO
20APO
05NO9
26NO9
25NO9
73SF9CDC
17OC9IAM
05NO9
26NO9
25NO9
23SE9CDC
17OC9IAM
05NO9
26NO9
26NO9
30OC9CDC
30OC9IAM
20APO
20APO
20APO
31AGO
27APO
31AGO
05MRO
05MRO
05MRO
12MYO
15JEOCDC
15JEOCDC
15JEOCDC
15JEOCDC
15JEOCDC
15JEOCDC
12MYO
12MYO
18MYO
20APO
20APO
20APO
20APO
05MRO
02OC9
24SE9

```

```

154 IF ( JN13(N) - JN23(N) ) 156, 156, 155
155 NDE = NDE + 1
156 IF ( IN23(N) - MX ) 158, 158, 157
157 NDE = NDE + 1
158 IF ( JN23(N) - MY ) 160, 160, 159
159 NDE = NDE + 1
160 IF ( KASEX(N) - 1 ) 162, 162, 161
161 NDE = NDE + 1
162 IF ( KASEY(N) - 1 ) 164, 164, 163
163 NDE = NDE + 1
164 IF ( KASEW(N) - 1 ) 166, 166, 165
165 NDE = NDE + 1
166 IF ( KASEP(N) - 1 ) 168, 168, 167
167 NDE = NDE + 1
168 IF ( NEND - 300 ) 174, 174, 173
173 NDE = NDE + 1
      PRINT 90, NEND
174 CONTINUE
175 CONTINUE
      GO TO 9000

```

```

24SF9
24SE9
24SF9
24SE9
24SE9
24SE9
09OC9
09OC9
09OC9
20AP0
20AP0
20AP0
20AP0
20AP0
20AP0
20AP0
05MRC
20AP0
20AP0
12MY0

```

C----- OUTPUTTABLE9

```

C
800 CONTINUE
      IF ( IPOP.EQ.3 ) MOP = 1
      IPOP = IPOP - 1
      DO 810 N = 1, NCT3
      IF ( KASEW(N) - 1 ) 818, 802, 9980
802 PRINT 86, IN13(N), JN13(N), IN23(N), JN23(N)
      I1 = IN13(N) + 2
      I2 = IN23(N) + 2
      J1 = JN13(N) + 2
      J2 = JN23(N) + 2
      NEND = (I2-I1+1)*(J2-J1+1)
      K = 0
      IF ( (J2-J1)-(I2-I1) ) 804, 804, 808
804 DO 806 J = J1, J2
      DO 806 I = I1, I2
      K = K + 1
      TEMX(K) = W(I,J)
806 CONTINUE
      GO TO 812
808 DO 810 I = I1, I2
      DO 810 J = J1, J2
      K = K + 1
      TEMX(K) = W(I,J)
810 CONTINUE
812 IF ( IPOP ) 814, 816, 816
814 CALL SPLTD2 ( 1, NEND, TEMX, 20. )
      GO TO 818
816 CONTINUE
      ID = ID1
      CALL ZOT 1 ( XX, TEMX, NEND, ID )
      NP2 = NEND + 2
      DO 817 I = 1, NP2
817 XX(I) = I - 1

```

```

15JFO
15JEOCNC
20MY0
20MY0
20MY0
20MY0
20AP0
20AP0
20AP0
20AP0
20AP0
20AP0
20MY0
20MYC
20MY0
20AP0
20AP0
20MY0
20MY0
20MY0
20AP0
20AP0
20MY0
20MY0
20MY0
25MY0
20MY0
15JFO
15JEOCNC
15JEOCNC
19JEO
19JFO
19JFO

```

818	IF (IPOP.EQ.1)	GO TO 814	20MYO
	CONTINUE		20MYO
820	CONTINUE		20MYO
	DO 880 N = 1, NCT3		05NO9
	IF (KASEX(N) = KASEY(N) - 1)	824, 822, 9980	20MYO
822	PRINT 69, IN13(N), JN13(N), IN23(N), JN23(N)		20MYO
	GO TO 832		20MYO
824	IF (KASEX(N) - 1)	828, 826, 9980	20MYO
826	PRINT 65, IN13(N), JN13(N), IN23(N), JN23(N)		20MYO
	GO TO 832		20MYO
828	IF (KASEY(N) - 1)	880, 830, 9980	20MYO
830	PRINT 67, IN13(N), JN13(N), IN23(N), JN23(N)		20MYO
832	CONTINUE		20MYO
	I1 = IN13(N) + 2		24SF9
	J1 = JN13(N) + 2		24SE9
	I2 = IN23(N) + 2		24SE9
	J2 = JN23(N) + 2		24SE9
	NEND = (I2-I1+1)*(J2-J1+1)		11NO9
	K = 0		25NO9
	DO 836 J = J1, J2		20MYO
	DO 834 I = I1, I2		20MYO
	K = K + 1		25NO9
	TEMX(K) = BMX(I,J)		25NO9
	TEMY(K) = BMY(I,J)		25NO9
834	CONTINUE		20MYO
836	CONTINUE		20MYO
	IF (IPOP)	838, 865, 865	21MYO
838	IF (KASEX(N) = KASEY(N) - 1)	842, 840, 9980	20MYO
840	CALL SPLTD2 (2, NEND, TEMX, TEMY)		25MYO
	GO TO 880		25MYO
842	IF (KASEX(N) - 1)	844, 843, 9980	20MYO
843	CALL SPLTD2 (1, NEND, TEMX, 20.)		25MYO
	GO TO 880		25MYO
844	IF (KASEY(N) - 1)	9980, 846, 9980	20MYO
846	IF ((J2-J1)-(I2-I1))	854, 854, 848	20MYO
848	K = 0		20MYO
	DO 852 I = I1, I2		20MYO
	DO 850 J = J1, J2		20MYO
	K = K + 1		12DE9
	TEMY(K) = BMY(I,J)		12DE9
850	CONTINUE		20MYO
852	CONTINUE		20MYO
854	CALL SPLTD2 (1, NEND, TEMY, 20.)		25MYO
856	CONTINUE		20MYO
865	CONTINUE		19JEO
	IF (KASEX(N).EQ.1)	ID = ID2	19JEOCNC
	IF (KASEX(N).EQ.1)	CALL ZOT 1 (XX, TEMX, NEND, ID)	19JEOCNC
	NP2 = NEND + 2		19JEO
	DO 870 I = 1, NP2		19JEO
	XX(I) = I - 1		19JEO
870	IF (KASEY(N).EQ.1)	ID = ID3	19JEOCNC
	IF (KASEY(N).EQ.1)	CALL ZOT 1 (XX, TEMY, NEND, ID)	19JEOCNC
	DO 872 I = 1, NP2		19JEO
	XX(I) = I - 1		19JEO
872	IF (IPOP.EQ.1)	GO TO 838	20MYO
880	CONTINUE		5NO9

20MYO
20MYO
07SEC
12MYO
12MYO
12MYO
12MYO
12MYO
02JEO
02JEO
02JEO
02JEO
02JEO
02JEO
02JEO
02JEO
02JEO
02JEO
02JEO
02JEO
20MYO
20MYO
20MYO
15JEO
15JEOCNC
15JEOCNC
19JEO
19JEO
19JEO
20MYO
20MYO
20MYO
20MYO
19MYO

```

SUBROUTINE SPLOT 3 ( X, NEND, WIDTH )
C * * * * THE LATEST REVISION DATE FOR THIS ROUTINE IS. - - 12 DEC 69
DIMENSION X(NEND), SPACE(15), SYMB(4)
COMMON /PLOT/ I1, I2, J1, J2
DATA SPACE / 15*4H /, SYMB / 4H* 4H* 4H* 4H* /
C***** THIS ROUTINE PRINTS AND PLOTS THE NEND VALUES OF X
C BEGINNING WITH THE INITIAL VALUE TRANSFERRED.
C THE PAPER SHOULD BE POSITIONED PROPERLY AND ALL
C HEADINGS PRINTED BEFORE CALLING. F. L. E.
C **** INPUT - X, THE FUNCTION TO BE PLOTTED
C NEND, THE NUMBER OF X TO BE PLOTTED
C WIDTH, WIDTH OF PLOT ( LESS THAN 61 )
C **** OUTPUT- NO ACTUAL VALUES ARE RETURNED TO THE
C CALLING ROUTINE - THE VALUES ARE PRINTED
C AND PLOTTED VERTICALLY.
10 FORMAT ( 5X, I2, 1X, I3, 1X, E10.3, 16A4 )
15 FORMAT ( 5X, I2, 1X, I3, 1X, E10.3 )
IF ( NEND .LE. 0 ) GO TO 990
IF ( WIDTH.GT.60. .OR. WIDTH.LT.1. ) WIDTH = 60.
ISKP = WIDTH / 8 + 1
SYMB = SYMB(1)
OMEGA = X(1)
THETA = X(1)
IF ( NEND .EQ. 1 ) GO TO 120
DO 50 I = 2, NEND
IF ( OMEGA.LT.X(I) ) OMEGA = X(I)
IF ( THETA.GT.X(I) ) THETA = X(I)
50 CONTINUE
IF ( OMEGA.EQ.THETA ) GO TO 60
SIGMA = ( WIDTH - 1. ) / ( OMEGA - THETA )
60 CONTINUE
IF ( (J2-J1-I2+I1) .GT. 0 ) GO TO 150
I = 0
DO 110 JS = J1, J2
JSTA = JS - 2
DO 100 IS = I1, I2
ISTA = IS - 2
I = I + 1
IF ( OMEGA.EQ.THETA ) GO TO 80
BETA = SIGMA * ( X(I) - THETA ) + 1.
IOTA = BETA
IF ( (BETA - IOTA).GE.0.5 ) IOTA = IOTA + 1
ISKP = ( IOTA - 1 ) / 4
IR = IOTA - 4 + ISKP
ISKP = ISKP + 1
SYMB = SYMB(IR)
80 PRINT 1, ISTA, JSTA, X(I), ( SPACE(I), I=1, ISKP ), SYMB
100 CONTINUE
110 CONTINUE
GO TO 990
150 CONTINUE
I = 0
DO 210 IS = I1, I2
ISTA = IS - 2
DO 200 JS = J1, J2
JSTA = JS - 2

```

I = I + 1	25N09
IF (OMEGA.EQ.THETA) GO TO 180	12DE9
BETA = SIGMA * (X(1) - THETA) + 1.	100C9
IOTA = BETA	100C9
IF ((BETA - IOTA).GE.0.5) IOTA = IOTA + 1	100C9
ISKP = (IOTA - 1) / 4	100C9
IR = IOTA - 4 * ISKP	100C9
ISKP = ISKP + 1	100C9
SYMD = SYMB(IR)	100C9
180 PRINT 10, ISTA, JSTA, X(1), (SPACE(L), L=1, ISKP), SYMD	12DE9
200 CONTINUE	12DE9
210 CONTINUE	12DE9
GO TO 990	12DE9
120 PRINT 15, I1, J1, X(1)	25N39
990 RETURN	11N09
C END SPLOT 3	18MY0
END	100C9

```

SUBROUTINE SPLOT 4 ( X, Y, NEND )
C * * * * THE LATEST REVISION DATE FOR THIS ROUTINE IS - - 25 NOV 69 REVISION
DIMENSION X(NEND), Y(NEND), SPACE( 8), SYMB(4)
COMMON /PLOT/ I1, I2, J1, J2
DATA SPACE / 8*4H /, SYMB / 4H* 4H* 4H* 4H* 4H* 4H* 4H* 4H* /
C***** THIS ROUTINE PRINTS AND PLOTS THE NEND VALUES OF X AND Y
C BEGINNING WITH THE INITIAL VALUE TRANSFERRED.
C THE PAPER SHOULD BE POSITIONED PROPERLY AND ALL
C HEADINGS PRINTED BEFORE CALLING. F. L. E.
C **** INPUT - X, THE FUNCTION TO BE PLOTTED
C Y, THE FUNCTION TO BE PLOTTED
C NEND, THE NUMBER OF X OR Y TO BE PLOTTED
C **** OUTPUT- NO ACTUAL VALUES ARE RETURNED TO THE
C CALLING ROUTINE - THE VALUES ARE PRINTED
C AND PLOTTED VERTICALLY.
10 FORMAT ( 5X, I2, 1X, I3, 1X, E10.3, 7A4, E10.3, 7A4 )
15 FORMAT ( 5X, I2, 1X, I3, 1X, E10.3, 28X, E10.3 )
IF ( NEND .LE. 0 ) GO TO 990
IW = 20
IX = IW / 4
ISKP = IW / 8
ISKP2 = ISKP
ISKPT = 4
ISKPF = ISKP
SYND = SYMB(1)
SYND2 = SYMB(1)
WIDTH = IW
OMEGA = X(1)
THETA = X(1)
OZ = Y(1)
T2 = Y(1)
IF ( NEND .EQ. 1 ) GO TO 120
DO 50 I = 2, NEND
IF ( OMEGA.LT.X(I) ) OMEGA = X(I)
IF ( THETA.GT.X(I) ) THETA = X(I)
IF ( OZ.LT.Y(I) ) OZ = Y(I)
IF ( T2.GT.Y(I) ) T2 = Y(I)
50 CONTINUE
IF ( OMEGA.EQ.THETA ) GO TO 60
SIGMA = ( WIDTH - 1. ) / ( OMEGA - THETA )
60 IF ( OZ.EQ.T2 ) GO TO 70
S2 = ( WIDTH - 1 ) / ( OZ - T2 )
70 CONTINUE
I = 0
DO 110 JS = J1, J2
JSTA = JS - 2
DO 100 IS = I1, I2
ISTA = IS - 2
I = I + 1
IF ( OMEGA.EQ.THETA ) GO TO 80
BETA = SIGMA * ( X(I) - THETA ) + 1.
IOTA = BETA
IF ( (BETA - IOTA).GE.0.5 ) IOTA = IOTA + 1
ISKP = ( IOTA - 1 ) / 4
IR = IOTA - 4 * ISKP
ISKP = ISKP + 1

```

	SYMD = SYMB(IR)	100C9
00	IF (02.EQ.T2) GO TO 90	140C9
	BETA = 52 * (Y(1) - T2) + 1.	150C9
	IOTA = BETA	140C9
	IF ((BETA - IOTA).GE.0.5) IOTA = IOTA + 1	140C9
	ISKP2 = (IOTA - 1) / 4	140C9
	IR = IOTA - 4 * ISKP2	140C9
	SYMD2 = SYMB(IR)	140C9
	ISKP2 = ISKP2 + 1	140C9
	ISKPT = IX - ISKP + 1	150C9
	90 PRINT 10, ISTA, JSTA, X(1), (SPACE(K),K=1,ISKP), SYMD	25N09
1	, (SPACE(L),L=1,ISKPT), Y(1), (SPACE(K),K=1,ISKP2), SYMD2	25N09
100	CONTINUE	25N09
110	CONTINUE	25N09
	GO TO 990	25N09
120	PRINT 15, 11, J1, X(1), Y(1)	25N09
990	RETURN	11N09
C	END SPLOT 4	18MY0
	END	100C9

COMPUTER RESULTS OF EXAMPLE PROBLEMS

DATA LISTING

SAMPLE PROBLEMS TO DEMONSTRATE PROGRAM USE

- 24 SEPT 70 - JJD,FLE,JLR

CONTRACT DACA 23-7C-C-GC76

UNITS ARE LBS AND INCHES

601K BRIDGE APPROACH SLAB (FROM REF 3, SIMILAR PROB IN REF 1)

[illegible]

JRS 4-25FT SQ TAXIWAY SLABS, 2 C-5A BOGIES CENTERED ON 25 PERCENT JOINTS

```

1 -      1      4      4      0      2      1      1      1      1
20 28 3.000E+01 2.150E+01 2.000E-01 5.000E+06 1.200E+01 1.250E+02
3   8   17   21   1   0   0   1
0  20  20  21   1   1   0   0
0  21  20  21   1   1   0   0
9   0   9  28   1   0   1   0
10  0  10  28-2.812E+08
10  1  10  27-2.812E+08
0  14  20  14          -2.812E+08
1  14  19  14          -2.812E+08
1  7   0  0 -2  1 -1  1  1  1  2  1 -1 -2  1 -2
        0-30000-30000-30000-30000-30000-30000

```

JM6 4-29FT SQ TAXIWAY SLABS, 2 B-747 BOGIES, 25 PERCENT JOINTS

-1			0	4	0	0	2	1	0	0	0	1	1
3	8	17	21	1	0	0	1						
0	21	20	21	1	1	0	0						
9	0	9	28	1	0	1	0						
12	0	12	28	1	0	1	0						
6	0	0	0	3	1	0	2	0	1	3	2	3	
	-41900-41900-	-41900-	-41900-	-41900-	-41900-	-41900-	-41900-	-41900-	-41900-	-41900-	-41900-	-41900-	-41900-
1	2	7	12	12	18								

SAC1 8 X 8 REG

8	8	6.	8	6.25E+05	6.25E+05	0.	0.	0.	0.	0.	0.
