A COMPUTER PROGRAM TO ANALYZE BENDING OF BENT CAPS

by

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Research Report Number 56-2

Development of Methods for Computer Simulation
of Beam-Columns and Grid-Beam and Slab Systems

Research Project 3-5-63-56

conducted for

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by the

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PREFACE

This report is one of a series of developments planned to facilitate the use of computers in the analysis of highway bridge structures. It specifically concerns a computer program for the bending analysis of bent caps.

The development of this program began in June 1963 under sponsorship of the Texas Highway Department, Research Project 3-5-63-56, in cooperation with the U. S. Department of Commerce, Bureau of Public Roads. A preliminary report on basic concepts was furnished the Texas Highway Department in December 1963 for a period of trial use. Following this period of trial use, revisions were made to the program based on comments and criticisms of the users. In March 1964 a version of the program was furnished to the Texas Highway Department for use on their CDC 1604A computer. Further comments from the users have resulted in the present program.

Although the program is written for the CDC 1604 computer, it is in FORTRAN language and only very minor changes would be required for it to be compatible with IBM 7090 systems. Duplicate copies of the program deck and test data cards for the example problems in this report may be obtained from the Center for Highway Research at The University of Texas.

The cooperation and support of Texas Highway Department personnel are gratefully acknowledged. Particular thanks are given to Mr. Larry G. Walker who has acted as project contact representative and has provided much helpful advice. The use of the computer and facilities of The University of Texas Computation Center is also gratefully acknowledged. A library subroutine written by the Computation Center Staff is used to operate the digital plotter used in conjunction with this program.

LIST OF REPORTS

Report No. 56-1, "A Finite-Element Method of Solution for Linearly Elastic Beam-Columns" by Hudson Matlock and T. Allan Haliburton, presents a finite-element solution for beam-columns that is a basic tool in subsequent reports.

Report No. 56-2, "A Computer Program to Analyze Bending of Bent Caps" by Hudson Matlock and Wayne B. Ingram, describes the application of the beam-column solution to the particular problem of bent caps.

Report No. 56-3, "A Finite-Element Method of Solution for Structural Frames" by Hudson Matlock and Berry Ray Grubbs, describes a solution for frames with no sway.

Report No. 56-4, "A Computer Program to Analyze Beam-Columns under Movable Loads" by Hudson Matlock and Thomas P. Taylor, describes the application of the beam-column solution to problems with any configuration of movable non-dynamic loads.

Report No. 56-5, "A Finite-Element Method for Bending Analysis of Layered Structural Systems" by Wayne B. Ingram and Hudson Matlock, describes an alternating-direction iteration method for solving two-dimensional systems of layered grids-over-beams and plates-over-beams.

Report No. 56-6, "Discontinuous Orthotropic Plates and Pavement Slabs" by W. Ronald Hudson and Hudson Matlock, describes an alternating-direction iteration method for solving complex two-dimensional plate and slab problems with emphasis on pavement slabs.

Report No. 56-7, "A Finite-Element Analysis of Structural Frames" by T. Allan Haliburton and Hudson Matlock, describes a method of analysis for rectangular plane frames with three degrees of freedom at each joint.

Report No. 56-8, "A Finite-Element Method for Transverse Vibrations of Beams and Plates" by Harold Salani and Hudson Matlock, describes an implicit procedure for determining the transient and steady-state vibrations of beams and plates, including pavement slabs.

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ABSTRACT

The problem of analyzing the cap of a highway bridge bent is handled by digital computer simulation. The solution is based on the beam-column method described in detail in Reference 1.

Any particular problem is solved in three phases. The first phase determines initial curves of bending moment and shear from dead loads only. The second phase applies a single movable load and expands the initial curves to positive and negative envelopes as this load is moved according to instructions from the user. The third phase duplicates the movable load configuration at the proper location in as many lanes as required to produce maximums of each design variable at each design-control point.

The program has numerous optional features including the ability to solve caps that are skewed, the ability to retain data or certain results from problem to problem, as well as the ability to give automatically plotted envelopes of maximums.

Three example solutions of one problem illustrate the various capabilities and uses of the program, including input data techniques and program control options.

NOMENCLATURE

Symbol	Typical Units	Definition
E	$kips/ft^2$	Modulus of elasticity
F	$kip\text{-}ft^2$	Flexural stiffness = EI
h	ft	Increment length
h_n	ft	Normal value of increment length
h_s	ft	Skewed value of increment length
i	-	Station number
I	ft^4	Moment of inertia of the cross section
Q	kips	Concentrated applied transverse load
θ	degrees	Skew angle of cap

CHAPTER 1. INTRODUCTION

In the design of highway bridge structures, prescribed configurations of live load are placed on the structure in such locations that maximum stresses are reached at each of many critical points. To analyze complete structures or structural systems under all possible loading conditions is at present a hopelessly complex and time-consuming problem. In current design practice it is therefore necessary (1) to make some severe simplifications in the structure and in the way the loads are transferred, so that a piecemeal analysis may be performed, and (2) to reduce the complexity of loadings by the application of considerable individual judgment. Even with these short-cuts, a great amount of effort is still required by manual methods.

As initial steps in overcoming some of the difficulties, two computer programs have been developed.

(1) The BMCOL program (Ref 1) is a finite-element representation of a beam-column that may be subjected to continuous or freely discontinuous loads and restraints. The approach constitutes direct numerical simulation of the physical system in the digital computer.

(2) The CAP program uses a simplified adaptation of the BMCOL method to analyze the bending of a highway bridge bent cap under various controlled loading situations.

The purpose of this report is to describe the CAP program. Sufficient detail is included so that the uninitiated user may understand the workings of the program and may apply it to problems of design. Three example solutions are included which illustrate some of the various uses of the program and its optional features.

CHAPTER 2. EXPLANATION OF METHOD

Computer Representation of Bent Cap

A wide variety of beam-column problems can be represented in the computer in accordance with the basic BMCOL method described in Ref 1. The more conventional case of a beam on simple supports with varying stiffness and with distributed and concentrated loads would be represented in the method as shown in Fig 1a. The beam is divided into many increments of equal length h .

Figure 1b shows one station along the beam as it is approximated in the computer. The flexural stiffness EI (the product of the modulus of elasticity and the moment of inertia of the beam, which will hereafter be designated by the term F) is represented at each station by a spring-restrained hinge. All stiffness and load values are applied only at station points and may vary in a freely discontinuous manner along the beam.

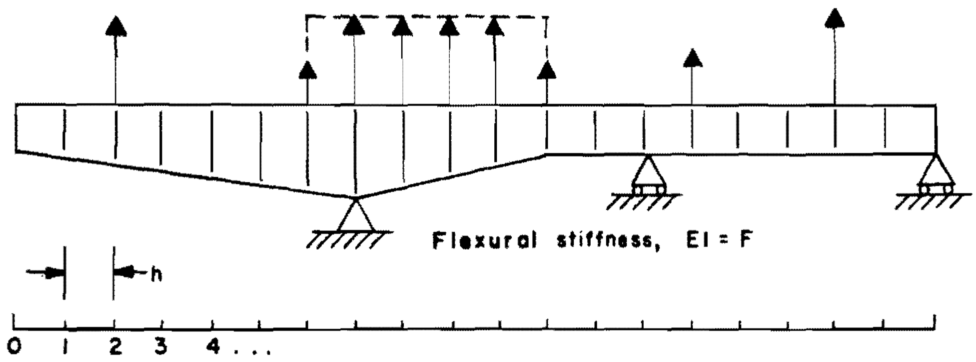
Figure 2a shows a generalized bent cap, simplified so that loads are transmitted through a slab and stringer system in accordance with current design practice. The structure is purposely shown somewhat distorted to illustrate generality. The supports are represented by knife-edges. The ends of the cap need not be at the zero station number nor at the last station number. They are not specifically designated but are established only by proper input of stiffness values; hinges or points of zero bending stiffness are automatically assumed at all stations beyond each end of the cap.

On the cap are stringers and the roadway slab rests in turn on the stringers. The slab may have curbs and a median and may be divided into lanes, usually according to AASHO design specifications (Ref 2). Simple-span distribution of slab loads is accomplished by the assumption of a hinge in the slab at each interior stringer.

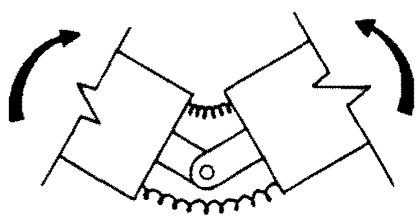
Caps may be skewed with respect to the roadway centerline.

Sign Conventions and Units

Upward deflections and upward loads are considered to be positive in accordance with the BMCOL method. Thus in the normal usage of the CAP program,



(a)



(b)

Fig 1. Finite-element representation of a beam. (a) Beam on simple supports, with varying flexural stiffness plus distributed and concentrated loads. (b) Flexural stiffness of the real beam is approximated at each station as a spring-restrained hinge.

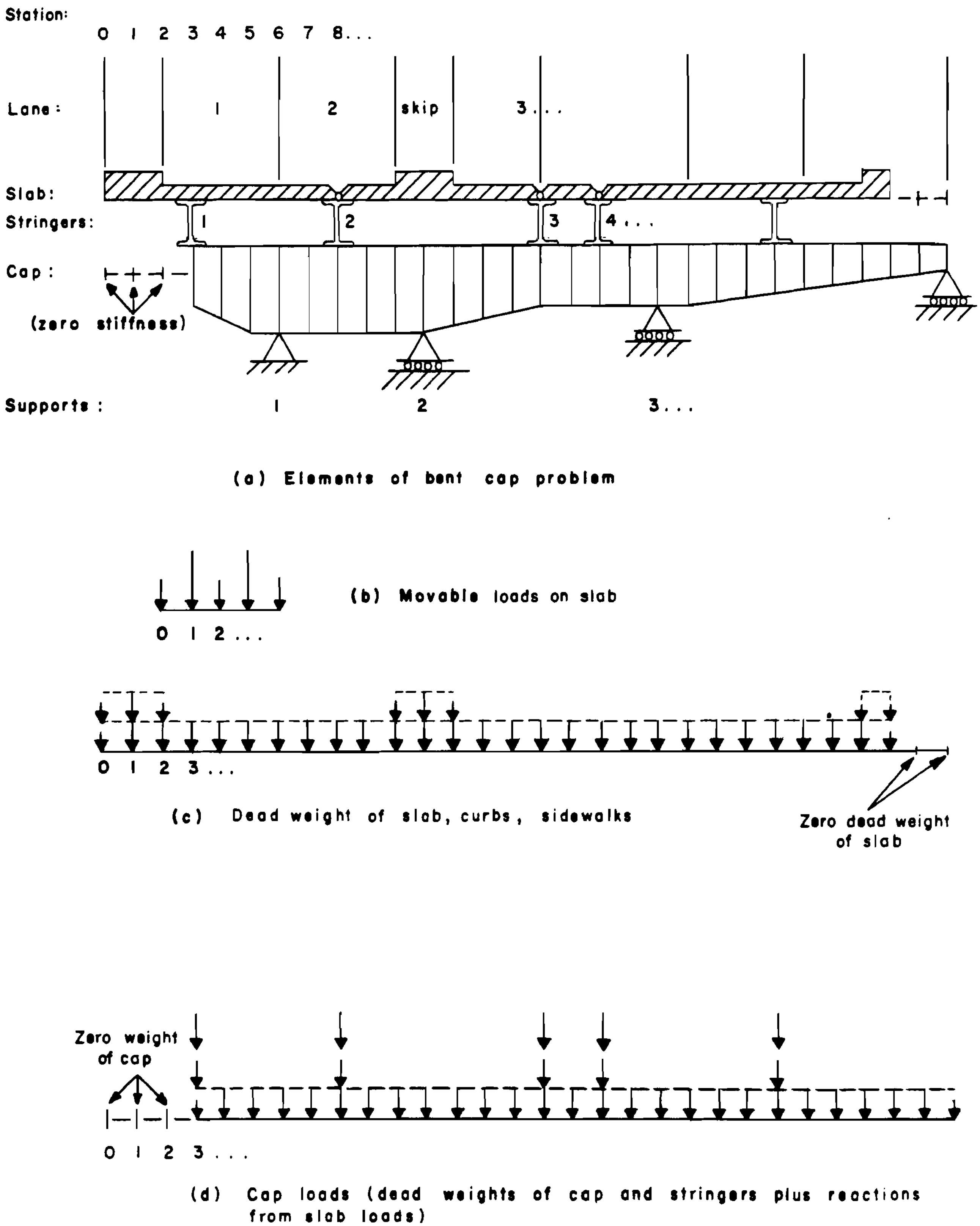


Fig 2. Representation of bent cap and loads.

downward loads have a negative sign.

Units of kips and feet have been adopted for the program. The user must conform to this system. All distances along the cap must be in roadway-width dimensions (normal to the roadway centerline). The input skew angle must be in degrees and decimals of degrees.

Loadings

The loads on the cap are of two types.

(1) Dead loads are developed directly from the dead weight of the stringers and from the dead weight of the cap itself.

(2) Reactions occur on the cap at the stringer locations from simple-span distribution of slab loads. These slab loads consist of dead weight of the slab, curbs, sidewalks and medians plus live loads that can be moved to represent traffic loadings.

All of the slab loads are transferred by simple-span distribution to the stringers and thence to the cap. If there are no stringers, the slab rests directly on the cap and the loads are transferred station-by-station directly to the cap.

The movable load may be any desired configuration or combination of distributed or concentrated loads. Figure 2b shows one possible movable-load configuration. The stations for the movable load are completely independent of the fixed stations along the slab or cap except that the spacing must be the same for both stationing systems.

A range of movement for the movable load is specified by (1) a start station on the slab where the zero station of the movable load is first placed and (2) a stop station which is the last station on the slab where the zero station of the movable load is to be placed.

The positioning of the movable load within the range of movement may be controlled by specifying the number of increments between each successive position of the movable load. A solution of the cap is made for each such position of the movable load. For this initial series of loadings and solutions, all medians and lane boundaries are disregarded.

Subsequently, in the usual operation of the program, the movable-load configuration is automatically duplicated in several appropriate lanes as may be required to develop critical design conditions. The process is described in the following sections.

Figure 2c shows the dead weights of the slab, curbs, sidewalks, and medians. Figure 2d shows the dead weights of the cap and stringers together with the forces transmitted to the cap from the slab.

Computer Representation of Skew

Regardless of the angle of skew of the bent, all values of load and stiffness are input to the computer in terms of roadway-width dimensions and in quantities per station, as if the cap were normal to the roadway in Fig 3a. In Fig 3b a corresponding cap is shown that has been skewed through an angle θ. Although distances along the cap will vary with skew angle, in accordance with the increase in increment length from the normal value h_n to the skewed value h_s, the number of stations will not change.

The program internally adjusts only two items to properly represent skewed caps: the increment length and the correspondingly increased distributed dead weight of the cap expressed in kips per station. Both are increased in inverse proportion to cos θ.

In essence, the cap is skewed but the roadway is not. Regardless of skew, loads from the slab are transmitted at the same station points. The only increase in load is that associated with the increase in dead weight of the cap itself. Concentrated loads applied in the input data directly to the cap are not affected, but all distributed loads directly designated as cap loads in the input data are assumed to represent dead weight of the cap and are therefore adjusted. When all loads finally have been stored in the computer at all appropriate stations, the solution for bending of the cap proceeds using the skewed increment length. The effect on bending moments is then properly reflected in the computed results.

Program Operations

The CAP program is guided by design-control variables (moment, shear, and reaction), by design-control points designated by the user (for moment and shear), and by certain loading options. Each support is automatically a design-control point for reaction.

In the usual application of the program, AASHO-type multiple-lane loads will be arranged to produce maximum and minimum values of each design-control variable

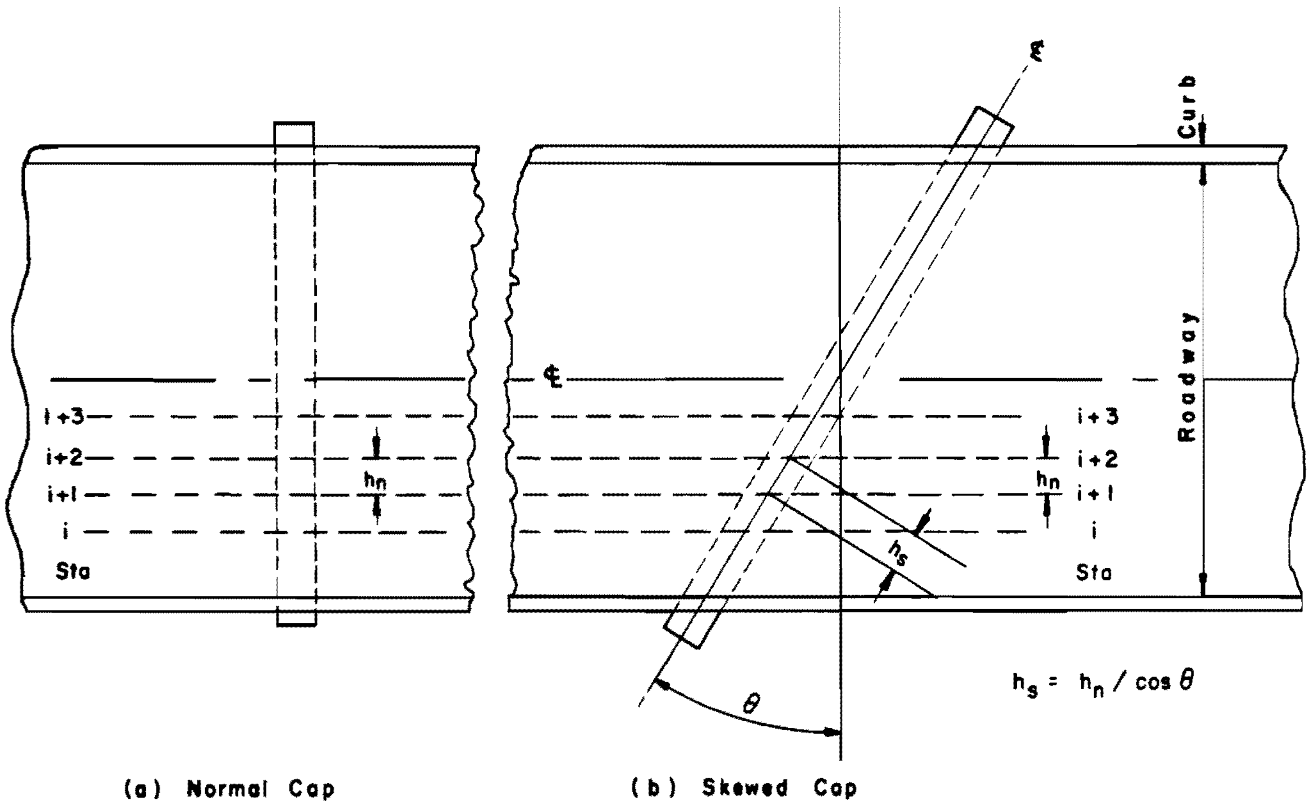


Fig 3. Computer representation of skew.

at each design-control point.

The effects of various dead and live loadings are not obtained separately and then superposed. Instead, each individual BMCOL-type solution constitutes a separate computer simulation of a complete structural system, including all dead and live loads that may be acting at the time.

After a solution is performed with each specific pattern of loads, the resulting design variables (bending moment, shear and support reactions) are compared at every station with the previous maximum and minimum values at that station. Whenever a new value is found that is more extreme than that retained from previous solutions, the new value replaces the old one. The resulting tabulations constitute envelopes of maximum positive and maximum negative effects at each station that have been progressively developed by the complete history of prior loadings. As shown in the simplified flow chart in Fig 4, a complete study for design of a bent cap is accomplished in three principal phases:

Phase 1. Determination of the initial envelopes of moment and shear from a single solution considering only the dead loads of the system.

Phase 2. Expanding of the envelopes due to effects of dead load plus the single movable load as it is shifted from position-to-position across the slab.

Phase 3. Duplication of the movable-load configuration simultaneously in the appropriate number of lanes to produce the maximum of each design-control variable at each design-control point.

For each critical pattern of multiple-lane loading that is established by the program the following operations are performed in Phase 3.

(1) The movable load is duplicated at the proper location in each of the appropriate lanes.

(2) The appropriate live-load reduction factors (specified by the user, but usually in accordance with AASHO recommendations) are applied.

(3) The dead weights of slab, stringers and cap are added.

(4) A BMCOL-type solution is performed.

(5) The computed results at each station are compared against previously stored maximum and minimum values and in each case the more extreme value is retained.

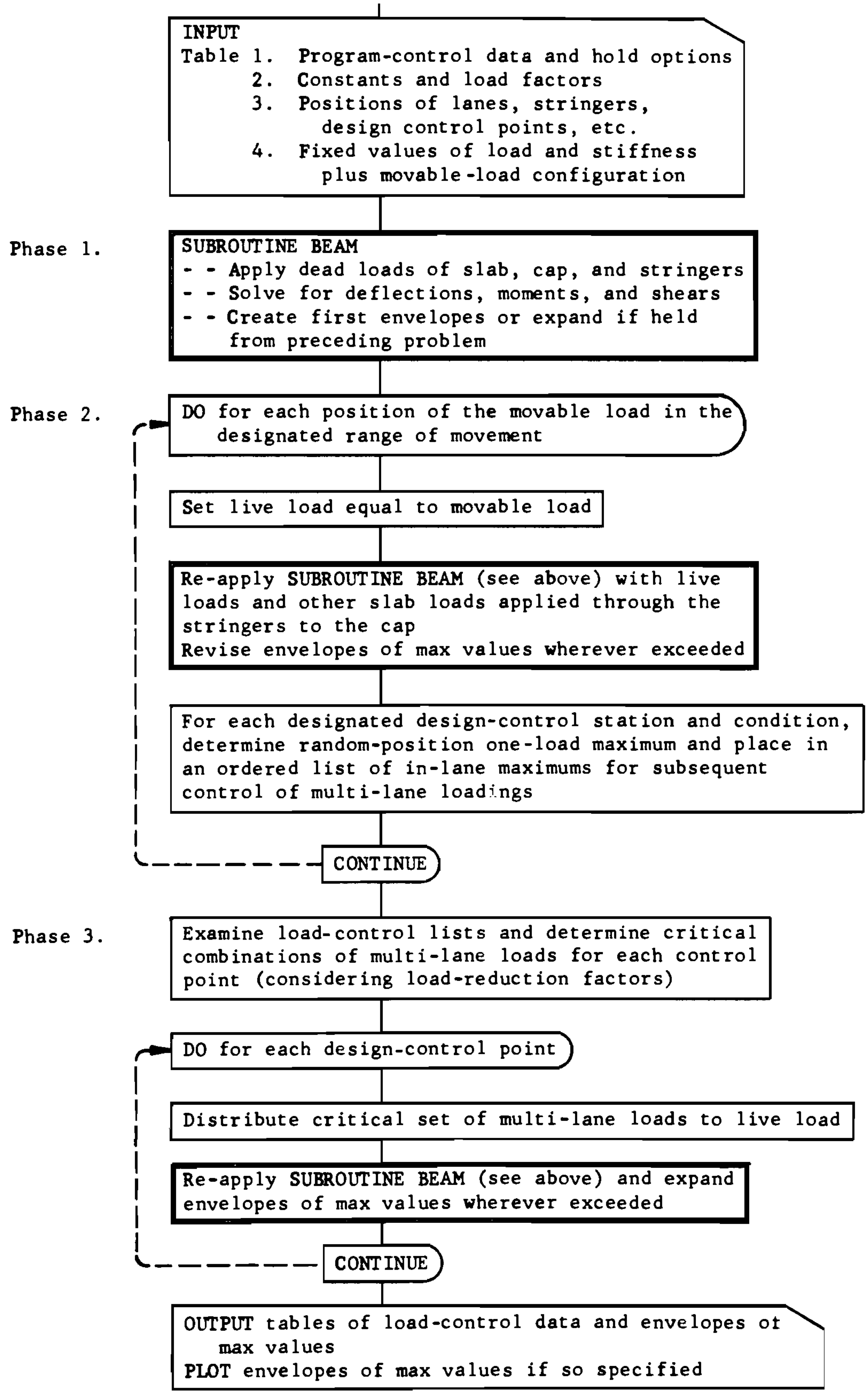


Fig 4. General flow diagram for program CAP 14.

Results Produced by the Program

Both input and output data are arranged and designated in terms of table numbers. Input data are always printed out in four tables which precede the computed results. The usual results of the program include

(1) Table 5, a summary of movable-load effects;

(2) Table 6, envelopes of extreme values of moment and shear;

(3) Table 7, extreme values of reaction at each control point;

(4) Table 8, scales used for automatic plots; plus

(5) automatically plotted envelopes of moment and shear.

Included in the movable loading summary in Table 5 is the lane and station number of each significant lane load, arranged in the table in order of the magnitude of the contribution of that lane load to the corresponding moment or shear value. The one most critical loading combination also is indicated. Data in this table are used by the program internally to control the multiple-lane loadings of Phase 3.

A number of options are available for control and operation of the program which allow various loadings to be considered separately and may result in some variation from the usual patterns described above. Details are given in the next chapter and are subsequently illustrated by three variations of an example problem. Included are options that allow the user to exclude either out-of-lane or in-lane loading effects as well as to retain input data and computed results for use in sequences of similar problems.

CHAPTER 3. DESCRIPTION OF CAP PROGRAM

The specific version of the CAP program that is described in this report is designated as CAP 14. The number indicates only that this version is the fourteenth significant revision in development of the program. It is to be expected that future developments will yield additional modifications.

The complete and detailed flow diagram for CAP 14 is shown in App 1. Appendix 1.1 is similar to Fig 4 and is included as a guide to the remainder of the flow diagram. The flow diagram is annotated at appropriate points to aid in understanding the program.

The program is written in FORTRAN-63 language for the Control Data Corporation 1604 and 1604A computers. With only minor changes it should be compatible with the IBM 7090-94 systems. Appendix 2 consists of a list of FORTRAN notation used and a complete listing of the program is in Appendix 3. One binary subroutine is included for plotting purposes. Storage requirement is approximately fourteen thousand words and the compile time is approximately two minutes and 30 seconds.

A guide for filling out coding forms is given at the end of this chapter of the report. It is designed so that additional copies may be furnished as separately bound extracts to be used in routine analysis with the program. Understanding of many of the following comments will be facilitated by a parallel study of the guide.

Standard Features of the CAP Program

Input of load, stiffness, and position data to the program is normally done according to station numbers. One exception is that stringer locations may be specified optionally in tenths of stations. This exception is discussed under optional features. It is permissible to use up to three hundred increments, ten lanes, twenty supports, thirty stringers, thirty design points for moment and thirty design points for shear. Each support is automatically a design point for reaction. There is a maximum number of five multiple-lane load-reduction factors and the solution is limited to five or fewer simultaneous lane loads. The load-reduction factors are left to the discretion of the user but ordinarily will be in accordance with AASHO recommendations (Ref 2).

The ends of the slab and cap are not defined except by stiffness and load data. Overhangs of cap or slab are permissible but no load should be entered, or held from a preceding problem, which would cause a force to be applied directly to the cap at the first station beyond either end of the real cap. The zero station for a problem usually should be the left-most extension of either the cap or the slab.

All loads and flexural stiffness values are stored at station points; provision is made for the program to distribute values to storage based on linear interpolation between input values. The cap stiffness values and various types of loads are algebraically added into storage at each designated station. Therefore, superposition of data can be done merely by adding more data into storage or subtracting data from storage.

Reactions from slab loads are transmitted to the cap at the stringer locations unless the optional feature for fractional stringer stations is used. If this option is used, the transmitted load will be proportionally split to each station adjacent to the fractional station. If dead load of any stringer is included, it must go in at even stations. Thus, if the fractional stringer station option is used, the stringer dead load must be proportioned by the user and input as a load at each of the two adjacent stations.

In CAP 14, solutions are done for every position of the movable load in the designated range of movement regardless of lane boundaries or medians. For purposes of studying only non-lane loadings, the user may specify a movable load wider than a lane provided that he also specifies that the number of lanes is zero and therefore that no conventional in-lane loadings are to be done.

Optional Features

There are several options which the user may apply at his discretion and for his particular needs. The principal options are as follows:

(1) Hold Envelopes. The envelopes of maximums may be retained from problem to problem in order to study cumulative effects of various loading situations. The envelopes will be appropriately expanded when a new maximum or minimum is encountered. Regardless of whether the envelopes are held or not, the multi-lane loading summary and control table is cleared for each new problem and therefore reflects only the movable load effects for the immediate problem considered.

(2) Data Hold. Table 1 controls the input of data and includes options for holding data or results from the preceding problem. It therefore must be input anew for each problem. Any number of problems may be worked as one run and the hold options enable very economical saving and reuse of data. Tables 2 and 3, giving constants and lists of stations, may be fully retained from the preceding problem or otherwise must be fully input. The load and stiffness data of Table 4 may be retained and modified if desired by additions or subtractions in subsequent problems since all data in Table 4 are algebraically summed into storage at each designated station. Any number of cards may be used in this table.

(3) Clear Envelopes. The envelopes of maximum and minimum design variables that are produced in Phase 2 by the single movable load may be erased prior to any multiple-lane loadings. The single movable-load option is a design condition which is usually considered by the Texas Highway Department. This allows a single movable load (truck) to be placed anywhere on the structure and not within the AASHO specified lane boundaries. The multiple-lane loading summary table would exhibit the appropriate results from all loadings but the envelopes would be from only the initial dead load solution of Phase 1 and the AASHO-type multiple-lane loading patterns of Phase 3.

(4) Plot Envelopes. This option is used to cause the envelopes of maximum and minimum moment and shear to be plotted versus distance along the cap. Engineering scales are internally generated to produce the best plot of moment or shear in a 4-inch by 10-inch space. Design-control points are also plotted as well as the identifying problem number. The scales are included in the printed output as Table 8.

(5) Table 5 Skip. This option allows suppression of printing the multiple-lane loading summary table. No computational advantage is gained through omission of this table; however, numerous pages of output can be saved from each problem. It is important that each user understand fully how the envelopes of maximums are created before arbitrarily electing to omit this information. Table 5 is the only source of this information.

(6) Skew. The skew capabilities have been previously described. If no skew angle is specified, zero degrees is assumed. To solve a series of similar caps for a given structure, all data may be retained with only the value of skew angle being changed from problem to problem. If the option to hold envelopes is used, the skew angle must not be changed.

(7) Movable-Load Incrementation. The positioning of the single movable load in Phase 2 of the cap solution may be controlled by specifying the number of increments between successive positions of the zero station of the movable load. This has the advantage of reducing computation time. If the bent cap is divided into a large number of increments (of very small size), this feature may be important. However, an extended period

of use of the BMCOL method has indicated that rarely is an increment length of less than one foot justified and virtually never less than one-half foot and then this feature need not be used. (The user may need to satisfy himself on this point by running trial solutions and it is strongly recommended that he do so.) It should be understood that in developing the critical multiple-lane loading patterns, the only load positions considered are those actually used in the Phase 2 loadings.

(8) Load Reduction Factors. The lane-load reduction factors may be anything desired by the user. It is expected that they usually will be in accordance with AASHO recommendations.

(9) Stringer Load Splitting. Stringers are normally specified exactly at stations. They may be specified optionally at the nearest one-tenth of an increment. A noticeable discrepancy in results may occur when a concentrated load, such as a stringer reaction, is improperly placed due to the increment spacing not precisely fitting the stringer positions. Reducing the increment size to match the stringer spacing is a solution, but may cause an unreasonable increase in computation time. To reduce both of these effects, stringer locations may be specified to the nearest one-tenth of an increment and the program automatically splits the stringer reaction in inverse proportion to the distances from the two adjacent stations. If this feature is employed, the user must proportion any dead load of the stringer and input it at the two adjacent stations on the cap. The program will not automatically split the dead load of the stringer itself.

Limitations

There are several things which CAP 14 will not do. A one-legged bent cannot be solved nor should the user attempt to specify two completely separated slabs on the same cap. Impact effects are not directly separated from those of static load, but it is permissible to run one problem with live load only and then one problem with live load plus impact to obtain the desired results.

CAP 14 does not output any of the deflections computed for the cap. Moment and shear diagrams from any particular loading are not directly available, but can be obtained in the form of identical maximum and minimum envelopes if a problem is arranged so that there is only one loading pattern considered. Where such results are desired, the BMCOL program normally should be used.

There is an arbitrary exclusion in the multiple-lane loading summary table of any contribution less than $\pm$ 0.001 ft-kips of moment or $\pm$ 0.001 kips of shear or reaction.

Error Messages

It is possible to get eight error messages from the main program of CAP 14 and three error messages from Subroutine BEAM. The main program gives error messages when

(1) non-zero Table 4 data is specified or held from the preceding problem beyond the end of the cap (the problem is abandoned),

(2) a movable load wider than a lane is specified and the number of lanes is not zero (the problem is abandoned),

(3) lanes are specified which overlap each other (the problem is abandoned),

(4) the design-variable values in the plot-control routine are beyond the range of the routine from $\pm 1.0 \times 10^{-100}$ to $\pm 1.0 \times 10^{100}$ (the problem is abandoned),

(5) a design-control point for shear is specified within one station of a concentrated load (the program will ignore the erroneous design-control point and continue with the problem),

(6) the number of increments between successive positions of the single movable load is left blank or is specified as zero (the program will assume a value of 1 and continue with the problem),

(7) data is retained from a problem in which an error occurred (the program continues to search until an independent problem is found), or

(8) a malfunction has occurred to cause the program to take one of several paths for which specific error messages are not provided (the problem is abandoned).

The Subroutine BEAM gives error messages when

(1) only one stringer is specified (the problem is abandoned),

(2) load is placed at any hinge location or point of zero bending stiffness (the problem is abandoned), or

(3) a malfunction has occurred to cause the program to take one of several paths for which specific error messages are not provided (the problem is abandoned).

When a problem is abandoned, the program begins to search through the remaining data cards until a new problem designation is encountered. If the new problem is found to be completely independent from the erroneous problem (no hold-options exercised) a new solution will be started; otherwise, another new problem will be sought. It is partly for this purpose that the problem designation is repeated on every data card as shown in the input forms. The general arrangement allows any number of problems from any number of users to be stacked for running in sequence. It reduces the danger that errors by one user will delay completion of subsequent sets of problems.

Guide for Data Input

On the following pages a condensed guide is given for preparing input data for the program. It is intended that separate copies be furnished for convenience in routine use.

One basic example problem is discussed in the next chapter. Three variations of the problem are solved to aid in learning to use the input data forms and to illustrate a variety of coding situations. Input and output listings for the examples are given in App 4 and App 5 and should be used to check practice coding.

GUIDE FOR DATA INPUT FOR CAP 14

with Supplementary Notes

extract from

A COMPUTER PROGRAM TO ANALYZE BENDING OF BENT CAPS

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Hudson Matlock and Wayne B. Ingram

1 October 1966

PROGRAM CAP 14 GUIDE FOR DATA INPUT --- Card forms

IDENTIFICATION OF PROBLEM (2 cards each problem; program stops if Prob designation is left blank)

Field	Columns
Prob	5–9
Description of problem (alphanumeric)	16–80

Field	Columns
Prob	5–9
Additional description of problem (alphanumeric)	16–80

TABLE 1. PROGRAM-CONTROL DATA (1 card each problem)

Field	Columns
Prob	5–9
Enter "1" to hold from preceding problem: Envelopes	20
Enter "1" to hold from preceding problem: Table 2	25
Enter "1" to hold from preceding problem: Table 3	30
Enter "1" to hold from preceding problem: Table 4	35
Num cards this prob: Table 2	36–40
Num cards this prob: Table 3	41–45
Num cards this prob: Table 4	46–50
Enter "1" to clear envelopes of maximum values prior to multi-lane loading.	55
Enter "1" to plot envelopes.	60
Enter "-1" to omit Table 5 from printed output.	61–65
Skew Angle	71–80

TABLE 2. CONSTANTS (2 cards unless data held from preceding problem)

Field	Columns
Prob	5–9
Num Incrs	16–20
Increment Length	21–30
Movable-Load Data: Num Incrs	36–40
Movable-Load Data: Start Sta	41–45
Movable-Load Data: Stop Sta	46–50
Number of increments per shift of movable load	51–55

Field	Columns
Prob	5–9
Max Num Lane Loads	16–20
Load-reduction factors according to number of lanes loaded: 1	21–30
2	31–40
3	41–50
4	51–60
5	61–70

TABLE 3. LISTS OF STATIONS (number of cards must be entered in Table I as either none or 14)

Prob	Lanes	Strs	Sups	Number of Moment-control Points	Number of Shear-control Points	
5 – 9	20	25	30	35	40	80

Card	Prob (5–9)	1 (16–20)	2 (–25)	3 (–30)	4 (–35)	5 (–40)	6 (–45)	7 (–50)	8 (–55)	9 (–60)	10 (–65)
Sta at Left of Lane											
Sta at Right of Lane											
Sta at Stringers (Fractional tenths of increments permitted)											
11 – 20											
21 – 30											
Sta at Supports											
11 – 20											
Sta at Design-control Points for Moment											
11 – 20											
21 – 30											
Sta at Design-control Points for Shear											
11 – 20											
21 – 30											

5 9 16 20 25 30 35 40 45 50 55 60 65 80

TABLE 4. STIFFNESS AND LOAD DATA (number of cards must be entered in Table 1; all data added to storage)

	Fixed or Movable			Fixed - position data			Movable - position
Prob	Sta from	Sta to	Cont'd if = 1	Flexural stiffness of cap	Sidewalk & Slab loads	Stringer & Cap loads	Slab loads
5–9	16–20	20–25	25–30	30–40	40–50	50–60	60–70

Card columns: 5, 9, 16, 20, 25, 30, 40, 50, 60, 70, 80

Blank card at end of each run to stop program (columns 1–80)

GENERAL NOTES

Two cards containing any desired alphabetic or numerical information are required (for identification purposes only) at the beginning of the data for each new problem.

All data cards for any particular problem must contain the same problem designation as letters or numbers in columns 5 through 9.

Any input error found by the program will generally cause the problem and any subsequent problem dependent on the erroneous problem to be abandoned at that time. The program will skip to the next independent problem.

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

Blank spaces are interpreted as zeros.

Units of feet and kips are to be used throughout. Skew angle must be input in degrees.

All data words must be justified completely to the right in the spaces provided.

All data words of 5 spaces or less are to be whole integer numbers: . . . . `-123`

The only exception is that stringer stations may be expressed either as integers or decimally to the nearest one-tenth of an increment: . . . . `123.4`

All data words of 10 spaces are to be entered as floating-point decimal numbers including a multiplier expressed in terms of an exponent of 10: . . . . `-1.234E+02`

TABLE 1. PROGRAM CONTROL DATA

Exercising the option to hold the envelopes of maximum and minimum design values from the preceding problems has no influence on the multiple-lane load-control table which is cleared prior to beginning each new problem.

For each of Tables 2 and 3, the user must decide whether (1) to hold all data in that table from the preceding problem or (2) to read in an entirely new set of data. If the option to hold is exercised, no data cards may be added for that table in the current problem.

In Table 4, the data are accumulated into storage by adding algebraically to any previously stored values, including data which may be held from the preceding problem. Thus any number of new cards may be input regardless of the hold option.

If the clear option is exercised, all the envelopes of maximum and minimum design values will be cleared to zero prior to the multiple-lane loadings. However, dead load effects will be properly restored.

If the plot option is exercised, all envelopes of moment and shear will be plotted.

The option to skip Table 5 has no effect on computations but simply reduces the amount of output when not needed.

A zero skew angle is assumed unless the user specifies otherwise.

All values in Table 1, particularly the card counts, should be carefully checked upon completion of coding of each problem (the card counts should be zero or 2 for Table 2, zero or 14 for Table 3, any number for Table 4).

TABLE 2. CONSTANTS

The maximum number of increments into which the cap may be divided is 300.

The number of increments for the movable load is not restricted except that if any multiple-lane loadings are to be done, the movable load must fit within the width of the narrowest lane designated in Table 3.

The start station is the first station of the slab where the zero station of the movable load is to be placed.

The stop station is the last station on the slab where the zero station of the movable load is to be placed. A movable-load solution will be performed for each station in the interval if the movable-load shift value is blank, zero or 1 increment. If the value is 2, a solution will be performed every two stations, and similarly if it is 3 or 4.

The maximum number of lanes that may be loaded simultaneously is 5.

The load-reduction factors will usually be those recommended by AASHO design specifications.

TABLE 3. LISTS OF STATIONS

There will be a total of either zero or fourteen cards. Cards with only a problem number must be inserted where necessary to complete the fourteen cards.

There is a maximum number of 10 lanes (one data card for left of lane and one data card for right of lane), 30 stringers (three data cards), 20 supports (two data cards), 30 design control points for moment (three data cards), and 30 design control points for shear (three data cards).

Design points for shear must be at least 2 increments from any support station, stringer station or from any station receiving load from a stringer specified between stations.

TABLE 4. STIFFNESS AND LOAD DATA

Units for flexural stiffness F are kips $\times$ ft^2 and for input loads Q are kips per station.

For convenience in input coding, stiffness or load data may be distributed to storage by interpolation. There are four variations in the station numbering and in referencing for continuation to a succeeding data card. These variations are explained and illustrated on the following page by cases a through d.

For input and data storage purposes the interpolation and distribution process for movable-position data is the same as for fixed-position data.

There is no restriction on the order of cards in Table 4 except that within a distribution sequence the stations must be in regular order. There is no limit to the number of cards that may be used in this table.

If stringer stations are specified at fractional increments, the user must proportion the dead load of the stringer as two concentrated loads at the two adjacent stations on the cap.

Any concentrated loads applied as "stringer and cap loads" are not affected by skew. However, any such loads entered as distributed loads are assumed to represent dead weight per station of the cap itself and are therefore increased according to the angle of skew of the bent.

Fixed - position Data

Individual - card Input

Case a.1. Data concentrated at one sta . . . .

Case a.2. Data uniformly distributed . . . .

Multiple - card Sequence

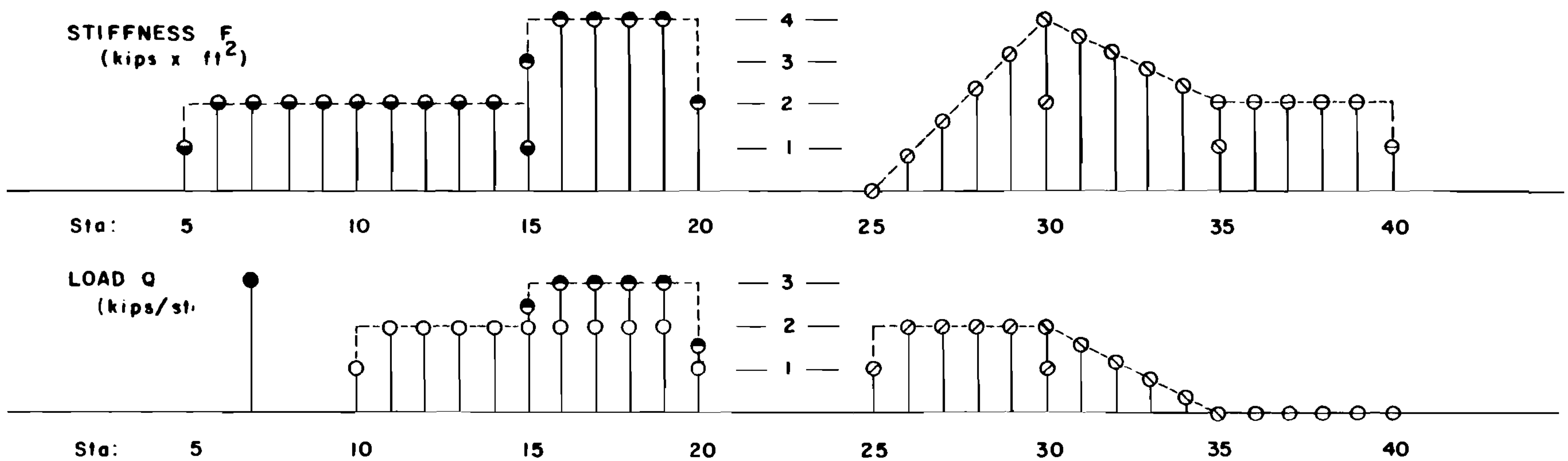
Case b. First - of - sequence . . . .

Case c. Interior - of - sequence . . . .

Case d. End - of - sequence . . . .

FROM STA	TO STA	CONT'D TO NEXT CARD ?	F BENDING STIFFNESS OF CAP	Q TYPICAL LOAD (FIXED OR MOVABLE)
7	→ 7	0 = NO		3.0
5	→ 15	0 = NO	2.0	
15	→ 20	0 = NO	4.0	1.0
10	→ 20	0 = NO		2.0
25		1 = YES	0.0	2.0
	→ 30	1 = YES	4.0	2.0
	→ 35	1 = YES	2.0	0.0
	→ 40	0 = NO	2.0	

Resulting Distributions of Data



CHAPTER 4. EXAMPLE PROBLEM

One basic problem has been selected to illustrate the principal features of CAP 14. Three variations of the problem will be solved to show typical uses of the program, including input data techniques and control options.

The problem is shown in Fig 5a. The structure consists of a slab, eight stringers, a cap, and four supports. An increment length of 0.5 ft was selected and the corresponding station numbers are shown directly below the structure. Fig 5b shows the structure simplified for representation in the computer. In accordance with conventional design practice, knife-edge supports are assumed and hinges are put in the slab at each interior stringer. The stations of moment and shear control points are indicated by asterisks.

The ability to vary flexural stiffness is illustrated in these problems only by the tapered ends of the cap. However, haunches or any other variations could have been described anywhere along the cap.

Figures 6a, b, and c give the various loads for the problem. The movable load is 20 increments wide and its zero station has a range of movement from Station 4 to Station 112. The movable load will be placed at each station within the range of movement. All loads are downward and therefore have a negative sign.

The actual input data listings are reproduced in App 4 and the computed results are in App 5.

Solution 1.

In this solution all stringers have been shifted to the nearest whole station. The station numbers are shown at each stringer position in Fig 5b.

A tabulation of the input data for this solution is given in App 4. No tables of data are retained from a preceding problem, the option to exclude the out-of-lane loadings is not exercised, and it is desired to have plots of the results.

The printed output from this solution is given as App 5.1. The items of primary interest are the multiple-lane loading summary in Table 5, the envelopes of extreme values of moment and shear in Table 6 and the support reactions given in Table 7. The following tabulation is an extract of one typical set of output for one design-control variable at one design-control point from the multiple-lane loading summary.

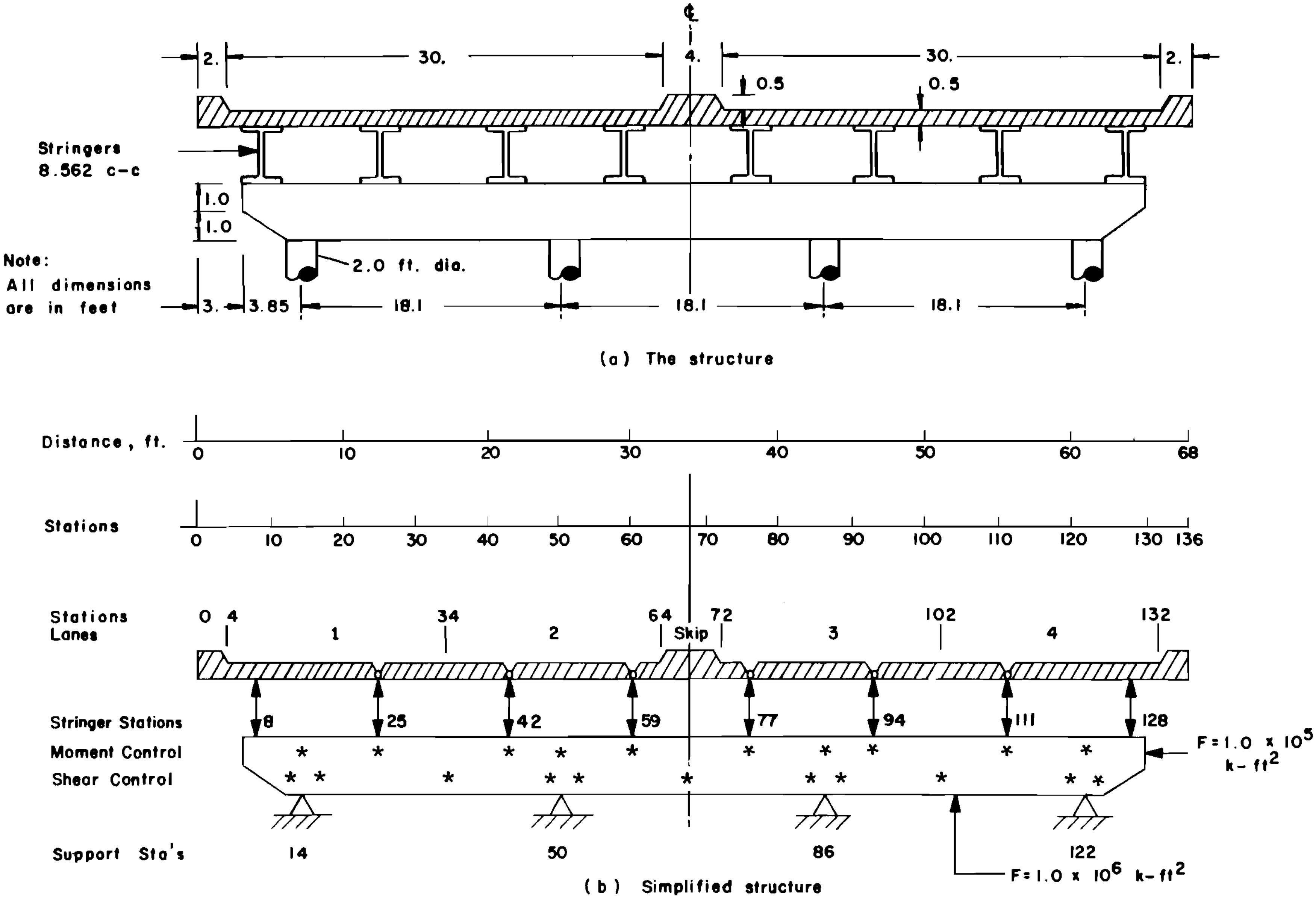


Fig 5. The real and the simplified structure of the example problems.

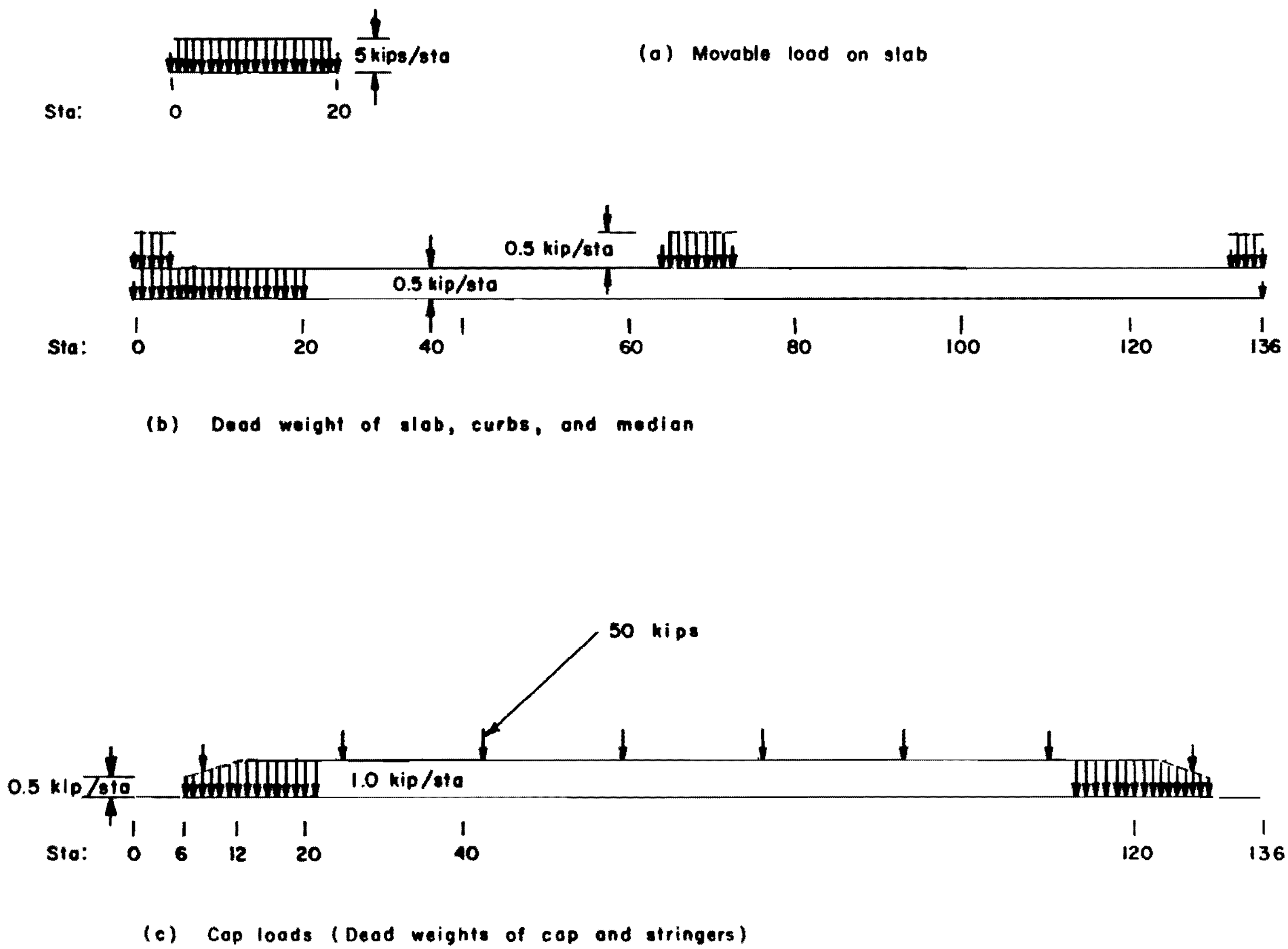


Fig 6. Loads of Example Solution 1.

Extract from Multi-Lane Loading Summary

TABLE 5 -- MULTI-LANE LOADING SUMMARY (*--CRITICAL NUMBER OF LANE LOADS)

MOMENT (FT-K) AT STA	DEAD LC EFFECT	LANE ORDER	POSITIVE MAXIMUM	LOAD LANE	AT STA	LANE ORDER	NEGATIVE MAXIMUM	LOAD LANE	AT STA
50	-2.697E C2								
		0	3.443E 01	0	93	0	-1.427E 02	0	31
		1	2.416E 01	4	102	1	-1.422E 02	2	34
		2	1.319E 01	3	82	2	-9.676E 01	1	14
		3	4.790E 00	1	4	3	-3.871E 01	3	72
		4	0			4	-1.196E 00	4	112
		3*				3*			

The design-control variable for the above extract is the bending moment and the design-control point is Station 50. The maximum moment at Station 50 due to all dead load effects is -2.697×10^2 ft-kips as shown in the second column. The next four columns give positive-moment effects and the last four columns give corresponding negative-moment values.

Consider the two columns marked "lane order". Lane order "0" represents the maximum effect of the single movable load on the design variable without regard to lane boundaries. Lane order "0" may be out-of-lane or in-lane. Lane order "1" represents the single in-lane movable-load position which contributes the largest effect on the particular design variable. The corresponding lane and station number are shown. (It is possible for this position and result to be the same as for lane order "0".) Lane order "2" represents the second largest in-lane contribution to the design variable and so on for the other lane orders.

The number of lane loads that will be critical is signified by the number with an asterisk at the bottom of the lane-order column. This represents the number of lane loads which will be applied simultaneously, with application of the proper load-reduction factors, to create the maximum or minimum design value at the particular design point. In the case considered, 3 lane loads will be applied simultaneously to produce maximum positive moment greater than the single-movable-load maximum at Station 50 and a different set of 3 lanes will be loaded to produce maximum negative moment. Nowhere in Lane 2 could the movable load be placed to produce positive moment and a Lane 2 loading effect therefore does not appear in the positive moment portion of the table. Notice that for negative moment, a fourth loaded lane contributed some negative moment but considering load reduction factors, only three lanes were loaded to develop the most critical value.

Table 6 in App 5.1 gives the envelopes of moment and shear for Solution 1. Some very small extraneous numbers are listed in the output but should be ignored as they are insignificant remnants from arithmetic operations in the computer. Table 7 is the summary of maximum support reactions. In the problem all maximum negative reactions are zero since negative contributions from the live loadings were never large enough to overcome the dead-load positive reactions. This can be seen by comparing Tables 5 and 7 for reactions.

Table 8 gives the engineering scales used with the plotted envelopes of moment and shear shown in Figs 7 and 8. The design-control points are automatically indicated by the row of points plotted above and below the curves. The station numbers and scales have been added by hand.

Solution 2.

The second variation to be illustrated is that of using fractional values for stringer stations. In this solution, the stringer positions have been rounded to the nearest one-tenth of an increment. The fractional stringer station numbers are shown in Fig 9. The dead weights on the cap for this solution are also in Fig 9; other loads are the same as for Solution 1.

A tabulation of the input data is given in App 4. The input stringer stations are listed to the nearest one-tenth of a station in Table 3. In Table 4 the stringer loads have been proportionately shared to each adjacent whole station. This requires two input cards for each stringer load instead of one.

The output from this solution is given in App 5.2 and the corresponding plots of moment and shear envelopes are in Figs 10 and 11. To simplify study of effects of the more precise stringer placement in Solution 2, the key results from both Solution 1 and Solution 2 are summarized in Table A.

For the particular problem considered, the largest effects on bending moment occur at Stations 42 and 94 where the change is approximately 6 percent. Effects on shears and reactions are quite small.

Table A. Comparison of maximum values at design-control points.

	Design-Control Stations	Solution 1	Solution 2
Bending moment (ft-kips)	14, 122	-391.3	-387.6
	25, 111	431.8	424.9
	42, 94	208.2	195.8
	50, 86	-519.7	-521.4
	59, 77	217.1	206.8
Shear (kips)	12, 124	131.1	132.0
	16, 120	127.6	125.9
	34, 102	33.8	35.5
	48, 88	180.8	183.1
	52, 84	143.7	141.9
	68 (center)	17.8	18.1
Support Reaction (kips)	14, 122	249.2	248.2
	50, 86	295.2	296.1

Solution 3.

The third variation is intended to demonstrate the various data-hold options plus the effect of an input skew angle of 30 degrees, which is the only real change from Solution 2.

A tabulation of the input data is given at the end of the listing in App 4. Notice that only three input cards are required, the two problem identification cards and the control card (Table 1) on which the hold options and the skew angle are entered.

The output from this solution is in App 5.3 and the plotted envelopes are in Figs 12 and 13. All moments, shears and reactions have changed significantly with the skew angle due to the increased dead weight of the cap. The values of moment have changed also because of the increased dimensions along the cap. However, in Table 5, the movable-load reactions from both the out-of-lane and in-lane loadings have not changed since the magnitude of the transferred load and its relative position on the cap remain the same. Notice that precisely the same lanes are loaded at precisely the same station numbers in both Solutions 2 and 3.

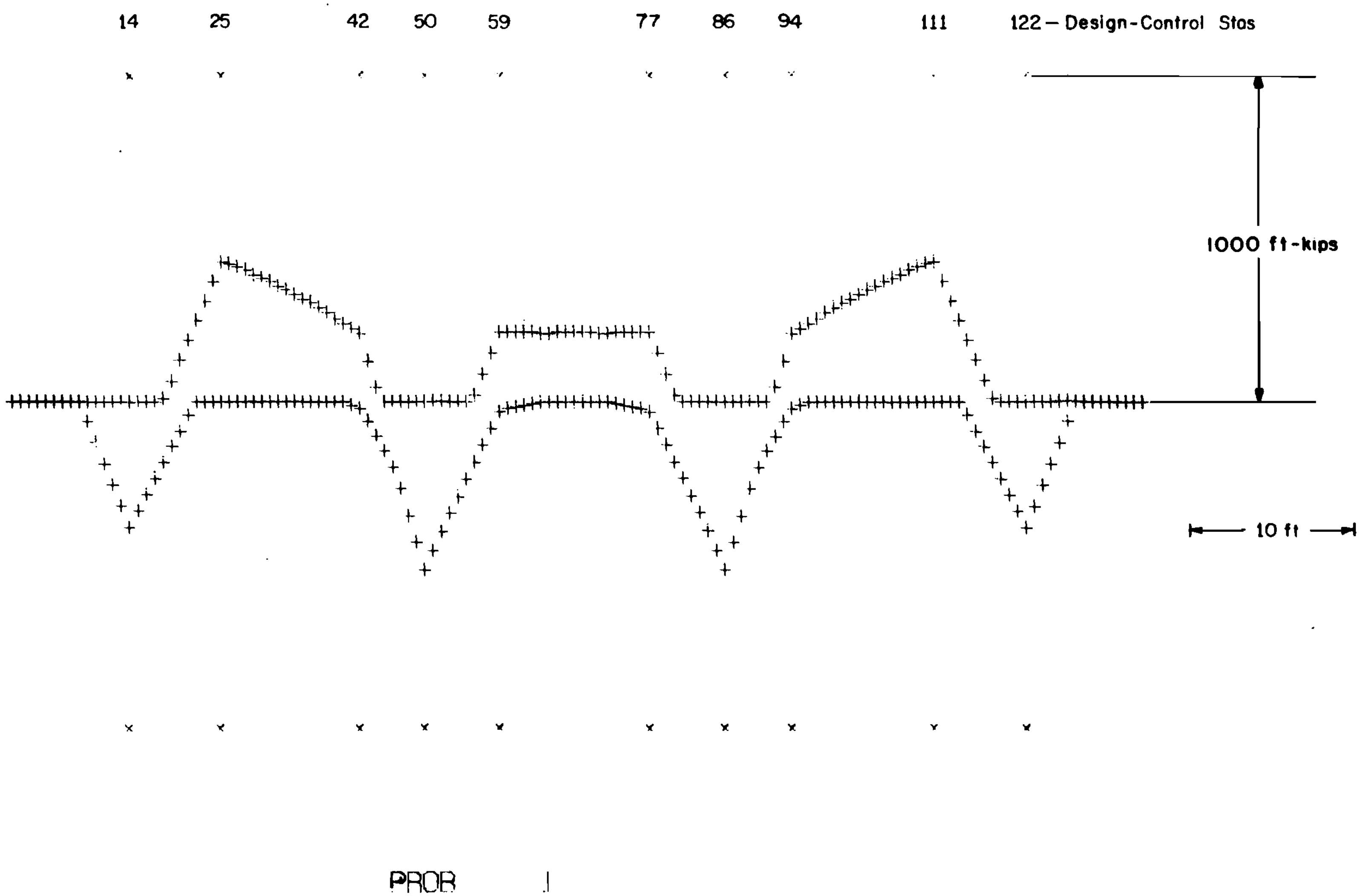


Fig 7. Envelopes of bending moment diagrams for Solution 1.

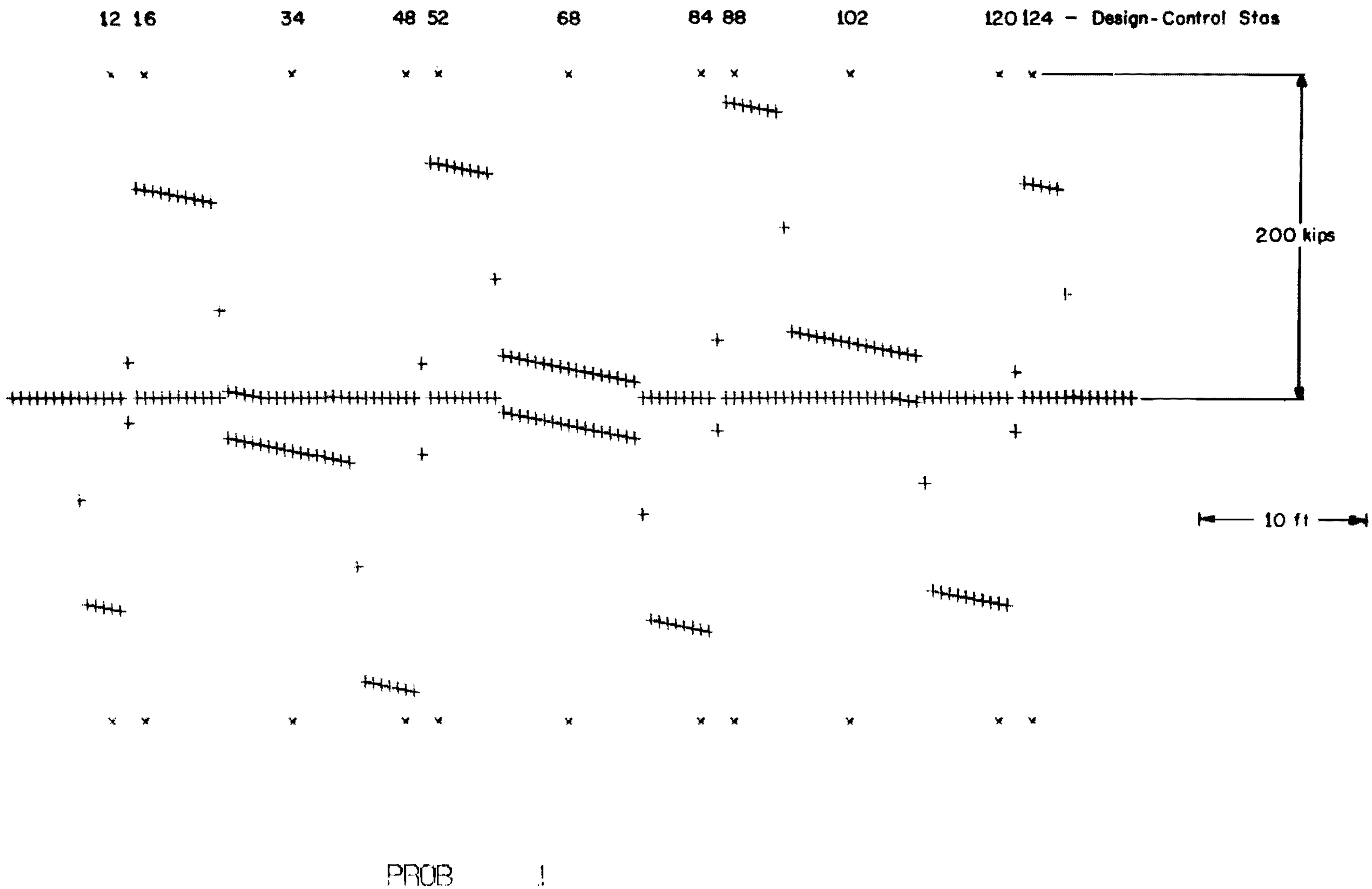


Fig 8. Envelopes of maximum shear values from Solution 1.

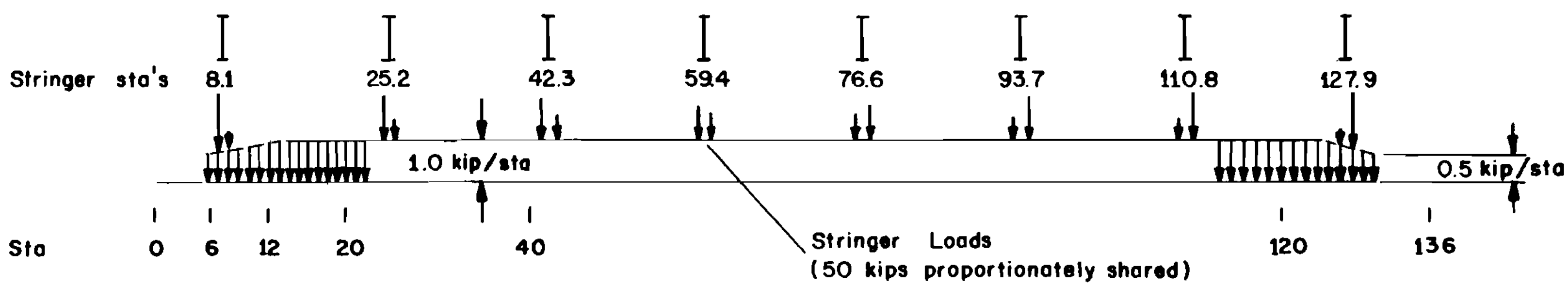


Fig 9. Dead loads of Example Solution 2.

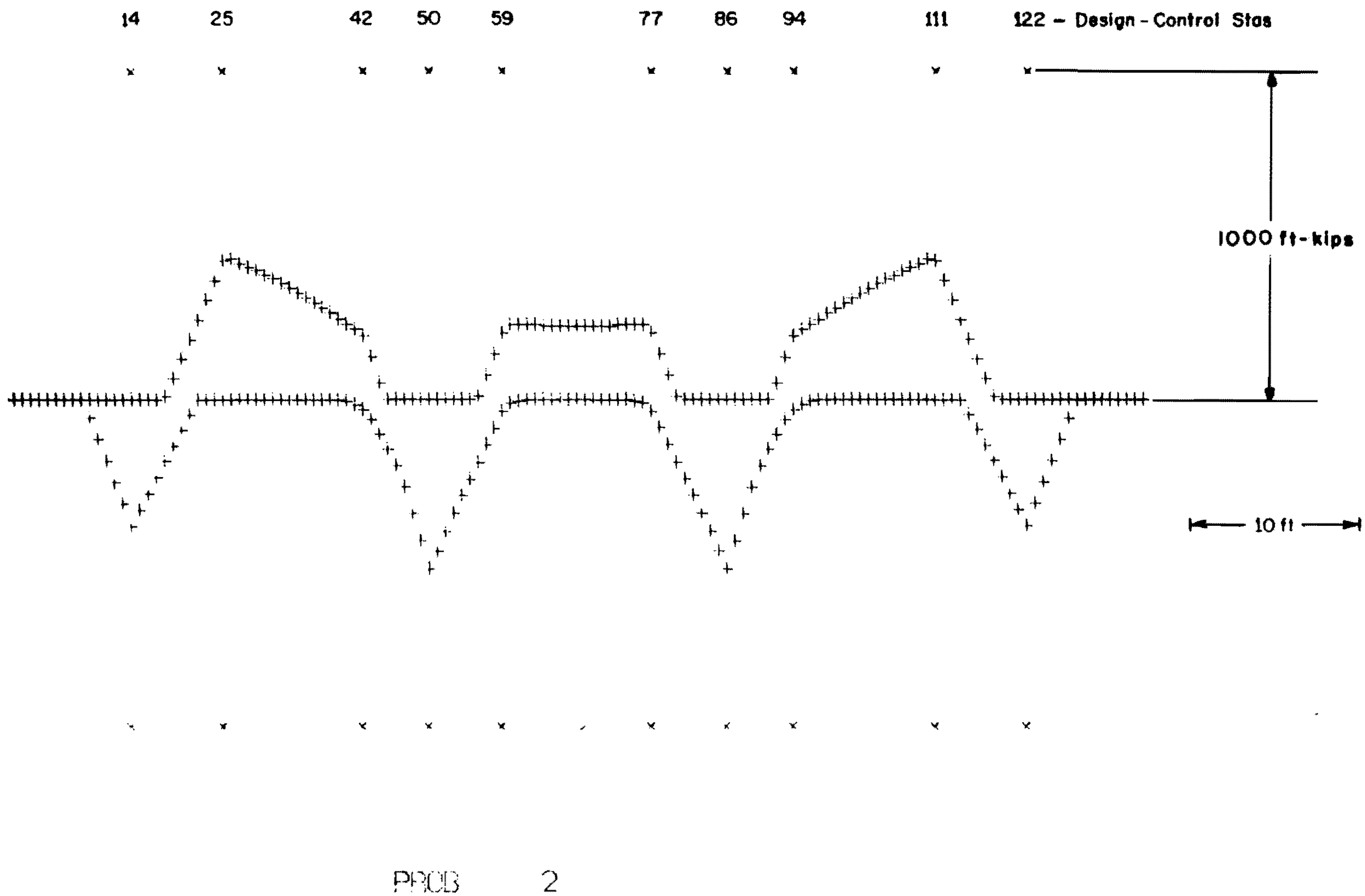


Fig 10. Envelopes of bending moment diagrams for Solution 2.