4	4	8	8	0.625E+06	0.625E+06					1.000E+20	0.
1	1	7	7	0.625E+06	0.625E+06						
0	0	8	8	0.625E+06	0.625E+06						
1	1	7	7	0.625E+06	0.625E+06					-1.000E+20	
4	4	4	4							-1.000E+05	
1	1	8	8								1.075E+04

PROGRAM SLAB FOR CASE SPECIAL DECK-ARE-JJP+LE REVISION DATE 07 SEP 70
 SAMPLE PROBLEMS TO BE USED FOR PROGRAM USE - 24 SEPT 70 - JJP+LE+JLH
 CONTRACT NO. 23-70-C-0070 UNITS ARE LBS AND INCHES

PROB
 6016 --10% APPROACH SLAB (FROM REF J. SIMILAR PROB IN REF 1)

TABLE 1 CONTROL DATA.

MULTIPLE LOAD OPTION (IF BLANK OR ZERO, PROB IS INDEPENDENT -- 0
 IF +1, PARENT FOR NEAT PROB -- IF -1, AN OFFSPRING PROB)

TABLE NUMBER
 2 3 4 5 6 7
 NUM CARDS INPUT THIS PROBLEM 1 3 13 2 4 2

COMPUTE OPTIONAL PAVEMENT STIFFNESS CONSTANTS (1=YES) DA+DY C S
 1 1 0

OPTION TO SUPPRESS DETAILED OUTPUT (1=YES) 0

OPTION TO PRINT PRIN STRESS INSTEAD OF MOM (1=YES) 0

TABLE 2. CONSTANTS--UNITS MUST BE CONSISTENT.

NUM INCREMENTS IN X DIRECTION 12
 NUM INCREMENTS IN Y DIRECTION 16
 INCR LENGTH IN X DIRECTION 2.400E+01
 INCR LENGTH IN Y DIRECTION 2.400E+01
 POISSON'S RATIO 2.500E-01
 MODULUS OF ELASTICITY 4.000E+06
 SLAB THICKNESS 1.000E+01
 SURGRADE MODULUS 0.

TABLE 3. SPECIFIED AREAS FOR SELECTED PLOTTED OUTPUT.

PLOT (1=YES)
 FROM THRU DEFL A-MOMENT Y-MOMENT PRIN MOMENT
 0 15 12 15 1 1 0 1
 4 0 16 16 1 0 1 1
 0 12 12 16 1 0 0 0

TABLE 4. STIFFNESS AND LOAD DATA.

FROM THRU DA DY Q S C
 0 0 12 15 -0. -0. -1.500E+02 -0. -0.
 0 1 12 15 -0. -0. -1.500E+02 -0. -0.
 1 0 11 15 -0. -0. -1.500E+02 -0. -0.
 1 1 11 15 -0. -0. -1.500E+02 -0. -0.
 0 7 12 7 -0. -1.777E+00 -0. -0. -0.
 1 7 11 7 -0. -1.777E+00 -0. -0. -0.
 0 0 0 15 -1.777E+00 -0. -0. -0. -0.
 0 1 0 15 -1.777E+00 -0. -0. -0. -0.
 0 0 12 1 -0. -0. -0. 1.000E+00 -0.

0	7	12	15	-0.	-0.	-0.	1.440E+04	-0.
1	7	11	15	-0.	-0.	-0.	1.440E+04	-0.
0	7	12	16	-0.	-0.	-0.	1.440E+04	-0.
1	7	11	16	-0.	-0.	-0.	1.440E+04	-0.

TABLE 4. (CONTD) COMPUTED OPTIONAL PAVEMENT STIFFNESSES

FROM	THRU	UX	UY	S	C
1	1 12 16	0.	0.	0.	2.667E+08
0	0 12 16	0.557E+07	0.509E+07	0.	0.
1	0 11 16	0.557E+07	0.509E+07	0.	0.
0	1 12 15	0.557E+07	0.509E+07	0.	0.
1	1 11 15	0.557E+07	0.509E+07	0.	0.

TABLE 5. AXIAL THRUST DATA.

FROM	THRU	PX	PY
0	1 12 16	-0.	-6.000E+04
1	1 11 16	-0.	-6.000E+04

TABLE 6. SPECIAL LOAD PATTERNS.

PATTERN NUM	NUM OF LOADS	PATTERN COORDINATES AND CONCENTRATED LOADS									
		REFERENCE		X		Y		X		Y	
1	4	0	0	3	0	0	3	3	3	3	3
		-10000	-10000	-10000	-10000						
2	2	0	0	-3	0						
		-5000	-5000								

TABLE 7. PLACEMENTS OF SPECIAL LOAD PATTERNS.

PATTERN NUM	NUM OF PLACEMENTS	LOCATION OF REFERENCE LOAD (SLAB COORDINATES)											
		X	Y	X	Y	X	Y	X	Y	X	Y	X	Y
1	2	1	15	1	-4								
2	1	4	-3										

NUM OF WHEEL LOADS APPLIED TO THE SLAB	=	2
SUM OF WHEEL LOADS APPLIED TO THE SLAB	=	-2.000E+04
NUM OF WHEEL LOADS PLACED OUTSIDE SLAB	=	8
SUM OF WHEEL LOADS PLACED OUTSIDE SLAB	=	-7.000E+04

PROGRAM SLAB-JOE CELE SPECIAL DECK-ARC-JUN-FLE
 SAMPLE PROBLEMS TO DEMONSTRATE PROGRAM USE
 CONTRACT DALL-23-76-C-0076

REVISION DATE 07 SEP 70
 - 24 SEPT 70 - J.M.FLEJUN
 - UNITS ARE LBS AND INCHES

PROB (CONT)
 6019 BRIDGE APPROACH SLAB (FROM REF 3. SIMILAR PROB IN REF 1)

TABLES RESULTS

X MOMENT AND A TWISTING MOMENT ACT IN THE X DIRECTION (ABOUT Y AXIS).
 Y TWISTING MOMENT & X TWISTING MOMENT, COUNTERCLOCKWISE BETA ANGLES
 ARE POSITIVE FROM X AXIS TO THE DIRECTION OF LARGEST PRINCIPAL MOMENT

X	Y	DEFL	X MOMENT	Y MOMENT	X TWISTING MOMENT	SUPPORT REACTION	LARGEST PRINCIPAL MOMENT	BETA X TO LARGEST
0	0	1.241E-27	2.657E-35	-9.300E-36	-6.955E+01	-1.241E+03	-6.955E+01	45.0
1	0	2.622E-27	-4.129E-22	-3.912E-35	-5.527E-22	-2.622E+03	-7.962E-22	34.8
2	0	2.577E-27	8.616E-24	-6.339E-35	1.339E-22	-2.577E+03	1.383E-22	44.1
3	0	2.552E-27	5.260E-24	-5.044E-35	3.693E-25	-2.562E+03	8.285E-24	2.6
4	0	2.575E-27	7.435E-24	-4.252E-35	-1.110E-22	-2.576E+03	150E-22	-44.0
5	0	2.617E-27	-1.204E-24	-3.100E-35	1.396E-22	-2.617E+03	-1.392E-22	-44.9
6	0	2.653E-27	-7.921E-27	-5.259E-35	-3.691E-24	-2.653E+03	-3.695E-24	45.0
7	0	2.631E-27	-1.345E-24	-5.669E-35	-1.459E-22	-2.631E+03	-1.465E-22	44.9
8	0	2.604E-27	7.715E-24	-4.872E-35	1.039E-22	-2.604E+03	1.078E-22	43.9
9	0	2.604E-27	5.176E-24	-4.252E-35	-7.434E-24	-2.604E+03	1.257E-22	-30.6
10	0	2.632E-27	6.523E-24	-3.720E-35	-1.443E-22	-2.632E+03	1.487E-22	-44.2
11	0	2.649E-27	-4.751E-22	-4.615E-35	5.576E-22	-2.649E+03	-8.093E-22	-34.6
12	0	1.277E-27	-3.432E-36	-1.082E-35	7.137E+01	-1.277E+03	-7.137E+01	-45.0
0	1	-1.945E-27	-9.095E-12	-1.291E+03	-1.442E+01	1.949E+03	-1.391E+03	89.4
1	1	-5.277E-27	-7.305E+02	-2.922E+03	1.668E+01	6.277E+03	-2.922E+03	-89.6
2	1	-5.392E-27	-7.193E+02	-2.877E+03	1.117E+01	5.392E+03	-2.877E+03	-89.7
3	1	-5.341E-27	-7.156E+02	-2.862E+03	2.262E+01	5.361E+03	-2.862E+03	-90.0
4	1	-5.337E-27	-7.149E+02	-2.876E+03	-1.021E+01	5.390E+03	-2.876E+03	89.7
5	1	-6.262E-27	-7.292E+02	-2.917E+03	-1.647E+01	6.262E+03	-2.917E+03	89.6
6	1	-5.112E-27	-7.230E+01	-2.953E+03	-2.639E+00	4.112E+03	-2.953E+03	89.9
7	1	-5.279E-27	-7.327E+02	-2.931E+03	9.241E+00	6.279E+03	-2.931E+03	-89.6
8	1	-5.425E-27	-7.200E+02	-2.904E+03	5.116E+00	5.425E+03	-2.904E+03	-89.9
9	1	-5.613E-27	-7.259E+02	-2.904E+03	-5.182E+00	5.413E+03	-2.904E+03	89.9
10	1	-5.462E-27	-7.329E+02	-2.932E+03	-1.600E+01	5.462E+03	-2.932E+03	89.6
11	1	-6.304E-27	-7.473E+02	-2.909E+03	-2.124E+01	6.388E+03	-2.989E+03	89.5
12	1	-1.995E-27	-1.415E-12	-1.427E+03	-1.372E+01	1.995E+03	-1.427E+03	-89.4
0	2	-4.507E+03	-4.457E-11	-4.565E+02	1.171E+02	0.	-4.867E+02	-76.5
1	2	-4.794E+03	-4.217E+02	-4.641E+02	5.222E+01	0.	-8.882E+02	-85.5
2	2	-4.591E+03	-4.471E+02	-4.672E+02	2.240E+01	0.	-8.880E+02	-88.0
3	2	-4.637E+03	-4.493E+02	-4.902E+02	-5.463E-01	0.	-8.902E+02	90.0
4	2	-4.654E+03	-4.443E+02	-4.918E+02	-2.264E+01	0.	-8.926E+02	88.0
5	2	-4.725E+03	-4.194E+02	-4.941E+02	-4.499E+01	0.	-8.978E+02	85.8
6	2	-4.744E+03	-4.331E+02	-4.974E+02	-7.310E+00	0.	-9.074E+02	89.6
7	2	-4.744E+03	-4.219E+02	-4.944E+02	3.556E+01	0.	-9.067E+02	-87.0
8	2	-4.744E+03	-4.331E+02	-4.913E+02	4.769E+00	0.	-9.131E+02	-89.2
9	2	-4.744E+03	-4.507E+02	-4.920E+02	-1.271E+01	0.	-9.212E+02	89.9
10	2	-4.744E+03	-4.507E+02	-4.925E+02	-3.505E+01	0.	-9.280E+02	87.0
11	2	-4.744E+03	-4.119E+02	-4.297E+02	-6.180E+01	0.	-9.354E+02	84.8

12	2	-4.433E-03	3.001E-11	-4.840E+02	-1.236E+02	0.	-5.137E+02	76.5
0	3	-1.120E+02	-5.457E-11	2.542E+02	1.041E+02	0.	2.949E+02	70.6
1	3	-1.040E+02	3.462E+01	5.026E+02	5.293E+01	0.	5.110E+02	82.4
2	3	-1.075E+02	6.433E+01	4.929E+02	1.794E+01	0.	4.936E+02	87.6
3	3	-1.075E+02	5.430E+01	4.865E+02	-3.448E+00	0.	4.865E+02	-89.5
4	3	-1.075E+02	5.294E+01	4.839E+02	-2.422E+01	0.	4.853E+02	-88.7
5	3	-1.053E+02	4.217E+01	4.836E+02	-6.771E+01	0.	4.937E+02	-81.5
6	3	-1.114E+02	1.426E+01	5.173E+02	-1.084E+01	0.	5.170E+02	-88.8
7	3	-1.044E+02	4.173E+01	4.756E+02	4.632E+01	0.	4.805E+02	84.0
8	3	-1.057E+02	5.027E+01	4.684E+02	3.877E+00	0.	4.684E+02	89.5
9	3	-1.049E+02	5.550E+01	4.644E+02	-1.540E+01	0.	4.650E+02	-87.8
10	3	-1.049E+02	5.525E+01	4.655E+02	-3.521E+01	0.	4.685E+02	-85.1
11	3	-1.114E+02	3.512E+01	4.711E+02	-7.905E+01	0.	4.850E+02	-80.0
12	3	-1.154E+02	1.114E-10	2.410E+02	-1.127E+02	0.	2.854E+02	-68.5

0	4	-1.479E+02	6.003E-11	6.711E+02	4.969E+01	0.	6.747E+02	85.8
1	4	-1.621E+02	1.605E+02	1.290E+03	2.958E+01	0.	1.290E+03	88.5
2	4	-1.601E+02	2.261E+02	1.271E+03	3.513E+00	0.	1.271E+03	89.8
3	4	-1.544E+02	2.455E+02	1.262E+03	-7.623E+00	0.	1.262E+03	-89.6
4	4	-1.604E+02	2.750E+02	1.260E+03	-1.924E+01	0.	1.260E+03	-89.0
5	4	-1.626E+02	1.641E+02	1.268E+03	-4.339E+01	0.	1.270E+03	-87.8
6	4	-1.675E+02	3.841E+01	1.395E+03	-1.362E+01	0.	1.395E+03	-89.4
7	4	-1.633E+02	1.644E+02	1.262E+03	1.675E+01	0.	1.262E+03	89.1
8	4	-1.627E+02	2.300E+02	1.249E+03	-6.678E+00	0.	1.249E+03	-89.6
9	4	-1.630E+02	2.400E+02	1.247E+03	-1.493E+01	0.	1.247E+03	-89.1
10	4	-1.644E+02	2.255E+02	1.252E+03	-2.360E+01	0.	1.252E+03	-88.7
11	4	-1.674E+02	1.593E+02	1.204E+03	-4.810E+01	0.	1.271E+03	-87.5
12	4	-1.731E+02	-1.019E-10	6.594E+02	-5.929E+01	0.	6.652E+02	-84.9

0	5	-1.944E+02	2.401E-10	7.651E+02	-2.236E+01	0.	7.663E+02	-88.3
1	5	-1.937E+02	1.864E+02	1.470E+03	-2.587E+01	0.	1.470E+03	-88.8
2	5	-1.917E+02	2.640E+02	1.448E+03	-1.726E+01	0.	1.448E+03	-89.2