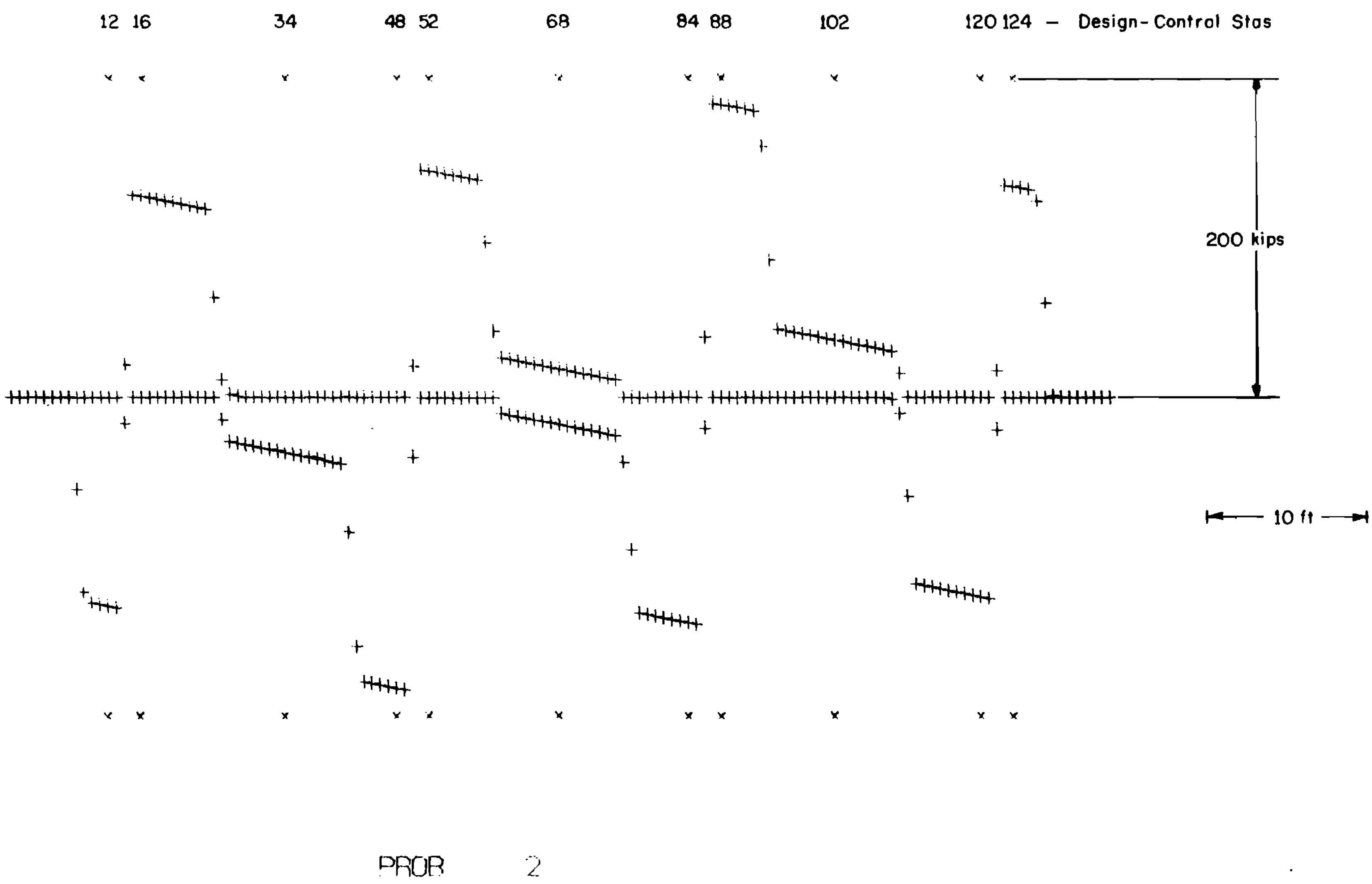


Fig 11. Envelopes of maximum shear values from Solution 2.

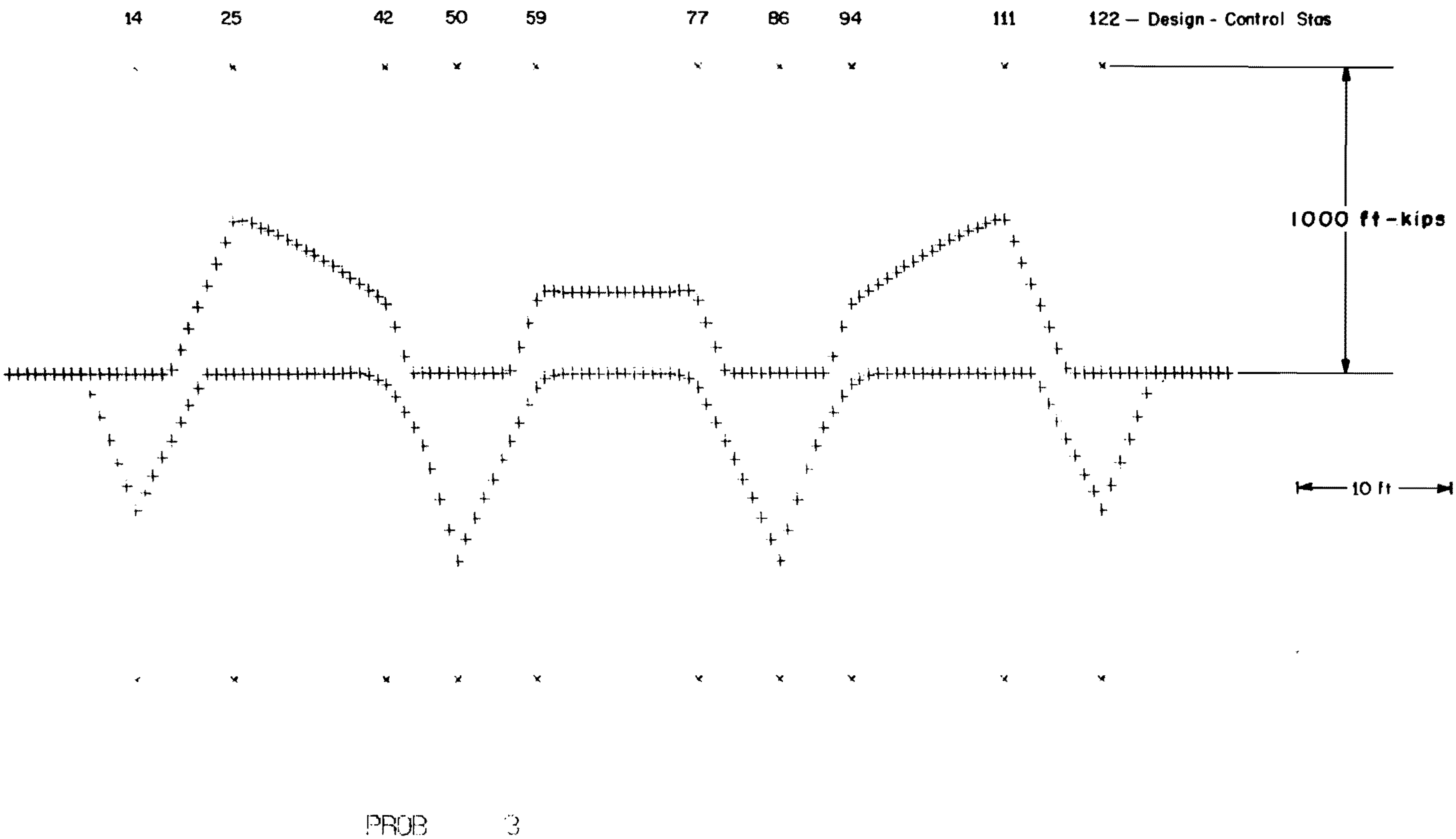


Fig 12. Envelopes of bending moment diagrams for Solution 3.

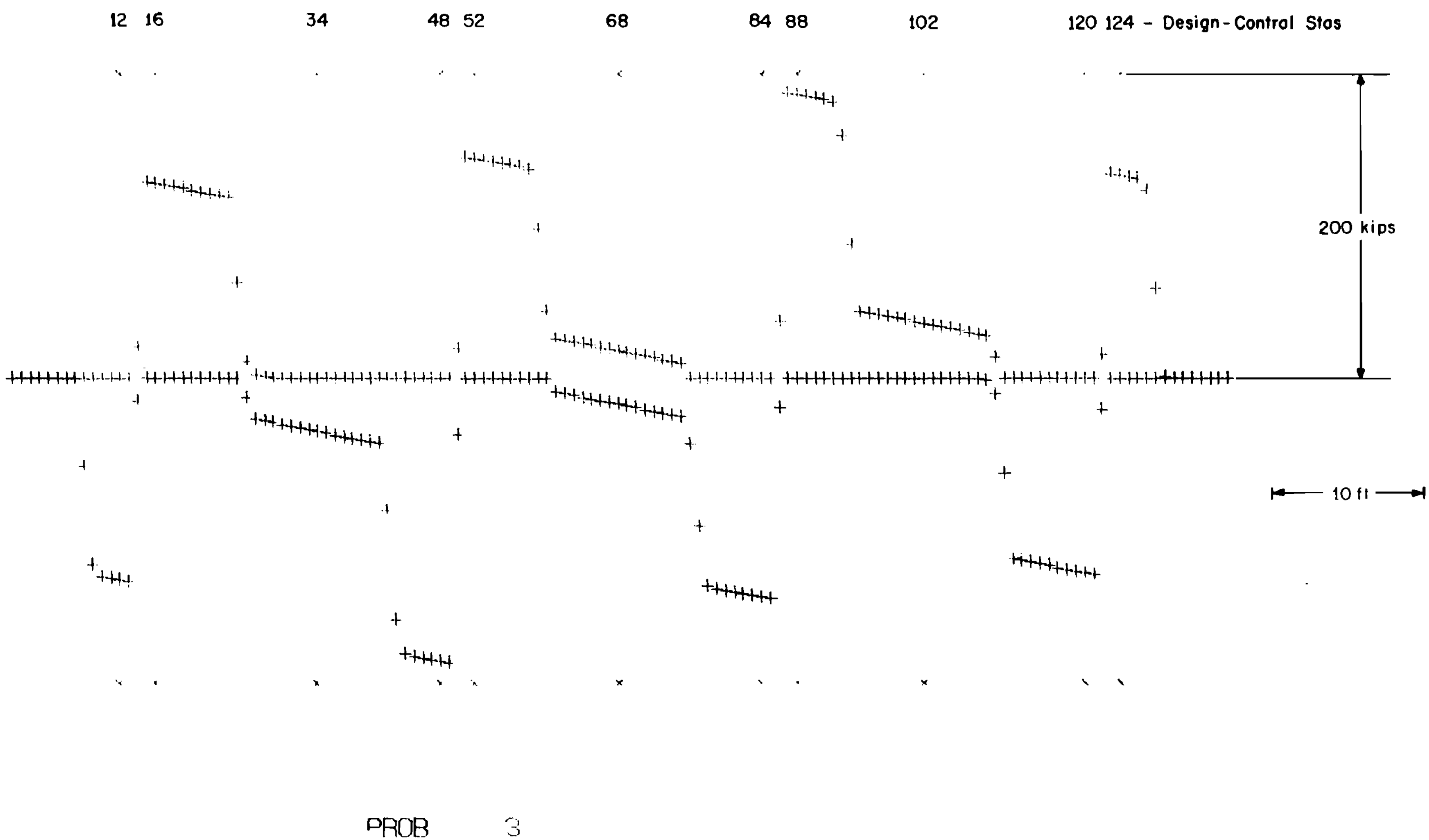


Fig 13. Envelopes of maximum shear values from Solution 3.

CHAPTER 5. SUMMARY AND RECOMMENDATIONS

Principal Assumptions and Approximations

In any general-purpose computer method every effort should be made to avoid burying items of engineering judgment and decision within the program. However, it is often necessary as a temporary expedient to include such items, as is the case with some aspects of the program described in this report. These items should be recognized, and eliminated wherever possible, as more realistic analyses of the total structure are developed.

The assumptions and approximations in the basic BMCOL method (Ref 1) should be clearly recognized by the users of the CAP program. There are various additional assumptions and approximations in the CAP analysis which are dictated by design practice and also must be clearly understood.

In the BMCOL method the beam is assumed to be replaced by a series of rigid bars, pin-connected and spring-restrained. These bars form the finite-element beam, a portion of which was shown in Fig 1b. All loads and stiffnesses are concentrated at regularly spaced station points.

The CAP analysis includes additional simplifications which are justified primarily by current design practice. A hinge is assumed in the slab at each interior stringer so that simple-span distribution of slab loads may be used. All columns are replaced by knife-edge supports acting at the nearest available station points.

Recommendations

The following recommendations are considered applicable to the use of program CAP 14.

(1) Each user should satisfy himself as to the most desirable practice in regard to (a) size of increment length, (b) the stringer load splitting option, and (c) the use of the variable incrementation in positioning the single movable load in the Phase 2 solutions. It has been found that rarely is an increment length of less than 0.5 ft necessary and if used in conjunction with the stringer load splitting technique 1.0 ft should be adequate for most cases.

(2) The user should run test solutions of cases for which independent hand solutions are also made, especially when

entering a new or uncertain area of analysis. Such trials also help to guard against improper use of input forms.

(3) CAP 14 should be used to study ways of improving or simplifying the more or less arbitrary loading rules that are currently used. Specifically, it is felt that through use of CAP 14, a fixed pattern of movable loads may be evolved that would give equally satisfactory results when compared to those based on the intricacies of the AASHO rules. A fixed pattern of movable loads would greatly reduce the amount of logic and computation and in turn might considerably reduce the overall costs of analysis. This will be increasingly important as larger and larger aggregations of structural elements are considered in more sophisticated computer programs of the future.

If properly and efficiently used, modern high-speed computers offer a tremendous advantage in the performance of engineering work. By freeing the engineer from many tedious hand computations, the computer greatly enhances the opportunities for creative improvements in design. Furthermore, many problems can be attacked that could not be considered by conventional methods. In this concept, the computer is used as an aid but never as a substitute for the application of sound engineering judgment and decision.

REFERENCES

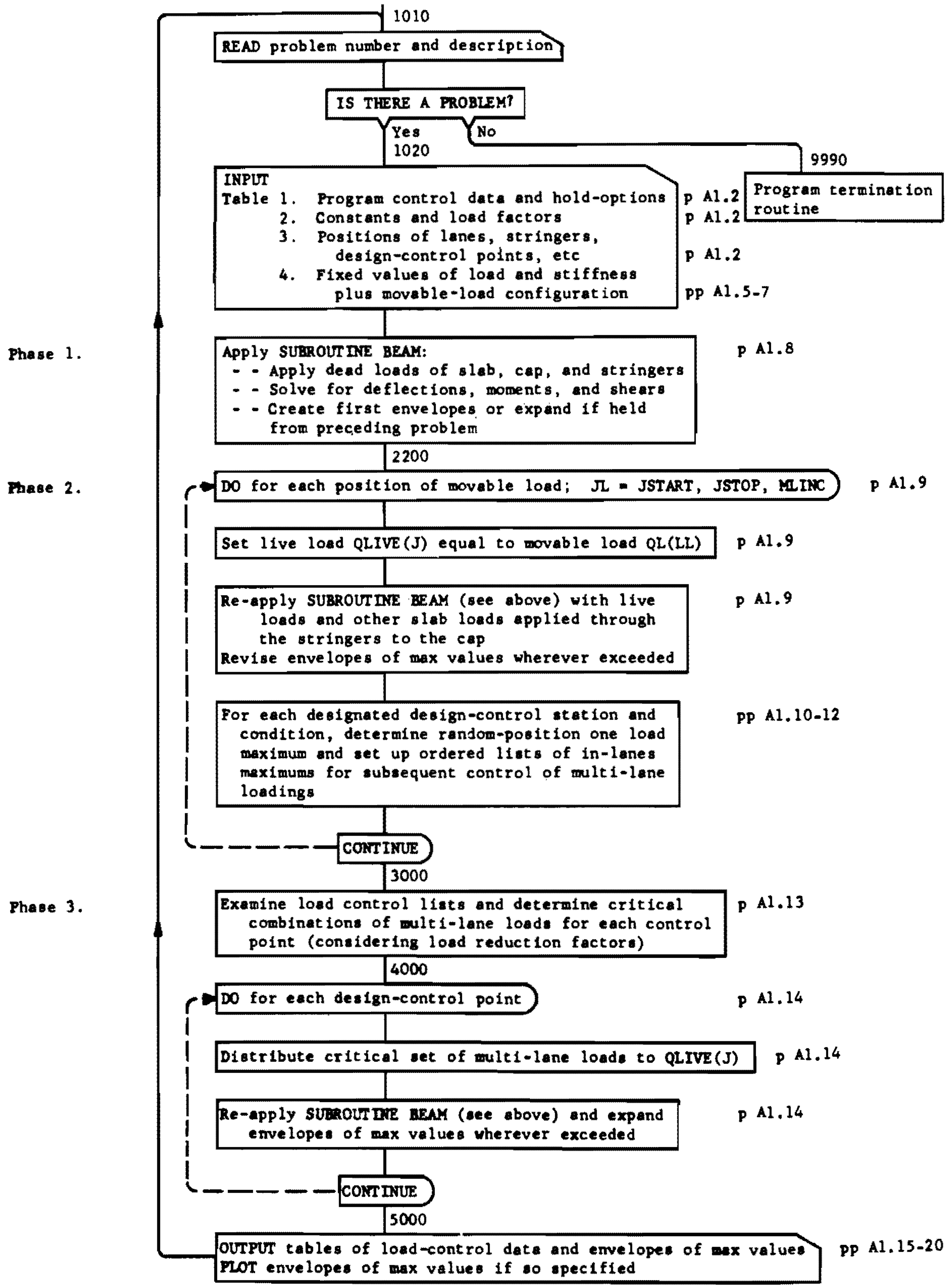
1. Matlock, Hudson, and Haliburton, T. A., "A Finite-Element Method of Solution for Linearly Elastic Beam-Columns," a report to the Texas Highway Department, February 1, 1965.

2. American Association of State Highway Officials Standard Specifications for Highway Bridges, Eighth Edition, General Offices, 917 National Press Building Washington, D. C., 1961.

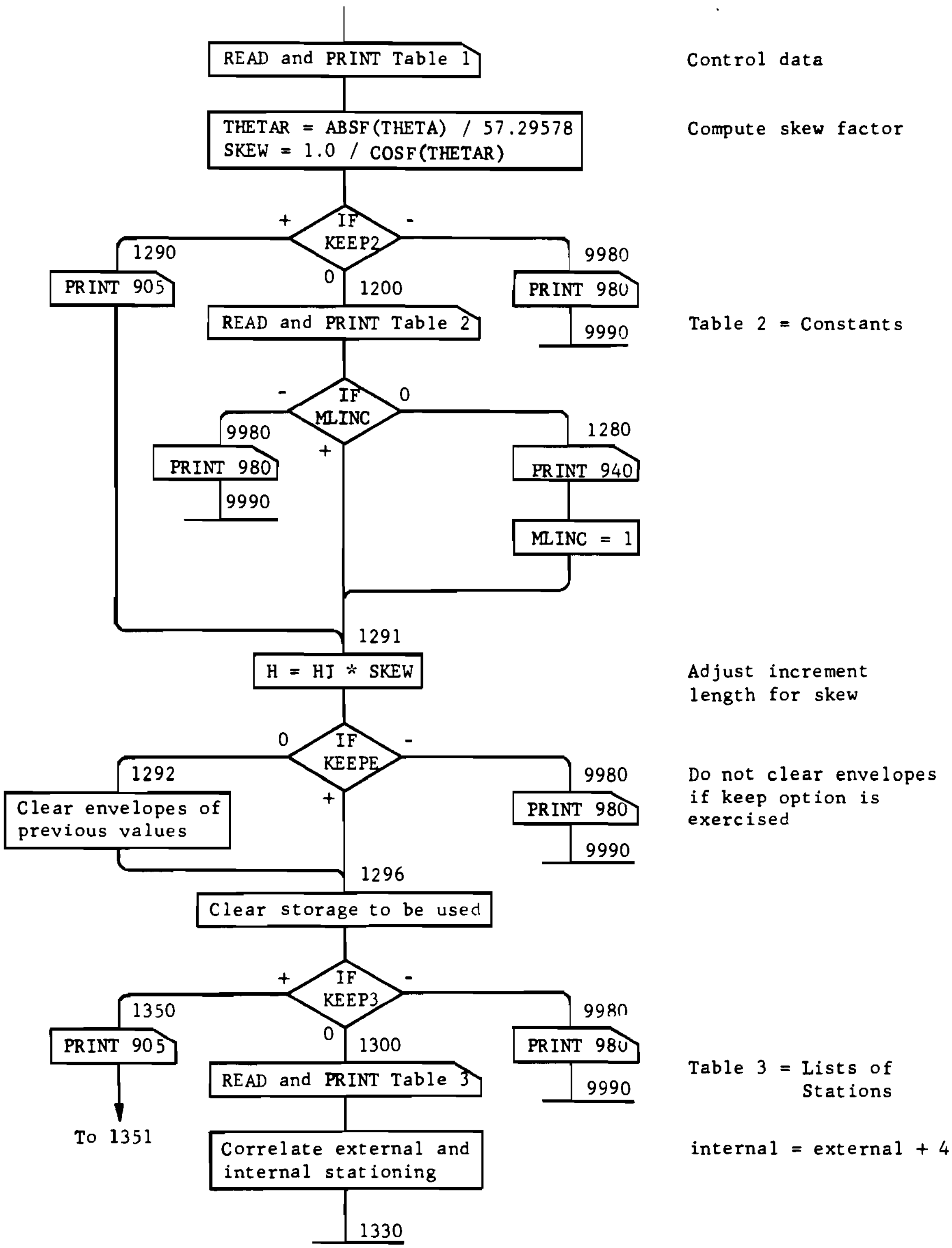
APPENDIX 1

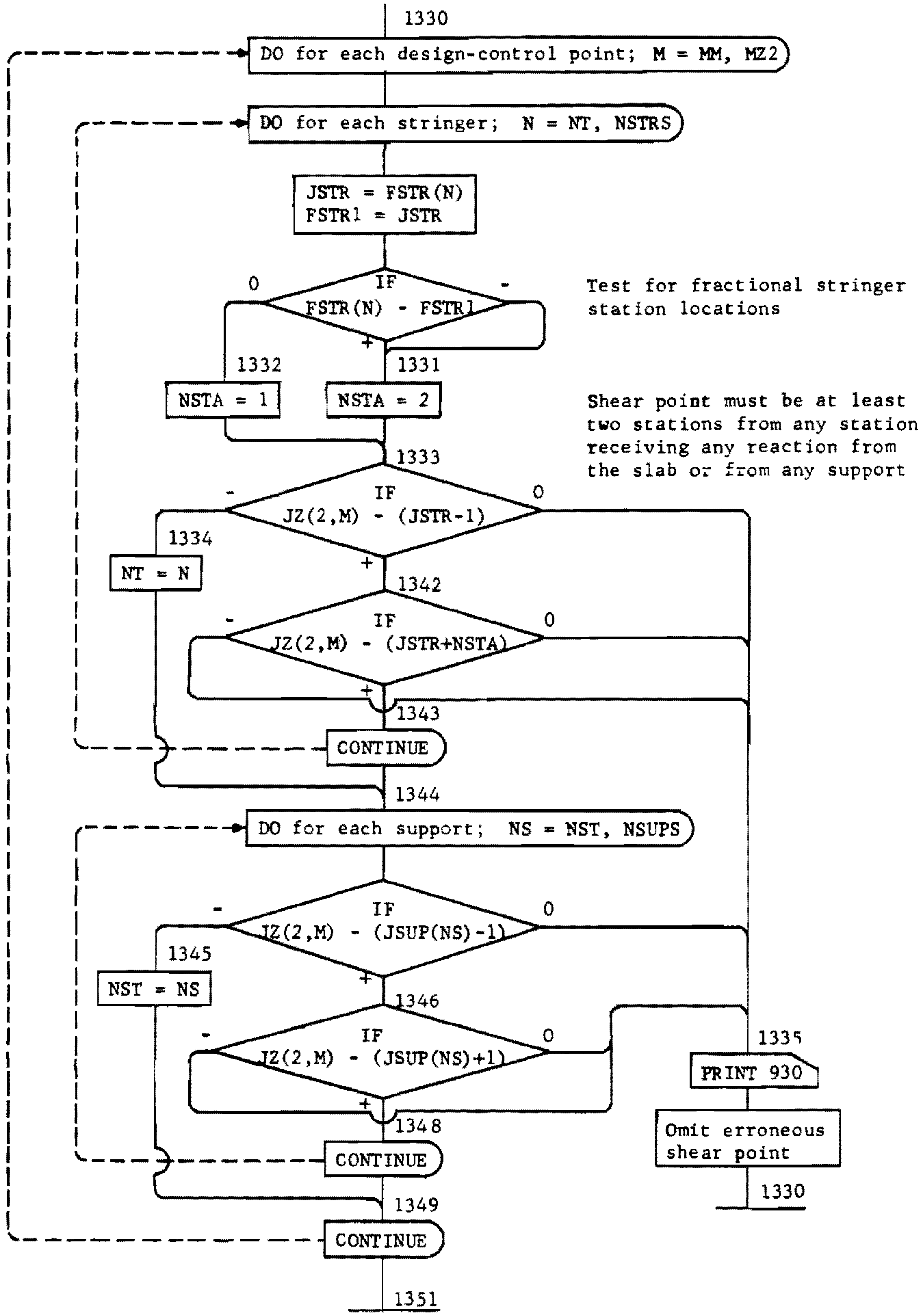
FLOW DIAGRAMS FOR PROGRAM CAP 14

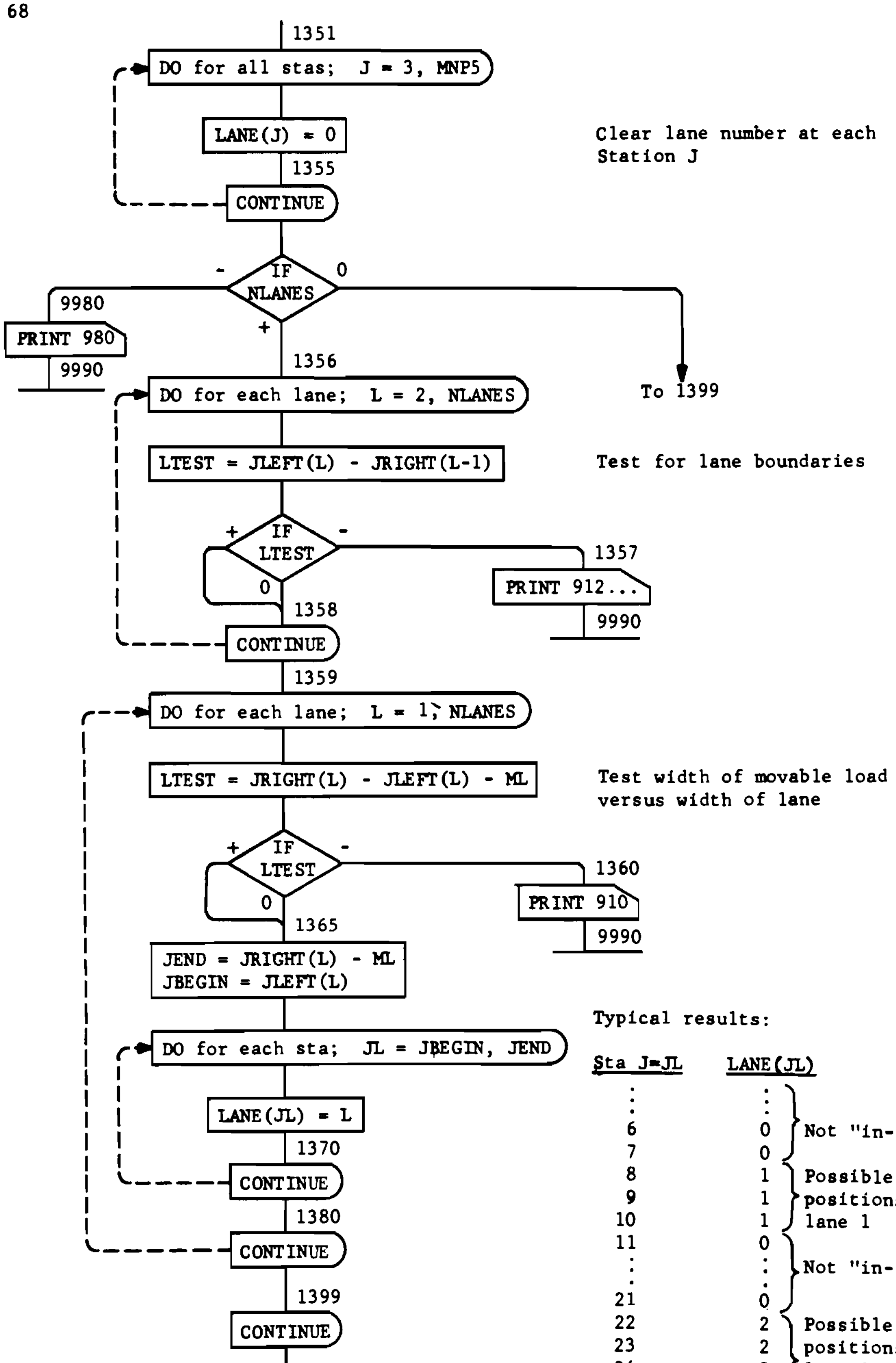
SUMMARY FLOW DIAGRAM FOR CAP 14



COMPLETE FLOW DIAGRAM FOR PROGRAM CAP 14

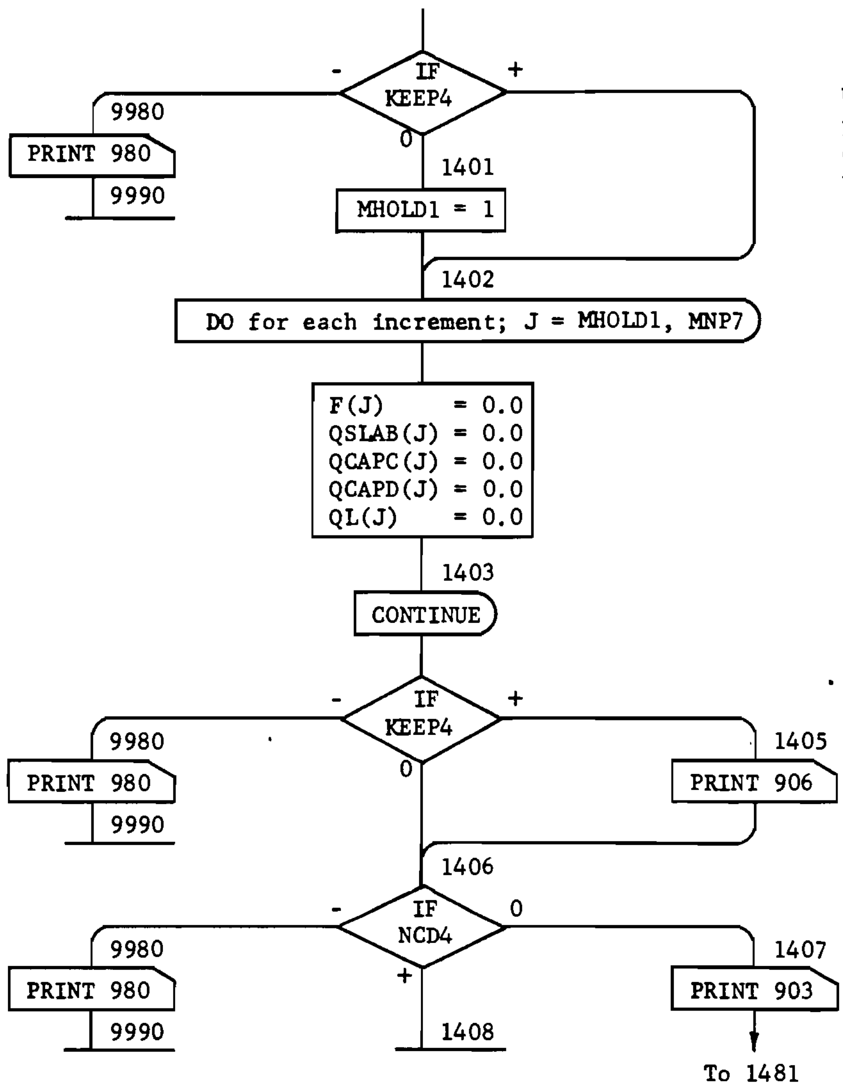



1330
DO for each design-control point; M = MM, MZ2
DO for each stringer; N = NT, NSTRS
JSTR = FSTR(N)
FSTR1 = JSTR
IF
FSTR(N) - FSTR1
0
-
+
Test for fractional stringer station locations
1332
1331
NSTA = 1
NSTA = 2
Shear point must be at least two stations from any station receiving any reaction from the slab or from any support
1333
IF
JZ(2,M) - (JSTR-1)
-
0
+
1334
NT = N
1342
IF
JZ(2,M) - (JSTR+NSTA)
-
0
+
1343
CONTINUE
1344
DO for each support; NS = NST, NSUPS
IF
JZ(2,M) - (JSUP(NS)-1)
-
0
+
1345
NST = NS
1346
IF
JZ(2,M) - (JSUP(NS)+1)
-
0
+
1335
PRINT 930
Omit erroneous shear point
1330
1348
CONTINUE
1349
CONTINUE
1351

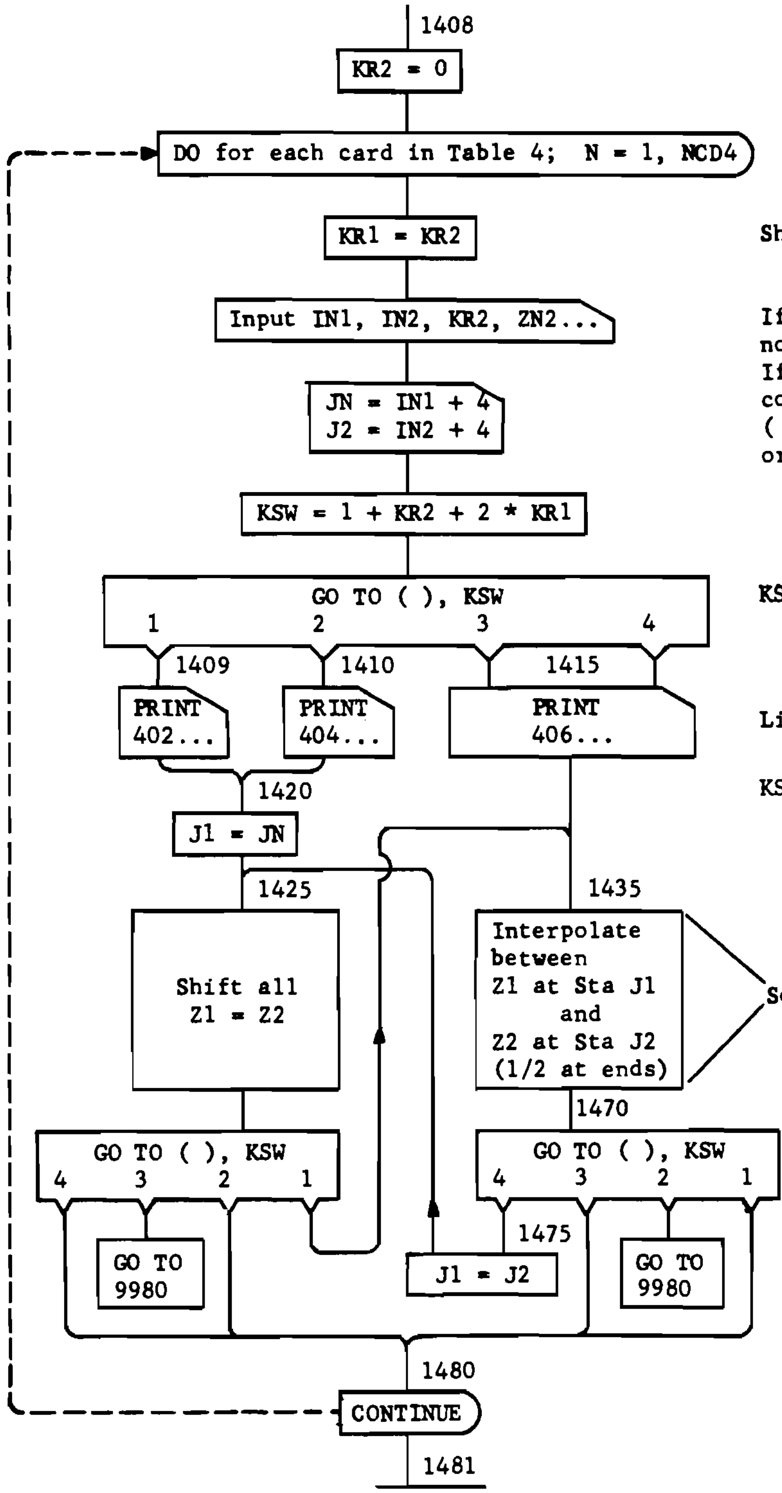


Typical results:

Sta J=JL	LANE(JL)	
⋮	⋮	Not "in-lane"
6	0	
7	0	
8	1	Possible load positions for lane 1
9	1	
10	1	
11	0	Not "in-lane"
⋮	⋮	
21	0	
22	2	Possible load positions for lane 2
23	2	
24	2	
⋮	⋮	⋮



Use data from previous problem or clear previous data from storage



Shifts KR1 = KR2

If KR2 = 0, data sequence not continued
If KR2 = 1, data will continue on next input card
(Z represents F, QS, QC, or QL)

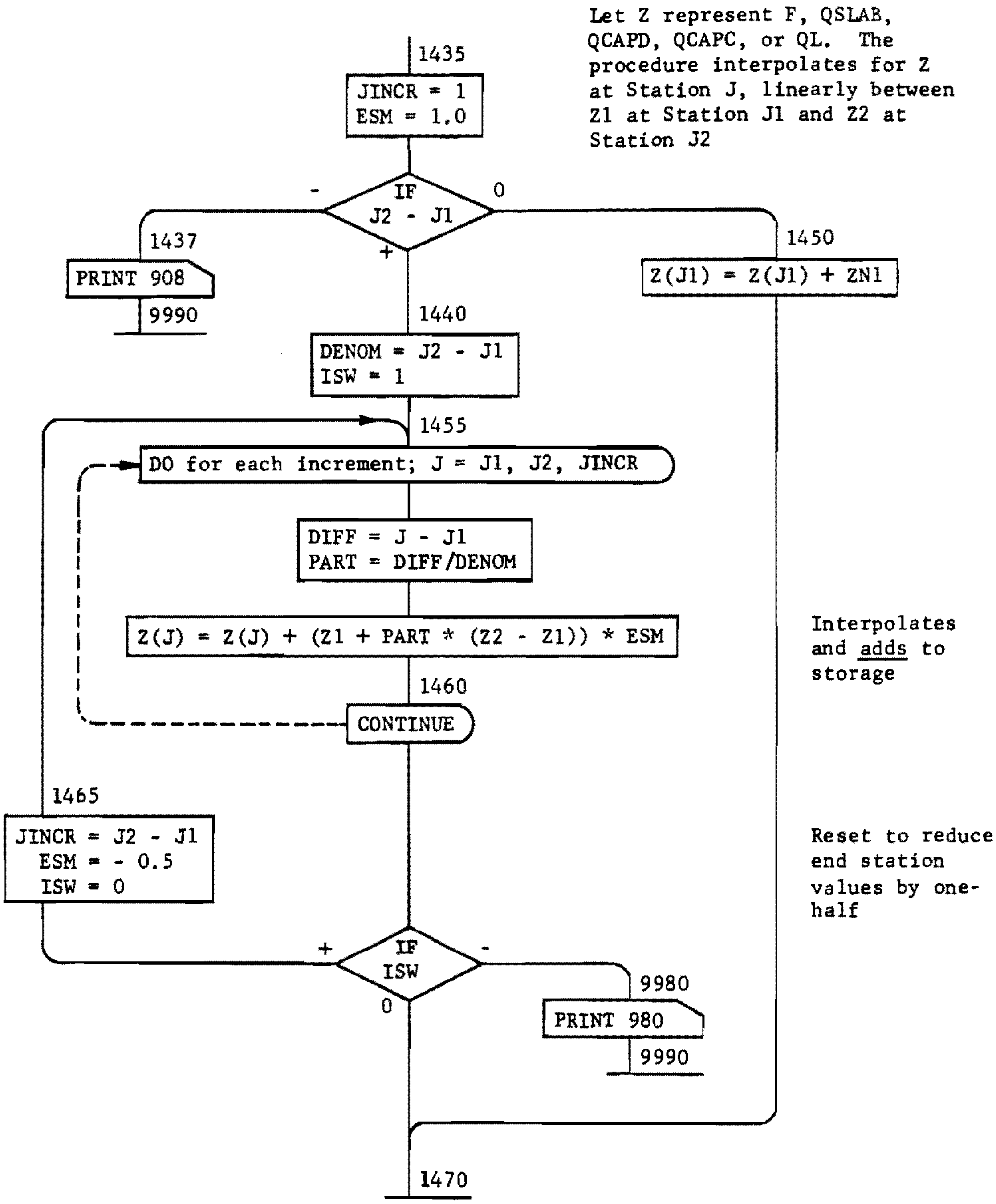
KSW = 1: Data concentrated at one station or constant in interval

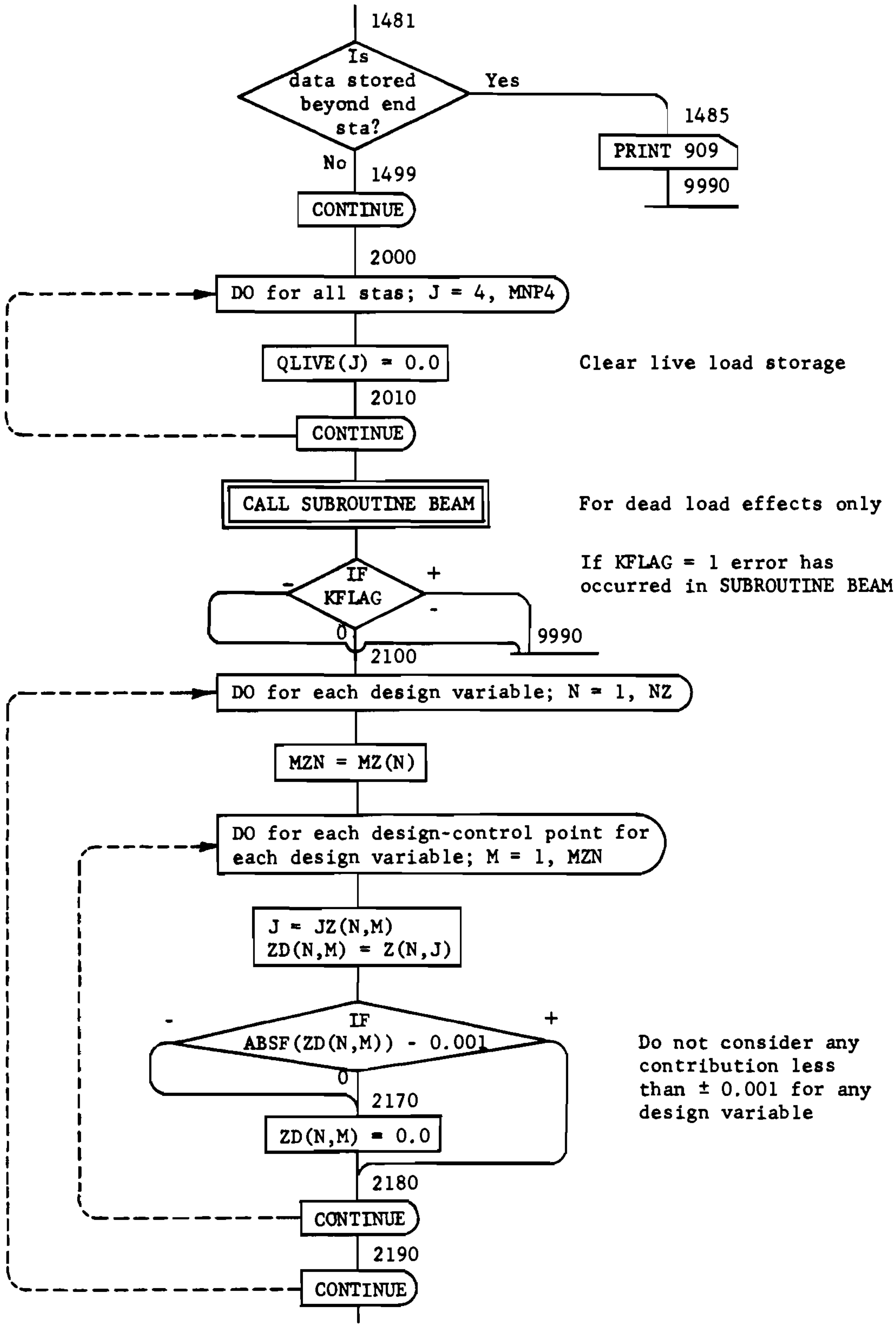
Linearly varying data, multiple cards

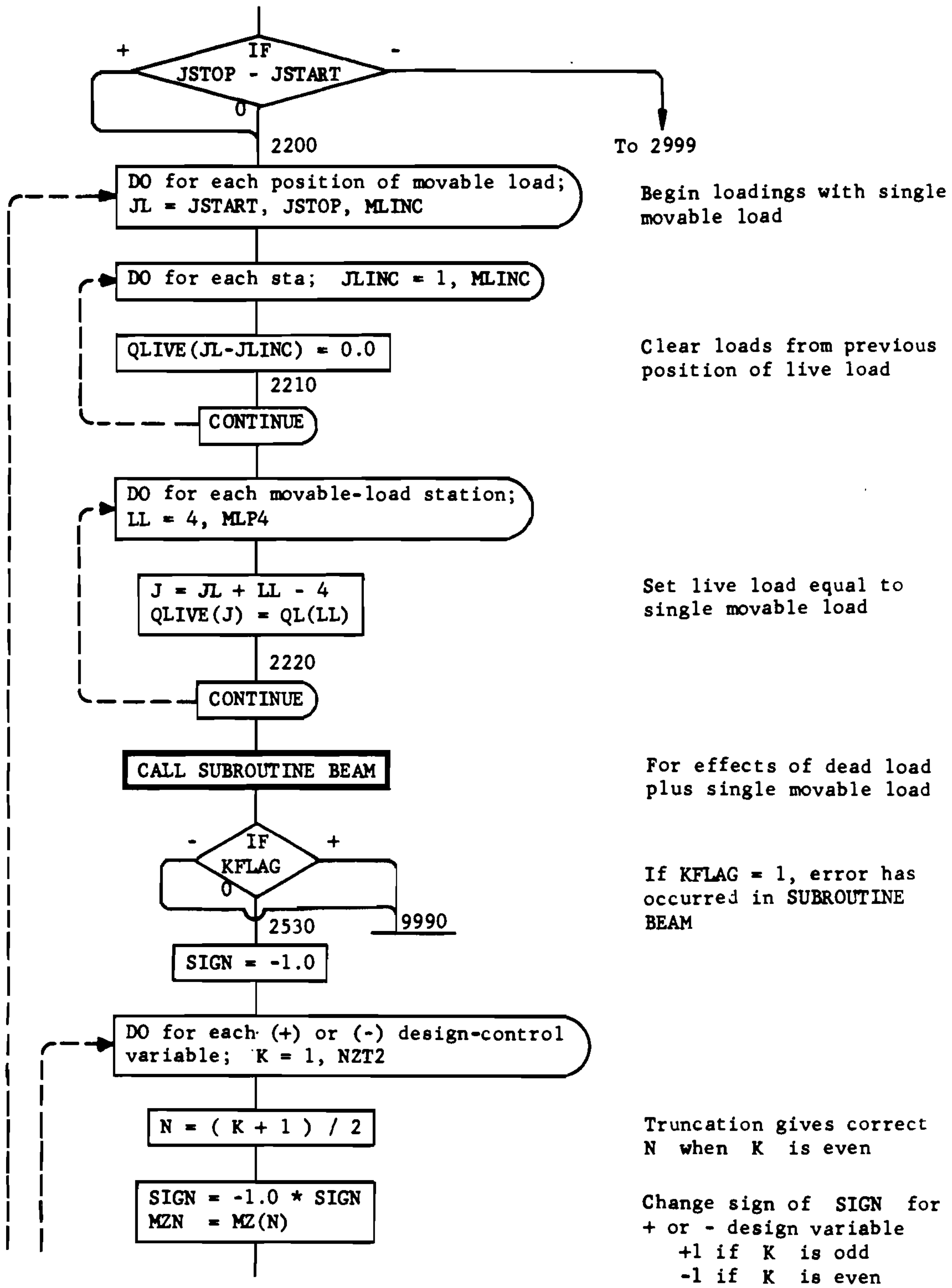
KSW = 2: First-of-sequence
3: End-of-sequence
4: Interior-of-sequence

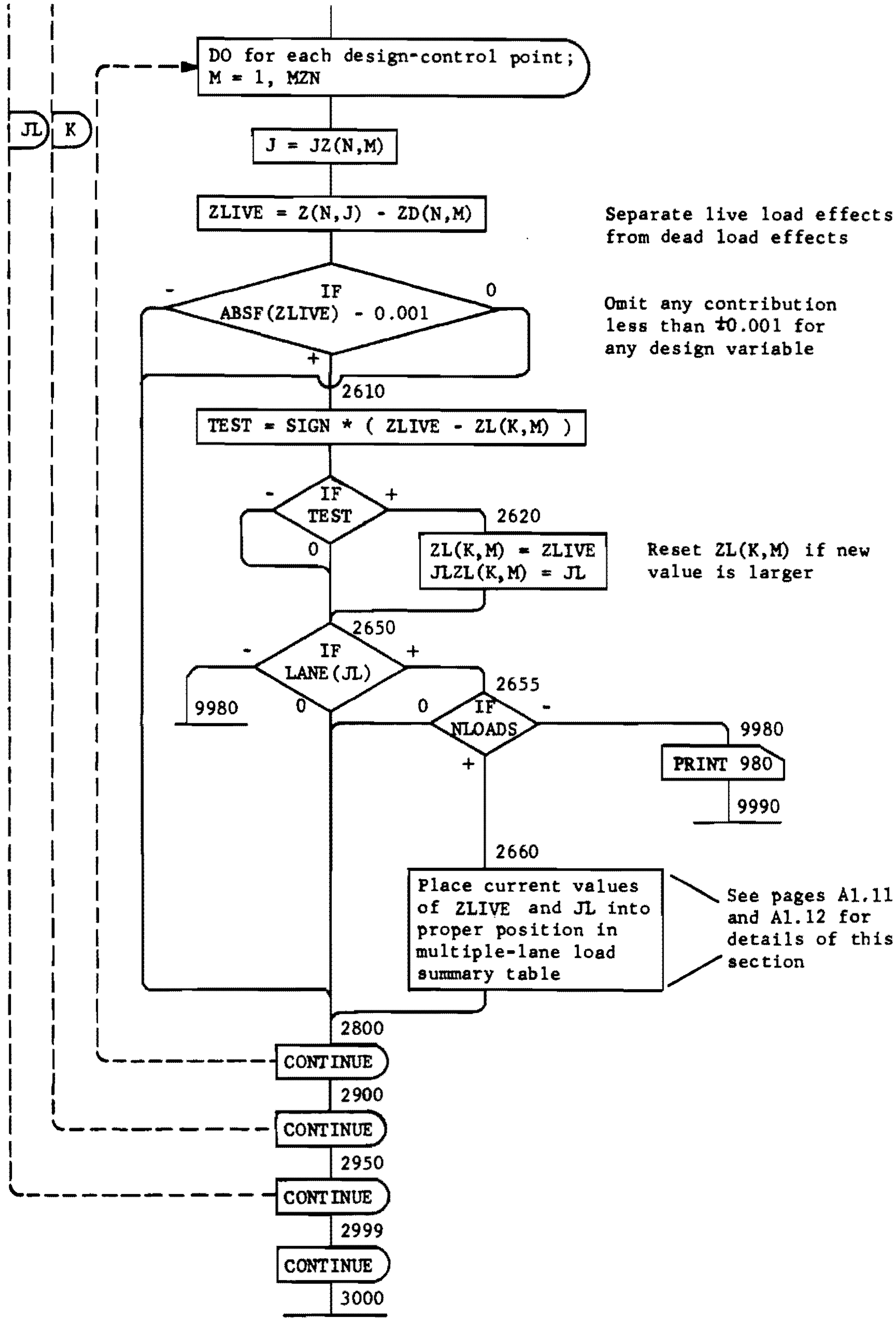
See next page

Expansion of statements
1435 through 1470 on page A1.6

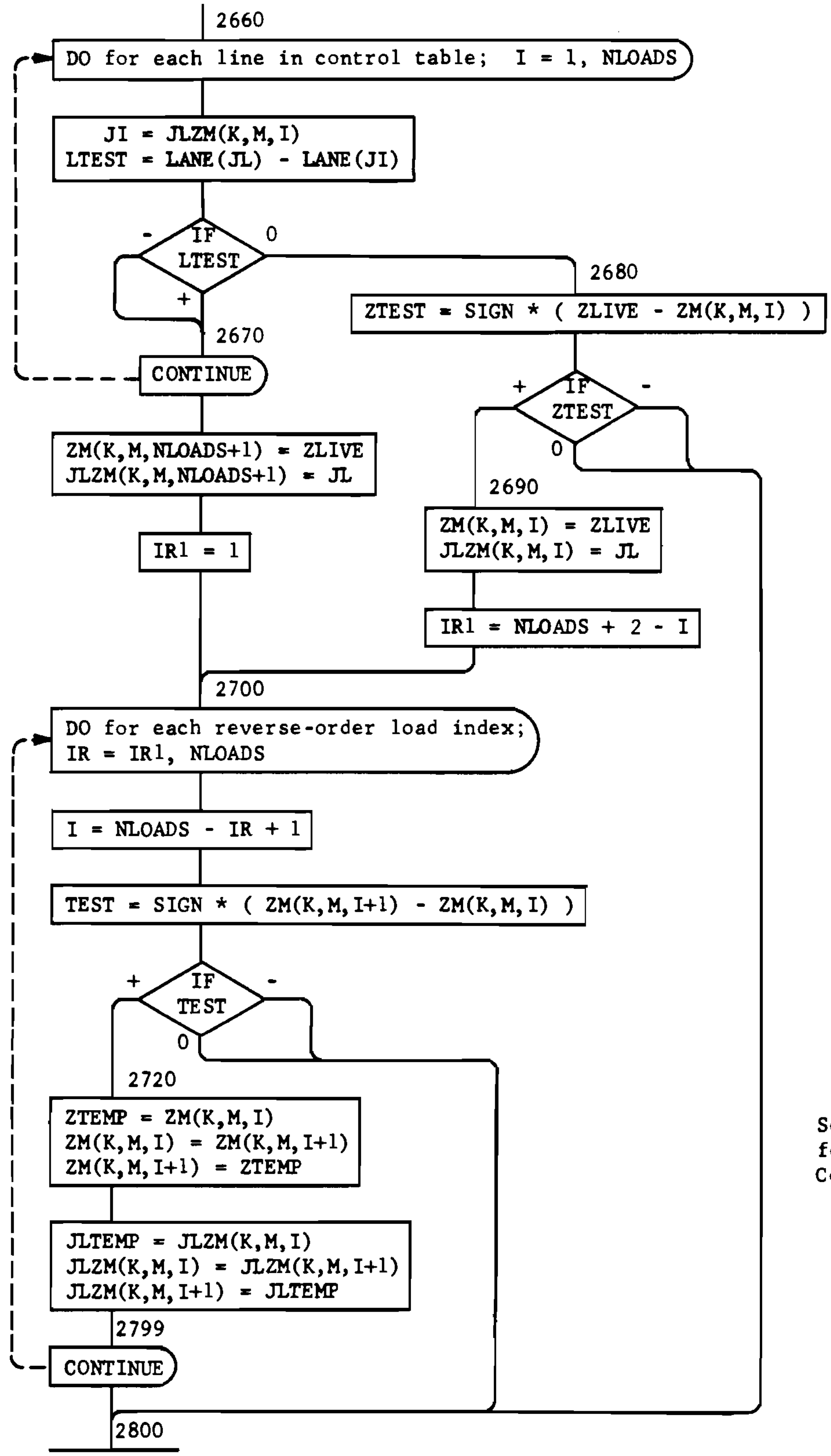



1481
Is data stored beyond end sta?
Yes
1485
PRINT 909
9990
No
1499
CONTINUE
2000
DO for all stas; J = 4, MNP4
QLIVE(J) = 0.0
Clear live load storage
2010
CONTINUE
CALL SUBROUTINE BEAM
For dead load effects only
IF KFLAG
+
-
0
If KFLAG = 1 error has occurred in SUBROUTINE BEAM
9990
2100
DO for each design variable; N = 1, NZ
MZN = MZ(N)
DO for each design-control point for each design variable; M = 1, MZN
J = JZ(N,M)
ZD(N,M) = Z(N,J)
IF ABSF(ZD(N,M)) - 0.001
-
+
0
Do not consider any contribution less than ± 0.001 for any design variable
2170
ZD(N,M) = 0.0
2180
CONTINUE
2190
CONTINUE


IF
JSTOP - JSTART
+
-
0
To 2999
2200
DO for each position of movable load;
JL = JSTART, JSTOP, MLINC
Begin loadings with single
movable load
DO for each sta; JLINC = 1, MLINC
QLIVE(JL-JLINC) = 0.0
Clear loads from previous
position of live load
2210
CONTINUE
DO for each movable-load station;
LL = 4, MLP4
J = JL + LL - 4
QLIVE(J) = QL(LL)
Set live load equal to
single movable load
2220
CONTINUE
CALL SUBROUTINE BEAM
For effects of dead load
plus single movable load
IF
KFLAG
-
+
0
If KFLAG = 1, error has
occurred in SUBROUTINE
BEAM
2530
9990
SIGN = -1.0
DO for each (+) or (-) design-control
variable; K = 1, NZT2
N = (K + 1) / 2
Truncation gives correct
N when K is even
SIGN = -1.0 * SIGN
MZN = MZ(N)
Change sign of SIGN for
+ or - design variable
+1 if K is odd
-1 if K is even


JL
K
DO for each design-control point; M = 1, MZN
J = JZ(N,M)
ZLIVE = Z(N,J) - ZD(N,M)
Separate live load effects from dead load effects
IF ABSF(ZLIVE) - 0.001
-
0
+
Omit any contribution less than ±0.001 for any design variable
2610
TEST = SIGN * (ZLIVE - ZL(K,M))
IF TEST
-
+
0
2620
ZL(K,M) = ZLIVE
JLZL(K,M) = JL
Reset ZL(K,M) if new value is larger
2650
IF LANE(JL)
-
+
0
9980
2655
IF NLOADS
0
-
+
9980
PRINT 980
9990
2660
Place current values of ZLIVE and JL into proper position in multiple-lane load summary table
See pages A1.11 and A1.12 for details of this section
2800
CONTINUE
2900
CONTINUE
2950
CONTINUE
2999
CONTINUE
3000

Expansion of statements 2660 through 2800 on page A1.10



See page A1.12 for the Load Control Table

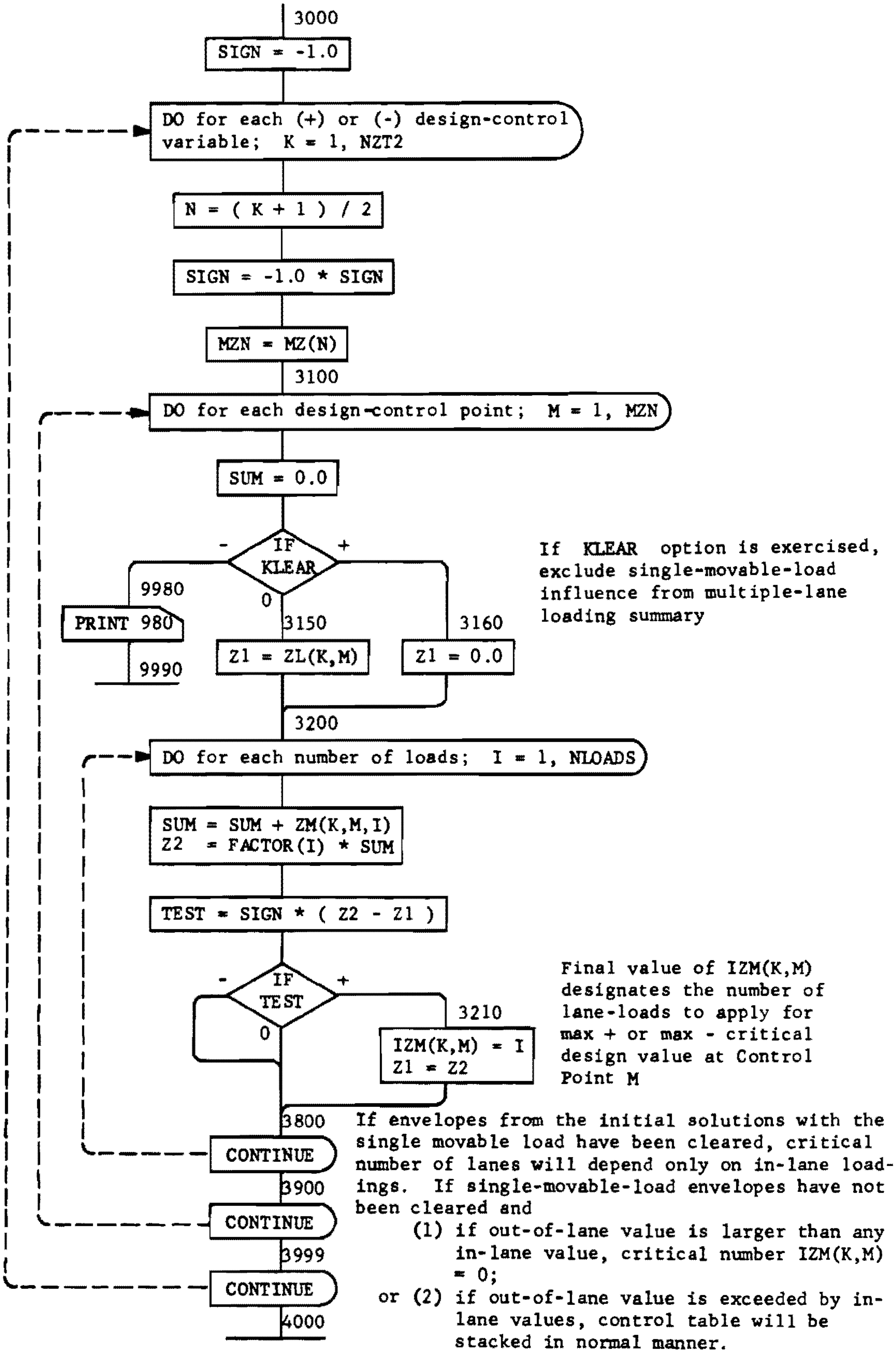
Multiple-Lane Load Summary Table

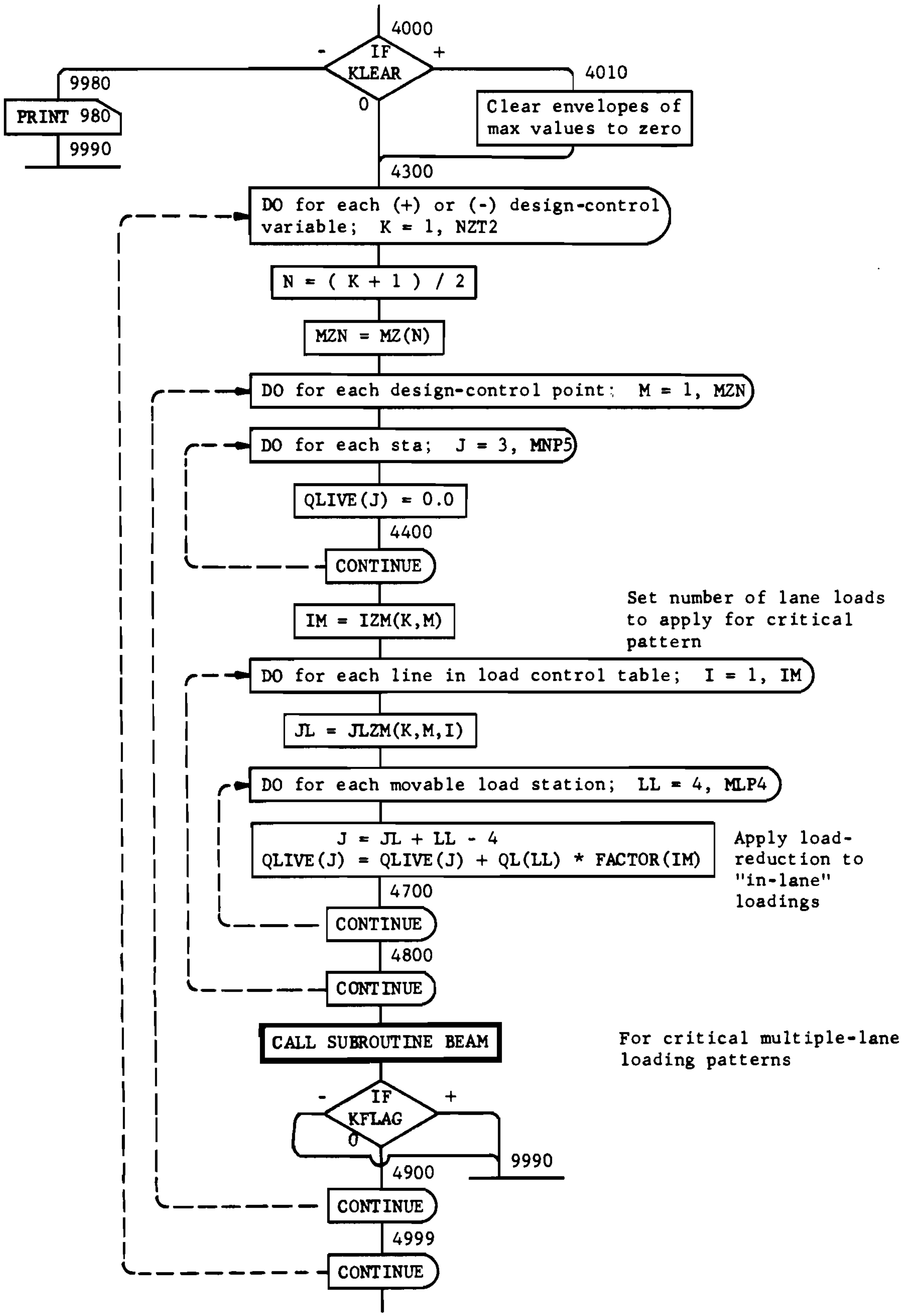
LOAD TYPE	LANE ORDER I	± DESIGN VARIABLE AT POINT M	LOAD PLACED AT	
			Lane Number	Station Number
Single Movable Load (A)	I = 0	ZL(K,M)	LANE(JL)	JL = JLZL(K,M)
In-Lane (B)	I = 1 2 ⋮ I ⋮ NLOADS	ZM(L,M,1) ⋮ ZM(K,M,I) ⋮	LANE(JL) ⋮ LANE(JL) ⋮	JL = JLZM(K,M,1) ⋮ JL = JLZM(K,M,I) ⋮
Position to Enter New Values (C)	NLOADS + 1	ZLIVE	LANE(JL)	JL = JLZM(K,M,NLOADS + 1)

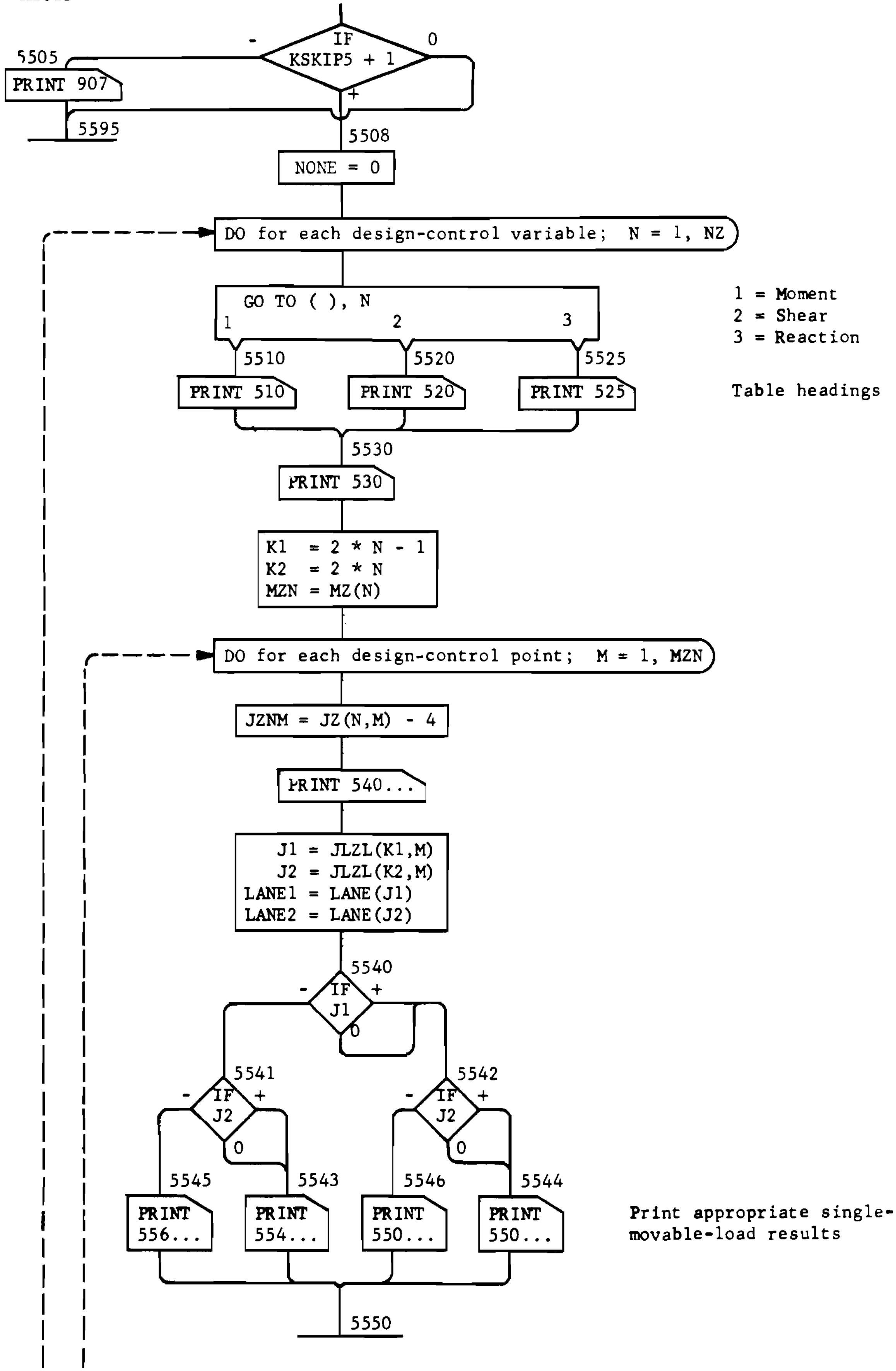
(A) "Single Movable Load" refers to the effect of the most critical, single movable load, placed without regard to lane boundaries. This loading will always have Order I = 0.