3	5	-1.914E+02	2.871E+02	1.440E+03	-1.208E+01	0.	1.440E+03	-89.4
4	5	-1.924E+02	2.634E+02	1.438E+03	-6.271E+00	0.	1.438E+03	-89.7
5	5	-1.953E+02	1.413E+02	1.450E+03	3.440E+00	0.	1.450E+03	89.8
6	5	-2.005E+02	4.239E+01	1.601E+03	-1.575E+01	0.	1.601E+03	-89.4
7	5	-1.948E+02	1.945E+02	1.441E+03	-3.414E+01	0.	1.447E+03	-88.4
8	5	-1.960E+02	2.736E+02	1.431E+03	-2.203E+01	0.	1.431E+03	-88.9
9	5	-1.956E+02	2.928E+02	1.429E+03	-1.281E+01	0.	1.430E+03	-89.4
10	5	-1.934E+02	2.435E+02	1.436E+03	-4.124E+00	0.	1.436E+03	-89.8
11	5	-2.017E+02	1.885E+02	1.457E+03	6.760E+00	0.	1.457E+03	89.7
12	5	-2.570E+02	-1.155E-12	7.594E+02	1.269E+01	0.	7.596E+02	89.0

0	6	-2.041E+02	1.865E-10	5.402E+02	-9.032E+01	0.	5.549E+02	-80.8
1	6	-2.086E+02	1.267E+02	1.039E+03	-7.575E+01	0.	1.045E+03	-85.3
2	6	-1.995E+02	1.769E+02	1.025E+03	-3.570E+01	0.	1.027E+03	-87.6
3	6	-1.945E+02	1.455E+02	1.020E+03	-1.595E+01	0.	1.020E+03	-88.9
4	6	-2.054E+02	1.461E+02	1.018E+03	4.914E+00	0.	1.018E+03	89.7
5	6	-2.031E+02	1.420E+02	1.025E+03	4.706E+01	0.	1.029E+03	87.0
6	6	-2.077E+02	2.957E+01	1.131E+03	-1.740E+01	0.	1.131E+03	-89.1
7	6	-2.057E+02	1.408E+02	1.024E+03	-8.082E+01	0.	1.031E+03	-84.1
8	6	-2.057E+02	1.455E+02	1.014E+03	-3.563E+01	0.	1.016E+03	-87.5
9	6	-2.048E+02	2.069E+02	1.014E+03	-1.025E+01	0.	1.014E+03	-89.3
10	6	-2.040E+02	1.886E+02	1.019E+03	1.429E+01	0.	1.019E+03	89.0
11	6	-2.116E+02	1.925E+02	1.033E+03	5.761E+01	0.	1.037E+03	86.4
12	6	-2.180E+02	-2.005E-10	5.374E+02	8.144E+01	0.	5.500E+02	81.6

0	7	-1.994E+02	-1.473E-10	3.288E+01	-1.020E+02	5.495E+02	1.022E+02	-45.0
1	7	-1.942E+02	-4.189E+01	6.702E+01	-8.137E+01	1.095E+03	-1.046E+02	37.7

2	7	-1.45E-02	-2.20E+01	8.40E-01	-2.55E+01	1.03E+03	-5.39E+01	25.1
3	7	-1.51E-02	-2.20E+01	7.11E-01	6.80E+00	1.10E+03	-3.58E+01	-10.6
4	7	-1.52E-02	-2.21E+01	7.45E-01	3.93E+01	1.10E+03	-5.59E+01	-34.7
5	7	-1.45E-02	-2.50E+01	7.82E-01	9.13E+01	1.11E+03	-1.06E+02	-41.0
6	7	-1.45E-02	-2.33E+01	8.22E-01	3.04E+00	1.13E+03	-3.54E+00	47.8
7	7	-1.47E-02	-1.53E+01	8.39E-01	-8.77E-01	1.13E+03	-9.56E+01	42.3
8	7	-1.47E-02	-1.07E+01	7.42E-01	-3.45E+01	1.14E+03	-4.02E+01	40.3
9	7	-2.03E-02	-1.22E+01	8.48E-01	-3.66E+00	1.14E+03	-1.31E+01	14.7
10	7	-2.02E-02	-2.15E+01	8.53E-01	2.66E+01	1.14E+03	-3.94E+01	-33.4
11	7	-2.02E-02	-3.05E+01	8.50E-01	7.71E+01	1.17E+03	-9.36E+01	-39.2
12	7	-2.02E-02	0.74E+11	4.25E-01	9.45E+01	5.95E+02	9.46E+01	45.1
0	8	-1.51E-02	-3.25E+10	-3.13E+02	-5.47E+01	4.40E+02	-3.25E+02	78.8
1	8	-1.54E-02	-7.51E+01	-5.94E+02	-5.04E+01	8.91E+02	-5.99E+02	84.3
2	8	-1.55E-02	-1.25E+02	-5.75E+02	1.06E+00	8.95E+02	-5.75E+02	-89.9
3	8	-1.55E-02	-1.25E+02	-5.57E+02	3.80E+01	8.93E+02	-5.60E+02	-85.0
4	8	-1.54E-02	-1.04E+02	-5.36E+02	7.49E+01	8.99E+02	-5.49E+02	-80.3
5	8	-1.55E-02	-1.35E+01	-5.15E+02	1.22E+02	8.94E+02	-5.47E+02	-75.5
6	8	-1.55E-02	-1.80E+01	-5.80E+02	3.06E+01	8.92E+02	-5.42E+02	-86.8
7	8	-1.55E-02	-5.85E+01	-4.74E+02	-6.39E+01	9.11E+02	-4.89E+02	81.5
8	8	-1.60E-02	-5.45E+01	-4.70E+02	-2.42E+01	9.25E+02	-4.71E+02	86.4
9	8	-1.62E-02	-9.51E+01	-4.65E+02	3.34E+00	9.35E+02	-4.65E+02	-89.5
10	8	-1.63E-02	-7.50E+01	-4.64E+02	2.47E+01	9.43E+02	-4.66E+02	-85.4
11	8	-1.64E-02	-7.50E+01	-4.64E+02	6.57E+01	9.50E+02	-4.79E+02	-80.7
12	8	-1.65E-02	4.32E+11	-2.45E+02	5.80E+01	4.76E+02	-2.58E+02	-77.2
0	9	-1.25E-02	1.72E+10	-4.76E+02	-2.46E+01	3.63E+02	-4.78E+02	86.6
1	9	-1.24E-02	-1.09E+02	-4.09E+02	-9.35E+00	7.44E+02	-9.09E+02	89.3
2	9	-1.30E-02	-1.55E+02	-8.70E+02	2.85E+01	7.49E+02	-8.71E+02	-87.7
3	9	-1.29E-02	-1.55E+02	-8.26E+02	6.08E+01	7.48E+02	-8.34E+02	-84.9
4	9	-1.24E-02	-1.22E+02	-7.81E+02	9.61E+01	7.42E+02	-7.95E+02	-81.9
5	9	-1.26E-02	-7.01E+01	-7.29E+02	1.35E+02	7.29E+02	-7.56E+02	-78.4
6	9	-1.22E-02	-3.25E+01	-7.35E+02	5.44E+01	7.04E+02	-7.39E+02	-85.8
7	9	-1.27E-02	-5.32E+01	-6.39E+02	-3.23E+01	7.32E+02	-6.41E+02	86.8
8	9	-1.30E-02	-5.54E+01	-6.18E+02	-8.35E+00	7.50E+02	-6.10E+02	89.1
9	9	-1.32E-02	-5.45E+01	-5.94E+02	1.04E+01	7.61E+02	-5.94E+02	-84.8
10	9	-1.33E-02	-5.57E+01	-5.86E+02	2.74E+01	7.67E+02	-5.87E+02	-86.7
11	9	-1.33E-02	-5.73E+01	-5.87E+02	4.67E+01	7.68E+02	-5.91E+02	-84.9
12	9	-1.32E-02	4.53E+11	-3.03E+02	2.43E+01	3.81E+02	-3.06E+02	-84.5
0	10	-1.15E-02	1.72E+11	-3.77E+02	6.17E+00	3.33E+02	-5.77E+02	-89.4
1	10	-1.14E-02	-1.10E+02	-1.10E+03	4.60E+01	6.84E+02	-1.10E+03	-87.3
2	10	-1.15E-02	-1.63E+02	-1.04E+03	7.45E+01	6.85E+02	-1.04E+03	-85.2
3	10	-1.17E-02	-1.52E+02	-9.73E+02	1.03E+02	6.77E+02	-9.46E+02	-82.9
4	10	-1.16E-02	-1.02E+02	-8.44E+02	1.40E+02	6.55E+02	-9.18E+02	-80.2
5	10	-1.07E-02	-4.85E+01	-8.02E+02	1.74E+02	6.29E+02	-8.42E+02	-77.4
6	10	-1.01E-02	-5.35E+01	-7.61E+02	1.03E+02	5.85E+02	-7.75E+02	-82.4
7	10	-1.05E-02	-3.22E+01	-6.36E+02	1.61E+01	6.15E+02	-6.38E+02	-88.5
8	10	-1.11E-02	-5.17E+01	-5.86E+02	2.20E+01	6.34E+02	-5.87E+02	-87.6
9	10	-1.11E-02	-7.48E+01	-5.53E+02	2.85E+01	6.43E+02	-5.55E+02	-86.8
10	10	-1.12E-02	-5.77E+01	-5.34E+02	3.11E+01	6.47E+02	-5.36E+02	-86.2
11	10	-1.11E-02	-5.18E+01	-5.26E+02	3.41E+01	6.44E+02	-5.30E+02	-86.0
12	10	-1.04E-02	1.72E+11	-2.67E+02	1.23E+01	3.16E+02	-2.68E+02	-87.4
0	11	-1.25E-02	0.	-6.56E+02	4.35E+01	3.61E+02	-6.59E+02	-86.2
1	11	-1.27E-02	-1.15E+02	-1.25E+03	1.14E+02	7.31E+02	-1.26E+03	-84.3
2	11	-1.27E-02	-1.57E+02	-1.16E+03	1.34E+02	7.21E+02	-1.16E+03	-82.2
3	11	-1.21E-02	-1.07E+02	-1.07E+03	1.64E+02	6.94E+02	-1.10E+03	-80.3
4	11	-1.15E-02	-5.01E+01	-9.65E+02	2.12E+02	6.63E+02	-1.01E+03	-77.4
5	11	-1.15E-02	-1.22E+01	-8.26E+02	2.63E+02	6.09E+02	-9.03E+02	-73.5

6	11	-9.015E-03	-9.177E-01	-7.265E+02	1.650E+02	5.360E+02	-7.731E+02	-76.5
7	11	-9.799E-03	-2.101E+01	-5.791E+02	6.277E+01	5.610E+02	-5.911E+02	-61.7
8	11	-9.799E-03	-9.557E+01	-5.040E+02	6.790E+01	5.740E+02	-5.139E+02	-61.7
9	11	-1.000E-02	-5.429E+01	-4.537E+02	5.340E+01	5.795E+02	-4.607E+02	-62.5
10	11	-1.000E-02	-4.249E+01	-4.225E+02	4.223E+01	5.780E+02	-4.272E+02	-63.7
11	11	-9.916E-03	-1.499E+01	-4.065E+02	3.233E+01	5.713E+02	-4.091E+02	-65.3
12	11	-9.650E-03	-3.001E-11	-2.014E+02	7.033E+00	2.779E+02	-2.017E+02	-66.0
0	12	-1.575E-02	4.264E-10	-6.960E+02	6.602E+01	4.540E+02	-7.065E+02	-63.1
1	12	-1.564E-02	-7.461E+01	-1.395E+03	1.941E+02	4.000E+02	-1.364E+03	-61.3
2	12	-1.579E-02	-1.653E+02	-1.223E+03	2.200E+02	6.644E+02	-1.267E+03	-76.7
3	12	-1.631E-02	-1.951E+02	-1.114E+03	2.331E+02	6.242E+02	-1.166E+03	-77.6
4	12	-1.622E-02	3.150E+01	-1.002E+03	3.042E+02	7.617E+02	-1.047E+03	-74.6
5	12	-1.145E-02	4.077E+01	-6.187E+02	3.931E+02	6.711E+02	-9.696E+02	-66.7
6	12	-9.856E-03	-5.525E+01	-6.709E+02	3.016E+02	5.562E+02	-7.866E+02	-69.0
7	12	-9.405E-03	-3.334E+01	-5.041E+02	1.660E+02	5.640E+02	-5.572E+02	-72.3
8	12	-9.799E-03	-5.445E+01	-4.137E+02	1.263E+02	5.641E+02	-4.841E+02	-72.3
9	12	-9.704E-03	-5.717E+01	-3.517E+02	8.685E+01	5.590E+02	-3.764E+02	-74.4
10	12	-9.584E-03	-3.523E+01	-3.112E+02	6.032E+01	5.500E+02	-3.230E+02	-76.2
11	12	-9.346E-03	-4.111E+00	-2.874E+02	3.934E+01	5.343E+02	-2.920E+02	-82.1
12	12	-9.020E-03	1.371E-10	-1.302E+02	9.591E+00	2.590E+02	-1.300E+02	-86.0
0	13	-2.134E-02	5.093E-11	-6.109E+02	1.240E+02	6.161E+02	-6.351E+02	-79.0
1	13	-2.083E-02	2.743E+01	-1.200E+03	2.732E+02	1.200E+03	-1.266E+03	-78.1
2	13	-1.970E-02	-1.479E+02	-1.074E+03	3.140E+02	1.135E+03	-1.170E+03	-72.9
3	13	-1.436E-02	-4.332E+01	-9.744E+02	2.403E+02	1.050E+03	-1.052E+03	-74.5
4	13	-1.660E-02	2.613E+02	-9.071E+02	4.056E+02	9.606E+02	-1.034E+03	-72.6
5	13	-1.415E-02	1.356E+02	-7.026E+02	5.594E+02	8.150E+02	-9.025E+02	-63.4
6	13	-1.108E-02	-7.493E+01	-5.566E+02	4.371E+02	6.394E+02	-7.967E+02	-61.2
7	13	-1.071E-02	-7.719E+01	-4.093E+02	2.571E+02	6.171E+02	-5.493E+02	-61.4
8	13	-1.030E-02	-1.060E+02	-3.264E+02	1.674E+02	5.933E+02	-4.336E+02	-68.2
9	13	-9.970E-03	-9.075E+01	-2.657E+02	1.262E+02	5.720E+02	-3.318E+02	-62.4
10	13	-9.502E-03	-5.174E+01	-2.220E+02	6.070E+01	5.531E+02	-2.550E+02	-66.3
11	13	-9.267E-03	-1.205E+01	-1.955E+02	5.001E+01	5.330E+02	-2.085E+02	-75.7
12	13	-9.464E-03	8.572E-11	-9.130E+01	1.503E+01	2.554E+02	-9.371E+01	-80.9
0	14	-2.913E-02	1.026E-10	-2.430E+02	1.234E+02	6.391E+02	-2.947E+02	-67.3
1	14	-2.813E-02	4.555E+07	-5.421E+02	3.154E+02	1.620E+03	-6.334E+02	-73.8