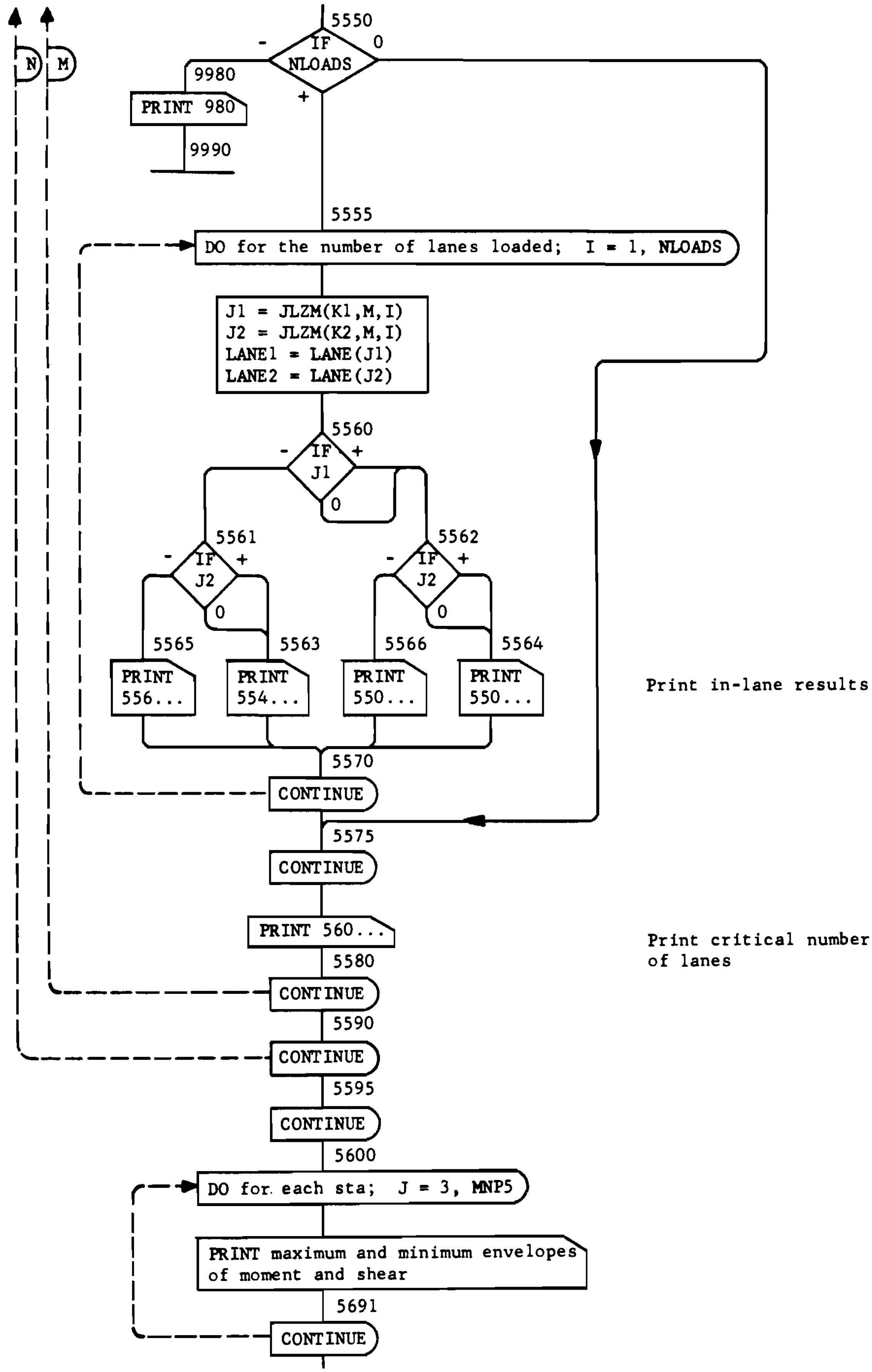
(B) "In-Lane" refers to the effect of the most critical, single movable load which is entirely with a lane. Therefore, ZL(K,M) for I = 0 will be the same value as ZM(K,M,I) for I = 1 when the most critical "single-movable-load" falls entirely within a lane.

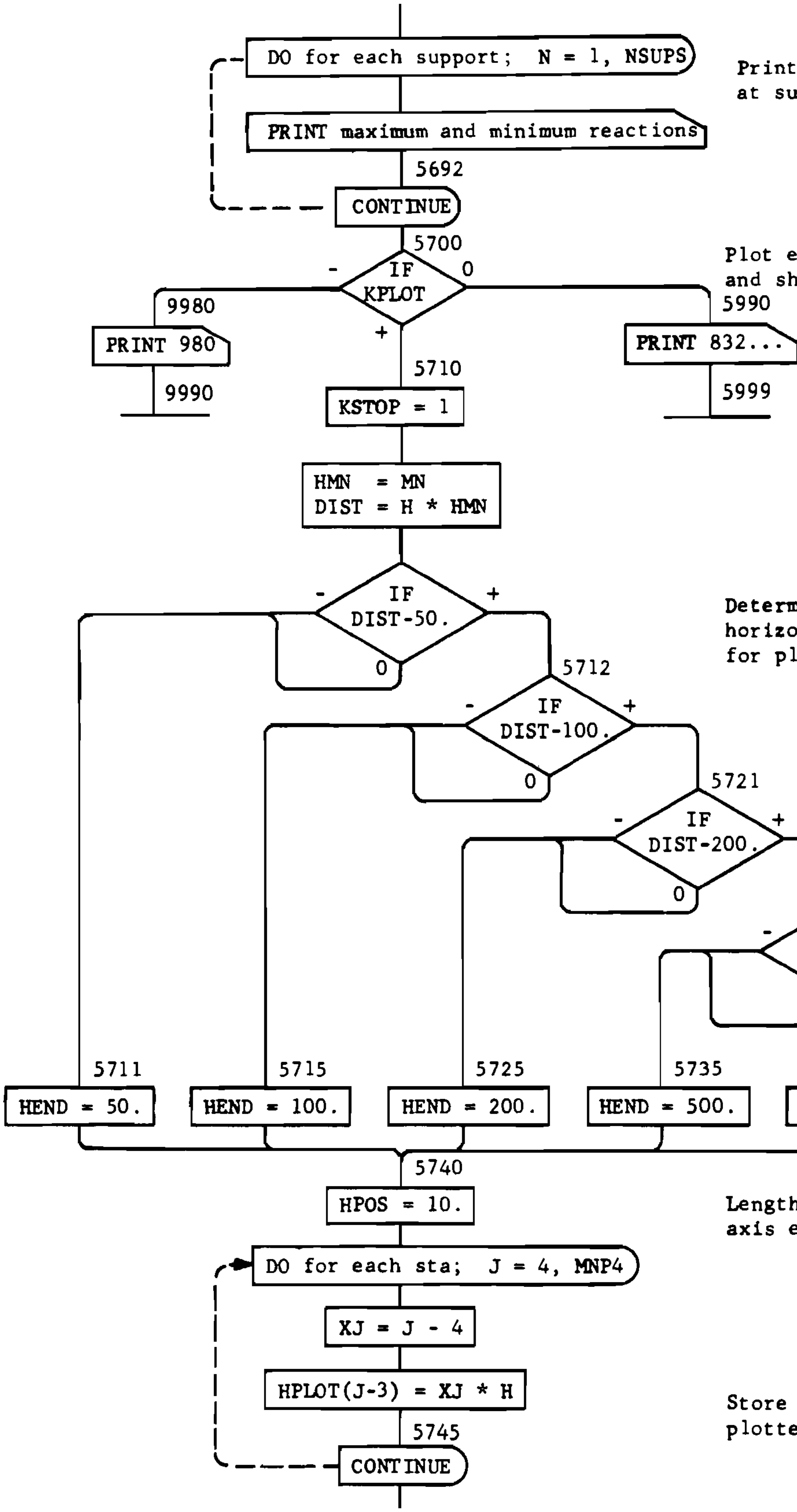
(C) New values of live-load ZLIVE in LANE(JL) at Station JL enter the table at the bottom and are compared to successive values in the table until the new values have progressed upwards to a value which is equal to or larger than the entering value. The values which are less than the new value are displaced one position downward with the least one (of previous order NLOADS) being discarded at the bottom.


3000
SIGN = -1.0
DO for each (+) or (-) design-control variable; K = 1, NZT2
N = (K + 1) / 2
SIGN = -1.0 * SIGN
MZN = MZ(N)
3100
DO for each design-control point; M = 1, MZN
SUM = 0.0
IF KLEAR
-
+
0
9980
PRINT 980
9990
3150
Z1 = ZL(K,M)
3160
Z1 = 0.0
If KLEAR option is exercised, exclude single-movable-load influence from multiple-lane loading summary
3200
DO for each number of loads; I = 1, NLOADS
SUM = SUM + ZM(K,M,I)
Z2 = FACTOR(I) * SUM
TEST = SIGN * (Z2 - Z1)
IF TEST
-
+
0
3210
IZM(K,M) = I
Z1 = Z2
Final value of IZM(K,M) designates the number of lane-loads to apply for max + or max - critical design value at Control Point M
3800
CONTINUE
3900
CONTINUE
3999
CONTINUE
4000
If envelopes from the initial solutions with the single movable load have been cleared, critical number of lanes will depend only on in-lane loadings. If single-movable-load envelopes have not been cleared and
(1) if out-of-lane value is larger than any in-lane value, critical number IZM(K,M) = 0;
or (2) if out-of-lane value is exceeded by in-lane values, control table will be stacked in normal manner.


4000
IF KLEAR
-
+
0
9980
PRINT 980
9990
4010
Clear envelopes of max values to zero
4300
DO for each (+) or (-) design-control variable; K = 1, NZT2
N = (K + 1) / 2
MZN = MZ(N)
DO for each design-control point; M = 1, MZN
DO for each sta; J = 3, MNP5
QLIVE(J) = 0.0
4400
CONTINUE
IM = IZM(K,M)
Set number of lane loads to apply for critical pattern
DO for each line in load control table; I = 1, IM
JL = JLZM(K,M,I)
DO for each movable load station; LL = 4, MLP4
J = JL + LL - 4
QLIVE(J) = QLIVE(J) + QL(LL) * FACTOR(IM)
Apply load-reduction to "in-lane" loadings
4700
CONTINUE
4800
CONTINUE
CALL SUBROUTINE BEAM
For critical multiple-lane loading patterns
IF KFLAG
-
+
0
9990
4900
CONTINUE
4999
CONTINUE


IF
KSKIP5 + 1
-
0
+
5505
PRINT 907
5595
5508
NONE = 0
DO for each design-control variable; N = 1, NZ
GO TO ( ), N
1
2
3
5510
5520
5525
PRINT 510
PRINT 520
PRINT 525
1 = Moment
2 = Shear
3 = Reaction
Table headings
5530
PRINT 530
K1 = 2 * N - 1
K2 = 2 * N
MZN = MZ(N)
DO for each design-control point; M = 1, MZN
JZNM = JZ(N,M) - 4
PRINT 540...
J1 = JLZL(K1,M)
J2 = JLZL(K2,M)
LANE1 = LANE(J1)
LANE2 = LANE(J2)
5540
IF
J1
5541
5542
IF
J2
5545
5543
5546
5544
PRINT
556...
PRINT
554...
PRINT
550...
PRINT
550...
Print appropriate single-
movable-load results
5550


5550
IF NLOADS
-
0
+
9980
PRINT 980
9990
N
M
5555
DO for the number of lanes loaded; I = 1, NLOADS
J1 = JLZM(K1,M,I)
J2 = JLZM(K2,M,I)
LANE1 = LANE(J1)
LANE2 = LANE(J2)
5560
IF J1
5561
IF J2
5562
IF J2
5565
5563
5566
5564
PRINT 556...
PRINT 554...
PRINT 550...
PRINT 550...
Print in-lane results
5570
CONTINUE
5575
CONTINUE
PRINT 560...
Print critical number of lanes
5580
CONTINUE
5590
CONTINUE
5595
CONTINUE
5600
DO for each sta; J = 3, MNP5
PRINT maximum and minimum envelopes of moment and shear
5691
CONTINUE



Print reactions only at supports

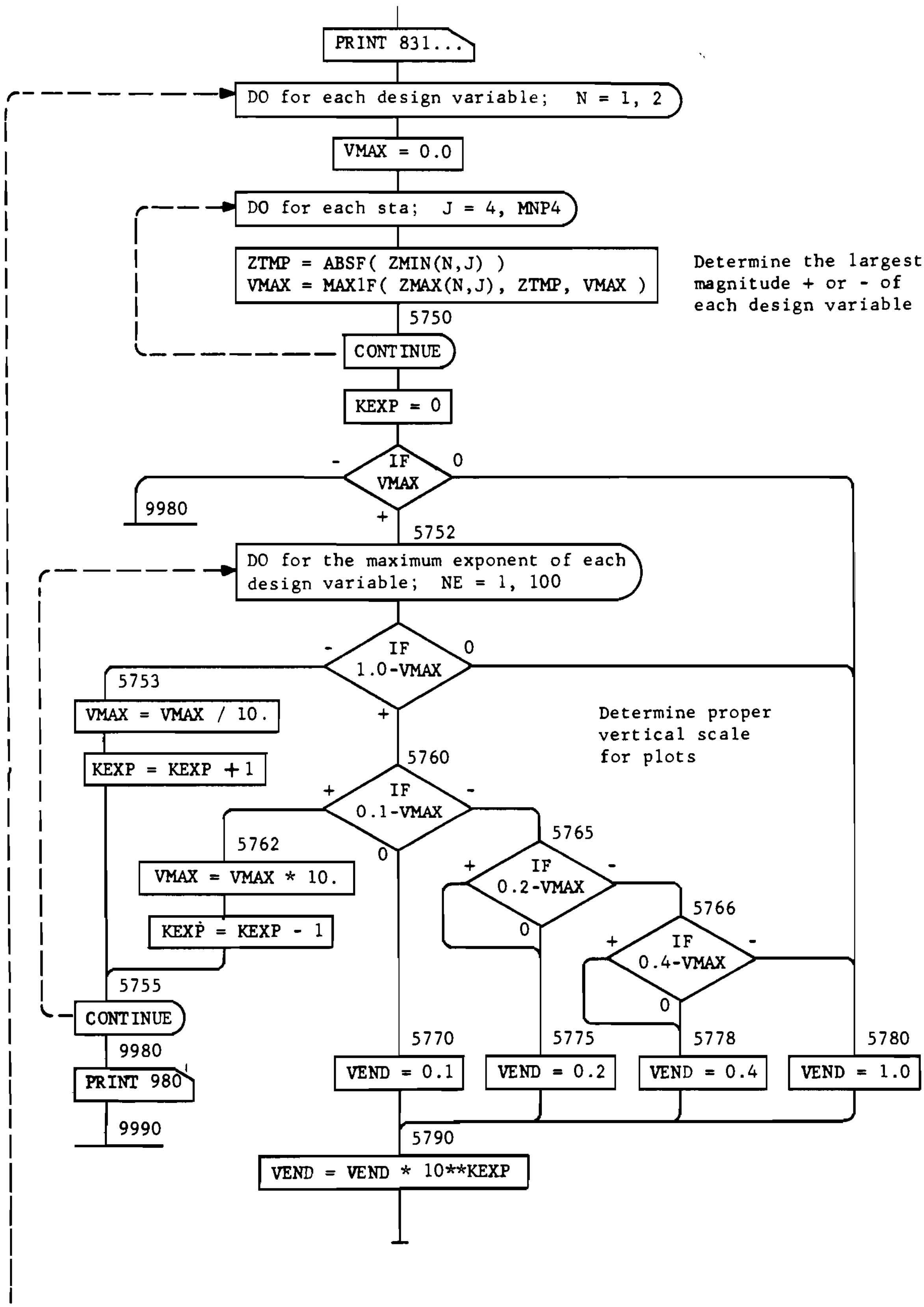
Plot envelopes of moment and shear if KPLOT = 1

KSTOP is for plot tape control

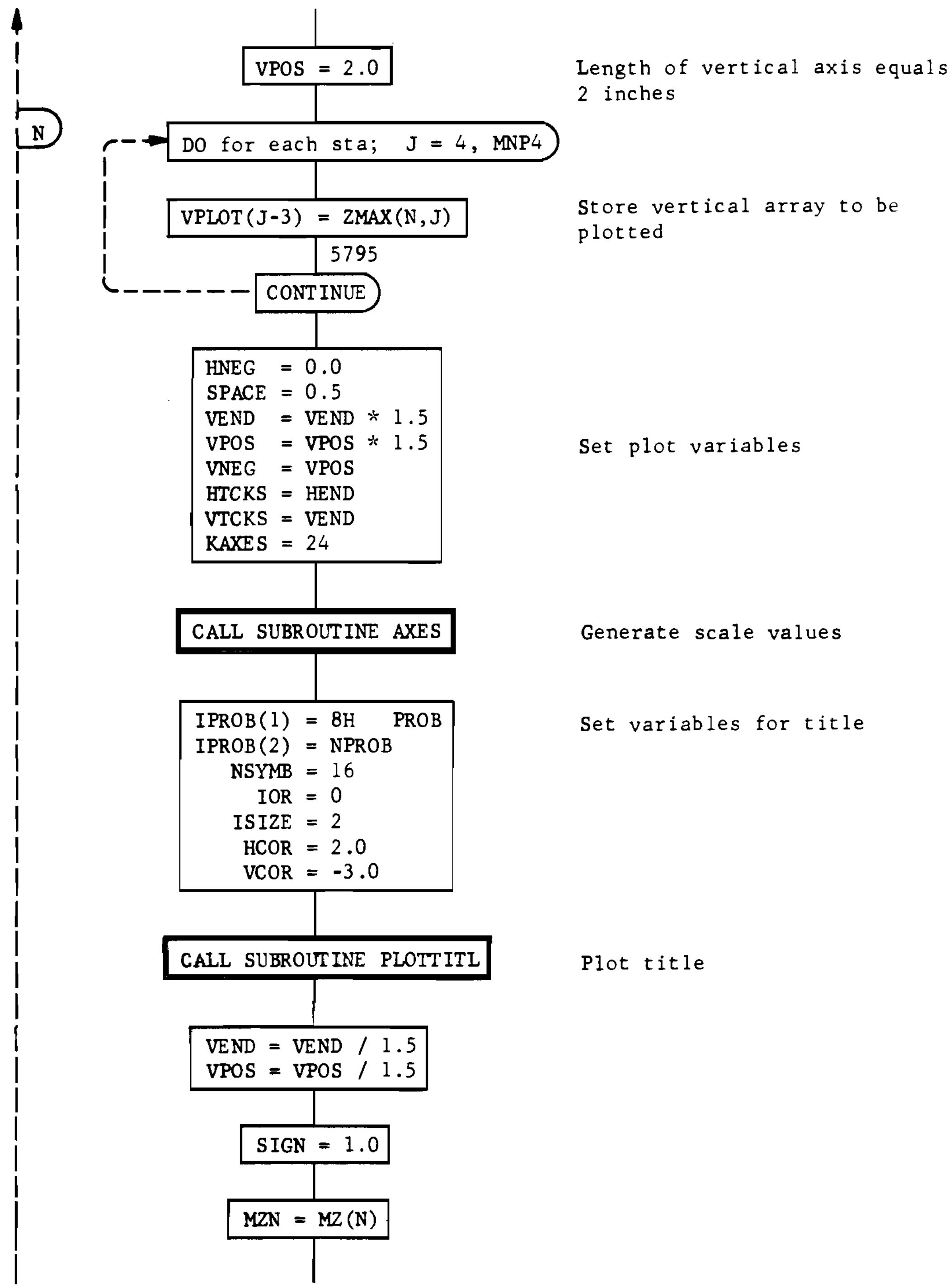
Determine proper horizontal scale for plots

Length of horizontal axis equals 10 inches

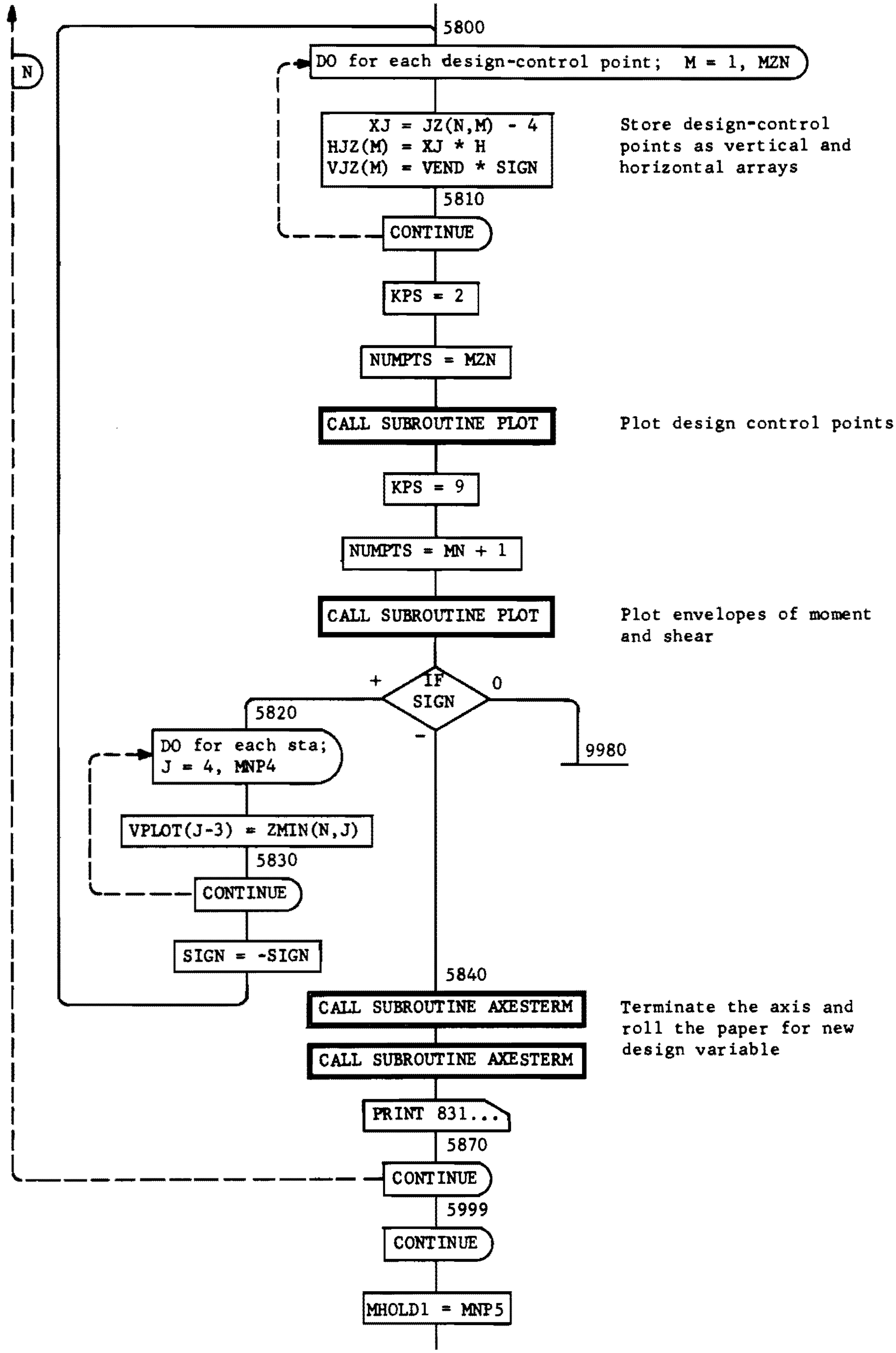
Store array to be plotted

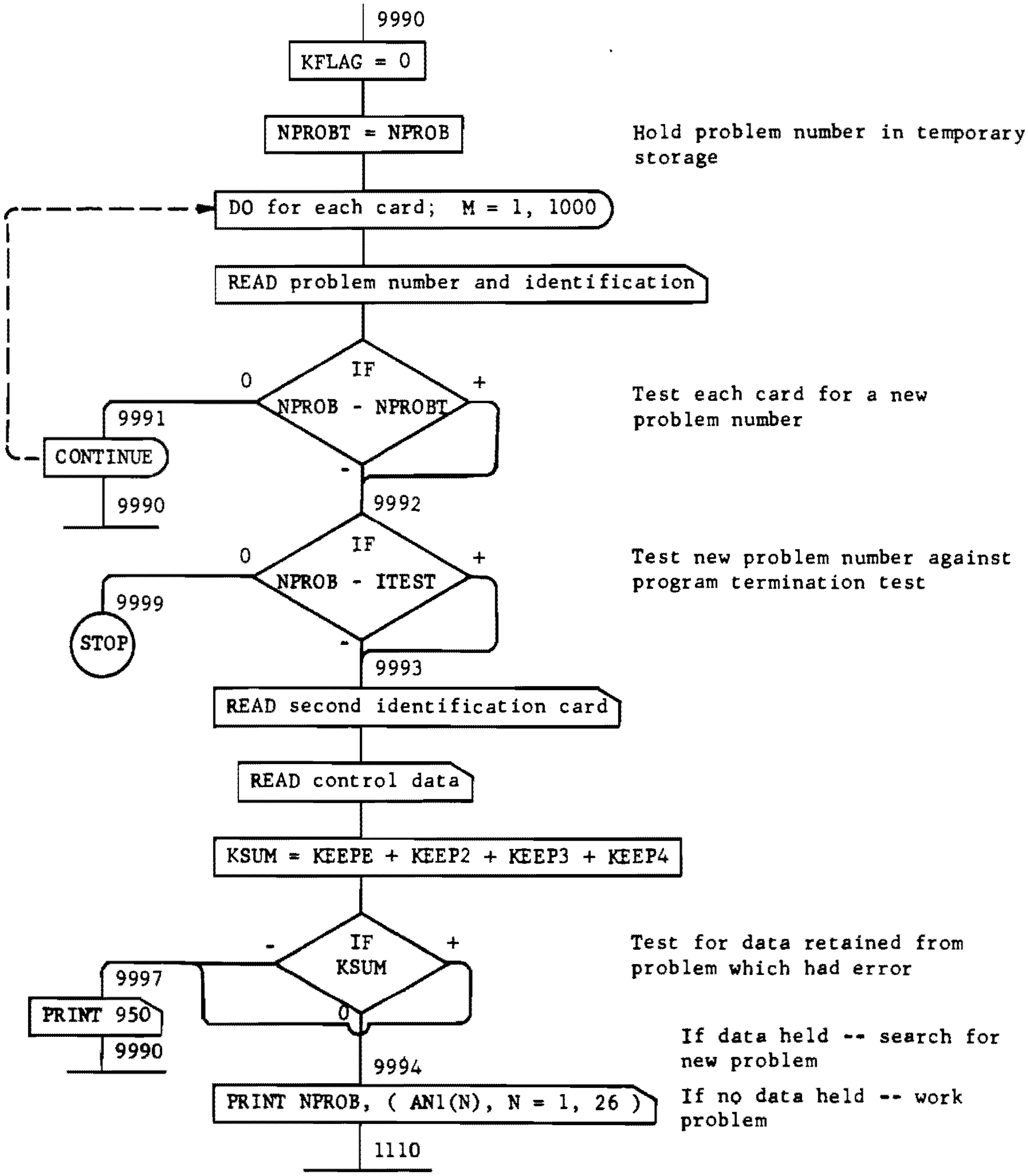


PRINT 831...
DO for each design variable; N = 1, 2
VMAX = 0.0
DO for each sta; J = 4, MNP4
ZTMP = ABSF(ZMIN(N,J))
VMAX = MAX1F(ZMAX(N,J), ZTMP, VMAX)
Determine the largest magnitude + or - of each design variable
5750
CONTINUE
KEXP = 0
IF VMAX
-
0
+
9980
5752
DO for the maximum exponent of each design variable; NE = 1, 100
IF 1.0-VMAX
-
0
+
5753
VMAX = VMAX / 10.
KEXP = KEXP + 1
Determine proper vertical scale for plots
5760
IF 0.1-VMAX
+
-
0
5762
VMAX = VMAX * 10.
KEXP = KEXP - 1
5765
IF 0.2-VMAX
+
-
0
5766
IF 0.4-VMAX
+
-
0
5755
CONTINUE
9980
PRINT 980
9990
5770
VEND = 0.1
5775
VEND = 0.2
5778
VEND = 0.4
5780
VEND = 1.0
5790
VEND = VEND * 10**KEXP

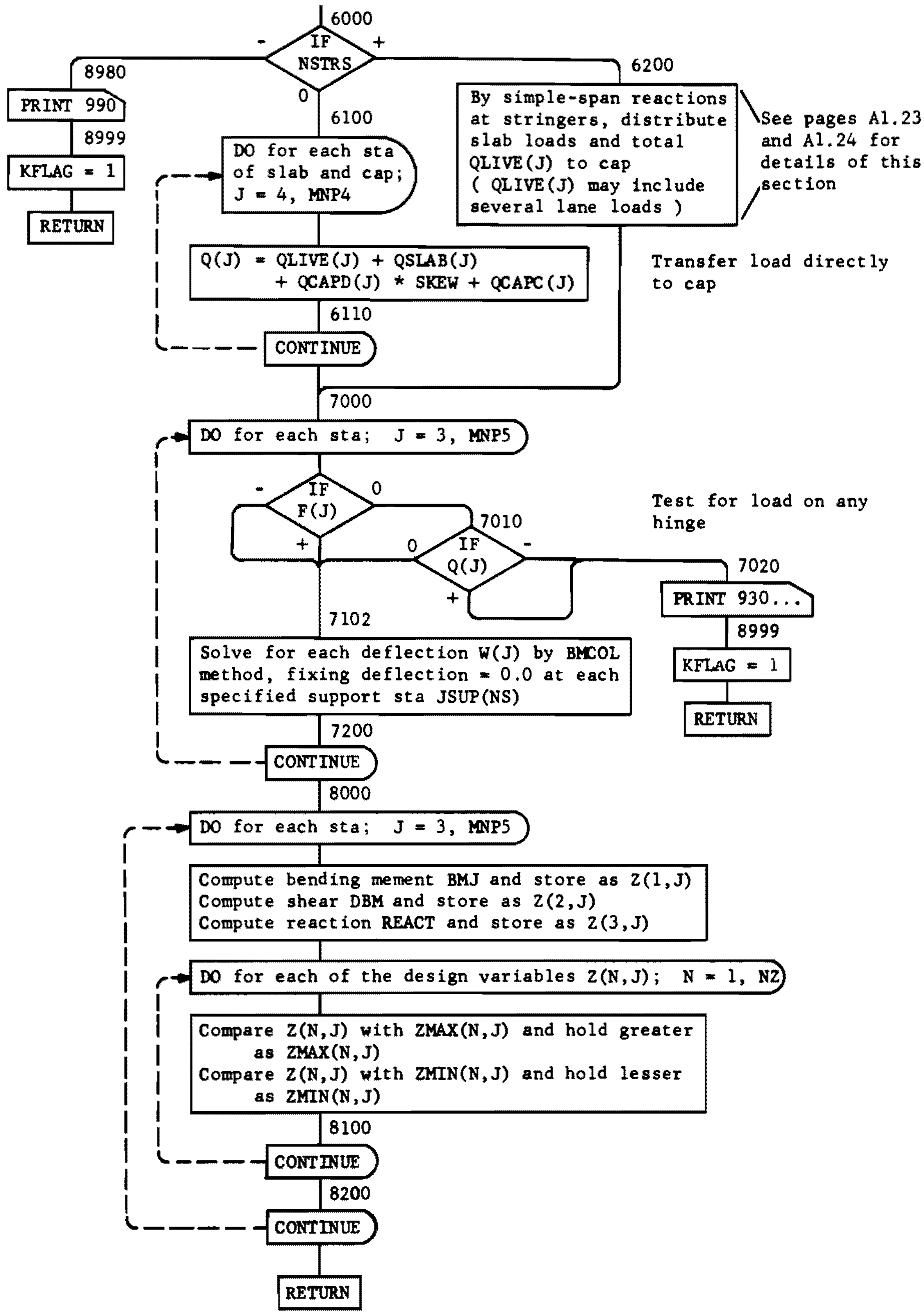


VPOS = 2.0
Length of vertical axis equals 2 inches
N
DO for each sta; J = 4, MNP4
VPLOT(J-3) = ZMAX(N,J)
Store vertical array to be plotted
5795
CONTINUE
HNEG = 0.0
SPACE = 0.5
VEND = VEND * 1.5
VPOS = VPOS * 1.5
VNEG = VPOS
HTCKS = HEND
VTCKS = VEND
KAXES = 24
Set plot variables
CALL SUBROUTINE AXES
Generate scale values
IPROB(1) = 8H PROB
IPROB(2) = NPROB
NSYMB = 16
IOR = 0
ISIZE = 2
HCOR = 2.0
VCOR = -3.0
Set variables for title
CALL SUBROUTINE PLOTTITL
Plot title
VEND = VEND / 1.5
VPOS = VPOS / 1.5
SIGN = 1.0
MZN = MZ(N)

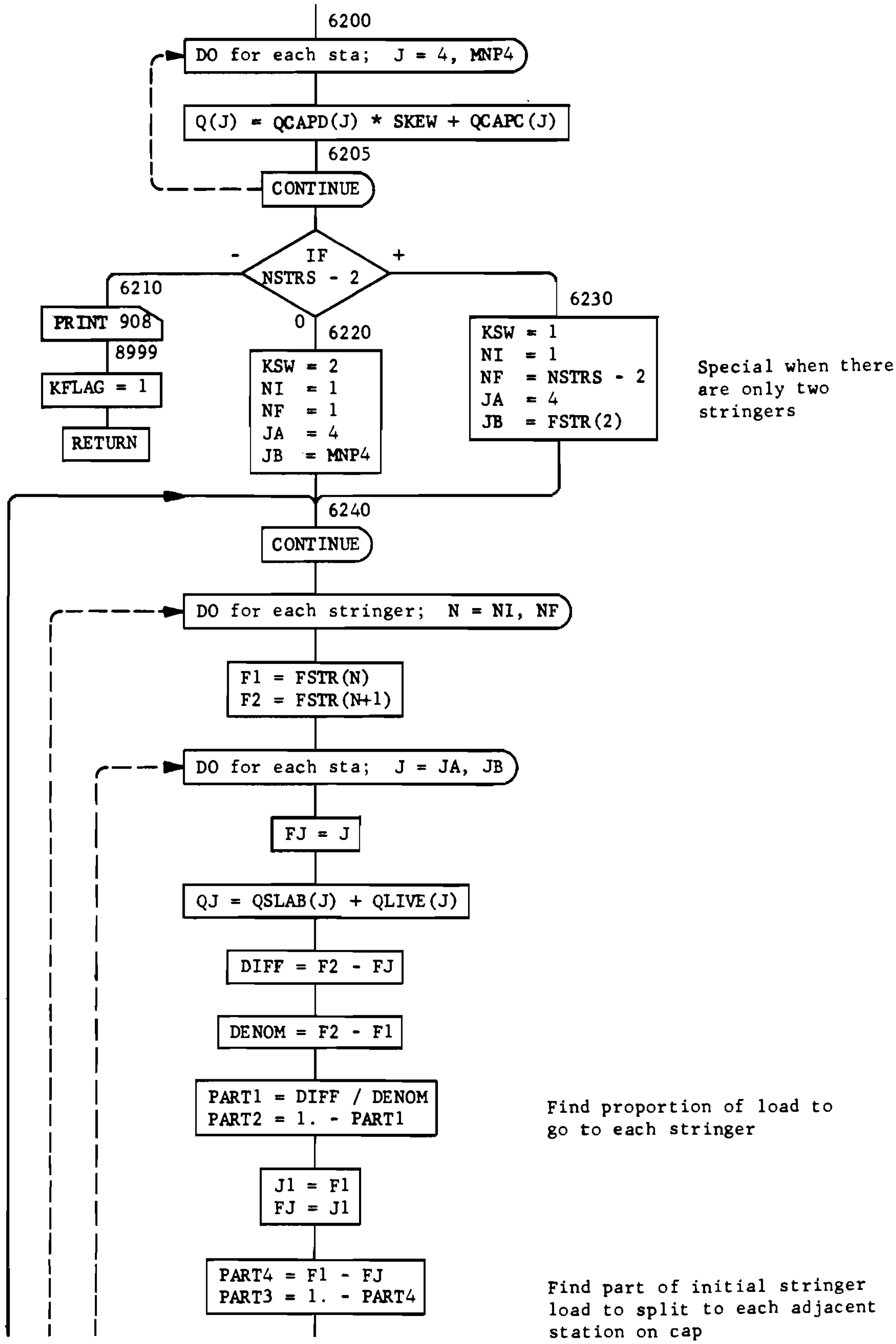

N
5800
DO for each design-control point; M = 1, MZN
XJ = JZ(N,M) - 4
HJZ(M) = XJ * H
VJZ(M) = VEND * SIGN
Store design-control points as vertical and horizontal arrays
5810
CONTINUE
KPS = 2
NUMPTS = MZN
CALL SUBROUTINE PLOT
Plot design control points
KPS = 9
NUMPTS = MN + 1
CALL SUBROUTINE PLOT
Plot envelopes of moment and shear
IF SIGN
+
0
-
9980
5820
DO for each sta; J = 4, MNP4
VPLOT(J-3) = ZMIN(N,J)
5830
CONTINUE
SIGN = -SIGN
5840
CALL SUBROUTINE AXESTERM
CALL SUBROUTINE AXESTERM
Terminate the axis and roll the paper for new design variable
PRINT 831...
5870
CONTINUE
5999
CONTINUE
MHOLD1 = MNP5


9990
KFLAG = 0
NPROBT = NPROB
Hold problem number in temporary storage
DO for each card; M = 1, 1000
READ problem number and identification
IF NPROB - NPROBT
0
+
-
Test each card for a new problem number
9991
CONTINUE
9990
9992
IF NPROB - ITEST
0
+
-
Test new problem number against program termination test
9999
STOP
9993
READ second identification card
READ control data
KSUM = KEEPE + KEEP2 + KEEP3 + KEEP4
IF KSUM
-
+
0
Test for data retained from problem which had error
9997
PRINT 950
9990
If data held -- search for new problem
9994
PRINT NPROB, (AN1(N), N = 1, 26)
If no data held -- work problem
1110

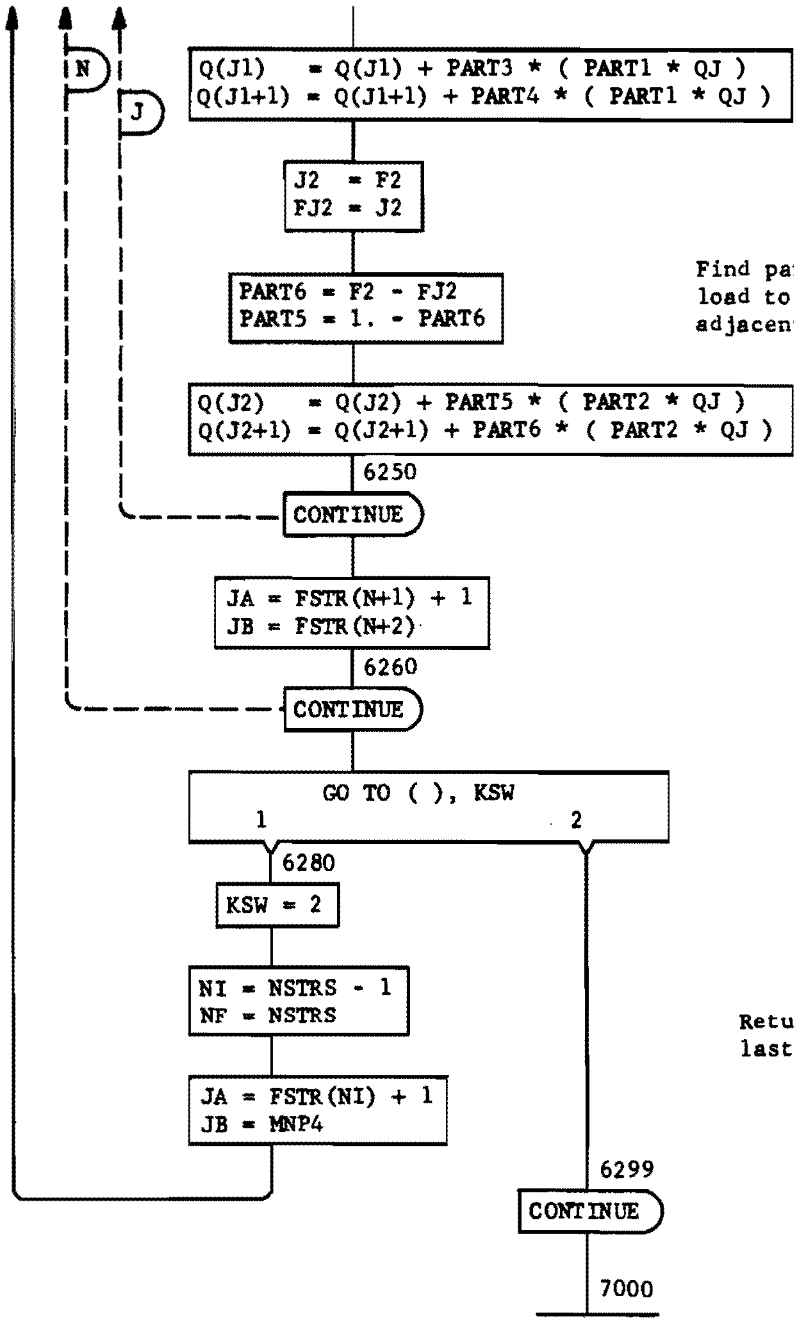
SUBROUTINE BEAM



SUBROUTINE BEAM cont'd



SUBROUTINE BEAM cont'd



Find part of final stringer load to split to each adjacent station on cap

Returns one time for last pass

APPENDIX 2

GLOSSARY OF NOTATION FOR CAP 14

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C-----NOTATION FOR CAP 14       * DENOTES INPUT                               18NO4
C         A(J)                  CONTINUITY COEFFICIENT                        20AG3
C         AA                    COEFF IN STIFFNESS MATRIX                     12JE3
C         AN1( )                IDENTIFICATION AND REMARKS (ALPHA-NUM)        20AG4
C         B(J)                  CONTINUITY COEFFICIENT                        20AG3
C         BB                    COEFF IN STIFFNESS MATRIX                     12JE3
C         BMI                   BENDING MOMENT AT STA J-1                     04JE3
C         BMJ                   BENDING MOMENT AT STA J                       07JE3
C         BMK                   BENDING MOMENT AT STA J+1                     04JE3
C         C(J)                  CONTINUITY COEFFICIENT                        20AG3
C         CC                    COEFF IN STIFFNESS MATRIX                     12JE3
C         D                     MULTIPLIER IN CONTINUITY COEFF EQS            20AG3
C         DBM                   FIRST DERIV OF BENDING MOMENT, DM/DX          07JE3
C         DD                    COEFF IN STIFFNESS MATRIX                     12JE3
C         DENOM                 DENOMINATOR                                   07JE3
C         DIFF                  DIFFERENCE                                    12JE3
C         DIST                  LENGTH OF CAP IN FEET                         15JL4
C         E                     TERM IN CONTINUITY COEFF EQS                  12JE3
C         EE                    COEFF IN STIFFNESS MATRIX                     12JE3
C         ESM                   MULTIPLIER FOR HALF VALUES AT END STAS        07JE3
C       * FACTOR(I)             MULTIPLE-LANE LOAD-REDUCTION FACTOR           20AG3
C         FF                    COEFF IN LOAD MATRIX                          12JE3
C         F1, F2                INITIAL AND FINAL DISTRIBUTION POINTS IN      03JN4
C                               SEQUENCE                                      03JN4
C         FJ, FJ2               FLOATING POINT STA NUM IN STRINGER LOAD       15JL4
C                               SPLIT ROUTINE                                 15JL4
C       * FN1, FN2, F(J)        FLEXURAL STIFFNESS (EI) (INPUT AND TOTAL)     20AG3
C         FSTR(N)               STATION FOR STRINGER N                        03JN4
C         FSTR1                 FLOATING POINT EQUIVALENT OF JSTR             15JL4
C         H                     INTERNAL INCREMENT LENGTH                     30JE4
C         HCOR                  HORIZONTAL COORDINATE OF THE FIRST SYMBOL     15JL4
C                               IN THE PLOT TITLE                             15JL4
C         HEND                  VALUE ASSIGNED TO END OF HORIZONTAL-AXIS.     16AP4
C         HE2                   H SQUARED                                     12JE3
C         HE3                   H CUBED                                       12JE3
C       * HI                    INCREMENT LENGTH                              30JE4
C         HJZ( )                HORIZONTAL VALUE OF DESIGN CONTROL POINT      15JL4
C         HMN                   FLOATING POINT EQUIVALENT OF MN               15JL4
C         HNEG                  LENGTH, IN INCHES, OF THE NEGATIVE H-AXIS.14AP4
C                               THIS VARIABLE MUST NOT ITSELF BE NEGATIVE.14AP4
C         HPLOT( )              NAME OF ARRAY TO BE PLOTTED ON H-AXIS         27AP4
C         HPOS                  LENGTH, IN INCHES, OF THE POSITIVE H-AXIS     14AP4
C         HTCKS                 INCREMENT LENGTH BETWEEN TICK MARKS ON        14AP4
C                               H-AXIS IN TERMS OF HEND                       27AP4
C         HT2                   H TIMES 2                                     12JE3
C         I                     INDEX IN LOAD-CONTROL TABLE                   31JA4
C         IM                    NUM OF CRITICAL LOAD REDUCTION FACTOR         26NO3
C         IN1, IN2, ISTA        EXTERNAL STA NUMBER = J - 4                   18DE3
C         IOR                   ORIENTATION OF THE TITLE, = PARALLEL TO       15JL4
C                               THE AXIS                                      15JL4
C         IPROB( )              VARIABLE USED TO PLOT TITLES ON PLOTS         15JL4
C         IR                    REVERSE-ORDER INDEX IN LOAD-CONTROL TABLE     22AG3
C         IR1                   INITIAL INDEX IN LOAD CONTROL TABLE           26NO3
C         ISIZE                 SIZE OF THE LETTERS IN THE PLOT TITLE         15JL4
C         ISW                   ROUTING SWITCH FOR TABLE 4                    18DE3
```

```
C         ITEST                 = 5 ALPHANUMERIC BLANKS, USED TO TERMINATE15JL4
C                               THE PROGRAM                                15JL4
C         IUNIT( )              UNITS OF OUTPUT TERMS, TABLE 7             15JL4
C         IZM(K,M)              CRITICAL NUMBER OF SIMULTANEOUS LANE LOADS22AG3
C         J, JN                 INTERNAL STA ALONG SLAB AND CAP = I + 4    20AG3
C         JA, JB                STRINGER DISTRIBUTION STATIONS             31JA4
C         J1, J2                INITIAL AND FINAL STATIONS IN SEQUENCE     05JE3
C         JBEGIN                INITIAL IN-LANE POSITION OF MOVABLE LOAD   26NO3
C         JEND                  FINAL IN-LANE POSITION OF MOVABLE LOAD     20AG3
C         JI                    NON-SUBSCRIPTED VALUE OF JLZM(K,M,I)       20AG4
C         JINCR                 INCREMENTATION INDEX                       12JE3
C         JL                    POSITION OF MOVABLE-LOAD STA ZERO (LL=0)   20AG3
C       * JLEFT(L)              STATION AT LEFT SIDE OF LANE L             20AG3
C         JLINC                 INDEX USED IN MOVING MOVABLE LOAD          15JL4
C         JLTEMP                TEMPORARY HOLD FOR CONTROL-TABLE ROUTINE   22AG3
C         JLZL(K,M)             LOAD STA FOR RANDOM-POS MIN OR MAX AT PT M22AG3
C         JLZM(K,M,I)           LOAD POS FOR I-TH MAX OR MIN AT DES PT M   22AG3
C       * JRIGHT(L)             STATION AT RIGHT SIDE OF LANE L            20AG3
C       * JSTART                INITIAL POSITION OF MOVABLE-LOAD STA ZERO  20AG3
C       * JSTOP                 FINAL POSITION OF MOVABLE-LOAD STA ZERO    09JA4
C         JSTR                  FIXED POINT EQUIVALENT OF FSTR(N)          15JL4
C       * JSUP(NS)              STATION FOR SUPPORT NS                     20AG3
C       * JZ(N,M)               STA AT DESIGN CONTROL POINT M FOR Z(N,J)   22AG3
C         JZNM                  TEMPORARY VALUE OF JZ(N,M)                 15JL4
C         K                     DO LOOP INDEX                              15JL4
C         K1, K2                INTERNAL VALUE OF NZ                       15JL4
C         KAXES                 INDEX USED TO DESCRIBE MANNER IN WHICH     10JL4
C                               AXES SHOULD BE PLACED ON PAPER             14AP4
C       * KEEP2 THRU KEEP4      IF = 1, KEEP PRIOR DATA, TABLES 2-4        20AG4
C       * KEEPE                 IF = 1, KEEP PRIOR ENVELOPES OF EXTREMES   18DE3
C         KEXP                  EXPONENT OF 10 TIMES DESIGN VARIABLE       20AG4
C                               REDUCED TO ONE SIGNIFICANT FIGURE          24AP4
C         KFLAG                 ERROR FLAG                                 20AG4
C       * KLEAR                 IF = 1, CLEAR ENVELOPES BEFORE LANE LOADS  18DE3
C       * KPLOT                 IF = 1, EXCLUDE PLOTS OF ENVELOPES         18DE3
C         KPS                   PLOT SYMBOL TO BE USED                     14AP4
C                               1 DENOTES SMALL PLUS SIGN                  14AP4
C                               2 DENOTES SMALL X                          14AP4
C                               3 DENOTES SMALL SQUARE                     14AP4
C                               4 DENOTES SMALL STAR (COMBINATION OF 1, 2)14AP4
C                               8 DENOTES NO SYMBOL TO BE PLOTTED, BUT     14AP4
C                                        PEN TO BE MOVED                   16AP4
C                               9 DENOTES LARGE PLUS SIGN                  14AP4
C                               10 DENOTES LARGE X                         14AP4
C                               11 DENOTES LARGE SQUARE                    14AP4
C                               12 DENOTES LARGE STAR (COMBINATION OF 9    16AP4
C                                        AND 10)                           16AP4
C                               A NEGATIVE NUMBER WILL MAKE THE SAME       14AP4
C                               SYMBOLS AS THE POSITIVE NUMBERS, BUT THE   14AP4
C                               POINTS WILL BE CONNECTED WITH STRAIGHT     14AP4
C                               LINES.  THUS IF KPS = -8 THE POINTS WILL   16AP4
C                               BE CONNECTED BY STRAIGHT LINES WITHOUT     16AP4
C                               THE POINTS BEING MARKED BY PLOT SYMBOLS    16AP4
C         KR1                   PRIOR VALUE OF KR2                         05AG3
C         KR2                   IF = 1, REFER TO NEXT CARD                 05AG3
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C          KSKIP5                 OPTION (IF= -1) TO OMIT OUTPUT TABLE5       18NO4
C          KSTOP                  ROUTING SWITCH TO SKIP PLOT TAPE (IF=0)     23JL4
C          KSUM                   SUM OF ALL KEEP OPTIONS                     20AG4
C          KSW                    ROUTING SWITCH FOR TABLE 4 AND OTHERS       19AG4
C          LANE(JL)               LANE FOR MOVABLE LD, ZERO IF NOT IN-LANE    20AG3
C          LANE1, LANE2           TEMPORARY LANE RANK OUTPUT DEVICES          26NO3
C          L, LLL                 LANE NUMBER IN LANE ROUTINE                 31JA4
C          LL                     MOVABLE-LOAD STATION                        20AG3
C          LTEST                  TEMPORARY TEST IN LANE ROUTINE              26NO3
C          M                      DO LOOP INDEX                               15JL4
C          MHOLD                  M FROM PREVIOUS PROBLEM                     15JL4
C        * ML                     TOTAL MOVABLE-LOAD WIDTH IN INCREMENTS      20AG3
C        * MLINC                  NUMBER OF STAS BETWEEN EACH POSITION OF     16JL4
C                                 MOVABLE LOAD                                16JL4
C          MLP4                   ML + 4                                      31JA4
C          MM                     DO LOOP INDEX                               20AG4
C        * MN                     TOTAL NUM INCREMENTS FOR SLAB AND CAP       20AG3
C          MNP4, MNP5, MNP7       MN + 4, MN + 5, MN + 7                      31JA4
C          MP1                    M + 1                                       20AG4
C          MT                     VARIABLE DO LOOP INDEX                      20AG4
C        * MZ(N), MZN             TOTAL NUM DES CONTROL POINTS FOR Z(N,J)     15MY4
C          MZ1, MZ2, MZ3          NON-SUBSCRIPTED VALUES OF DESIGN POINTS     20AG4
C          N                      NUMBER OF THE PARTICULAR DESIGN VARIABLE    31JA4
C          NAME(N)                AXIS NAME - OUTPUT IN TABLE 7               15MY4
C        * NCD2 THRU NCD4         NUM CARDS IN TABLES 2 THRU 4, THIS PROB     20AG3
C          NE                     INDEX IN SCALE DETERMINATION ROUTINE        24AP4
C          NI, NF                 STRINGER DISTRIBUTION INDICES               03FE4
C        * NLANES                 TOTAL NUMBER OF LANES                       20AG3
C        * NLOADS                 MAX NUM LANES TO BE LOADED SIMULTANEOUSLY   20AG3
C          NONE                   OUTPUT CONSTANT EQUAL TO ZERO               26NO3
C        * NPROB                  PROBLEM NUMBER (PROG STOPS IF BLANK)        15JL4
C          NPROBT                 TEMPORARY HOLD OF NPROB                     20AG4
C          NS                     INDEX NUM FOR SUPPORT POINT                 18DE3
C          NSTA                   NUM OF STA REQUIRED BETWEEN A SUPPORT AND   15JL4
C                                 A DESIGN CONTROL POINT                      15JL4
C        * NSTRS                  TOTAL NUMBER OF STRINGERS                   20AG3
C        * NSUPS                  TOTAL NUMBER OF SUPPORTS                    20AG3
C          NSYMB                  NUM OF SYMBOLS TO BE PLOTTED IN THE TITLE   15JL4
C          NT, NST                INDICES IN SHEAR DESIGN POINT CHECK         06MY4
C          NUMPTS                 NUMBER OF POINTS TO BE PLOTTED              14AP4
C          NZ  (=3FOR CAP 14)     TOTAL NUM OF DES VARIABLES (INTERNAL)       20AG4
C          NZT2                   NZ TIMES 2                                  15JL4
C          PART,PART1-6           FRACTIONS                                   15JL4
C        * QCAPC(J)               CONCENTRATED DEAD LOAD FROM CAP AT STA J    03JN4
C        * QCAPD(J)               DISTRIBUTED DEAD LOAD FROM CAP AT STA J     03JN4
C          QJ                     TEMP VALUE OF LOADS IN SUBROUTINE BEAM      15JL4
C        * QL(LL)                 FORCE AT MOVABLE-LOAD STA LL                20AG3
C          QLIVE(J)               TOTAL LIVE-LOAD DISTRIBUTION                06MY4
C          Q(J)                   TRANSVERSE FORCE ( INPUT, TOTAL )           20AG4
C          QS1, QC1, QL1          TRANSVERSE FORCE ( INTERNAL DISTRIBUTION )26NO3
C          QS2, QC2, QL2          TRANSVERSE FORCE (INPUT)                    26NO3
C        * QSLAB(J)               DEAD LOAD FROM SLAB OR SIDEWALK AT STA J    20AG3
C          REACT                  SECOND DERIV OF BENDING MOMENT              20AG4
C          SIGN                   SWITCH CONTROL ON + OR - DESIGN VARIABLE    26NO3
C          SKEW                   1.0 DIVIDED BY COSINE OF THETAR             15JL4
```

```
C          SPACE                DISTANCE, IN INCHES, FROM LEFT EDGE OF     14AP4
C                               PAPER TO END OF NEGATIVE H-AXIS            14AP4
C          SUM                  CUMULATIVE EFFECT OF MULTI-LANE LOADING    22AG3
C          TEST, ZTEST          TEMPORARY TEST IN CONTROL TABLE ROUTINE    26NO3
C        * THETA                ANGLE OF SKEW, DEGREES AND DECIMALS        15JL4
C          THETAR               ABSOLUTE VALUE OF THETA IN RADIANS         15JL4
C          VCOR                 VERTICAL COORDINATE OF THE BOTTOM OF THE   15JL4
C                               PLOT TITLE                                 15JL4
C          VEND                 VERTICAL AXIS VALUE AT 2 INCHES            24AP4
C          VJZ( )               VERTICAL PLOT VALUE OF DES CONTROL POINT   15JL4
C          VMAX                 ABSOLUTE MAXIMUM VALUE OF DESIGN VARIABLE  24AP4
C          VNEG                 LENGTH, IN INCHES, OF THE NEGATIVE V-AXIS.14AP4
C                               THIS VARIABLE MUST NOT ITSELF BE NEGATIVE.14AP4
C          VPLOT( )             NAME OF ARRAY TO BE PLOTTED ON V-AXIS      27AP4
C          VPOS                 LENGTH, IN INCHES, OF THE POSITIVE V-AXIS  14AP4
C          VTCKS                INCREMENT LENGTH BETWEEN TICK MARKS ON     14AP4
C                               V-AXIS IN TERMS OF VEND                    16AP4
C          W(J)                 LATERAL DEFLECTION OF BMCOL AT STA J       12JE3
C          X                    DISTANCE ALONG THE BMCOL                   30MY3
C          XJ                   FLOATING POINT EQUIVALENT OF THE STA NUM   15JL4
C          Z(N,J)               DESIGN VARIABLE NUM N AT STA J             22AG3
C          Z1,Z2                SUCCESSIVE VALUES IN CRITICAL-LOAD STUDY   22AG3
C          ZD(N,M)              DESIGN VARIABLE N AT DESIGN POINT M        10JA4
C          ZL(K,M)              MAX OR MIN ONE-LOAD INFLUENCE AT DES PT M  22AG3
C          ZLIVE                DESIGN VARIABLE FROM LIVE LOAD ONLY        31JA4
C          ZM(K,M,I)            I-TH VALUE IN IN-LANE LOAD-CONTROL TABLE   22AG3
C          ZMAX(N,J)            MAX Z(N,J) FROM ALL PRIOR LOADINGS         22AG3
C          ZMIN(N,J)            MIN Z(N,J) FROM ALL PRIOR LOADINGS         22AG3
C          ZTEMP                TEMPORARY HOLD FOR CONTROL-TABLE ROUTINE   22AG3
C          ZTMP                 TEMPORARY HOLD FOR SCALE DETERMINATION     24AP4
```

APPENDIX 3

LISTING OF PROGRAM DECK OF CAP 14

```
      PRCGRAM CAP 14
    1 FCRMAT (     51H PRCGRAM CAP 14 -      DECK 2 - MATLOCK - INGRAM
     1             28H REVISICN DATE = 30AUG 66      )                    25JL6
      DIMENSION      AN1(27),                                             04AG4
     1          JLEFT(10), JRIGHT(10), JSUP(20), FSTR(30), F(307),        04AG4
     2          QL(3C7), LANE(3C7), FACTOR(5), QLIVE(307), CSLAB(307),    10AP4
     3          QCAPD(307), Z(3,3C7), ZMAX(3,307),ZMIN(3,307),QCAPC(307),03AG4
     4          MZ(3), JZ(3,3C), ZM(6,3C,6), JLZM(6,30,6), ZL(6,30),      03AG4
     5          JLZL(6,30), IZM(6,30), ZD(3,30),                          03AG4
     6          VPLCT(307), HPLCT(307), VJZ(30), HJZ(30), NAME(3),        30JE4
     7          IPRCB(2), IUNIT(3)                                        02JL4
      COMMCN QLIVE, CSLAB, QCAPD, QCAPC, FSTR, JSUP, F, ZMAX, ZMIN, Z     05JE4
   11 FCRMAT ( 1H1 )                                                      14AG4
   12 FCRMAT  ( 4X, A5, 6X, 13A5 )                                        04AG4
   13 FORMAT (     5X, 16A5 )                                             26AG3 ID
   14 FCRMAT  ( 15X, 13A5 )                                               04AG4
   15 FCRMAT (///10H      PRCB , /, 5X, A5, 5X, 13A5, /, 15X, 13A5 )      04AG4
   16 FCRMAT (///17H      PROB (CCNTD) / 5X, A5, 5X, 13A5, /, 15X, 13A5)  04AG4
  100 FCRMAT (// 36H      TABLE 1 -- PRCGRAM-CONTROL DATA          /      29AP4
     1       50X, 30H      ENVELCPES    TABLE NUMBER               /      220C3
     2       50X, 30H      OF MAXIMUMS   2    3    4               /      220C3
     3            52H            CPTIONS TO HOLD (IF=1) FROM PRECEDING PROB220C3
     4              , I10, 3X, 3I5,                                /      15MY4
     5            52H            NUMBER OF ADDITIONAL CARDS FCR CURRENT PRO220C3
     6             1HB, 12X, 3I5,                                 //      03FE4
     7            52H            CPTION (IF=1) TO CLEAR ENVELCPES BEFORE LA290C3
     8            11HNE LCADINGS, 14X, I3 )                               07N03
  101 FCRMAT (    52H            OPTION (IF=1) TO PLCT DESIGN VARIABLE ENVE29AP4
     1             5HLOPES, 2CX, I3, //                                   20MY4
     2            46H            CPTION (IF=-1)TO OMIT OUTPUT TABLE 5, 31X,18N04
     3              I3, //                                                17N04
     4            32H            ANGLE CF SKEW, DEGREES, 38X, E10.3 )     18N04
  105 FCRMAT( 15X, 1CI5, 5X, E10.3 )                                      17N04
  200 FCRMAT (// 25H      TABLE 2 -- CCNSTANTS / )                        29AP4
  205 FCRMAT ( 15X, I5, E1C.3, 5X, 4I5  )                                 03AG4
  206 FCRMAT ( 15X, I5, 5E10.3  )                                         03AG4
  220 FCRMAT (    47H            NUMBER OF INCREMENTS FOR SLAB AND CAP,   220C3
     1              28X, I5,                                       /      220C3
     2            30H            INCREMENT LENGTH, FT, 40X, E10.3, /      08JL4
     3            47H            NUMBER OF INCREMENTS FOR MOVABLE LOAD,   220C3
     4              28X, I5,                                       /      220C3
     5            51H            INITIAL POSITION OF MOVABLE-LOAD STA ZERO,220C3
     6              24X, I5,                                       /      220C3
     7            49H            FINAL PCSITICN OF MOVABLE LCAD STA ZERO,  220C3
     8              26X, I5    )                                          220C3
  225 FCRMAT (    52H            NUMBER CF INCREMENTS BETWEEN EACH PCSITION08JL4
     1            16H OF MCVABLE LCAD, 7X, I5 )                           08JL4
  230 FCRMAT (    52H            MAXIMUM NUMBER OF LANES TO BE LOADED SIMUL220C3
     1             9HTANECUSLY, 14X, I5,                           /      250C3
     2            52H            LIST OF LOAD COEFFICIENTS CORRESPONDING TO220C3
     3            23H NUMBER CF LANES LCADED /, 26X, 2H 1, 10X, 2H 2, 10X220C3
     4              , 2H 3, 1CX, 2H 4, 10X, 2H 5, /                       220C3
     5              , 2CX, 5(2X, E10.3) )                                 23MR4
  300 FCRMAT (// 35H      TABLE 3 -- LISTS CF STATIONS    /  )            12N03
  305 FCRMAT ( 15X, 13I5 )                                                03AG4
  308 FCRMAT (    50H                NUM CF     NUM OF     NUM OF    NUM  230C3
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     1          15HMCM   NUM SHEAR   ,/                                   230C3
     2          50H                   LANES   STRINGERS  SUPPORTS  CONTR  29AP4
     3          16H PTS  CCNTR PTS   ,/                                   06MY4
     4          15H             TCTAL,  5(I5, 5X) )                       28JA4
310 FCRMAT ( / 52H                             1     2      3      4      13JL4
     1          33H5      6     7     8     9    10   )                   13JL4
312 FCRMAT ( / 20H              LANE LEFT      3X, 10I6, /, 23X, 5I6 )    13JL4
314 FCRMAT (   20H              LANE RIGHT     3X, 10I6, /, 23X, 5I6 )    13JL4
315 FORMAT ( 15X, 10I5 )                                                  03AG4
316 FCRMAT (   20H              STRINGERS      5X, 10F6.1, /, 25X, 10F6.1,14JL4
     1                                         /, 25X, 10F6.1 )           14JL4
318 FORMAT ( 15X, 10F5.0 )                                                03AG4
320 FORMAT (   20H              SUPPORTS       3X, 10I6, /, 23X, 5I6 )    13JL4
322 FCRMAT (   20H              MCM CONTR      3X, 10I6, /, 23X, 10I6, /, 13JL4
     1                                         23X, 10I6 )                13JL4
324 FCRMAT (   22H              SHEAR CONTR    1X, 10I6, /, 23X, 10I6, /, 14JL4
     1                                         23X, 10I6 )                13JL4
400 FCRMAT (// 72H     TABLE 4 -- CAP STIFFNESS, AND DATA FOR BCTH FIX05SE3
   1ED AND MOVABLE LOADS  /)                                              12N03
401 FORMAT ( 15X, 3I5, 4E10.3 )                                           03AG4
402 FORMAT ( 10X, 3I5, 4(5X, E10.3) )                                     23MR4
4C4 FCRMAT ( 10X, I5, 5X, I5, 4(5X, E10.3) )                              23MR4
406 FORMAT ( 15X, 2I5, 4(5X, E10.3) )                                     23MR4
410 FCRMAT (   85H              FIXED-OR-MOVABLE   - - - - - FIXED-POSITI290C3
   1CN DATA - - - - -       MCVABLE-        )                             07N03
420 FORMAT (   85H              STA  STA    CCNTD    CAP BENDING    SIDEWAL20SE3
   1K,      STRINGER,       PCSITION        )                             05SE3
430 FCRMAT (   85H              FRCM  TC    IF=1    STIFFNESS      SLAB LO20SE3
   1ACS     CAP LCADS       SLAB LOADS      /  83H                        02JL4
   2        ( K-FT*FT )        ( K )           ( K )           ( K )   / )02JL4
440 FORMAT ( 10X, 3I5, 4(5X, E10.3)   /)                                  23MR4
500 FORMAT (// 85H     TABLE 5 -- MULTI-LANE LOADING SUMMARY        ( 18N03
   1*--CRITICAL NUMBER OF LANE LOADS) )                                   120C3
510 FORMAT ( / 25H              MCMENT ( FT-K ) )                         02JL4
520 FORMAT ( / 20H              SHEAR ( K ) )                             02JL4
525 FCRMAT ( / 24H              REACTION ( K ) )                          04AG4
530 FCRMAT (   50H              AT      DEAD LC    LANE     PCSITIVE   LOA  18N04
     1          35HD AT    LANE     NEGATIVE   LOAD AT /                  18N04
     2          50H             STA      EFFECT    ORDER    MAXIMUM    LAN  17JA4
     3          36HE STA   CRDER   MAXIMUM     LANE STA )                 17JA4
540 FORMAT ( / I13, 2X, E10.3 )                                           23MR4
550 FORMAT ( 25X, 2(I7, E13.3, 2I5) )                                     23MR4
554 FCRMAT ( 25X, I7, E13.3, 10X, I7, E13.3, 2I5 )                        23MR4
556 FORMAT ( 25X, 2(I7, E13.3, 10X) )                                     23MR4
560 FCRMAT ( 31X, I1, 1H*, 28X, I1, 1H* )                                 18N03
600 FORMAT (   45H     TABLE 6 -- ENVELOPES OF MAXIMUM VALUES   //      19N03
     1          52H             STA      DIST X       MAX + MCM      MAX - M11SE3
     2          35HCM     MAX + SHEAR    MAX - SHEAR    /                 02JL4
     3          52H                  ( FT )         ( FT-K )         ( FT-K 02JL4
     4          35H)           ( K )          ( K )        / )            02JL4
610 FORMAT ( 10X, I3, 2X, 5(E10.3, 5X) )                                  23MR4
700 FCRMAT (// 45H     TABLE 7 -- MAXIMUM SUPPORT REACTICNS    //      03AG4
     1          52H             STA     DIST X      MAX + REACT    MAX - RE10AG4
     2           5HACT   /                                                10AG4
     3          50H                     FT              K               K/)10AG4
710 FORMAT  ( 10X, I3, 2X, 3(E10.3, 5X) )                                 03AG4
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  830 FORMAT (///38H     TABLE 8 -- SCALES FOR PLOT OUTPUT / )           03AG4
  831 FORMAT ( 10X, A8, F5.0, 10H INCHES = , F10.0, A5 )                 03AG4
  832 FORMAT (    40H          NO PLOTS SPECIFIED FOR PROBLEM, 1X, A5 )  03AG4
  903 FORMAT (   25H                     NONE )                          28JA4
  905 FORMAT (5X,41H     USING DATA FROM THE PREVIOUS PROBLEM )          28JA4
  906 FORMAT (5X,46H     USING DATA FROM THE PREVIOUS PROBLEM PLUS /   ) 03FE4
  907 FORMAT(/5X,45H     TABLE 5 OUTPUT OMITTED FROM THIS PROBLEM // )  17NO64
  908 FORMAT (// 40H     ERROR STOP -- STATIONS NOT IN ORDER )           10JE6
  909 FORMAT ( //46H     ERROR -- NON-ZERO TABLE 4 DATA BEYOND END )     21JL6
  910 FORMAT (///50H     LANE TOO NARROW FOR WIDTH OF MOVABLE LOAD     ) 13DE3
  912 FORMAT (///18H     LANE NUMBERS , I5, 3HAND, I5, 8H OVERLAP      ) 03FE4
  920 FORMAT ( //52H     ERROR IN PLOT ROUTINE, EXPONENT GREATER THAN E 29AP4
     1          10H+ OR -10C    )                                        18NO4
  930 FORMAT (///52H     SHEAR DESIGN CONTROL POINT DESIGNATED TOO CLOSE11MY4
     1         / 50H     TO A CONCENTRATED LOAD                         )03AG4
  940 FORMAT (///50H     --- MOVABLE LOAD INCREMENT ASSUMED = 1 ---     )18NO4
  950 FORMAT (/  10H     PROB  A5, 30H  HAS RETAINED DATA FROM PROB  A5,10AG4
     1          29H  IN WHICH AN ERROR OCCURRED.                         10AG4
     2        /  10H     PROB  A5, 20H  HAS BEEN REJECTED. )             10AG4
  980 FORMAT (///50H     UNDESIGNATED ERROR STOP                        )13AG4
C
 1000 CALL TIME                                                          13AG4
C-----PROGRAM AND PROBLEM IDENTIFICATION                                 04MY3 ID
              KFLAG = 0                                                  03AG4
              KSTOP = 0                                                  29AP4
 1010 READ    12, NPROB, ( AN1(N), N = 1, 13  )                          04AG4
              ITEST = 5H                                                 16JE4
          IF ( NPROB - ITEST ) 1020, 9995, 1020                          03AG4
 1020 PRINT 11                                                           26AG3
      PRINT 1                                                            04AG4
      READ    14,         ( AN1(N), N = 14, 26 )                         06AG4
      PRINT 15, NPROB, ( AN1(N), N = 1, 26 )                             06AG4
C-----INPUT TABLE 1 = CONTROL DATA                                       14JA4
 1100 READ  105, KEEPE, KEEP2, KEEP3, KEEP4, NCD2, NCD3, NCD4, KLEAR,    06MY4
     1          KPLOT, KSKIP5, THETA                                     17NO4
 1110 PRINT 100, KEEPE, KEEP2, KEEP3, KEEP4, NCD2, NCD3, NCD4, KLEAR     03AG4
      PRINT 101, KPLOT, KSKIP5, THETA                                    17NO4
              THETAR = ABSF(THETA) / 57.29578                            03JE4
              SKEW = 1.0 / COSF( THETAR )                                22MY4
C-----INPUT TABLE 2 = CONSTANTS                                          14JA4
      PRINT 200                                                          01NO3
          IF ( KEEP2 ) 9980, 1200, 1290                                  29AP4
 1200 READ 205, MN, HI, ML, JSTART, JSTOP, MLINC                         08JL4
 1205 READ 206,  NLOADS, ( FACTOR(I), I=1, NLOADS )                      01OC3IBM
              NZ = 3                                                     03AG4
              NZT2 = NZ + NZ                                             29AG3
      PRINT 220, MN, HI, ML, JSTART, JSTOP                               22MY4
      PRINT 225, MLINC                                                   08JL4
          IF ( MLINC ) 9980, 1280, 1285                                  04AG4
 1280 PRINT 940                                                          04AG4
              MLINC = 1                                                  04AG4
 1285 PRINT 230, NLOADS, ( FACTOR(I), I = 1, NLOADS )                    14JL4IBM
              JSTART = JSTART + 4                                        09OC3
              JSTOP  = JSTOP  + 4                                        09OC3
          GO TO 1291                                                     06DE3
 1290 PRINT 905                                                          01OC3
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```
 1291           H = HI * SKEW                                             22MY4
                HT2 = H + H                                               22MY4
                HE2 = H * H                                               30MY3
                HE3 = H * HE2                                             30MY3
                MNP4 = MN + 4                                             09SE3
                MNP5 = MN + 5                                             09SE3
                MNP6 = MN + 6                                             25JL6
                MNP7 = MN + 7                                             09SE3
                MLP4 = ML + 4                                             29AG3
C-----CLEAR ENVELOPES OF PREVIOUS VALUES                                  05MR4
          IF ( KEEPE ) 9980, 1292, 1296                                   22MY4
 1292     DO 1295  N = 1, NZ                                              06MY4
          DO 1295  J = 1, MNP7                                            28JA4
                ZMAX(N,J) = 0.0                                           08OC3
                ZMIN(N,J) = 0.0                                           08OC3
 1295     CONTINUE                                                        06DE3
 1296     DO 1298  K = 1, NZT2                                            22MY4
          DO 1298  M = 1, 30                                              28JAJDIM
C-----IF A CHANGE IS EVER MADE IN THE DIMENSIONED VALUES OF DESIGN        13NO3
C     POINTS, THIS DO LOOP MUST BE CHANGED APPROPRIATELY                  13DE3
                ZL(K,M) = 0.0                                             02OC3
                JLZL(K,M) = -1                                            30OC3
                IZM(K,M) = 0                                              02OC3
          DO 1298  I = 1, 6                                               27FE4DIM
                ZM(K,M,I) = 0.0                                           02OC3
                JLZM(K,M,I) = -1                                          30OC3
 1298     CONTINUE                                                        13DE3
 1299     CONTINUE                                                        01OC3
C                                                                             -
C-----INPUT TABLE 3 = STATION NUMBER LISTS                                14JA4
      PRINT 300                                                           29OC3
C-----SKIP TO 1390 IF TABLE 3 IS RETAINED FROM PREVIOUS PROB              13JA4
          IF ( KEEP3 ) 9980, 1300, 1350                                   15JL4
 1300 READ  305, NLANES, NSTRS, NSUPS, MZ(1), MZ(2)                       04SE3
      PRINT 308, NLANES, NSTRS, NSUPS, MZ(1), MZ(2)                       12NO3
                MZ(3) = NSUPS                                             03AG4
                MZ3 = MZ(3)                                               04AG4
      PRINT 310                                                           01OC3
      READ 315,  ( JLEFT(L) ,  L = 1, 10 )                                03AG4DIM
      READ 315,  ( JRIGHT(L),  L = 1, 10 )                                03AG4DIM
      READ 318,  ( FSTR(N)  ,  N = 1, 30 )                                05JE4
      READ 315,  ( JSUP(NS) , NS = 1, 20 )                                03AG4DIM
      READ 315,  ( JZ(1,M)  ,  M = 1, 30 )                                30JA4DIM
      READ 315,  ( JZ(2,M)  ,  M = 1, 30 )                                30JA4DIM
      PRINT 312, ( JLEFT(L) ,  L = 1, NLANES )                            30JA4IBM
      PRINT 314, ( JRIGHT(L),  L = 1, NLANES )                            30JA4IBM
      PRINT 316, ( FSTR(N)  ,  N = 1, NSTRS  )                            05JE4
      PRINT 320, ( JSUP(NS) , NS = 1, NSUPS  )                            03FE4
                MZ1 = MZ(1)                                               04SE3
      PRINT 322, ( JZ(1,M), M = 1, MZ1 )                                  29OC3IBM
                MZ2 = MZ(2)                                               04SE3
      PRINT 324, ( JZ(2,M), M = 1, MZ2 )                                  29OC3IBM
C-----CONVERT ALL EXTERNAL STATIONS TO INTERNAL STATIONS                  13JA4
          DO 1310  L = 1, NLANES                                          24SE3IBM
                JRIGHT(L) = JRIGHT(L) + 4                                 24SE3
                JLEFT(L)  = JLEFT(L)  + 4                                 24SE3
```