2	14	-2.610E-02	-1.257E+02	-4.918E+02	4.070E+02	1.503E+03	-7.552E+02	-57.1
3	14	-2.408E-02	3.573E+01	-4.375E+02	2.624E+02	1.387E+03	-5.542E+02	-66.0
4	14	-2.141E-02	8.373E+02	-4.044E+02	4.621E+02	1.256E+03	9.905E+02	18.3
5	14	-1.722E-02	2.754E+02	-3.230E+02	7.112E+02	1.032E+03	-7.951E+02	-56.4
6	14	-1.341E-02	-9.523E+01	-3.263E+02	5.375E+02	7.724E+02	-7.252E+02	-53.4
7	14	-1.230E-02	-1.524E+02	-2.749E+02	3.251E+02	7.042E+02	-5.446E+02	-50.3
8	14	-1.130E-02	-1.555E+02	-2.340E+02	2.334E+02	6.524E+02	-4.444E+02	-48.0
9	14	-1.054E-02	-1.510E+02	-1.913E+02	1.552E+02	6.092E+02	-3.277E+02	-46.7
10	14	-1.000E-02	-1.925E+01	-1.548E+02	9.705E+01	5.763E+02	-2.244E+02	-54.3
11	14	-9.529E-03	-2.944E+01	-1.299E+02	5.747E+01	5.444E+02	-1.563E+02	-65.4
12	14	-9.031E-03	8.140E-11	-6.000E+01	1.463E+01	2.601E+02	-6.531E+01	-74.1
0	15	-3.771E-02	3.429E-10	4.020E+02	9.328E+01	1.086E+03	5.000E+02	79.4
1	15	-3.655E-02	1.619E+03	1.602E+03	2.451E+02	2.106E+03	1.495E+03	44.0
2	15	-3.330E-02	-1.746E+02	5.445E+02	3.154E+02	1.914E+03	6.632E+02	69.4
3	15	-3.057E-02	4.419E+01	5.407E+02	3.065E+02	1.761E+03	6.469E+02	64.5
4	15	-2.801E-02	2.153E+03	1.500E+03	4.334E+02	1.613E+03	2.369E+03	26.5
5	15	-2.237E-02	3.725E+02	4.247E+02	5.769E+02	1.280E+03	9.762E+02	46.3
6	15	-1.627E-02	-1.115E+00	-1.453E+01	4.908E+02	9.369E+02	-5.007E+02	-45.5
7	15	-1.425E-02	-2.424E+02	-1.170E+02	3.349E+02	8.224E+02	-5.256E+02	-39.8
8	15	-1.265E-02	-2.774E+02	-1.304E+02	2.500E+02	7.301E+02	-6.646E+02	-36.8
9	15	-1.144E-02	-2.232E+02	-1.130E+02	1.676E+02	6.617E+02	-3.445E+02	-35.9

10	15	-1.044E-02	-1.146E-02	-8.959E+01	1.031E+02	6.120E+02	-2.201E+02	-38.3
11	15	-4.943E-03	-5.857E+01	-7.217E+01	5.756E+01	5.751E+02	-1.224E+02	-40.9
12	15	-9.401E-03	-1.711E-11	-3.466E+01	1.670E+01	2.787E+02	-4.141E+01	-66.0
0	16	-4.443E-02	-3.769E-10	5.463E-10	2.705E+01	6.420E+02	2.705E+01	45.0
1	16	-4.242E-02	5.027E+02	7.021E-10	4.652E+01	1.236E+03	5.172E+02	9.5
2	16	-3.944E-02	-3.347E+01	4.224E-10	1.120E+02	1.137E+03	-1.300E+02	-40.0
3	16	-3.615E-02	4.167E+01	5.462E-10	1.541E+02	1.041E+03	1.065E+02	37.4
4	16	-3.254E-02	7.772E+02	6.105E-10	1.445E+02	9.371E+02	8.210E+02	13.0
5	16	-2.864E-02	2.291E+02	4.561E-10	2.244E+02	7.557E+02	3.710E+02	31.7
6	16	-1.915E-02	-5.224E+01	1.744E-10	2.257E+02	5.510E+02	-2.260E+02	-45.0
7	16	-1.614E-02	-1.553E+02	1.642E-10	1.743E+02	4.717E+02	-2.671E+02	-33.1
8	16	-1.413E-02	-1.759E+02	1.371E-10	1.249E+02	4.070E+02	-2.412E+02	-27.3
9	16	-1.250E-02	-1.443E+02	1.197E-10	8.024E+01	3.559E+02	-1.801E+02	-26.0
10	16	-1.111E-02	-4.372E+01	4.275E-11	4.645E+01	3.272E+02	-1.123E+02	-22.4
11	16	-1.059E-02	-4.369E+01	6.661E-11	2.265E+01	3.039E+02	-5.346E+01	-23.0
12	16	-9.449E-03	1.713E-11	3.641E-11	5.691E+00	1.424E+02	5.691E+00	45.0

X , Y	DEFL	A MOMENT	Y MOMENT	A TORSION MOMENT	SUPPORT REACTION	LARGEST PRINCIPAL MOMENT	BETA A TO LARGEST
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STATICS CHECK: SUMMATION OF REACTIONS = 1.362E+05

PROG# SLA-ONE OF L SPECIAL DECK-ONE-JAP-FILE
 SAMPLE PROGRAMS TO DEMONSTRATE PROGRAM USE
 CONTRACT JACA 23-76-C-0076

REVISION DATE 07 SEP 70
 - 24 SEPT 70 - JAP-FILE-JAN
 UNITS ARE LBS AND INCHES

PH09 (C) (111)

601- H-102C APPROACH SLAB (FROM REF 3, SIMILAR PROB IN REF 1)

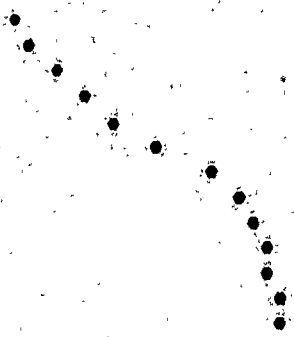
TABLE: SELECTED OUTPUT

X - Y DEFLECTIONS IN THE X DIRECTION (ABOUT Y AXIS)

DEFLECTIONS: BETWEEN (0, 15) AND (12, 15)

X - Y DEFLECTION

0	15	-3.771E-02
1	15	-3.650E-02
2	15	-3.532E-02
3	15	-3.417E-02
4	15	-2.811E-02
5	15	-2.237E-02
6	15	-1.627E-02
7	15	-1.425E-02
8	15	-1.25E-02
9	15	-1.145E-02
10	15	-1.044E-02
11	15	-9.433E-03
12	15	-7.401E-03



DEFLECTIONS: BETWEEN (0, 0) AND (16, 10)

X - Y DEFLECTION

0	0	2.575E-01
1	0	5.350E-01
2	0	8.550E-01
3	0	1.175E-01
4	0	1.575E-01
5	0	1.920E-01
6	0	2.035E-01
7	0	1.925E-01
8	0	1.575E-01
9	0	1.255E-01
10	0	1.152E-01
11	0	1.152E-01
12	0	1.32E-01
13	0	1.65E-01
14	0	2.181E-01
15	0	2.501E-01
16	0	3.255E-01



DEFLECTIONS: DELTA (0. 12) AND (12. 10)

A. Y. DELTA-00104

0	12	-1.574E-02
1	12	-1.554E-02
2	12	-1.534E-02
3	12	-1.514E-02
4	12	-1.494E-02
5	12	-1.474E-02
6	12	-1.454E-02
7	12	-1.434E-02
8	12	-1.414E-02
9	12	-1.394E-02
10	12	-1.374E-02
11	12	-1.354E-02
12	12	-1.334E-02
0	13	-2.135E-02
1	13	-2.115E-02
2	13	-2.095E-02
3	13	-2.075E-02
4	13	-2.055E-02
5	13	-2.035E-02
6	13	-2.015E-02
7	13	-1.995E-02
8	13	-1.975E-02
9	13	-1.955E-02
10	13	-1.935E-02
11	13	-1.915E-02
12	13	-1.895E-02
0	14	-2.913E-02
1	14	-2.893E-02
2	14	-2.873E-02
3	14	-2.853E-02
4	14	-2.833E-02
5	14	-2.813E-02
6	14	-2.793E-02
7	14	-2.773E-02
8	14	-2.753E-02
9	14	-2.733E-02
10	14	-2.713E-02
11	14	-2.693E-02
12	14	-2.673E-02
0	15	-3.771E-02
1	15	-3.751E-02
2	15	-3.731E-02
3	15	-3.711E-02
4	15	-3.691E-02
5	15	-3.671E-02
6	15	-3.651E-02
7	15	-3.631E-02
8	15	-3.611E-02
9	15	-3.591E-02
10	15	-3.571E-02
11	15	-3.551E-02
12	15	-3.531E-02
0	16	-4.453E-02
1	16	-4.433E-02

2 15 -1.517e-02
 3 15 -1.517e-02
 4 15 -1.517e-02
 5 15 -1.517e-02
 6 15 -1.517e-02
 7 15 -1.517e-02
 8 15 -1.517e-02
 9 15 -1.517e-02
 10 15 -1.517e-02
 11 15 -1.517e-02
 12 15 -1.517e-02

X MOMENTS ONLY, BETWEEN (0, 15) AND (12, 15)

X * Y X MOMENT

0 15 3.429e-10
 1 15 1.517e-03
 2 15 -1.745e-02
 3 15 4.415e-01
 4 15 2.153e-03
 5 15 3.726e-02
 6 15 -1.115e-03
 7 15 -2.424e-02
 8 15 -2.774e-02
 9 15 -2.722e-02
 10 15 -1.346e-02
 11 15 -5.537e-01
 12 15 -1.711e-11

Y MOMENTS ONLY, BETWEEN (4, 0) AND (4, 16)

X * Y Y MOMENT

0 -4.252e-15
 1 -2.870e-03
 2 -6.414e-02
 3 4.815e-02
 4 1.265e-03
 5 1.438e-03
 6 1.614e-03
 7 7.452e-01
 8 -5.347e-02
 9 -7.512e-02
 10 -2.944e-02
 11 -9.662e-02
 12 -1.302e-03
 13 -9.071e-02
 14 -4.644e-02
 15 1.939e-15
 16 6.155e-10

PRINCIPAL MOMENTIES BETWEEN (0. 15) AND (12. 15)

X . Y MOMENT

0	15	3.000E+02
1	15	1.000E+03
2	15	0.000E+00
3	15	5.000E+02
4	15	2.000E+03
5	15	1.750E+02
6	15	-5.000E+02
7	15	-5.250E+02
8	15	-5.000E+02
9	15	-3.250E+02
10	15	-2.250E+02
11	15	-1.225E+02
12	15	-4.141E+01

PRINCIPAL MOMENTIES BETWEEN (0. 0) AND (4. 10)

X . Y MOMENT

4	0	1.137E+22
4	1	-2.070E+03
4	2	-8.925E+02
4	3	4.053E+02
4	4	1.260E+03
4	5	1.430E+03
4	6	1.010E+03
4	7	-5.595E+01
4	8	-5.455E+02
4	9	-7.057E+02
4	10	-9.144E+02
4	11	-1.014E+03
4	12	-1.017E+03
4	13	-1.034E+03
4	14	-9.905E+02
4	15	2.345E+03
4	16	8.210E+02

TIME FOR THIS PROBLEM = 0 MINUTES 5.400 SECONDS

ELAPSED TIME = 0 MINUTES 15.643 SECONDS

PROJECT: JLA-7016 C-401 SPECIAL UPCA-MHE-JLA-FILE REVISION DATE: 07 SEP 70
 SAMPLE PROBLEMS TO BE UNSTATED PROGRAM USE - 24 SEPT 70 - JLA-FILE-JLA
 CONTRACT JACA 23-70-C-0070 UNITS ARE LBS AND INCHES

PROJ: JRS
 4-25FT SO TAXIWAY SLABS, 2 C-5A BODIES CENTERED ON 25 PERCENT JOINTS

TABLE 1. CONTROL DATA.

MULTIPLE LOAD OPTION (IF BLANK OR ZERO, PROB IS INDEPENDENT -- IF -1: PARENT FOR HEAT PROB -- IF -1: AN OFFSPRING PROB)	1
NUM CARDS INPUT THIS PROBLEM	2 3 4 5 6 7
COMPUTE OPTIONAL PAVEMENT STIFFNESS CONSTANTS (1=YES) DATA C	1 1 1 1 1 1
OPTION TO SUPPRESS DETAILED OUTPUT (1=YES)	1
OPTION TO PRINT PRIN STRESS INSTEAD OF MOM (1=YES)	1

TABLE 2. CONSTANTS—UNITS MUST BE CONSISTENT.

NUM INCREMENTS IN X DIRECTION	20
NUM INCREMENTS IN Y DIRECTION	20
INCH LENGTH IN X DIRECTION	3.000E+01
INCH LENGTH IN Y DIRECTION	2.150E+01
POISSON'S RATIO	2.000E-01
MODULUS OF ELASTICITY	5.000E+06
SLAB THICKNESS	1.200E+01
SUBGRADE MODULUS	1.250E+02

TABLE 3. SPECIFIED AREAS FOR SELECTED PLOTTED OUTPUT.

FROM THRU	DEFL	X-MOMENT	Y-MOMENT	PRIN STRESS
3 4 17 21	1	0	0	1
0 20 20 21	1	1	0	0
0 21 20 21	1	1	0	0
0 0 0 20	1	0	1	0

TABLE 4. STIFFNESS AND LOAD DATA.

FROM THRU	UX	UY	0	5	C
10 0 10 24	-2.612E+04	-0.	-0.	-0.	-0.
10 1 10 27	-2.612E+03	-0.	-0.	-0.	-0.
0 14 20 14	-0.	-2.612E+04	-0.	-0.	-0.
1 14 14 14	-0.	-2.612E+04	-0.	-0.	-0.

PROGRAM DEMO-ONE C-FL SPECIAL DECK-ONE-JUMPLE REVISION DATE 07 SEP 70
 SAMPLE RESULTS TO DEMONSTRATE PROGRAM USE - 20 SEPT 70 - JUMPLE-JCR
 CONTRACT DATA 25-10-C-0070 UNITS ARE LBS AND INCHES

PROB (C).ITD)
 JRS 4-25FT SO TAXIWAY SLABS, 2 C-5A BOGIES CENTERED ON 25 PERCENT JOINTS

TABLE RESULTS.

X MOMENT AND A TWISTING MOMENT ACT IN THE X DIRECTION (ABOUT Y AXIS).
 Y TWISTING MOMENT = -X TWISTING MOMENT, COUNTERCLOCKWISE BETA ANGLES
 ARE POSITIVE FROM X AXIS TO THE DIRECTION OF LARGEST PRINCIPAL STRESS.