```
 1310      CCNTINUE                                                      24SE3
           CC 1315  N = 1, NSTRS                                         28JA4IBM
                FSTR(N) = FSTR(N) + 4                                    05JE4
 1315      CCNTINUE                                                      24SE3
           CC 1321  NS = 1, NSUPS                                        28JA4
                JSUP(NS) = JSUP(NS) + 4                                  24SE3
                JZ(3,NS) = JSUP(NS)                                      03AG4
 1321      CCNTINUE                                                      25SE3
           CC 1325  M = 1, MZ1                                           28JA4IBM
                JZ(1,M) = JZ(1,M) + 4                                    25SE3
 1325      CCNTINUE                                                      24SE3
           CC 1329  M = 1, MZ2                                           03AG4IBM
                JZ(2,M) = JZ(2,M) + 4                                    24SE3
 1329      CCNTINUE                                                      03AG4
C-----CHECK OF PROXIMITY OF SHEAR STA TO CONCENTRATED LOAD FOLLOWS        11MY4
                NT = 1                                                   11MY4
                NST = 1                                                  11MY4
                MM = 1                                                   10AG4
 1330      CC 1349 M = MM, MZ2                                           10AG4
C-----PRCXIMITY TO STRINGERS                                             04AG4
           CO 1343  N = NT, NSTRS                                        14AG4
                JSTR = FSTR(N)                                           05JE4
                FSTR1 = JSTR                                             10JL4
           IF ( FSTR(N) - FSTR1 ) 1331, 1332, 1331                       10JL4
 1331           NSTA = 2                                                 10JL4
           GC TO 1333                                                    10JL4
 1332           NSTA = 1                                                 10JL4
 1333      IF ( JZ(2,M) - ( JSTR - 1 ) ) 1334, 1335, 1342                03AG4
 1334           NT = N                                                   10JL4
           GC TO 1344                                                    03AG4
 1335 PRINT 930                                                          11MY4
C-----CMIT CNE SHEAR DESIGN CCNTROL PCINT IF TOO NEAR A CONC LOAD         04AG4
           IF ( MZ2 - M )  999C, 1338, 1336                              04AG4
 1336           MP1 = M + 1                                              03AG4
           CC 1337  MT = MP1, MZ2                                        04AG4
                JZ(2,MT-1) = JZ(2,MT)                                    03AG4
 1337      CCNTINUE                                                      03AG4
C-----RECUCE NUMBER CF SHEAR CESIGN CCNTROL POINTS                        04AG4
 1338           MZ(2) = MZ2 - 1                                          04AG4
                MZ2 = MZ(2)                                              04AG4
                MM = M                                                   18NO4
           GC TO 133C                                                    03AG4
 1342      IF ( JZ(2,M) - ( JSTR + NSTA ) ) 1335, 1335, 1343             03AG4
 1343      CCNTINUE                                                      03AG4
C-----PRCXIMITY TC SUPPCRTS                                              04AG4
 1344      CC 1348  NS = NST, NSUPS                                      03AG4
           IF ( JZ(2,M) - ( JSUP(NS) - 1 ) ) 1345, 1335, 1346            03AG4
 1345           NST = NS                                                 03AG4
           GO TO 1349                                                    11MY4
 1346      IF ( JZ(2,M) - ( JSUP(NS) + 1 ) ) 1335, 1335, 1348            06JL4
 1348      CCNTINUE                                                      11MY4
 1349      CCNTINUE                                                      11MY4
C-----LANE ROUTINE FCLLCWS                                               17DE3
      PRINT 11                                                           08MY3 ID
           GC TO 1351                                                    15JL4
 1350 PRINT 905                                                          15JL4
```

```
 1351      CC 1355  J = 3, MNP5                                     15JL4
                LANE(J) = 0                                          29AG3
 1355      CCNTINUE                                                  04SE3
C-----CMIT LANE RCUTINE IF ZERC LANES ARE SPECIFIED                  13JA4
           IF ( NLANES ) 9980, 1359, 1356                            29AP4
C-----TEST FCR LANE BOUNCARIES                                       13JA4
1356       CC 1358  L = 2, NLANES                                    09JA4IBM
                LTEST = JLEFT(L) - JRIGHT(L-1)                       16SE3
           IF ( LTEST ) 1357, 1358, 1358                             03DE3
 1357           LLL = L - 1                                          13DE3
      PRINT  912, LLL, L                                             01NO3
           GC TO 999C                                                29AP4
 1358      CCNTINUE                                                  09SE3
C-----TEST FOR LOAC WIDER THAN WIDTH OF LANE                         13JA4
 1359      CC 1380  L = 1, NLANES                                    13DE3IBM
                LTEST = JRIGHT(L) - JLEFT(L) - ML                    09SE3
           IF ( LTEST ) 136C, 1365, 1365                             03DE3
 1360 PRINT 910                                                      300C3
           GC TO 999C                                                29AP4
 1365           JENC = JRIGHT(L) - ML                                04SE3
                JBEGIN = JLEFT(L)                                    29AG3
           CO 1370  JL = JBEGIN , JENI                               04SE3
                LANE(JL) = L                                         29AG3
 1370      CCNTINUE                                                  04SE3
 1380      CCNTINUE                                                  04SE3
 1399      CCNTINUE                                                  29AG3
C
C-----INPUT TABLE 4 = LCACS ANC STIFFNESSES                           14JA4
 1400 PRINT 400                                                      04JE3
           IF (KEEP4) 9980, 14C1, 1402                               17JL6
 1401           MHOLC1 = 1                                           10JE6
 1402      CO 1403  J = MHOLD1, MNP7                                 17JL6
                F(J) = 0.0                                           30MY3
                QSLAB(J) = C.C                                       30AG3
                QCAPC(J) = C.C                                       22MY4
                QCAPD(J) = C.C                                       22MY4
                QL(J) = C.C                                          30AG3
 1403      CCNTINUE                                                  17JL6
           IF (KEEP4) 998C, 14C6, 1405                               17JL6
 1405 PRINT 906                                                      17JL6
 1406      IF ( NCC4 ) 9980, 1407, 1408                              17JL6
 1407 PRINT 903                                                      17JL6
           GC TO 1481                                                21JL6
 1408           KR2 = 0                                              17JL6
      PRINT 410                                                      05SE3
      PRINT 420                                                      05SE3
      PRINT 430                                                      05SE3
           CC 1480  N = 1, NCC4                                      28JA4
                KR1 = KR2                                            28MY3
      READ 401, IN1, IN2, KR2, FN2, CS2, QC2, QL2                    20SE3
                JN = IN1 + 4                                         28MY3
                J2 = IN2 + 4                                         28MY3
                KSW = 1 + KR2 + 2 * KR1                              28MY3
           GC TO ( 1409, 141C, 1415, 1415 ), KSW                     17JL6
 1409 PRINT 402, IN1, IN2, KR2, FN2, CS2, QC2, QL2                   17JL6
           GC TO 142C                                                04JE3
```

```
 1410 PRINT 404, IN1, KR2, FN2, CS2, QC2, QL2                            24SE3
         GO TO 1420                                                      04JE3
 1415 PRINT 406, IN2, KR2, FN2, CS2, QC2, QL2                            09SE3
         GO TO 1435                                                      04JE3
 1420          J1 = JN                                                   04JE3
 1425          FN1 = FN2                                                 04JE3
               QS1 = QS2                                                 09SE3
               QC1 = QC2                                                 30AG3
               QL1 = QL2                                                 30AG3
         GO TO (1435, 1480, 9980, 1480), KSW                             10JE6
 1435          JINCR = 1                                                 07JE3
               ESM = 1.0                                                 07JE3
         IF (J2 - J1) 1437, 1450, 1440                                   10JE6
 1437 PRINT 908                                                          10JE6
         GO TO 9990                                                      10JE6
 1440          DENOM = J2 - J1                                           07JE3
               ISW = 1                                                   07JE3
         GO TO 1455                                                      07JE3
 1450          F(J1) = F(J1) + FN1                                       22MY4
               QSLAB(J1) = QSLAB(J1) + QS1                               22MY4
               QCAPC(J1) = QCAPC(J1) + QC1                               22MY4
               QL(J1) = QL(J1) + QL1                                     22MY4
         GO TO 1470                                                      22MY4
 1455    DO 1460  J = J1, J2, JINCR                                      04JE3
               DIFF = J - J1                                             28MY3
               PART = DIFF / DENOM                                       28MY3
               F(J) = F(J) + ( FN1 + PART * ( FN2 - FN1 ) ) * ESM        28MY3
               QSLAB(J) = QSLAB(J) + ( QS1 + PART * ( QS2 - QS1 ) )*ESM  30AG3
               QCAPC(J) = QCAPC(J) + ( QC1 + PART * ( QC2 - QC1 ) )*ESM  22MY4
               QL(J)    =  QL(J)    + ( QL1 + PART * ( QL2 - QL1 ) )*ESM 17SE3
 1460    CONTINUE                                                        04JE3
         IF ( ISW ) 9980, 1470, 1465                                     28AG4
 1465          JINCR = J2 - J1                                           07JE3
               ESM = - 0.5                                               07JE3
               ISW = 0                                                   28MY3
         GO TO 1455                                                      04JE3
 1470    GO TO (1480, 9980, 1480, 1475), KSW                             10JE6
 1475          J1 = J2                                                   04JE3
         GO TO 1425                                                      04JE3
 1480    CONTINUE                                                        04JE3
C-----TEST FOR DATA ERRONEOUSLY STORED BEYOND END STA                     21JL6
 1481    IF ( F(MNP5) + F(MNP6) + QSLAB(MNP5) + QCAPC(MNP5)              21JL6
     1        + QCAPC(MNP5) + QL(MNP5) )  1485, 1499, 1485               21JL6
 1485 PRINT 909                                                          21JL6
         GO TO 9990                                                      21JL6
 1499    CONTINUE                                                        04JE3
C
C-----CLEAR MOVABLE-LOAD VALUES FROM TEMPORARY LIVE LOAD STORAGE          13JA4
 2000    DO 2010  J = 4, MNP4                                            09SE3
               QLIVE(J) = 0.0                                            29AG3
 2010    CONTINUE                                                        29AG3
C
C-----COMPUTE EFFECTS OF DEAD LOAD ONLY                                   16OC3
      CALL BEAM ( NSTRS, MN, MNP4, MNP5, H, HE2, HE3, HT2, NZ, SKEW,     03AG4
     1            KFLAG )                                                03AG4
C
```

```
C-----SKIP TO CARD EJECT ROUTINE IF KFLAG = 1 FROM SUBROUTINE BEAM      04AG4
         IF ( KFLAG ) 9990, 2100, 9990                                  03AG4
 2100    DO 2190 N = 1, NZ                                              03AG4
              MZN = MZ(N)                                               160C3
         DO 2180  M = 1, MZN                                            160C3IBM
              J = JZ(N,M)                                               160C3
              ZD(N,M) = Z(N,J)                                          160C3
         IF ( ABSF(ZD(N,M))- 0.001 ) 2170, 2170, 2180                   08JL4
 2170         ZD(N,M) = 0.0                                             08JL4
 2180    CONTINUE                                                       160C3
 2190    CONTINUE                                                       160C3
C-----COMPUTE EFFECTS OF DEAD LOAD PLUS SINGLE LOAD MOVED ACROSS SLAB   160C3
         IF ( JSTOP - JSTART ) 2999, 2200, 2200                         01NO3
 2200    DO 2950  JL = JSTART, JSTOP, MLINC                             08JL4
         DO 2210  JLINC = 1, MLINC                                      13JL4
              QLIVE(JL - JLINC) = 0.0                                   13JL4
 2210    CONTINUE                                                       13JL4
C-----SET LIVE LOAD EQUAL TO SINGLE MOVABLE LOAD                        13JA4
         DO 2220  LL = 4, MLP4                                          29JA4
              J = JL + LL - 4                                           29AG3
              QLIVE(J) = QL(LL)                                         29AG3
 2220    CONTINUE                                                       160C3
C
C-----COMPUTE EFFECT OF RANDOM-POSITION ONE-TRUCK LOADING               14JA4
      CALL BEAM ( NSTRS, MN, MNP4, MNP5, H, HE2, HE3, HT2, NZ, SKEW,    03AG4
     1            KFLAG )                                               03AG4
C
C------SKIP TO CARD EJECT ROUTINE IF KFLAG = 1 FROM SUBROUTINE BEAM     04AG4
         IF ( KFLAG ) 9990, 2530, 9990                                  03AG4
C-----ARRANGE CONTROL TABLE FOR MULTI-LANE LOADINGS                     14JA4
C-----SIGN TAKES CARE OF + AND - DESIGN VARIABLES                       29AP4
 2530         SIGN = -1.0                                               20SE3
         DO 2900  K = 1, NZT2                                           20SE3
              N = ( K + 1 ) / 2                                         30JA4
              SIGN = -1.0 * SIGN                                        30AG3
              MZN = MZ(N)                                               070C3
         DO 2800  M = 1, MZN                                            28JA4IBM
              J = JZ(N,M)                                               30AG3
              ZLIVE = Z(N,J) - ZD(N,M)                                  160C3
         IF ( ABSF(ZLIVE) - 0.001 ) 2800, 2800, 2610                    04MY4
 2610         TEST = SIGN * ( ZLIVE - ZL(K,M) )                         06MY4
         IF ( TEST ) 2650, 2650, 2620                                   030E3
 2620         ZL(K,M) = ZLIVE                                           160C3
              JLZL(K,M) = JL                                            30AG3
 2650    IF ( LANE(JL) ) 9980, 2800, 2655                               28AG4
 2655    IF ( NLOADS ) 9980, 2800, 2660                                 29AP4
 2660    DO 2670  I = 1, NLOADS                                         28JA4IBM
              JI = JLZM(K,M,I)                                          110C3
              LTEST = LANE(JL) - LANE(JI)                               110C3
         IF ( LTEST ) 2670, 2680, 2670                                  030E3
 2670    CONTINUE                                                       110C3
              ZM(K,M,NLOADS+1) = ZLIVE                                  160C3
              JLZM(K,M,NLOADS+1) = JL                                   100C3
              IR1 = 1                                                   110C3
         GO TO 2700                                                     110C3
 2680         ZTEST = SIGN * ( ZLIVE - ZM(K,M,I) )                      160C3
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```
          IF ( ZTEST ) 2800, 2800, 2690                                       03DE3
 2690          ZM(K,M,I) = ZLIVE                                              160C3
               JLZM(K,M,I) = JL                                               110C3
               IR1 = NLOADS + 2 - I                                           110C3
 2700     DO 2799  IR = IR1, NLOADS                                           28JA4IBM
               I = NLOADS - IR + 1                                            30AG3
               TEST = SIGN * ( ZM(K,M,I+1) - ZM(K,M,I) )                      30AG3
          IF ( TEST ) 2800, 2800, 2720                                        29JA4
 2720          ZTEMP = ZM(K,M,I)                                              30AG3
               ZM(K,M,I) = ZM(K,M,I+1)                                        30AG3
               ZM(K,M,I+1) = ZTEMP                                            30AG3
               JLTEMP = JLZM(K,M,I)                                           30AG3
               JLZM(K,M,I) = JLZM(K,M,I+1)                                    30AG3
               JLZM(K,M,I+1) = JLTEMP                                         30AG3
 2799     CONTINUE                                                            30AG3
 2800     CONTINUE                                                            30AG3
 2900     CONTINUE                                                            30AG3
 2950     CONTINUE                                                            13DE3
 2999     CONTINUE                                                            30AG3
C
C-----ESTABLISH CRITICAL PATTERN OF MULTI-LANE LOADING                         14JA4
 3000          SIGN = -1.0                                                    30AG3
          DO 3999  K = 1, NZT2                                                28JA4
               N = ( K + 1 ) / 2                                              30JA4
               SIGN = -1.0 * SIGN                                             30AG3
               MZN = MZ(N)                                                    30AG3
 3100     DO 3900  M = 1, MZN                                                 28JA4IBM
               SUM = 0.0                                                      30AG3
C-----IF KLEAR = 1, EXCLUDE ONE-TRUCK INFLUENCE                                14JA4
          IF ( KLEAR ) 9980, 3150, 3160                                       29AP4
 3150          Z1 = ZL(K,M)                                                   160C3
          GO TO 3200                                                          160C3
 3160          Z1 = 0.0                                                       160C3
 3200     DO 3800  I = 1, NLOADS                                              28JA4IBM
               SUM = SUM + ZM(K,M,I)                                          30AG3
               Z2 = FACTOR(I) * SUM                                           30AG3
               TEST = SIGN * (Z2 - Z1)                                        30AG3
          IF ( TEST ) 3800, 3800, 3210                                        090C3
 3210          IZM(K,M) = I                                                   30AG3
               Z1 = Z2                                                        160C3
 3800     CONTINUE                                                            30AG3
 3900     CONTINUE                                                            30AG3
 3999     CONTINUE                                                            30AG3
C
C-----APPLY MULTI-LANE LOADINGS                                                14JA4
 4000     IF ( KLEAR ) 9980, 4300, 4010                                       29AP4
 4010     DO 4200  J = 3, MNP5                                                09SE3
          DO 4100  N = 1, NZ                                                  09SE3
               ZMAX(N,J) = 0.0                                                30AG3
               ZMIN(N,J) = 0.0                                                30AG3
 4100     CONTINUE                                                            30AG3
 4200     CONTINUE                                                            30AG3
 4300     DO 4999  K = 1, NZT2                                                30AG3
               N = ( K + 1 ) / 2                                              30AG3
               MZN = MZ(N)                                                    210C3
          DO 4900  M = 1, MZN                                                 210C3IBM
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         DO 4400  J = 3, MNP5                                          02JA4
              QLIVE(J) = 0.0                                           30AG3
 4400    CONTINUE                                                      30AG3
              IM = IZM(K,M)                                            30AG3
         DO 4800  I = 1, IM                                            30AG3
              JL = JLZM(K,M,I)                                         30AG3
         DO 4700  LL = 4, MLF4                                         30AG3
              J = JL + LL - 4                                          30AG3
              QLIVE(J) = QLIVE(J) + QL(LL) * FACTOR(IM)                210C3
 4700    CONTINUE                                                      30AG3
 4800    CONTINUE                                                      30AG3
C
C-----COMPUTE EFFECTS OF CRITICAL MULTI-LANE LOADING PATTERNS           13JA4
      CALL BEAM ( NSTRS, MN, MNP4, MNP5, H, HE2, HE3, HT2, NZ, SKEW,    03AG4
     1             KFLAG )                                             03AG4
C
C------SKIP TO CARD EJECT ROUTINE IF KFLAG = 1 FROM SUBROUTINE BEAM     04AG4
         IF ( KFLAG ) 9990, 4900, 9990                                 03AG4
 4900    CONTINUE                                                      30AG3
 4999    CONTINUE                                                      30AG3
C
      PRINT 11                                                         08MY3 ID
      PRINT 16, NPROB, ( AN1(N), N = 1, 26 )                           06AG4
C-----OUTPUT TABLE 5 - MULTI-LANE LOADING CONTROL                       18N03
      PRINT 500                                                        21JL6
         IF( KSKIP5 + 1 ) 5595, 5505, 5508                             17N064
 5505 PRINT 907                                                        17N064
         GO TO 5595                                                    17N064
 5508         NONE = 0                                                 17N064
         DO 5590  N = 1, NZ                                            28JA4
         GO TO ( 5510, 5520, 5525 ), N                                 03AG4
 5510 PRINT 510                                                        18N03
         GO TO 5530                                                    130C3
 5520 PRINT 520                                                        18N03
         GO TO 5530                                                    03AG4
 5525 PRINT 525                                                        03AG4
 5530 PRINT 530                                                        18N03
              K1 = 2 * N - 1                                           130C3
              K2 = 2 * N                                               130C3
              MZN = MZ(N)                                              130C3
         DO 5580  M = 1, MZN                                           130C3IBM
              JZNM = JZ(N,M) - 4                                       130C3
      PRINT 540, JZNM, ZD(N,M)                                         18N03
              J1 = JLZL(K1,M)                                          130C3
              J2 = JLZL(K2,M)                                          130C3
              LANE1 = LANE(J1)                                         130C3
              LANE2 = LANE(J2)                                         130C3
 5540    IF ( J1 ) 5541, 5542, 5542                                    280C3
 5541    IF ( J2 ) 5545, 5543, 5543                                    280C3
 5542    IF ( J2 ) 5546, 5544, 5544                                    280C3
 5543         J2 = J2 - 4                                              300C3
      PRINT 554, NONE, ZL(K1,M), NONE, ZL(K2,M), LANE2, J2             18N03
         GO TO 5550                                                    280C3
 5544         J1 = J1 - 4                                              01N03
              J2 = J2 - 4                                              300C3
      PRINT 550, NONE, ZL(K1,M), LANE1, J1, NONE, ZL(K2,M), LANE2, J2  18N03
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          GC TO 5550                                                   28OC3
 5545 PRINT 556, NCNE, ZL(K1,M), NONE, ZL(K2,M)                        18NO3
          GC TO 5550                                                   28OC3
 5546           J1 = J1 - 4                                            30OC3
      PRINT 550, NCNE, ZL(K1,M), LANE1, J1, NCNE, ZL(K2,M)             18NO3
 5550     IF ( NLCADS ) 9980, 5575, 5555                               13MY4
 5555     DO 5570  I = 1, NLCADS                                       13DE3IBM
                J1 = JLZM(K1,M,I)                                      13OC3
                J2 = JLZM(K2,M,I)                                      13OC3
                LANE1 = LANE(J1)                                       13OC3
                LANE2 = LANE(J2)                                       13OC3
 5560     IF ( J1 ) 5561, 5562, 5562                                   29OC3
 5561     IF ( J2 ) 5565, 5563, 5563                                   29OC3
 5562     IF ( J2 ) 5566, 5564, 5564                                   29OC3
 5563           J2 = J2 - 4                                            03FE3
      PRINT 554, I, ZM(K1,M,I), I, ZM(K2,M,I), LANE2, J2               18NO3
          GC TO 5570                                                   29OC3
 5564           J1 = J1 - 4                                            28JA4
                J2 = J2 - 4                                            28JA4
      PRINT 550, I, ZM(K1,M,I), LANE1, J1, I, ZM(K2,M,I), LANE2, J2    18NO3
          GC TO 5570                                                   29OC3
 5565 PRINT 556, I, ZM(K1,M,I), I, ZM(K2,M,I)                          05FE4
          GC TO 5570                                                   30OC3
 5566           J1 = J1 - 4                                            28JA4
      PRINT 550, I, ZM(K1,M,I), LANE1, J1, I, ZM(K2,M,I)               18NO3
 5570     CCNTINUE                                                     13OC3
 5575     CCNTINUE                                                     13DE3
      PRINT 560, IZM(K1,M), IZM(K2,M)                                  18NO3
 5580     CCNTINUE                                                     13OC3
 5590     CCNTINUE                                                     13OC3
C-----CUTPUT TABLE 6 - ENVELCPES OF MAXIMUM VALUES                      13JA4
 5595     CCNTINUE                                                     30NO4
      PRINT 11                                                         30NO4
      PRINT 600                                                        06SE3
 5600     DO 5691  J = 3, MNP5                                         03AG4
                ISTA = J - 4                                           28JA4
                XJ = ISTA                                              17SE3
                X  = XJ * H                                            06SE3
      PRINT 610, ISTA, X, ZMAX(1,J), ZMIN(1,J), ZMAX(2,J), ZMIN(2,J)   18NO3
 5691     CCNTINUE                                                     03AG4
C-----CUTPUT TABLE 7 -- MAXIMUM SUPPORT REACTIONS                       03AG4
      PRINT 11                                                         04AG4
      PRINT 700                                                        03AG4
          DO 5692  N = 1, NSUPS                                        03AG4
                ISTA = JSUP(N) - 4                                     03AG4
                J = JSUP(N)                                            03AG4
                XJ = ISTA                                              03AG4
                X = XJ * H                                             03AG4
      PRINT 710, ISTA, X, ZMAX(3,J), ZMIN(3,J)                         03AG4
 5692     CCNTINUE                                                     03AG4
 5699     CCNTINUE                                                     03AG4
C
C-----PLCT ROUTINE FCLLCWS                                              13JA4
      CALL TIME                                                        17AP4
                NAME(1) = 8HDISTANCE                                   30JE4
                NAME(2) = 8HMCMENT                                     14MY4
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              NAME(3) = 8HSHEAR                                            14MY4
              IUNIT(1) = 5H FT                                             02JL4
              IUNIT(2) = 5H FT-K                                           02JL4
              IUNIT(3) = 5H K                                              02JL4
      PRINT 830                                                            03AG4
 5700     IF ( KPLOT ) 5980, 5990, 5710                                    04MY4
C-----SKIP TO 5990 IF NO PLOTS ARE DESIRED                                 17JA4
 5710         KSTOP = 1                                                    20AP4
              HMN = MN                                                     30JE4
              DIST = H * HMN                                               30JE4
          IF ( DIST - 50. ) 5711, 5711, 5712                               30JE4
 5711         HEND = 50.                                                   30JE4
          GO TO 5740                                                       25MY4
 5712     IF ( DIST - 100. ) 5715, 5715, 5721                              30JE4
 5715         HEND = 100.                                                  30JE4
          GO TO 5740                                                       16JA4
 5721     IF ( DIST - 200. ) 5725, 5725, 5731                              06JL4
 5725         HEND = 200.                                                  06JL4
          GO TO 5740                                                       20MR4
 5731     IF ( DIST - 500. ) 5735, 5735, 5736                              30JE4
 5735         HEND = 500.                                                  30JE4
          GO TO 5740                                                       30JE4
 5736         HEND = 1000.                                                 30JE4
 5740         HPOS = 10.                                                   30JE4
          DO 5745  J = 4, MNP4                                             01JL4
              XJ = J - 4                                                   02JL4
              HPLOT(J-3) = XJ * H                                          02JL4
 5745     CONTINUE                                                         30JE4
      PRINT 831, NAME(1), HPOS, HEND, IUNIT(1)                             04AG4
          DO 5870  N = 1, 2                                                03AG4
              VMAX = 0.0                                                   16AP4
C-----FIND LARGEST VALUE OF DESIGN VARIABLE                                17JA4
          DO 5750  J = 4, MNP4                                             20AP4
              ZTMP = ABSF( ZMIN(N,J) )                                     28JA4
              VMAX = MAX1F( ZMAX(N,J), ZTMP, VMAX )                        16AP4
 5750     CONTINUE                                                         16JA4
C-----DETERMINE EXPONENT FOR DESIGN VARIABLE EQUAL OR LESS THAN UNITY       29AP4
              KEXP = 0                                                     16AP4
          IF ( VMAX ) 9980, 5780, 5752                                     29AP4
 5752     DO 5755  NE = 1, 100                                             23MR4
          IF ( 1.0 - VMAX ) 5753, 5780, 5760                               16AP4
 5753         VMAX = VMAX / 10.                                            16AP4
              KEXP = KEXP + 1                                              16AP4
 5755     CONTINUE                                                         16JA4
      PRINT 920                                                            18NO4
          GO TO 9980                                                       29AP4
 5760     IF ( 0.1 - VMAX ) 5765, 5770, 5762                               16AP4ARB
 5762         VMAX = VMAX * 10.0                                           16AP4
              KEXP = KEXP - 1                                              16AP4
          GO TO 5755                                                       23MR4
 5765     IF ( 0.2 - VMAX ) 5766, 5775, 5775                               16AP4ARB
 5766     IF ( 0.4 - VMAX ) 5780, 5778, 5778                               16AP4ARB
 5770         VEND = 0.1                                                   16AP4
          GO TO 5790                                                       23MR4
 5775         VEND = 0.2                                                   16AP4
          GO TO 5790                                                       16JA4
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 5778          VENC = 0.4                                                  16AP4
         GC TO 579C                                                        16JA4
 5780          VEND = 1.C                                                  16AP4
C-----SET VALUE CF CESIGN VARIABLE AT END OF VERTICAL AXIS                 29AP4
 5790          VENC = VEND * 1C**KEXP                                      16AP4
C-----SET CESIGN VARIABLE AXIS LENGTH ( IN INCHES )                        29AP4
               VPOS = 2.0                                                  16AP4
C-----TRANSFER POSITIVE CESIGN VARIABLE TO PLOT NCTATION                   17JA4
         DC 5795  J = 4, MNP4                                              16AP4
               VPLCT(J-3) = ZMAX(N,J)                                      16AP4
 5795    CCNTINUE                                                          16JA4
               HNEG = 0.0                                                  16AP4
               SPACE = C.5                                                 16AP4
               VEND = VEND * 1.5                                           16JE4
               VPOS = VPOS * 1.5                                           16JE4
               VNEG = VPCS                                                 16AP4
               HTCKS = HENC                                                16AP4
               VTCKS = VENC                                                16AP4
               KAXES = 24                                                  16AP4
C-----TRANSFER AXES INFCRMATICN -- DC NOT DRAW AXES                        04AG4
C
      CALL AXES ( HEND, HPCS, HNEG, SPACE, VEND, VPOS, VNEG, HTCKS,        16AP4
     1             VTCKS, KAXES )                                          16AP4
C                                                                          04AG4
               IPRCB(1) = 8H   PROB                                        01JL4
               IPRCB(2) = NPRCB                                            01JL4
               NSYMB = 16                                                  01JL4
               ICR = 0                                                     01JL4
               ISIZE = 2                                                   01JL4
               HCOR = 2.0                                                  01JL4
               VCOR = -3.0                                                 01JL4
C-----PRINT PROBLEM NUMBER BELCW EACH PLOT                                 04AG4
C                                                                          04AG4
      CALL PLOTTITL ( IPRCB, NSYMB, ICR, ISIZE, HCOR, VCCR )               01JL4
C                                                                          04AG4
               VENC = VEND / 1.5                                           16JE4
               VPOS = VPCS / 1.5                                           16JE4
C-----CCMPUTE DESIGN CONTRCL PCINTS                                        17JA4
               SIGN = +1.0                                                 16JA4
               MZN = MZ(N)                                                 16JA4
 5800    CC 5810  M = 1, MZN                                               30JE4
               XJ = JZ(N,M) - 4                                            02JL4
               HJZ(M) = XJ * H                                             02JL4
               VJZ(M) = VENC * SIGN                                        16AP4
 5810    CCNTINUE                                                          16JA4
C-----PLCT CESIGN CCNTRCL POINTS AND CESIGN VARIABLES                      17JA4
               KPS = 2                                                     20AP4
               NUMPTS = MZN                                                29AP4
      CALL PLCT ( HJZ, VJZ, NUMPTS, KPS )                                  29AP4
               KPS = 9                                                     20AP4
               NUMPTS = MN + 1                                             17AP4
      CALL PLOT ( HPLCT, VPLCT, NUMPTS, KPS )                              17AP4
C                                                                          04AG4
         IF ( SIGN ) 5840, 5SEC, 5820                                      06MY4
C-----TRANSFER NEGATIVE CESIGN VARIABLE TO PLOT NOTATION                   17JA4
 5820    CC 5830  J = 4, MNP4                                              16AP4
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            VPLCT(J-3) = ZMIN(N,J)                                      16AP4
 5830       CONTINUE                                                    27JA4
            SIGN = -SIGN                                                16JA4
        GO TO 5800                                                      16JA4
C-----ROLL PAPER FOR NEW DESIGN VARIABLE                                17JA4
 5840 CALL AXESTERM (1)                                                 23MR4
      CALL AXESTERM (1)                                                 15MY4
C-----PRINT LINES OF OUTPUT IN TABLE 7                                  15MY4
      PRINT 831, NAME(N+1), VPCS, VEND, IUNIT(N+1)                      03AG4
 5870       CONTINUE                                                    27JA4
        GO TO 5995                                                      17JA4
 5990 PRINT 832, NPROB                                                  03AG4
 5999       CONTINUE                                                    17JA4
C
      CALL TIME                                                         17AP4
            MHOLD1 = MNP5                                               10JE6
C-----RETURN FOR NEW PROBLEM                                            14JA4
        GO TO 1010                                                      26AG3 ID
 9980 PRINT 980                                                         15MY4
 9990       KFLAG = 0                                                   03AG4
            NPROBT = NPROB                                              04AG4
        DO 9991 M = 1, 1000                                             03AG4
        READ 12, NPROB, (AN1(N), N=1,13 )                               04AG4
        IF ( NPROB-NPROBT )  9992, 9991, 9992                           04AG4
 9991       CONTINUE                                                    03AG4
        GO TO 9990                                                      10AG4
 9992       IF ( NPROB - ITEST )  9993, 9999, 9993                      04AG4
 9993 READ  14, ( AN1(N), N = 14, 26 )                                  06AG4
      READ 105, KEEPE, KEEP2, KEEP3, KEEP4, NCD2, NCD3, NCD4, KLEAR,    06AG4
     1              KPLCT, KSKIP5, THETA                                18NO4
            KSUM = KEEPE + KEEP2 + KEEP3 + KEEP4                        03AG4
        IF ( KSUM ) 9997, 9994, 9997                                    10AG4
 9994 PRINT 15, NPROB, ( AN1(N), N = 1, 26 )                            06AG4
        GO TO 1110                                                      06AG4
 9997 PRINT 950, NPROB, NPROBT, NPROB                                   10AG4
        GO TO 9990                                                      10AG4
 9995       IF ( KSTOP ) 9999, 9999, 9996                               03AG4
 9996       CALL AXESTERM (0)                                           03AG4
 9999       CONTINUE                                                    03AG4
      CALL TIME                                                         17AP4
      END                                                               04MA3 ID
C
```