X - Y	DEFL	X MOMENT	Y MOMENT	X TWISTING MOMENT	SUPPORT REACTION	LARGEST PRINCIPAL STRESS	BETA X TO LARGEST
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*** THE DETAILED OUTPUT HAS BEEN DELETED BY THE OPTION IN TABLE 1.
 A SINGLE SET OF VALUES IS PRINTED AT OR NEAR THE SLAB CENTER FOR REFERENCE

10 14 -3.037E-02 4.429E+02 -2.530E+03 -5.164E-11 2.448E+03 -1.054E+02 98.0

X - Y	DEFL	X MOMENT	Y MOMENT	X TWISTING MOMENT	SUPPORT REACTION	LARGEST PRINCIPAL STRESS	BETA X TO LARGEST
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STATICS CHECK.

SUMMATION OF REACTIONS = 3.600E+05

PROGRAM: SAMPLE CASE, SPECIAL DECK-AWE-JJM-FLE
 SAMPLE AVAILABLE TO DEMONSTRATE PROGRAM USE
 COWI-ACI DATA 23-70-C-0076

REVISION DATE 07 SEP 70
 = 24 SEPT 70 - JJM-FLE-JCH
 UNITS ARE LBS AND INCHES

PROP (CG) (U)

JMS 4-25FT SO TAXIWAY SLABS, 2 C-9A BODIES CENTERED ON 25 PERCENT JOINTS.

TABLE 9. SELECTED OUTPUT

A POSITIVE ACTS IN THE X DIRECTION (ABOUT Y AXIS)

DEFLECTIONS BETWEEN (1, 3), (8, 9) AND (17, 21).

X - Y DEFLECTION

3	8	1.675E-04
4	8	-1.502E-03
5	8	-4.432E-03
6	8	-1.055E-02
7	8	-1.475E-02
8	8	-2.571E-02
9	8	-3.475E-02
10	8	-4.201E-02
11	8	-3.645E-02
12	8	-2.571E-02
13	8	-1.475E-02
14	9	-1.044E-02
15	8	-4.432E-03
16	8	-1.502E-03
17	3	1.675E-04
3	9	1.161E-04
4	9	-1.424E-03
5	9	-5.644E-03
6	9	-1.225E-02
7	9	-2.134E-02
8	9	-3.329E-02
9	9	-4.237E-02
10	9	-4.648E-02
11	9	-4.247E-02
12	9	-3.324E-02
13	9	-2.140E-02
14	9	-1.225E-02
15	9	-5.644E-03
16	9	-1.502E-03
17	9	1.161E-04
3	10	1.677E-04
4	10	-1.646E-03
5	10	-6.054E-03
6	10	-1.321E-02
7	10	-2.376E-02
8	10	-3.632E-02
9	10	-4.537E-02
10	10	-4.824E-02
11	10	-4.537E-02
12	10	-3.632E-02

13 10 -2.37E-02
 14 10 -1.321E-02
 15 10 -5.07E-03
 16 10 -1.84E-03
 17 10 1.677E-04
 3 11 4.04E-04
 4 11 -1.882E-03
 5 11 -5.815E-03
 6 11 -1.902E-02
 7 11 -7.3E-02
 8 11 -3.71E-02
 9 11 -4.57E-02
 10 11 -4.851E-02
 11 11 -4.559E-02
 12 11 -3.71E-02
 13 11 -2.399E-02
 14 11 -1.302E-02
 15 11 -5.61E-03
 16 11 -1.652E-03
 17 11 4.04E-04
 3 12 7.74E-04
 4 12 -1.049E-03
 5 12 -4.93E-03
 6 12 -1.15E-02
 7 12 -2.11E-02
 8 12 -3.23E-02
 9 12 -4.00E-02
 10 12 -4.337E-02
 11 12 -4.00E-02
 12 12 -3.23E-02
 13 12 -2.11E-02
 14 12 -1.15E-02
 15 12 -4.93E-03
 16 12 -1.049E-03
 17 12 7.74E-04
 3 13 1.23E-03
 4 13 -3.43E-04
 5 13 -3.63E-03
 6 13 -9.25E-03
 7 13 -1.72E-02
 8 13 -2.62E-02
 9 13 -3.24E-02
 10 13 -3.55E-02
 11 13 -3.24E-02
 12 13 -2.62E-02
 13 13 -1.72E-02
 14 13 -9.25E-03
 15 13 -3.63E-03
 16 13 -3.43E-04
 17 13 1.23E-03
 3 14 1.70E-03
 4 14 4.54E-04
 5 14 -2.25E-03
 6 14 -5.42E-03
 7 14 -1.34E-02
 8 14 -2.07E-02
 9 14 -2.57E-02
 10 14 -3.03E-02
 11 14 -2.87E-02
 12 14 -2.07E-02

13	14	-1.34E-02
14	14	-7.31E-03
15	14	-2.26E-03
16	14	4.54E-04
17	14	1.73E-03
3	15	1.51E-03
4	15	2.50E-04
5	15	-2.44E-03
6	15	-7.12E-03
7	15	-1.36E-02
8	15	-2.09E-02
9	15	-2.73E-02
10	15	-3.11E-02
11	15	-2.73E-02
12	15	-2.09E-02
13	15	-1.36E-02
14	15	-7.13E-03
15	15	-2.44E-03
16	15	2.50E-04
17	15	1.51E-03
3	16	1.28E-03
4	16	-1.23E-04
5	16	-3.05E-03
6	16	-7.94E-03
7	16	-1.44E-02
8	16	-2.30E-02
9	16	-3.03E-02
10	16	-3.43E-02
11	16	-3.03E-02
12	16	-2.30E-02
13	16	-1.44E-02
14	16	-7.94E-03
15	16	-3.05E-03
16	16	-1.23E-04
17	16	1.28E-03
3	17	4.62E-04
4	17	-6.40E-04
5	17	-3.54E-03
6	17	-9.39E-03
7	17	-1.72E-02
8	17	-2.67E-02
9	17	-3.54E-02
10	17	-3.95E-02
11	17	-3.54E-02
12	17	-2.67E-02
13	17	-1.72E-02
14	17	-9.39E-03
15	17	-3.54E-03
16	17	-6.40E-04
17	17	4.62E-04
3	18	5.90E-04
4	18	-1.23E-03
5	18	-4.49E-03
6	18	-1.10E-02
7	18	-2.00E-02
8	18	-3.05E-02
9	18	-4.12E-02
10	18	-4.49E-02
11	18	-4.12E-02
12	18	-3.05E-02

13	18	-2.554E-02
14	18	-1.107E-02
15	14	-4.842E-03
16	14	-1.230E-03
17	18	5.477E-04
3	19	2.573E-04
4	19	-1.775E-03
5	19	-5.001E-03
6	19	-1.251E-02
7	19	-2.250E-02
8	19	-3.424E-02
9	19	-4.400E-02
10	19	-4.815E-02
11	19	-4.494E-02
12	19	-3.424E-02
13	19	-2.250E-02
14	19	-1.251E-02
15	19	-5.501E-03
16	19	-1.775E-03
17	19	2.503E-04
3	20	-2.079E-03
4	20	-2.155E-03
5	20	-6.371E-03
6	20	-1.355E-02
7	20	-2.407E-02
8	20	-3.657E-02
9	20	-4.562E-02
10	20	-4.927E-02
11	20	-4.562E-02
12	20	-3.657E-02
13	20	-2.407E-02
14	20	-1.355E-02
15	20	-6.371E-03
16	20	-2.155E-03
17	20	-2.079E-03
3	21	-1.603E-04
4	21	-2.251E-03
5	21	-6.372E-03
6	21	-1.341E-02
7	21	-2.333E-02
8	21	-3.674E-02
9	21	-4.492E-02
10	21	-4.741E-02
11	21	-4.492E-02
12	21	-3.673E-02
13	21	-2.334E-02
14	21	-1.341E-02
15	21	-6.372E-03
16	21	-2.251E-03
17	21	-1.603E-04

DEFLECTIONS BETWEEN (0, 20) AND (20, 21)

X Y DEFLECTION

0	20	1.375E-03
1	20	1.201E-03

2	20	-0.033E-04
3	20	-2.077E-05
4	20	-2.145E-03
5	20	-0.371E-03
6	20	-1.335E-02
7	20	-2.407E-02
8	20	-3.657E-02
9	20	-4.552E-02
10	20	-4.927E-02
11	20	-4.502E-02
12	20	-3.537E-02
13	20	-2.407E-02
14	20	-1.335E-02
15	20	-0.371E-03
16	20	-2.145E-03
17	20	-2.077E-05
18	20	-0.033E-04
19	20	1.201E-03
20	20	1.336E-03
0	21	1.163E-03
1	21	1.041E-03
2	21	7.249E-04
3	21	-1.603E-04
4	21	-2.251E-03
5	21	-6.372E-03
6	21	-1.341E-02
7	21	-2.334E-02
8	21	-3.674E-02
9	21	-4.492E-02
10	21	-4.741E-02
11	21	-4.492E-02
12	21	-3.674E-02
13	21	-2.334E-02
14	21	-1.341E-02
15	21	-6.372E-03
16	21	-2.251E-03
17	21	-1.603E-04
18	21	7.249E-04
19	21	1.041E-03
20	21	-1.163E-03

DEFLECTIONS BETWEEN (0, 21) AND (20, 21)

X Y DEFLECTION

0	21	1.163E-03
1	21	1.041E-03
2	21	7.249E-04
3	21	-1.603E-04
4	21	-2.251E-03
5	21	-6.372E-03
6	21	-1.341E-02
7	21	-2.334E-02
8	21	-3.674E-02
9	21	-4.492E-02
10	21	-4.741E-02
11	21	-4.492E-02

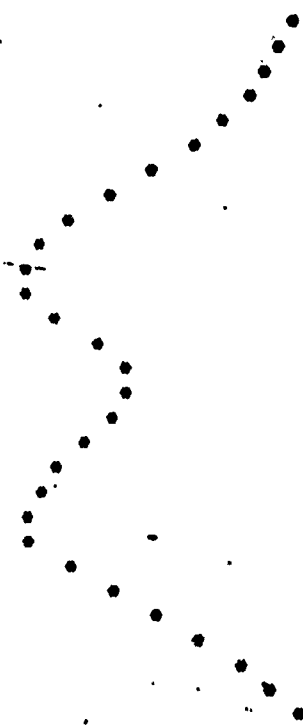
12	21	-3.67E-02
13	21	-2.34E-02
14	21	-1.34E-02
15	21	-6.37E-03
16	21	-2.24E-03
17	21	-1.60E-04
18	21	7.29E-04
19	21	1.04E-03
20	21	1.14E-03



DEFLECTIONS BETWEEN (9. 0) AND (9. 28)

X Y DEFLECTION

9	0	4.32E-03
9	1	1.66E-03
9	2	-1.25E-03
9	3	-4.74E-03
9	4	-4.33E-03
9	5	-1.51E-02
9	6	-2.23E-02
9	7	-3.05E-02
9	8	-3.66E-02
9	9	-4.24E-02
9	10	-4.54E-02
9	11	-4.56E-02
9	12	-4.01E-02
9	13	-3.74E-02
9	14	-2.67E-02
9	15	-2.73E-02
9	16	-3.03E-02
9	17	-3.54E-02
9	18	-4.12E-02
9	19	-4.40E-02
9	20	-4.56E-02
9	21	-4.42E-02
9	22	-3.61E-02
9	23	-2.94E-02
9	24	-2.09E-02
9	25	-1.33E-02
9	26	-5.61E-03
9	27	-1.12E-03
9	28	4.14E-03



X MOMENTS ONLY BETWEEN (0. 20) AND (20. 21)

X Y X MOMENT

0	20	-6.02E-11
1	20	-1.47E-02
2	20	-4.70E-02
3	20	-9.82E-02
4	20	-1.64E-01
5	20	-2.21E-01



6	20	-2.442E+03
7	20	-1.071E+03
8	20	3.772E+03
9	20	5.229E+03
10	20	1.755E+03
11	20	5.229E+03
12	20	3.572E+03
13	20	-1.071E+03
14	20	-2.442E+03
15	20	-2.203E+03
16	20	-1.044E+03
17	20	-7.023E+02
18	20	-4.740E+02
19	20	-1.459E+02
20	20	-2.435E-11
0	21	-1.044E-11
1	21	-1.459E+02
2	21	-4.566E+02
3	21	-9.471E+02
4	21	-1.544E+03
5	21	-2.212E+03
6	21	-2.415E+03
7	21	-1.121E+03
8	21	5.029E+03
9	21	6.644E+03
10	21	1.415E+03
11	21	6.644E+03
12	21	5.029E+03
13	21	-1.121E+03
14	21	-2.415E+03
15	21	-2.212E+03
16	21	-1.544E+03
17	21	-9.471E+02
18	21	-4.566E+02
19	21	-1.459E+02
20	21	-9.335E-12

X MOMENTS ONLY BETWEEN (0, 21) AND (20, 21)

X	Y	X-MOMENT
0	21	-1.044E-11
1	21	-1.459E+02
2	21	-4.566E+02
3	21	-9.471E+02
4	21	-1.544E+03
5	21	-2.212E+03
6	21	-2.415E+03
7	21	-1.121E+03
8	21	5.029E+03
9	21	6.644E+03
10	21	1.415E+03
11	21	6.644E+03
12	21	5.029E+03
13	21	-1.121E+03
14	21	-2.415E+03
15	21	-2.212E+03

16	21	-1.514E+03
17	21	-4.471E+02
18	21	-4.567E+02
19	21	-1.495E+02
20	21	-8.335E-12

Y MOMENTS ONLY, BETWEEN (9, 0) AND (9, 28)

X , Y Y MOMENT

9	0	-1.342E-10
9	1	-4.043E+02
9	2	-9.595E+02
9	3	-1.530E+03
9	4	-1.956E+03
9	5	-1.944E+03
9	6	-1.243E+03
9	7	1.101E+03
9	8	7.224E+03
9	9	3.531E+03
9	10	4.772E+03
9	11	1.053E+04
9	12	2.973E+03
9	13	-8.945E+02
9	14	-2.652E+03
9	15	-3.490E+03
9	16	-2.819E+03
9	17	-3.914E+02
9	18	6.102E+03
9	19	2.845E+03
9	20	4.549E+03
9	21	1.043E+04
9	22	3.730E+03
9	23	2.526E+02
9	24	-1.230E+03
9	25	-1.557E+03
9	26	-1.224E+03
9	27	-6.150E+02
9	28	-1.694E-10

PRINCIPAL STRESSES, BETWEEN (3, 0) AND (17, 21)

X , Y STRESS

3	0	-3.551E+01
4	0	-8.046E+01
5	0	-8.751E+01
6	0	-1.039E+02
7	0	-8.529E+01
8	0	1.331E+02
9	0	3.192E+02
10	0	2.147E+02
11	0	3.142E+02
12	0	1.331E+02

13	8	-7.525E+01
14	8	-1.035E+02
15	8	-8.758E+01
16	8	-6.056E+01
17	8	-3.551E+01
3	9	-3.858E+01
4	9	-6.534E+01
5	9	-9.254E+01
6	9	-1.038E+02
7	9	8.212E+01
8	9	1.137E+02
9	9	2.150E+02
10	9	1.837E+02
11	9	2.150E+02
12	9	1.137E+02
13	9	8.212E+01
14	9	-1.038E+02
15	9	-9.254E+01
16	9	-6.534E+01
17	9	-3.858E+01
3	10	-4.041E+01
4	10	-6.832E+01
5	10	-9.543E+01
6	10	-1.041E+02
7	10	1.141E+02
8	10	1.774E+02
9	10	2.328E+02
10	10	2.216E+02
11	10	2.328E+02
12	10	1.774E+02
13	10	1.141E+02
14	10	-1.041E+02
15	10	-9.583E+01
16	10	-6.832E+01
17	10	-4.041E+01
3	11	-4.087E+01
4	11	-6.925E+01
5	11	-9.745E+01
6	11	-1.075E+02
7	11	1.674E+02
8	11	4.153E+02
9	11	4.405E+02
10	11	3.043E+02
11	11	4.405E+02
12	11	4.153E+02
13	11	1.674E+02
14	11	-1.075E+02
15	11	-9.745E+01
16	11	-6.925E+01
17	11	-4.087E+01
3	12	-3.742E+01
4	12	-7.775E+01
5	12	-9.556E+01
6	12	-1.075E+02
7	12	1.047E+02
8	12	1.475E+02
9	12	1.713E+02
10	12	1.250E+02
11	12	1.713E+02
12	12	1.575E+02

13	12	1.047E+02	.	.
14	12	-1.075E+02	.	.
15	12	-4.556E+01	.	.
16	12	-7.77E+01	.	.
17	12	-3.44E+01	.	.
3	13	-3.74E+01	.	.
4	13	-6.43E+01	.	.
5	13	-9.09E+01	.	.
6	13	-1.055E+02	.	.
7	13	-9.31E+01	.	.
8	13	9.214E+01	.	.
9	13	9.697E+01	.	.
10	13	6.070E+01	.	.
11	13	9.807E+01	.	.
12	13	9.214E+01	.	.
13	13	-9.31E+01	.	.
14	13	-1.055E+02	.	.
15	13	-9.09E+01	.	.
16	13	-6.43E+01	.	.
17	13	-3.74E+01	.	.
3	14	-3.29E+01	.	.
4	14	-5.64E+01	.	.
5	14	-7.79E+01	.	.
6	14	-8.75E+01	.	.
7	14	-8.65E+01	.	.
8	14	-9.69E+01	.	.
9	14	-1.10E+02	.	.
10	14	-1.05E+02	.	.
11	14	-1.10E+02	.	.
12	14	-9.60E+01	.	.
13	14	-8.65E+01	.	.
14	14	-8.75E+01	.	.
15	14	-7.79E+01	.	.
16	14	-5.64E+01	.	.
17	14	-3.29E+01	.	.
3	15	-3.16E+01	.	.
4	15	-5.30E+01	.	.
5	15	-7.11E+01	.	.
6	15	-7.49E+01	.	.
7	15	-8.86E+01	.	.
8	15	-1.230E+02	.	.
9	15	-1.46E+02	.	.
10	15	-1.50E+02	.	.
11	15	-1.46E+02	.	.
12	15	-1.230E+02	.	.
13	15	-7.85E+01	.	.
14	15	-7.49E+01	.	.
15	15	-7.11E+01	.	.
16	15	-5.30E+01	.	.
17	15	-3.16E+01	.	.
3	16	-3.55E+01	.	.
4	16	-5.63E+01	.	.
5	16	-7.77E+01	.	.
6	16	-9.03E+01	.	.
7	16	-9.47E+01	.	.
8	16	-1.17E+02	.	.
9	16	-1.24E+02	.	.
10	16	-1.15E+02	.	.
11	16	-1.24E+02	.	.
12	16	-1.15E+02	.	.

13 16 -4.475E+01
 14 16 -4.031E+01
 15 16 -7.77E+01
 16 16 -5.03E+01
 17 16 -3.370E+01
 3 17 -3.637E+01
 4 17 -0.123E+01
 5 17 -4.54E+01
 6 17 -1.010E+02
 7 17 -9.774E+01
 8 17 -7.14E+01
 9 17 1.57E+02
 10 17 7.005E+01
 11 17 1.557E+02
 12 17 -7.174E+01
 13 17 -9.77E+01
 14 17 -1.010E+02
 15 17 -5.54E+01
 16 17 -6.123E+01
 17 17 -3.637E+01
 3 18 -1.45E+01
 4 18 -0.50E+01
 5 18 -9.173E+01
 6 18 -1.042E+02
 7 18 -9.242E+01
 8 18 8.557E+01
 9 18 2.773E+02
 10 18 1.671E+02
 11 18 2.773E+02
 12 18 8.557E+01
 13 18 -8.242E+01
 14 18 -1.042E+02
 15 18 -9.173E+01
 16 18 -0.54E+01
 17 18 -3.57E+01
 3 19 -4.063E+01
 4 19 -0.40E+01
 5 19 -9.459E+01
 6 19 -1.035E+02
 7 19 -6.13E+01
 8 19 8.274E+01
 9 19 2.152E+02
 10 19 1.533E+02
 11 19 2.152E+02
 12 19 8.274E+01
 13 19 -5.13E+01
 14 19 -1.035E+02
 15 19 -9.459E+01
 16 19 -0.40E+01
 17 19 -4.063E+01
 3 20 -4.04E+01
 4 20 -6.552E+01
 5 20 -9.522E+01
 6 20 -1.022E+02
 7 20 1.074E+02
 8 20 1.471E+02
 9 20 2.371E+02
 10 20 2.141E+02
 11 20 2.371E+02
 12 20 1.471E+02

13	20	1.077E+02
14	20	-1.022E+02
15	20	-9.522E+01
16	20	-6.772E+01
17	20	-4.072E+01
3	21	-3.472E+01
4	21	-6.677E+01
5	21	-4.342E+01
6	21	-1.041E+02
7	21	1.740E+02
8	21	4.242E+02
9	21	4.574E+02
10	21	3.232E+02
11	21	4.544E+02
12	21	4.294E+02
13	21	1.750E+02
14	21	-1.041E+02
15	21	-4.372E+01
16	21	-6.072E+01
17	21	-3.472E+01

TIME FOR THIS PROBLEM = 0 MINUTES 22.583 SECONDS

ELAPSED TIME = 0 MINUTES 30.226 SECONDS

PROGRAM: SLAB30E CENL SPECIAL DECK-AWE-JJP.FLE REVISION DATE 07 SEP 70
 SAMPLE PROBLEMS TO DEMONSTRATE PROGRAM USE - 24 SEPT 70 - JJP.FLE+JLW
 CONTACT DATA 23-79-C-0076 UNITS ARE LBS AND INCHES

PROB
 JR6 4-25FT SO TAXIWAY SLABS, 2 B-747 BOGIES, 25 PERCENT JOINTS

TABLE 1. CONTROL DATA.

MULTIPLE LOAD OPTION (IF BLANK OR ZERO, PROB IS INDEPENDENT -- -1
 IF +1, PARENT FOR NEXT PROB -- IF -1, AN OFFSPRING PROB)

	TABLE NUMBER						
	2	3	4	5	6	7	
NO. CASES INPUT THIS PROBLEM	0	4	0	0	2	1	
COMPUTE OPTIONAL PAYMENT STIFFNESS CONSTANTS (1=YES)							
OPTION TO SUPPRESS DETAILED OUTPUT (1=YES)							
OPTION TO PRINT PRIN STRESS INSTEAD OF MOM (1=YES)							

TABLE 2. CONSTANTS--UNITS MUST BE CONSISTENT.

NU4 INCREMENTS IN X DIRECTION	20
NU4 INCREMENTS IN Y DIRECTION	20
INCR LENGTH IN X DIRECTION	3.000E+01
INCR LENGTH IN Y DIRECTION	2.150E+01
POISSON'S RATIO	2.000E-01
MODULUS OF ELASTICITY	5.000E+06
SLAB THICKNESS	1.200E+01
SUBGRADE MODULUS	1.250E+02

TABLE 3. SPECIFIED AREAS FOR SELECTED PLOTTED OUTPUT.

				PLOT (1=YES)			
FROM	THRU	DEFL		X-MOMENT	Y-MOMENT	PRIN STRESS	
3	8 17 21	1		0	0	1	
0	21 20 21	1		1	0	0	
9	0 7 20	1		0	1	0	
12	0 12 24	1		0	1	0	

TABLE 4. LOAD DATA--REPLACES LOAD IN PREVIOUS PROBLEM.

ALL STIFFNESS TERMS ARE RETAINED FROM PARENT PROBLEM JR5

FROM THRU 0

NONE

TABLE 5. AXIAL THRUST DATA.

FROM IN-CL

PX

PY

NO 12

TABLE 6. SPECIAL LOAD PATTERNS.

PATTERN NUM	NUM. OF LOADS	PATTERN COORDINATES AND CONCENTRATED LOADS											
		A REFERENCE	T	X	Y	X	Y	X	Y	X	Y	X	Y
1	6	0	0	0	3	1	0	2	0	1	3	2	3
		-41500		-41500		-41500		-41500		-41500		-41500	
2	2	0	0	-3	0								
		-5000		-5000									

TABLE 7. PLACEMENTS OF SPECIAL LOAD PATTERNS.

PATTERN NUM	NUM. OF PLACEMENTS	LOCATION OF REFERENCE LOAD (SLAB COORDINATES)															
		A	T	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y
1	2	7	12	12	18												

NUM OF WHEEL LOADS APPLIED TO THE SLAB	*	12
SUM OF WHEEL LOADS APPLIED TO THE SLAB	*	-4.980E+05
NUM OF WHEEL LOADS PLACED OUTSIDE SLAB	*	0
SUM OF WHEEL LOADS PLACED OUTSIDE SLAB	*	0.

PROGRAM SLAB-302 CEMT SPECIAL DECK-ARE-JJP,FLE REVISION DATE 07 SEP 70
 SAMPLE PROBLEMS TO DEMONSTRATE PROGRAM USE - 24 SEPT 70 - JJP,FLE,JLK
 CONTRACT JACA 23-70-C-0076 UNITS ARE LBS AND INCHES

PROB (C) 10)
 JK6 4-25FT SQ TAXIWAY SLABS, 2 B-747 BOGIES, 25 PERCENT JOINTS

TABLE 8. RESULTS—USING STIFFNESS DATA FROM PARENT PROBLEM JR5.

X MOMENT AND X TWISTING MOMENT ACT IN THE X DIRECTION (ABOUT Y AXIS).
 Y TWISTING MOMENT = -X TWISTING MOMENT, COUNTERCLOCKWISE BETA ANGLES
 ARE POSITIVE FROM X AXIS TO THE DIRECTION OF LARGEST PRINCIPAL STRESS

X , Y	DEFL°	X MOMENT	Y MOMENT	X TWISTING MOMENT	SUPPORT REACTION	LARGEST PRINCIPAL STRESS	BETA X TO LARGEST
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*** THE DETAILED OUTPUT HAS BEEN DELETED BY THE OPTION IN TABLE 1.
 A SINGLE SET OF VALUES IS PRINTED AT OR NEAR THE SLAB CENTER FOR REFERENCE

10 14 -5.733E-02 -2.400E+01 2.178E+03 -2.165E+03 4.622E+03 1.461E+02 -58.5

X , Y	DEFL	X MOMENT	Y MOMENT	X TWISTING MOMENT	SUPPORT REACTION	LARGEST PRINCIPAL STRESS	BETA X TO LARGEST
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STATICS CHECK. SUMMATION OF REACTIONS = 4.980E+05

PROGRAM SCATJOL C-E-L SPECIAL DECK-ARE-JJP+LE REVISION DATE 07 SEP 70
 SAMPLE PROBLEMS TO DEMONSTRATE PROGRAM USE - 24 SEPT 70 - JJP+LE+JLP
 CONTRACT JACA 23-70-C-0070 UNITS ARE LBS AND INCHES

PROB (C) ID)
 JR6 4-25FT SQ TAXIWAY SLABS, 2 B-747 BOGIES, 25 PERCENT JOINTS

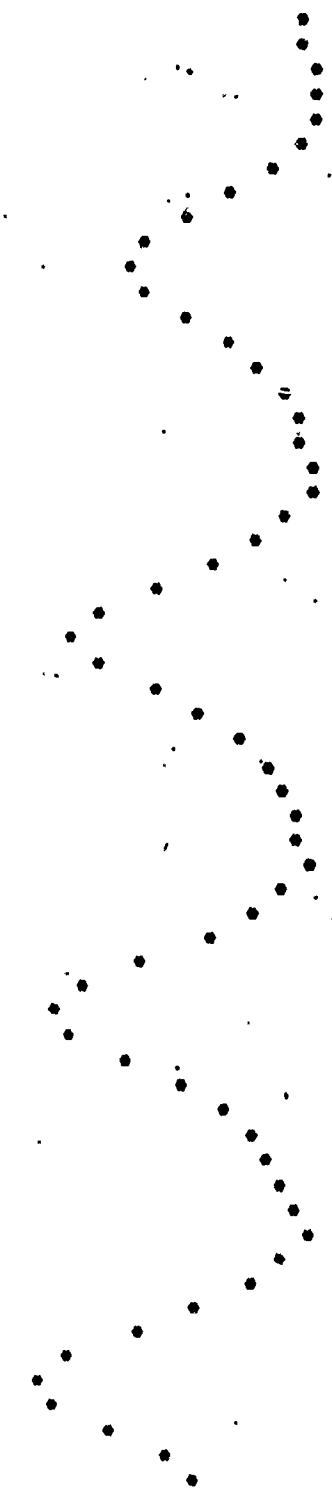
TABLE 9. SELECTED OUTPUT—USING STIFFNESS DATA FROM PARENT PROBLEM JRS.
 A MOMENT ACTS IN THE X DIRECTION (ABOUT Y AXIS)

DEFLECTIONS BETWEEN (3, 8) AND (17, 21)

X, Y DEFLECTION

3	8	-4.619E-04
4	8	-3.238E-03
5	8	-7.197E-03
6	8	-1.199E-02
7	8	-1.592E-02
8	8	-1.740E-02
9	8	-1.554E-02
10	8	-1.110E-02
11	8	-5.517E-03
12	8	-2.660E-03
13	8	-1.019E-04
14	8	1.226E-03
15	8	1.835E-03
16	8	1.440E-03
17	8	1.725E-03
3	9	-1.632E-03
4	9	-5.692E-03
5	9	-1.160E-02
6	9	-1.840E-02
7	9	-2.525E-02
8	9	-2.773E-02
9	9	-2.449E-02
10	9	-1.824E-02
11	9	-1.127E-02
12	9	-5.537E-03
13	9	-1.807E-03
14	9	3.703E-04
15	9	1.430E-03
16	9	1.420E-03
17	9	1.877E-03
3	10	-3.035E-03
4	10	-8.547E-03
5	10	-1.640E-02
6	10	-2.720E-02
7	10	-3.703E-02
8	10	-4.041E-02
9	10	-3.033E-02
10	10	-2.710E-02
11	10	-1.717E-02
12	10	-4.434E-03

13	10	-4.272E-03
14	10	-1.157E-03
15	10	4.637E-04
16	10	1.451E-03
17	10	1.475E-03
3	11	-4.491E-03
4	11	-1.152E-02
5	11	-2.215E-02
6	11	-3.620E-02
7	11	-5.032E-02
8	11	-5.590E-02
9	11	-5.050E-02
10	11	-3.644E-02
11	11	-2.330E-02
12	11	-1.411E-02
13	11	-7.602E-03
14	11	-3.502E-03
15	11	-9.256E-04
16	11	6.595E-04
17	11	1.622E-03
3	12	-5.732E-03
4	12	-1.411E-02
5	12	-2.649E-02
6	12	-4.410E-02
7	12	-6.255E-02
8	12	-6.945E-02
9	12	-6.342E-02
10	12	-4.592E-02
11	12	-3.064E-02
12	12	-1.945E-02
13	12	-1.193E-02
14	12	-6.832E-03
15	12	-3.224E-03
16	12	-6.791E-04
17	12	1.053E-03
3	13	-5.731E-03
4	13	-1.594E-02
5	13	-3.006E-02
6	13	-4.844E-02
7	13	-6.802E-02
8	13	-7.610E-02
9	13	-6.971E-02
10	13	-5.244E-02
11	13	-3.685E-02
12	13	-2.540E-02
13	13	-1.737E-02
14	13	-1.135E-02
15	13	-6.442E-03
16	13	-2.670E-03
17	13	4.437E-04
3	14	-7.144E-03
4	14	-1.675E-02
5	14	-3.163E-02
6	14	-5.134E-02
7	14	-7.165E-02
8	14	-8.625E-02
9	14	-7.430E-02
10	14	-5.733E-02
11	14	-4.235E-02
12	14	-3.145E-02



13	14	-2.40-E-02
14	14	-1.71-E-02
15	14	-1.07-E-02
16	14	-5.35-E-03
17	14	-1.24-E-03
3	15	-6.00-E-03
4	15	-1.44-E-02
5	15	-2.73-E-02
6	15	-4.59-E-02
7	15	-4.54-E-02
8	15	-7.44-E-02
9	15	-7.05-E-02
10	15	-5.65-E-02
11	15	-4.71-E-02
12	15	-4.10-E-02
13	15	-3.51-E-02
14	15	-2.83-E-02
15	15	-1.92-E-02
16	15	-1.04-E-02
17	15	-4.63-E-03
3	16	-4.44-E-03
4	16	-1.16-E-02
5	16	-2.27-E-02
6	16	-3.75-E-02
7	16	-5.32-E-02
8	16	-8.16-E-02
9	16	-6.07-E-02
10	16	-5.33-E-02
11	16	-5.10-E-02
12	16	-5.04-E-02
13	16	-4.62-E-02
14	16	-4.03-E-02
15	16	-2.84-E-02
16	16	-1.64-E-02
17	16	-8.12-E-03
3	17	-2.77-E-03
4	17	-4.34-E-03
5	17	-1.64-E-02
6	17	-2.82-E-02
7	17	-4.00-E-02
8	17	-4.75-E-02
9	17	-4.47-E-02
10	17	-4.89-E-02
11	17	-5.43-E-02
12	17	-6.12-E-02
13	17	-6.14-E-02
14	17	-5.32-E-02
15	17	-3.75-E-02
16	17	-2.24-E-02
17	17	-1.14-E-02
3	18	-1.19-E-03
4	18	-5.25-E-03
5	18	-1.14-E-02
6	18	-1.95-E-02
7	18	-2.44-E-02
8	18	-3.52-E-02
9	18	-3.94-E-02
10	18	-4.46-E-02
11	18	-5.62-E-02
12	18	-6.74-E-02

13	19	-7.347E-02
14	19	-5.411E-02
15	19	-4.445E-02
16	19	-2.715E-02
17	19	-1.400E-02
3	19	4.574E-05
4	19	-2.635E-03
5	19	-6.457E-03
6	19	-1.251E-02
7	19	-1.905E-02
8	19	-2.531E-02
9	19	-3.147E-02
10	19	-3.855E-02
11	19	-5.443E-02
12	19	-7.040E-02
13	19	-7.613E-02
14	19	-6.745E-02
15	19	-4.820E-02
16	19	-2.956E-02
17	19	-1.545E-02
3	20	1.022E-03
4	20	-6.532E-04
5	20	-3.346E-03
6	20	-7.268E-03
7	20	-1.205E-02
8	20	-1.740E-02
9	20	-2.445E-02
10	20	-3.360E-02
11	20	-5.151E-02
12	20	-6.401E-02
13	20	-7.533E-02
14	20	-6.725E-02
15	20	-4.831E-02
16	20	-2.978E-02
17	20	-1.572E-02
3	21	1.576E-03
4	21	6.865E-04
5	21	-9.373E-04
6	21	-3.481E-03
7	21	-7.043E-03
8	21	-1.140E-02
9	21	-1.456E-02
10	21	-2.791E-02
11	21	-4.544E-02
12	21	-6.424E-02
13	21	-7.102E-02
14	21	-6.375E-02
15	21	-4.514E-02
16	21	-2.741E-02
17	21	-1.405E-02

DEFLECTIONS BETWEEN (0, 21) AND (20, 21)

X Y DEFLECTION

0	21	2.665E-03
1	21	2.325E-03

2	21	2.027E-03
3	21	1.574E-03
4	21	6.608E-04
5	21	-4.373E-04
6	21	-3.451E-03
7	21	-7.044E-03
8	21	-1.146E-02
9	21	-1.556E-02
10	21	-2.791E-02
11	21	-4.594E-02
12	21	-6.425E-02
13	21	-7.102E-02
14	21	-6.375E-02
15	21	-4.514E-02
16	21	-2.741E-02
17	21	-1.465E-02
18	21	-5.681E-03
19	21	5.719E-04
20	21	5.633E-03

DEFLECTIONS BETWEEN (9. 0) AND (9. 28)

X . Y DEFLECTION

9	0	2.051E-03
9	1	1.937E-03
9	2	1.750E-03
9	3	1.357E-03
9	4	4.935E-04
9	5	-1.172E-03
9	6	-4.065E-03
9	7	-8.692E-03
9	8	-1.554E-02
9	9	-2.496E-02
9	10	-3.693E-02
9	11	-5.059E-02
9	12	-6.342E-02
9	13	-6.971E-02
9	14	-7.430E-02
9	15	-7.065E-02
9	16	-6.072E-02
9	17	-4.977E-02
9	18	-3.985E-02
9	19	-3.147E-02
9	20	-2.444E-02
9	21	-1.956E-02
9	22	-1.337E-02
9	23	-5.734E-03
9	24	-4.695E-03
9	25	-1.161E-03
9	26	2.033E-03
9	27	5.041E-03
9	28	8.191E-03

DEFLECTIONS BETWEEN (12, 0) AND (12, 28)

X, Y DEFLECTION

12	0	1.240E-03
12	1	1.394E-03
12	2	1.547E-03
12	3	1.657E-03
12	4	1.639E-03
12	5	1.363E-03
12	6	6.703E-04
12	7	-6.171E-04
12	8	-2.668E-03
12	9	-5.597E-03
12	10	-9.434E-03
12	11	-1.410E-02
12	12	-1.945E-02
12	13	-2.540E-02
12	14	-3.195E-02
12	15	-4.103E-02
12	16	-5.095E-02
12	17	-6.128E-02
12	18	-6.982E-02
12	19	-7.088E-02
12	20	-6.901E-02
12	21	-6.428E-02
12	22	-5.219E-02
12	23	-3.859E-02
12	24	-2.633E-02
12	25	-1.594E-02
12	26	7.427E-03
12	27	2.628E-04
12	28	6.223E-03

X MOMENTS ONLY BETWEEN (0, 21) AND (28, 21)

X, Y X MOMENT

0	21	1.594E-11
1	21	9.242E+00
2	21	-1.740E+02
3	21	-4.721E+02
4	21	-7.467E+02
5	21	-1.050E+03
6	21	-1.257E+03
7	21	-1.527E+03
8	21	-2.015E+03
9	21	-2.444E+03
10	21	-1.766E+03
11	21	7.246E+02
12	21	1.206E+04
13	21	1.450E+04
14	21	1.144E+04
15	21	2.441E+02
16	21	-2.059E+03
17	21	-5.055E+03

19 21 -2.174E+03
19 21 -4.071E+02
20 21 -6.935E-12

Y MOMENTS ONLY, BETWEEN (9. 0) AND (9. 28)

X , Y Y MOMENT

9 0 -6.082E-11
9 1 -1.135E+02
9 2 -3.535E+02
9 3 -7.315E+02
9 4 -1.250E+03
9 5 -1.908E+03
9 6 -2.645E+03
9 7 -3.343E+03
9 8 -3.763E+03
9 9 -3.476E+03
9 10 -1.757E+03
9 11 2.694E+03
9 12 1.242E+04
9 13 4.574E+03
9 14 3.747E+03
9 15 1.194E+04
9 16 2.674E+03
9 17 -1.186E+03
9 18 -2.345E+03
9 19 -2.503E+03
9 20 -2.100E+03
9 21 -1.603E+03
9 22 -1.376E+03
9 23 -1.255E+03
9 24 -1.056E+03
9 25 -7.254E+02
9 26 -3.433E+02
9 27 -3.754E+01
9 28 -3.203E-10

Y MOMENTS ONLY, BETWEEN (12. 0) AND (12. 28)

X , Y Y MOMENT

12 0 -3.007E-11
12 1 -3.912E+00
12 2 -7.926E+01
12 3 -2.275E+02
12 4 -4.474E+02
12 5 -7.302E+02
12 6 -1.053E+03
12 7 -1.376E+03
12 8 -1.641E+03
12 9 -1.745E+03
12 10 -1.774E+03
12 11 -1.444E+03

12	12	-1.504E+03
12	13	-1.554E+03
12	14	-1.186E+03
12	15	-1.435E+03
12	16	-2.225E+02
12	17	3.450E+03
12	18	1.345E+04
12	19	6.475E+03
12	20	6.514E+03
12	21	1.349E+04
12	22	3.747E+03
12	23	-7.725E+02
12	24	-2.447E+03
12	25	-2.554E+03
12	26	-1.877E+03
12	27	-4.152E+02
12	28	-6.617E-11

PRINCIPAL STRESSES BETWEEN (3, 8) AND (17, 21)

X, Y STRESS

3	8	-0.473E+01
4	8	-1.036E+02
5	8	-1.343E+02
6	8	-1.551E+02
7	8	-1.653E+02
8	8	-1.692E+02
9	8	-1.693E+02
10	8	-1.641E+02
11	8	-1.435E+02
12	8	-1.156E+02
13	8	-3.544E+01
14	8	-5.851E+01
15	8	-3.719E+01
16	8	-2.134E+01
17	8	-1.040E+01
3	9	-0.547E+01
4	9	-1.240E+02
5	9	-1.554E+02
6	9	-1.667E+02
7	9	-1.694E+02
8	9	-1.554E+02
9	9	-1.651E+02
10	9	-1.759E+02
11	9	-1.650E+02
12	9	-1.344E+02
13	9	-1.053E+02
14	9	-7.654E+01
15	9	-5.244E+01
16	9	-3.324E+01
17	9	-1.844E+01
3	10	-4.455E+01
4	10	-1.422E+02
5	10	-1.632E+02
6	10	-1.546E+02
7	10	2.240E+02

8	10	2.475E+02
9	10	2.195E+02
10	10	-1.605E+02
11	10	-1.745E+02
12	10	-1.545E+02
13	10	-1.233E+02
14	10	-9.445E+01
15	10	-6.975E+01
16	10	-4.775E+01
17	10	-2.434E+01
3	11	-1.105E+02
4	11	-1.545E+02
5	11	-1.693E+02
6	11	1.950E+02
7	11	3.664E+02
8	11	3.964E+02
9	11	3.435E+02
10	11	1.475E+02
11	11	-1.655E+02
12	11	-1.542E+02
13	11	-1.324E+02
14	11	-1.102E+02
15	11	-8.424E+01
16	11	-6.405E+01
17	11	-4.227E+01
3	12	-1.147E+02
4	12	-1.611E+02
5	12	-1.634E+02
6	12	2.414E+02
7	12	5.943E+02
8	12	6.224E+02
9	12	5.464E+02
10	12	1.454E+02
11	12	-1.464E+02
12	12	-1.471E+02
13	12	-1.245E+02
14	12	-1.215E+02
15	12	-1.055E+02
16	12	-8.241E+01
17	12	-5.646E+01
3	13	-1.231E+02
4	13	-1.631E+02
5	13	-1.424E+02
6	13	-1.544E+02
7	13	4.173E+02
8	13	5.312E+02
9	13	4.014E+02
10	13	1.093E+02
11	13	-1.361E+02
12	13	-1.245E+02
13	13	-1.127E+02
14	13	-1.255E+02
15	13	-1.212E+02
16	13	-1.004E+02
17	13	-7.251E+01
3	14	-1.297E+02
4	14	-1.737E+02
5	14	-1.524E+02
6	14	1.317E+02
7	14	4.244E+02

8	14	5.492E+02
9	14	4.212E+02
10	14	1.451E+02
11	14	-1.92E+02
12	14	-1.573E+02
13	14	-3.430E+01
14	14	-1.15E+02
15	14	-1.41E+02
16	14	-1.322E+02
17	14	-1.01E+02
3	15	-1.251E+02
4	15	-1.710E+02
5	15	-1.736E+02
6	15	2.235E+02
7	15	5.381E+02
8	15	6.172E+02
9	15	6.141E+02
10	15	3.010E+02
11	15	-2.762E+02
12	15	-1.475E+02
13	15	-1.00E+02
14	15	-1.124E+02
15	15	-1.570E+02
16	15	-1.543E+02
17	15	-1.25E+02
3	16	-1.177E+02
4	16	-1.657E+02
5	16	-1.849E+02
6	16	1.652E+02
7	16	3.059E+02
8	16	3.450E+02
9	16	3.723E+02
10	16	2.926E+02
11	16	-2.954E+02
12	16	2.305E+02
13	16	1.795E+02
14	16	1.664E+02
15	16	-1.342E+02
16	16	-1.637E+02
17	16	-1.350E+02
3	17	-1.065E+02
4	17	-1.540E+02
5	17	-1.84E+02
6	17	-1.710E+02
7	17	1.550E+02
8	17	1.71E+02
9	17	2.00E+02
10	17	-2.737E+02
11	17	3.045E+02
12	17	4.02E+02
13	17	3.00E+02
14	17	3.214E+02
15	17	2.011E+02
16	17	-1.594E+02
17	17	-1.421E+02
3	18	-9.21E+01
4	18	-1.353E+02
5	18	-1.72E+02
6	18	-1.83E+02
7	18	-1.633E+02

8 14 -1.503E+02
 9 14 -1.014E+02
 10 14 -2.132E+02
 11 14 3.107E+02
 12 14 6.609E+02
 13 14 0.992E+02
 14 14 5.117E+02
 15 14 2.743E+02
 16 14 -1.457E+02
 17 14 -1.433E+02
 3 14 -7.591E+01
 4 14 -1.147E+02
 5 14 -1.514E+02
 6 14 -1.720E+02
 7 14 -1.714E+02
 8 14 -1.554E+02
 9 14 -1.562E+02
 10 14 -1.467E+02
 11 14 1.940E+02
 12 14 4.343E+02
 13 14 5.374E+02
 14 14 4.147E+02
 15 14 2.145E+02
 16 14 -1.299E+02
 17 14 -1.404E+02
 3 20 -5.910E+01
 4 20 -4.145E+01
 5 20 -1.242E+02
 6 20 -1.455E+02
 7 20 -1.547E+02
 8 20 -1.355E+02
 9 20 -1.141E+02
 10 20 -9.019E+01
 11 20 1.642E+02
 12 20 4.352E+02
 13 20 5.495E+02
 14 20 4.245E+02
 15 20 2.173E+02
 16 20 -1.272E+02
 17 20 -1.392E+02
 3 21 -4.335E+01
 4 21 -5.645E+01
 5 21 -9.672E+01
 6 21 -1.271E+02
 7 21 -1.310E+02
 8 21 -1.222E+02
 9 21 -1.043E+02
 10 21 -4.203E+01
 11 21 2.144E+02
 12 21 5.454E+02
 13 21 5.404E+02
 14 21 6.347E+02
 15 21 2.451E+02
 16 21 -1.375E+02
 17 21 -1.342E+02

TIME FOR THIS PROBLEM = 0 MINUTES 6.726 SECONDS

ELAPSED TIME = 0 MINUTES 44.952 SECONDS

PROGRAM: SLAB-AGE CIVIL SPECIAL DECK-AGE-JJP.FLE REVISION DATE 07 SEP 70
 SAMPLE PROBLEM IS TO DEMONSTRATE PROGRAM USE - 24 SEPT 70 - JJP.FLE.JLN
 CONTRACT JACA 23-70-C-0076 UNITS ARE LBS AND INCHES

PROB
 SAC1 M X B NEG

TABLE 1. CONTROL DATA.

MULTIPLE LOAD OPTION (IF BLANK OR ZERO, PROB IS INDEPENDENT -- -0
 IF +1, PARENT FOR NEXT PROB -- IF -1, AN OFFSPRING PROB)

	TABLE NUMBER					
	2	3	4	5	6	7
MU4 CARDS INPUT THIS PROBLEM	1	0	6	0	0	0
COMPUTE OPTIONAL PAVEMENT STIFFNESS CONSTANTS (1=YES)						
OPTION TO SUPPRESS DETAILED OUTPUT (1=YES)						
OPTION TO PRINT PRIN STRESS INSTEAD OF MOM (1=YES)						

TABLE 2. CONSTANTS—UNITS MUST BE CONSISTENT.

MU4 INCREMENTS IN X DIRECTION	8
MU4 INCREMENTS IN Y DIRECTION	8
INCH LENGTH IN X DIRECTION	6.000E+00
INCH LENGTH IN Y DIRECTION	6.000E+00
POISSONS RATIO	2.500E-01
MODULUS OF ELASTICITY	0.
SLAB THICKNESS	9.788E-01
SUBGRADE MODULUS	0.

TABLE 3. SPECIFIED AREAS FOR SELECTED PLOTTED OUTPUT.

FROM THRU		PLOT (1=YES)			
		DEFL	X-MOMENT	Y-MOMENT	PRIN MOMENT
NONE					

TABLE 4. STIFFNESS AND LOAD DATA.

FROM	THRU	OX	OY	Q	S	C
0	0	3	6	6.250E+05	6.250E+05	-0.
1	0	7	6	6.250E+05	6.250E+05	-0.
0	1	8	7	6.250E+05	6.250E+05	-0.
1	1	7	7	6.250E+05	6.250E+05	-0.
4	4	4	4	-0.	-0.	-1.000E+05
1	1	8	8	-0.	-0.	-0.

TABLE 5. AXIAL THRUST DATA.

FROM THRU

PX

PY

NONE

TABLE 6. SPECIAL LOAD PATTERNS.

NONE

TABLE 7. PLACEMENTS OF SPECIAL LOAD PATTERNS.

NONE

PROGRAM SLA-30E C-E-L SPECIAL DECK-AHE-JJP.FLE REVISION DATE 07 SEP 70
 SAMPLE PROBLEMS TO DEMONSTRATE PROGRAM USE - 24 SEPT 70 - JJP.FLE.JLN
 CONTRACT DACA 23-70-C-0070 UNITS ARE LBS AND INCHES

PROB (CONT'D)
 SAC1 H A 3 REG

TABLE 8. RESULTS.

X MOMENT AND X TWISTING MOMENT ACT IN THE X DIRECTION (ABOUT Y AXIS).
 Y TWISTING MOMENT = -X TWISTING MOMENT. COUNTERCLOCKWISE BETA ANGLES
 ARE POSITIVE FROM X AXIS TO THE DIRECTION OF LARGEST PRINCIPAL MOMENT

X . Y	DEFL	X MOMENT	Y MOMENT	X TWISTING MOMENT	SUPPORT REACTION	LARGEST PRINCIPAL MOMENT	BETA X TO LARGEST
0 0	1.267E-16	7.190E-26	-1.233E-25	-1.584E+03	-1.267E+04	-1.584E+03	45.0
1 0	-2.275E-17	-3.390E-12	-2.976E-11	-3.013E+03	2.275E+03	-3.013E+03	45.0
2 0	-4.779E-17	-1.544E-11	-6.168E-11	-2.490E+03	4.779E+03	-2.490E+03	45.0
3 0	-7.350E-17	-3.047E-11	-1.233E-10	-1.480E+03	7.350E+03	-1.480E+03	45.0
4 0	-8.864E-17	-2.976E-11	-1.231E-10	-6.129E-10	8.864E+03	-6.912E-10	47.2
5 0	-7.350E-17	-3.047E-11	-1.233E-10	1.480E+03	7.350E+03	-1.480E+03	-45.0
6 0	-4.779E-17	-1.544E-11	-6.168E-11	2.490E+03	4.779E+03	-2.490E+03	-45.0
7 0	-2.275E-17	-3.390E-12	-2.976E-11	3.013E+03	2.275E+03	-3.013E+03	-45.0
8 0	1.267E-16	7.533E-26	-1.096E-25	1.584E+03	-1.267E+04	-1.584E+03	-45.0
0 1	-2.275E-17	-6.060E-11	-1.110E-11	-3.013E+03	2.275E+03	-3.013E+03	45.0
1 1	-1.216E-01	1.034E+03	1.034E+03	-5.773E+03	0.	6.807E+03	-45.0
2 1	-2.314E-01	2.297E+03	1.839E+03	-4.882E+03	0.	6.956E+03	-43.7
3 1	-3.124E-01	3.766E+03	2.209E+03	-3.016E+03	0.	6.102E+03	-37.8
4 1	-3.451E-01	4.766E+03	2.165E+03	-1.203E-09	0.	4.728E+03	-7.0
5 1	-3.124E-01	3.766E+03	2.209E+03	3.016E+03	0.	6.102E+03	37.8
6 1	-2.314E-01	2.297E+03	1.839E+03	4.882E+03	0.	6.956E+03	43.7
7 1	-1.216E-01	1.034E+03	1.034E+03	5.773E+03	0.	6.807E+03	45.0
8 1	-2.275E-17	4.734E-11	1.589E-11	3.013E+03	2.275E+03	3.013E+03	45.0
0 2	-4.779E-17	-6.168E-11	-1.544E-11	-2.490E+03	4.779E+03	-2.490E+03	45.0
1 2	-2.314E-01	1.839E+03	2.297E+03	-4.882E+03	0.	6.956E+03	-46.3
2 2	-4.433E-01	4.251E+03	4.251E+03	-4.449E+03	0.	8.700E+03	-45.0
3 2	-6.063E-01	7.466E+03	5.362E+03	-3.155E+03	0.	9.759E+03	-35.8
4 2	-6.750E-01	1.066E+04	5.347E+03	-1.203E-09	0.	1.028E+04	-7.0
5 2	-6.063E-01	7.466E+03	5.362E+03	3.155E+03	0.	9.759E+03	35.8
6 2	-4.433E-01	4.251E+03	4.251E+03	4.449E+03	0.	8.700E+03	45.0
7 2	-2.314E-01	1.839E+03	2.297E+03	4.882E+03	0.	6.956E+03	46.3
8 2	-4.779E-17	3.063E-11	7.688E-12	2.490E+03	4.779E+03	-2.490E+03	45.0
0 3	-7.350E-17	-1.233E-10	-3.047E-11	-1.480E+03	7.350E+03	-1.480E+03	45.0
1 3	-3.124E-01	2.209E+03	3.766E+03	-3.016E+03	0.	6.102E+03	-52.2
2 3	-6.063E-01	5.362E+03	7.466E+03	-3.155E+03	0.	9.759E+03	-54.2
3 3	-9.459E-01	1.066E+04	1.066E+04	-3.016E+03	0.	1.370E+04	-45.0
4 3	-9.623E-01	1.810E+04	1.177E+04	-8.769E-10	0.	1.810E+04	-7.0
5 3	-9.459E-01	1.066E+04	1.066E+04	3.016E+03	0.	1.370E+04	45.0
6 3	-6.063E-01	5.362E+03	7.466E+03	3.155E+03	0.	9.759E+03	54.2
7 3	-3.124E-01	2.209E+03	3.766E+03	3.016E+03	0.	6.102E+03	52.2
8 3	-7.350E-17	3.047E-11	1.579E-11	1.480E+03	7.350E+03	1.480E+03	45.0

0	4	-4.874E-17	2.620E-13	1.051E-12	-2.313E-11	4.864E+03	2.379E-11	-45.5
1	4	-3.451E-01	2.175E+03	4.720E+03	-1.385E-10	0.	4.720E+03	-40.0
2	4	-5.750E-01	5.447E+03	1.024E+04	-5.049E-10	0.	1.020E+04	-90.0
3	4	-9.623E-01	1.177E+04	1.810E+04	-9.252E-10	0.	1.810E+04	-90.0
4	4	-1.13E+00	3.056E+04	3.056E+04	-4.626E-10	0.	3.056E+04	-45.0
5	4	-9.623E-01	1.177E+04	1.810E+04	2.313E-10	0.	1.810E+04	90.0
6	4	-6.750E-01	5.347E+03	1.020E+04	6.708E-10	0.	1.020E+04	90.0
7	4	-3.451E-01	2.165E+03	4.720E+03	7.464E-10	0.	4.720E+03	90.0
8	4	-8.804E-17	2.470E-10	6.273E-11	2.544E-10	4.864E+03	4.254E-10	35.0
0	5	-7.350E-17	9.101E-14	3.672E-13	1.480E+03	7.350E+03	1.480E+03	45.0
1	5	-3.127E-01	2.209E+03	3.766E+03	3.016E+03	0.	6.102E+03	52.2
2	5	-6.063E-01	5.302E+03	7.486E+03	3.155E+03	0.	9.759E+03	54.2
3	5	-3.451E-01	1.005E+04	1.008E+04	3.016E+03	0.	1.370E+04	45.0
4	5	-9.623E-01	1.810E+04	1.177E+04	3.701E-10	0.	1.810E+04	.0
5	5	-8.457E-01	1.008E+04	1.008E+04	-3.016E+03	0.	1.370E+04	-45.0
6	5	-6.063E-01	5.302E+03	7.486E+03	-3.155E+03	0.	9.759E+03	-54.2
7	5	-3.127E-01	2.209E+03	3.766E+03	-3.016E+03	0.	6.102E+03	-52.2
8	5	-7.350E-17	-1.849E-10	-4.569E-11	-1.480E+03	7.350E+03	-1.480E+03	45.0
0	6	-4.779E-17	-6.108E-11	-1.544E-11	2.490E+03	4.779E+03	-2.490E+03	-45.0
1	6	-2.314E-01	1.839E+03	2.297E+03	4.842E+03	0.	6.956E+03	46.3
2	6	-4.433E-01	4.251E+03	4.251E+03	4.449E+03	0.	8.700E+03	45.0
3	6	-6.063E-01	7.486E+03	5.302E+03	3.155E+03	0.	9.759E+03	35.8
4	6	-6.750E-01	1.020E+04	5.347E+03	1.365E-09	0.	1.020E+04	.0
5	6	-6.063E-01	7.486E+03	5.302E+03	-3.155E+03	0.	9.759E+03	-35.8
6	6	-4.433E-01	4.251E+03	4.251E+03	-4.449E+03	0.	8.700E+03	-45.0
7	6	-2.314E-01	1.839E+03	2.297E+03	-4.842E+03	0.	6.956E+03	-46.3
8	6	-4.779E-17	-1.234E-10	-3.086E-11	-2.490E+03	4.779E+03	-2.490E+03	45.0
0	7	-2.275E-17	-6.060E-11	-1.110E-11	3.013E+03	2.275E+03	-3.013E+03	-45.0
1	7	-1.216E-01	1.034E+03	1.034E+03	5.773E+03	0.	6.807E+03	45.0
2	7	-2.314E-01	2.297E+03	1.839E+03	4.842E+03	0.	6.956E+03	43.7
3	7	-3.127E-01	3.766E+03	2.209E+03	3.016E+03	0.	6.102E+03	37.8
4	7	-3.451E-01	4.720E+03	2.165E+03	1.711E-09	0.	4.720E+03	.0
5	7	-3.127E-01	3.766E+03	2.209E+03	-3.016E+03	0.	6.102E+03	-37.8
6	7	-2.314E-01	2.297E+03	1.839E+03	-4.842E+03	0.	6.956E+03	-43.7
7	7	-1.216E-01	1.034E+03	1.034E+03	-5.773E+03	0.	6.807E+03	-45.0
8	7	-2.275E-17	-7.602E-11	-1.495E-11	-3.013E+03	2.275E+03	-3.013E+03	45.0
0	8	-1.267E-16	-4.109E-20	-2.414E-25	1.584E+03	-1.267E+04	-1.584E+03	-45.0
1	8	-2.275E-17	-3.037E-11	-1.377E-10	3.013E+03	2.275E+03	-3.013E+03	-45.0
2	8	-4.779E-17	-4.620E-11	-1.850E-10	2.490E+03	4.779E+03	-2.490E+03	-45.0
3	8	-7.350E-17	-3.047E-11	-1.233E-10	1.480E+03	7.350E+03	-1.480E+03	-45.0
4	8	-8.864E-17	-2.979E-11	-1.231E-10	8.864E-10	8.864E+03	-9.682E-10	-46.5
5	8	-7.350E-17	-1.505E-11	-6.159E-11	-1.480E+03	7.350E+03	-1.480E+03	45.0
6	8	-4.779E-17	-2.347E-14	-5.867E-15	-2.490E+03	4.779E+03	-2.490E+03	45.0
7	8	-2.275E-17	1.203E-11	3.192E-11	-3.013E+03	2.275E+03	3.013E+03	-45.0
8	8	1.267E-16	3.424E-26	-6.848E-26	-1.584E+03	-1.267E+04	-1.584E+03	45.0

X	Y	DEFL	A MOMENT	Y MOMENT	X TWISTING MOMENT	SUPPORT REACTION	LARGEST PRINCIPAL MOMENT	BETA X TO LARGEST
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STATICS CHECK.

SUMMATION OF REACTIONS = 1.000E+05

TIME FOR THIS PROBLEM = 0 MINUTES 1.557 SECONDS

ELAPSED TIME = 0 MINUTES 46.509 SECONDS

PROGRAM: SERIES E CFPL SPECIAL DECK-ARE-JJP.FLE: REVISION DATE 07 SEP 70
SAMPLE PROBLEMS TO DEMONSTRATE PROGRAM USE - 24 SEPT 70 - JJP.FLE+JLH
CONTRACT DACA 23-70-C-0076 UNITS ARE LBS AND INCHES

ELAPSED TIME = 0 MINUTES 46.524 SECONDS

***THIS SERIES OF PROBLEMS WAS RUN USING A PROGRAM DEVELOPED FOR THE
TRANSPORTATION FACILITIES BRANCH,
DEPARTMENT OF THE ARMY,
CONSTRUCTION ENGINEERING RESEARCH LABORATORY,
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BY

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REFERENCES

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