```
      SUBROUTINE BEAM ( NSTRS, MN, MNP4, MNP5, H, HE2, HE3, HT2, NZ,     03AG4
     1                    SKEW, KFLAG )                                   03AG4
C
      DIMENSION  A(307), B(307), C(307), F(307), W(307),                 10AP4
     1          Q(307), QLIVE(307), QSLAB(307), QCAPD(307),QCAPC(307),   22MY4
     2          Z(3,307), ZMAX(3,307), ZMIN(3,307),                      03AG4
     3          FSTR(30), JSUP(20)                                       04AG4
      COMMON QLIVE, QSLAB, QCAPD, QCAPC, FSTR, JSUP, F, ZMAX, ZMIN, Z    03JE4
  908 FORMAT (///45H      ERROR -- LESS THAN 2 STRINGERS INPUT      ///  )06SE3
  930 FORMAT (///31H      ILLEGAL LOAD PLACED AT STA, I4,                18MY4
     1          25H      PROBLEM TERMINATED       )                      14AG4
  990 FORMAT (///50H      UNDESIGNATED ERROR STOP IN SUBROUTINE          )18NO4
C-----DISTRIBUTE LOAD DIRECTLY TO CAP IF NUM STRINGERS = 0                14JA4
          Q(3) = 0.0                                                     13MY4
          Q(MNP5) = 0.0                                                  15MY4
 6000     IF ( NSTRS ) 8980, 6100, 6200                                  04MY4
 6100     DO 6110  J = 4, MNP4                                           29JA4
          Q(J) = QLIVE(J) + QSLAB(J) + QCAPD(J) * SKEW + QCAPC(J)        22MY4
 6110     CONTINUE                                                       29AG3
          GO TO 6299                                                     29AG3
C-----LOAD DISTRIBUTION THRU STRINGERS                                   34MY4
 6200     DO 6205  J = 4, MNP4                                           29JA4
          Q(J) = QCAPD(J) * SKEW + QCAPC(J)                              22MY4
 6205     CONTINUE                                                       010C3
          IF ( NSTRS - 2 ) 6210, 6220, 6230                              29JA4
 6210 PRINT 908                                                          10SE3
          GO TO 8999                                                     12SE3
 6220          KSW = 2                                                   29AG3
               NI  = 1                                                   29AG3
               NF  = 1                                                   29AG3
               JA  = 4                                                   29AG3
               JB  = MNP4                                                10SE3
          GO TO 6240                                                     29AG3
 6230          KSW = 1                                                   10JE4
               NI = 1                                                    03JE4
               NF = NSTRS - 2                                            03JE4
               JA = 4                                                    03JE4
               JB = FSTR(2)                                              03JE4
 6240     CONTINUE                                                       03JE4
          DO 6260  N = NI, NF                                            03JE4
               F1 = FSTR(N)                                              03JE4
               F2 = FSTR(N+1)                                            03JE4
          DO 6250  J = JA, JB                                            03JE4
               FJ = J                                                    03JE4
               QJ = QSLAB(J) + QLIVE(J)                                  03JE4
               DIFF = F2 - FJ                                            03JE4
               DENOM = F2 - F1                                           03JE4
               PART1 = DIFF / DENOM                                      03JE4
               PART2 = 1. - PART1                                        03JE4
               J1 = F1                                                   03JE4
               FJ = J1                                                   03JE4
               PART4 = F1 - FJ                                           03JE4
               PART3 = 1. - PART4                                        03JE4
               Q(J1) = Q(J1) + PART3 * ( PART1 * QJ )                    03JE4
               Q(J1+1) = Q(J1+1) + PART4 * ( PART1 * QJ )                09JE4
               J2 = F2                                                   09JE4
```

```
                FJ2 = J2                                                09JE4
                PART6 = F2 - FJ2                                        09JE4
                PART5 = 1. - PART6                                      09JE4
                Q(J2) = Q(J2) + PART5 * ( PART2 * QJ )                  09JE4
                Q(J2+1) = Q(J2+1) + PART6 * ( PART2 * QJ )              09JE4
 6250     CONTINUE                                                      03JE4
                JA = FSTR(N+1) + 1                                      03JE4
                JB = FSTR(N+2)                                          03JE4
 6260     CONTINUE                                                      03JE4
          GO TO ( 6280, 6299 ), KSW                                     03JE4
 6280           KSW = 2                                                 03JE4
                NI = NSTRS - 1                                          03JE4
                NF = NSTRS                                              03JE4
                JA = FSTR(NI) + 1                                       03JE4
                JB = MNP4                                               03JE4
          GO TO 6240                                                    03JE4
 6299     CONTINUE                                                      03JE4
 7000           NS = 1                                                  30AG3
          DO 7160  J = 3, MNP5                                          04MY4
C-----PREVENT LOADING ANY HINGE                                         15MY4
          IF ( F(J) )  7102, 7010, 7102                                 15MY4
 7010     IF ( Q(J) )  7020, 7102, 7020                                 15MY4
 7020           ISTA = J - 4                                            18MY4
      PRINT 930, ISTA                                                   18MY4
          GO TO 8999                                                    13MY4
C-----ZERO INITIAL VALUES AND SET CONTINUITY COEFFS AT SUPPORT STAS     30AG6
 7102           A(1) = 0.0                                              30AG6
                A(2) = 0.0                                              30AG6
                B(1) = 0.0                                              30AG6
                B(2) = 0.0                                              30AG6
                C(1) = 0.0                                              30AG6
                C(2) = 0.0                                              30AG6
          IF ( J - JSUP(NS) ) 7104, 7103, 7104                          04MY4
 7103           C(J) = 0.0                                              04MY4
                B(J) = 0.0                                              28MY3
                A(J) = 0.0                                              30AG3
                NS = NS + 1                                             05JE3
          GO TO 7160                                                    04MY4
C-----COMPUTE MATRIX COEFFS                                             14JA4
 7104           AA = F(J-1)                                             04MY4
                BB = - 2.0 * ( F(J-1) + F(J) )                          28MY3
                CC = F(J-1) + 4.0 * F(J) + F(J+1)                       30AG3
                DD = - 2.0 * ( F(J) + F(J+1) )                          28MY3
                EE = F(J+1)                                             30AG3
                FF = HE3 * Q(J)                                         30AG3
                E = AA * B(J-2) + BB                                    28MY3
                DENOM = E * B(J-1) + AA * C(J-2) + CC                   28MY3
          IF ( DENOM ) 7110, 7105, 7110                                 04MY4
 7105           D = 0.0                                                 04MY4
          GO TO 7115                                                    04MY4
C-----COMPUTE CONTINUITY COEFFS                                         14JA4
 7110           D = - 1.0 / DENOM                                       04MY4
 7115           C(J) = D * EE                                           04MY4
                B(J) = D * ( E * C(J-1) + DD )                          28MY3
                A(J) = D * ( E * A(J-1) + AA * A(J-2) - FF )            28MY3
 7160 CONTINUE                                                          04MY4
```

```
C-----COMPUTE DEFLECTION W(J)                                          14JA4
               W(MNP5 + 1) = 0.0                                       17JL6
               W(MNP5 + 2) = 0.0                                       17JL6
          DO 7200  L = 3, MNP5                                         04MY4
               J = MN + 8 - L                                          10SE3
               W(J) = A(J) + B(J) * W(J+1) + C(J) * W(J+2)             30MY3
 7200     CONTINUE                                                     04MY4
               BMJ = 0.0                                               08JE3
               BMK = 0.0                                               03JE3
C-----COMPUTE BENDING MOMENTS SHEARS AND REACTIONS AT EACH STA J        03AG4
 8000     DO 8200  J = 3, MNP5                                         29JA4
               BMI = BMJ                                               03JE3
               BMJ = BMK                                               03JE3
               BMK = F(J+1) * ( W(J) - 2.0 * W(J+1) + W(J+2) ) / HE2   03JE3
               DBM = ( - BMI + BMK ) / HT2                             05JE3
               REACT = ( BMI - 2.0 * BMJ + BMK ) / H - Q(J)            03AG4
               Z(1,J) = BMJ                                            29AG3
               Z(2,J) = DBM                                            29AG3
               Z(3,J) = REACT                                          03AG4
C-----HCLC MAX AND MIN DESIGN VARIABLES AT EACH STATION J              14JA4
          DO 8100  N = 1, NZ                                           29AG3
               ZMAX(N,J) =  MAX1F( Z(N,J), ZMAX(N,J) )                 29AG3
               ZMIN(N,J) =  MIN1F( Z(N,J), ZMIN(N,J) )                 29AG3
 8100     CONTINUE                                                     29AG3
 8200     CONTINUE                                                     29AG3
          RETURN                                                       10SE3
 8990 PRINT 990                                                        18MY4
 8999 KFLAG = 1                                                        03AG4
          RETURN                                                       03AG4
          END                                                          29AG3
      END
         FINIS
-EXECUTE,,,1.
```

Add data cards here. The first card of data is the first card described in the Guide for Data Input for CAP 14.

When plot capabilities are not available by library tape routine, a plot subroutine must be properly added. A binary deck of Subroutine PLOT 63 is to be provided with all CAP 14 decks.

APPENDIX 4

LISTING OF INPUT DATA FOR EXAMPLE PROBLEMS

```
SOL 1        EXAMPLE CAP - NO SKEW,
SOL 1        STRINGERS POSITIONED AT NEAREST WHOLE STATIONS
SOL 1      0    0    0    0    2   14   17    0    1    0     0.000E+00
SOL 1    136 0.500E+00        20    4  112    1
SOL 1      4 1.000E+00 1.000E+00 0.900E+00 0.750E+00
SOL 1      4    8    4   10   11
SOL 1      4   34   72  102
SOL 1     34   64  102  132
SOL 1      8   25   42   59   77   94  111  128
SOL 1
SOL 1
SOL 1     14   50   86  122
SOL 1
SOL 1     14   25   42   50   59   77   86   94  111  122
SOL 1
SOL 1
SOL 1     12   16   34   48   52   68   84   88  102  120
SOL 1    124
SOL 1
SOL 1      6         1 1.000E+05           -5.000E-01
SOL 1          12    1 1.000E+06           -1.000E+00
SOL 1         124    1 1.000E+06           -1.000E+00
SOL 1         130    0 1.000E+05           -5.000E-01
SOL 1      8    8    0                     -5.000E+01
SOL 1     25   25    0                     -5.000E+01
SOL 1     42   42    0                     -5.000E+01
SOL 1     59   59    0                     -5.000E+01
SOL 1     77   77    0                     -5.000E+01
SOL 1     94   94    0                     -5.000E+01
SOL 1    111  111    0                     -5.000E+01
SOL 1    128  128    0                     -5.000E+01
SOL 1      0  136    0           -5.000E-01
SOL 1      0    4    0           -5.000E-01
SOL 1     64   72    0           -5.000E-01
SOL 1    132  136    0           -5.000E-01
SOL 1      0   20    0                               -5.000E+00
SOL 2        EXAMPLE CAP - NO SKEW, SAME AS SOLUTION 1 EXCEPT
SOL 2        STRINGERS INPUT AT FRACTIONAL STATIONS
SOL 2      0    0    0    0    2   14   25    0    1    0     0.000E+00
SOL 2    136 0.500E+00        20    4  112    1
SOL 2      4 1.000E+00 1.000E+00 0.900E+00 0.750E+00
SOL 2      4    8    4   10   11
SOL 2      4   34   72  102
SOL 2     34   64  102  132
SOL 2    8.1 25.2 42.3 59.4 76.6 93.7110.8127.9
SOL 2
SOL 2
SOL 2     14   50   86  122
SOL 2
SOL 2     14   25   42   50   59   77   86   94  111  122
SOL 2
SOL 2
SOL 2     12   16   34   48   52   68   84   88  102  120
SOL 2    124
SOL 2
```

```
SOL 2          6         1 1.000E+05          -5.000E-01
SOL 2               12    1 1.000E+06          -1.000E+00
SOL 2              124    1 1.000E+06          -1.000E+00
SOL 2              130    0 1.000E+05          -5.000E-01
SOL 2          8    8    0                    -4.500E+01
SOL 2          9    9    0                    -5.000E+00
SOL 2         25   25    0                    -4.000E+01
SOL 2         26   26    0                    -1.000E+01
SOL 2         42   42    0                    -3.500E+01
SOL 2         43   43    0                    -1.500E+01
SOL 2         59   59    0                    -3.000E+01
SOL 2         60   60    0                    -2.000E+01
SOL 2         76   76    0                    -2.000E+01
SOL 2         77   77    0                    -3.000E+01
SOL 2         93   93    0                    -1.500E+01
SOL 2         94   94    0                    -3.500E+01
SOL 2        110  110    0                    -1.000E+01
SOL 2        111  111    0                    -4.000E+01
SOL 2        127  127    0                    -5.000E+00
SOL 2        128  128    0                    -4.500E+01
SOL 2          0  136    0          -5.000E-01
SOL 2          0    4    0          -5.000E-01
SOL 2         64   72    0          -5.000E-01
SOL 2        132  136    0          -5.000E-01
SOL 2          0   20    0                              -5.000E+00
SOL 3           EXAMPLE CAP - SAME AS SOLUTION 2 EXCEPT
SOL 3           SKEW = 30.0 DEGREES
SOL 3          0    1    1    1    0    0    0    0    1    0      3.000E+01
```

APPENDIX 5

COMPUTED RESULTS FOR EXAMPLE PROBLEMS

```
PROGRAM CAP 14 -    DECK 2 - MATLOCK - INGRAM      REVISION DATE = 30AUG 66


PROB
SOL 1           EXAMPLE CAP - NO SKEW,
                STRINGERS POSITIONED AT NEAREST WHOLE STATIONS


TABLE 1 -- PROGRAM-CONTROL DATA
                                                         ENVELOPES    TABLE NUMBER
                                                         OF MAXIMUMS   2    3    4
     OPTIONS TO HOLD (IF=1) FROM PRECEDING PROB               0        0    0    0
     NUMBER OF ADDITIONAL CARDS FOR CURRENT PROB                       2   14   17

     OPTION (IF=1) TO CLEAR ENVELOPES BEFORE LANE LOADINGS                      0
     OPTION (IF=1) TO PLOT DESIGN VARIABLE ENVELOPES                            1

     OPTION (IF=-1)TO OMIT OUTPUT TABLE 5                                       0

     ANGLE OF SKEW, DEGREES                                                     0


TABLE 2 -- CONSTANTS

     NUMBER OF INCREMENTS FOR SLAB AND CAP                                    136
     INCREMENT LENGTH, FT                                               5.000E-01
     NUMBER OF INCREMENTS FOR MOVABLE LOAD                                     20
     INITIAL POSITION OF MOVABLE-LOAD STA ZERO                                  4
     FINAL POSITION OF MOVABLE LOAD STA ZERO                                  112
     NUMBER OF INCREMENTS BETWEEN EACH POSITION OF MOVABLE LOAD                 1
     MAXIMUM NUMBER OF LANES TO BE LOADED SIMULTANEOUSLY                        4
     LIST OF LOAD COEFFICIENTS CORRESPONDING TO NUMBER OF LANES LOADED
                      1          2          3          4          5
                1.000E 00  1.000E 00  9.000E-01  7.500E-01


TABLE 3 -- LISTS OF STATIONS

          NUM OF    NUM OF     NUM OF    NUM MOM    NUM SHEAR
          LANES   STRINGERS   SUPPORTS  CONTR PTS  CONTR PTS
     TOTAL   4        8          4         10         11

                      1      2      3      4      5      6      7      8      9     10

     LANE LEFT        4     34     72    102
     LANE RIGHT      34     64    102    132
     STRINGERS      8.0   25.0   42.0   59.0   77.0   94.0  111.0  128.0
     SUPPORTS        14     50     86    122
     MOM CONTR       14     25     42     50     59     77     86     94    111    122

     SHEAR CONTR     12     16     34     48     52     68     84     88    102    120
                    124
```

TABLE 4 -- CAP STIFFNESS, AND DATA FOR BOTH FIXED AND MOVABLE LOADS

FIXED-OR-MOVABLE			- - - - - FIXED-POSITION DATA - - - - -			MOVABLE-
STA FROM	STA TO	CONTD IF=1	CAP BENDING STIFFNESS (K-FT*FT)	SIDEWALK, SLAB LOADS (K)	STRINGER, CAP LOADS (K)	POSITION SLAB LOADS (K)
6		1	1.000E 05	0	-5.000E-01	0
	12	1	1.000E 06	0	-1.000E 00	0
	124	1	1.000E 06	0	-1.000E 00	0
	130	0	1.000E 05	0	-5.000E-01	0
8	8	0	0	0	-5.000E 01	0
25	25	0	0	0	-5.000E 01	0
42	42	0	0	0	-5.000E 01	0
59	59	0	0	0	-5.000E 01	0
77	77	0	0	0	-5.000E 01	0
94	94	0	0	0	-5.000E 01	0
111	111	0	0	0	-5.000E 01	0
128	128	0	0	0	-5.000E 01	0
0	136	0	0	-5.000E-01	0	0
0	4	0	0	-5.000E-01	0	0
64	72	0	0	-5.000E-01	0	0
132	136	0	0	-5.000E-01	0	0
0	20	0	0	0	0	-5.000E 00

PROB (CONTD)
SOL 1 EXAMPLE CAP - NO SKEW,
STRINGERS POSITIONED AT NEAREST WHOLE STATIONS

TABLE 5 -- MULTI-LANE LOADING SUMMARY (*--CRITICAL NUMBER OF LANE LOADS)

MOMENT (FT-K)

AT STA	DEAD LD EFFECT	LANE ORDER	POSITIVE MAXIMUM	LOAD LANE	AT STA	LANE ORDER	NEGATIVE MAXIMUM	LOAD LANE	AT STA
14	-1.971E 02								
		0	0			0	-1.941E 02	1	4
		1	0			1	-1.941E 02	1	4
		2	0			2	0		
		3	0			3	0		
		4	0			4	0		
		0*				0*			
25	1.381E 02								
		0	2.378E 02	0	18	0	-3.110E 01	0	57
		1	2.164E 02	1	14	1	-1.183E 01	3	72
		2	7.733E 01	2	34	2	-3.655E-01	4	112
		3	7.383E 00	4	102	3	-3.095E-01	2	44
		4	4.029E 00	3	82	4	0		
		2*				0*			
42	5.388E 01								
		0	1.309E 02	0	29	0	-7.918E 01	0	57
		1	1.168E 02	2	34	1	-3.010E 01	3	72
		2	3.585E 01	1	14	2	-9.304E-01	4	112
		3	1.879E 01	4	102	3	-7.878E-01	2	44
		4	1.026E 01	3	82	4	0		
		3*				0*			
50	-2.697E 02								
		0	3.443E 01	0	93	0	-1.427E 02	0	31
		1	2.416E 01	4	102	1	-1.422E 02	2	34
		2	1.319E 01	3	82	2	-9.676E 01	1	14
		3	4.790E 00	1	4	3	-3.871E 01	3	72
		4	0			4	-1.196E 00	4	112
		3*				3*			
59	6.439E 01								
		0	1.527E 02	0	52	0	-9.478E 01	0	23
		1	1.083E 02	2	44	1	-6.653E 01	1	14
		2	2.072E 01	3	72	2	-3.190E 01	2	34
		3	3.294E 00	1	4	3	-6.069E 00	4	102
		4	3.004E-01	4	112	4	-1.840E 00	3	82
		0*				2*			
77	6.439E 01								
		0	1.527E 02	0	64	0	-9.478E 01	0	93
		1	1.083E 02	3	72	1	-6.653E 01	4	102
		2	2.072E 01	2	44	2	-3.190E 01	3	82
		3	3.294E 00	4	112	3	-6.069E 00	1	14

		4	3.004E-01	1	4	4	-1.840E 00	2	34
		0*				2*			
86	-2.697E 02								
		0	3.443E 01	0	23	0	-1.427E 02	0	85
		1	2.416E 01	1	14	1	-1.422E 02	3	82
		2	1.319E 01	2	34	2	-9.676E 01	4	102
		3	4.790E 00	4	112	3	-3.871E 01	2	44
		4	0			4	-1.196E 00	1	4
		3*				3*			
94	5.388E 01								
		0	1.309E 02	0	87	0	-7.918E 01	0	59
		1	1.168E 02	3	82	1	-3.010E 01	2	44
		2	3.585E 01	4	102	2	-9.304E-01	1	4
		3	1.879E 01	1	14	3	-7.878E-01	3	72
		4	1.026E 01	2	34	4	0		
		3*				0*			
111	1.381E 02								
		0	2.378E 02	0	98	0	-3.110E 01	0	59
		1	2.164E 02	4	102	1	-1.183E 01	2	44
		2	7.733E 01	3	82	2	-3.655E-01	1	4
		3	7.383E 00	1	14	3	-3.095E-01	3	72
		4	4.029E 00	2	34	4	0		
		2*				0*			
122	-1.971E 02								
		0	0			0	-1.941E 02	4	112
		1	0			1	-1.941E 02	4	112
		2	0			2	0		
		3	0			3	0		
		4	0			4	0		
		0*				0*			

SHEAR (K)

AT STA	DEAD LD EFFECT	LANE ORDER	POSITIVE MAXIMUM	LOAD LANE	AT STA	LANE ORDER	NEGATIVE MAXIMUM	LOAD LANE	AT STA
12	-6.640E 01								
		0	0			0	-6.471E 01	1	4
		1	0			1	-6.471E 01	1	4
		2	0			2	0		
		3	0			3	0		
		4	0			4	0		
		0*				0*			
16	6.445E 01								
		0	4.905E 01	1	14	0	-5.655E 00	0	57
		1	4.905E 01	1	14	1	-2.150E 00	3	72
		2	1.406E 01	2	34	2	-6.646E-02	4	112
		3	1.342E 00	4	102	3	-5.627E-02	2	44
		4	7.326E-01	3	82	4	0		
		2*				0*			
34	-1.040E 01								
		0	5.165E 00	2	36	0	-2.166E 01	0	16
		1	5.165E 00	2	36	1	-2.124E 01	1	14
		2	1.342E 00	4	102	2	-2.150E 00	3	72
		3	7.326E-01	3	82	3	-6.646E-02	4	112

		4	2.661E-01	1	4	4	-5.627E-02	2	44
		3*				2*			
48	-8.290E 01								
		0	1.913E 00	0	93	0	-6.838E 01	0	30
		1	1.342E 00	4	102	1	-6.476E 01	2	34
		2	7.326E-01	3	82	2	-3.315E 01	1	14
		3	2.661E-01	1	4	3	-2.150E 00	3	72
		4	0			4	-6.646E-02	4	112
		3*				2*			
52	7.675E 01								
		0	6.058E 01	0	50	0	-9.571E 00	0	93
		1	5.371E 01	2	44	1	-6.718E 00	4	102
		2	1.321E 01	3	72	2	-3.339E 00	3	82
		3	6.718E 00	1	14	3	-3.326E-01	1	4
		4	3.326E-01	4	112	4	0		
		2*				2*			
68	0								
		0	1.124E 01	0	68	0	-1.124E 01	0	48
		1	9.733E 00	3	72	1	-9.733E 00	2	44
		2	6.718E 00	1	14	2	-6.718E 00	4	102
		3	3.339E 00	2	34	3	-3.339E 00	3	82
		4	3.326E-01	4	112	4	-3.326E-01	1	4
		3*				3*			
84	-7.675E 01								
		0	9.571E 00	0	23	0	-6.058E 01	0	66
		1	6.718E 00	1	14	1	-5.371E 01	3	72
		2	3.339E 00	2	34	2	-1.321E 01	2	44
		3	3.326E-01	4	112	3	-6.718E 00	4	102
		4	0			4	-3.326E-01	1	4
		2*				2*			
88	8.290E 01								
		0	6.838E 01	0	86	0	-1.913E 00	0	23
		1	6.476E 01	3	82	1	-1.342E 00	1	14
		2	3.315E 01	4	102	2	-7.326E-01	2	34
		3	2.150E 00	2	44	3	-2.661E-01	4	112
		4	6.646E-02	1	4	4	0		
		2*				3*			
102	1.040E 01								
		0	2.166E 01	0	100	0	-5.165E 00	3	80
		1	2.124E 01	4	102	1	-5.165E 00	3	80
		2	2.150E 00	2	44	2	-1.342E 00	1	14
		3	6.646E-02	1	4	3	-7.326E-01	2	34
		4	5.628E-02	3	72	4	-2.661E-01	4	112
		2*				3*			
120	-6.445E 01								
		0	5.655E 00	0	59	0	-4.905E 01	4	102
		1	2.150E 00	2	44	1	-4.905E 01	4	102
		2	6.646E-02	1	4	2	-1.406E 01	3	82
		3	5.627E-02	3	72	3	-1.342E 00	1	14
		4	0			4	-7.326E-01	2	34
		0*				2*			
124	6.640E 01								

		0	6.471E 01	4	112	0	0		
		1	6.471E 01	4	112	1	0		
		2	0			2	0		
		3	0			3	0		
		4	0			4	0		
		0*				0*			

REACTION (K)

AT STA	DEAD LD EFFECT	LANE ORDER	POSITIVE MAXIMUM	LOAD LANE	AT STA	LANE ORDER	NEGATIVE MAXIMUM	LOAD LANE	AT STA
14	1.348E 02								
		0	1.003E 02	1	4	0	-5.655E 00	0	57
		1	1.003E 02	1	4	1	-2.150E 00	3	72
		2	1.406E 01	2	34	2	-6.646E-02	4	112
		3	1.342E 00	4	102	3	-5.627E-02	2	44
		4	7.326E-01	3	82	4	0		
		2*				0*			
50	1.637E 02								
		0	9.095E 01	2	38	0	-1.148E 01	0	93
		1	9.095E 01	2	38	1	-6.061E 00	4	102
		2	3.987E 01	1	14	2	-4.072E 00	3	82
		3	1.536E 01	3	72	3	-5.987E-01	1	4
		4	3.990E-01	4	112	4	0		
		3*				2*			
86	1.637E 02								
		0	9.095E 01	3	78	0	-1.148E 01	0	23
		1	9.095E 01	3	78	1	-6.061E 00	1	14
		2	3.987E 01	4	102	2	-4.072E 00	2	34
		3	1.536E 01	2	44	3	-5.987E-01	4	112
		4	3.990E-01	1	4	4	0		
		3*				2*			
122	1.348E 02								
		0	1.003E 02	4	112	0	-5.655E 00	0	59
		1	1.003E 02	4	112	1	-2.150E 00	2	44
		2	1.406E 01	3	82	2	-6.646E-02	1	4
		3	1.342E 00	1	14	3	-5.627E-02	3	72
		4	7.326E-01	2	34	4	0		
		2*				0*			

TABLE 6 -- ENVELOPES OF MAXIMUM VALUES

STA	DIST X (FT)	MAX + MOM (FT-K)	MAX - MOM (FT-K)	MAX + SHEAR (K)	MAX - SHEAR (K)
-1	-5.000E-01	0	0	0	0
0	0	0	0	0	0
1	5.000E-01	0	0	0	0
2	1.000E 00	0	0	0	0
3	1.500E 00	0	0	0	0
4	2.000E 00	0	0	0	0
5	2.500E 00	0	0	4.547E-08	-9.095E-08
6	3.000E 00	4.547E-08	-9.095E-08	0	-1.250E-01
7	3.500E 00	0	-1.250E-01	0	-5.417E-01
8	4.000E 00	0	-5.417E-01	0	-6.447E 01
9	4.500E 00	0	-6.459E 01	0	-1.285E 02
10	5.000E 00	0	-1.290E 02	0	-1.293E 02
11	5.500E 00	0	-1.939E 02	0	-1.301E 02
12	6.000E 00	0	-2.592E 02	0	-1.311E 02
13	6.500E 00	0	-3.250E 02	0	-1.321E 02
14	7.000E 00	0	-3.913E 02	2.168E 01	-1.555E 01
15	7.500E 00	0	-3.405E 02	1.286E 02	0
16	8.000E 00	0	-2.903E 02	1.276E 02	0
17	8.500E 00	0	-2.405E 02	1.266E 02	0
18	9.000E 00	1.072E 01	-1.912E 02	1.256E 02	0
19	9.500E 00	6.712E 01	-1.425E 02	1.246E 02	0
20	1.000E 01	1.291E 02	-9.424E 01	1.236E 02	0
21	1.050E 01	1.907E 02	-4.649E 01	1.226E 02	0
22	1.100E 01	2.517E 02	0	1.216E 02	0
23	1.150E 01	3.122E 02	0	1.206E 02	0
24	1.200E 01	3.723E 02	0	1.196E 02	0
25	1.250E 01	4.318E 02	0	5.429E 01	0
26	1.300E 01	4.226E 02	0	4.112E 00	-2.580E 01
27	1.350E 01	4.128E 02	0	3.112E 00	-2.680E 01
28	1.400E 01	4.026E 02	0	2.112E 00	-2.780E 01
29	1.450E 01	3.918E 02	0	1.112E 00	-2.880E 01
30	1.500E 01	3.806E 02	0	1.120E-01	-2.980E 01
31	1.550E 01	3.688E 02	0	0	-3.080E 01
32	1.600E 01	3.566E 02	0	0	-3.180E 01
33	1.650E 01	3.438E 02	0	0	-3.280E 01
34	1.700E 01	3.306E 02	0	0	-3.380E 01
35	1.750E 01	3.168E 02	0	0	-3.480E 01
36	1.800E 01	3.026E 02	0	0	-3.580E 01
37	1.850E 01	2.878E 02	0	0	-3.680E 01
38	1.900E 01	2.726E 02	0	0	-3.780E 01
39	1.950E 01	2.568E 02	0	0	-3.880E 01
40	2.000E 01	2.406E 02	-2.237E 00	0	-3.980E 01
41	2.050E 01	2.240E 02	-1.352E 01	0	-4.080E 01
42	2.100E 01	2.082E 02	-2.530E 01	0	-1.049E 02
43	2.150E 01	1.261E 02	-6.743E 01	0	-1.758E 02
44	2.200E 01	4.339E 01	-1.101E 02	0	-1.768E 02
45	2.250E 01	0	-1.537E 02	0	-1.778E 02
46	2.300E 01	0	-2.054E 02	0	-1.788E 02
47	2.350E 01	0	-2.706E 02	0	-1.798E 02
48	2.400E 01	0	-3.526E 02	0	-1.808E 02
49	2.450E 01	0	-4.350E 02	0	-1.818E 02
50	2.500E 01	0	-5.197E 02	2.139E 01	-3.642E 01
51	2.550E 01	0	-4.605E 02	1.447E 02	0
52	2.600E 01	0	-4.019E 02	1.437E 02	0

53	2.650E 01	0	-3.460E 02	1.427E 02	0
54	2.700E 01	0	-2.928E 02	1.417E 02	0
55	2.750E 01	0	-2.400E 02	1.407E 02	0
56	2.800E 01	2.017E 01	-1.878E 02	1.397E 02	0
57	2.850E 01	8.629E 01	-1.360E 02	1.387E 02	0
58	2.900E 01	1.519E 02	-8.478E 01	1.377E 02	0
59	2.950E 01	2.171E 02	-3.404E 01	7.283E 01	0
60	3.000E 01	2.167E 02	-2.476E 01	2.581E 01	-9.812E 00
61	3.050E 01	2.158E 02	-1.865E 01	2.481E 01	-1.081E 01
62	3.100E 01	2.147E 02	-1.390E 01	2.381E 01	-1.181E 01
63	3.150E 01	2.133E 02	-9.649E 00	2.281E 01	-1.281E 01
64	3.200E 01	2.119E 02	-5.897E 00	2.181E 01	-1.381E 01
65	3.250E 01	2.114E 02	-2.644E 00	2.081E 01	-1.481E 01
66	3.300E 01	2.127E 02	0	1.981E 01	-1.581E 01
67	3.350E 01	2.134E 02	0	1.881E 01	-1.681E 01
68	3.400E 01	2.137E 02	0	1.781E 01	-1.781E 01
69	3.450E 01	2.134E 02	0	1.681E 01	-1.881E 01
70	3.500E 01	2.127E 02	0	1.581E 01	-1.981E 01
71	3.550E 01	2.114E 02	-2.644E 00	1.481E 01	-2.081E 01
72	3.600E 01	2.119E 02	-5.897E 00	1.381E 01	-2.181E 01
73	3.650E 01	2.133E 02	-9.649E 00	1.281E 01	-2.281E 01
74	3.700E 01	2.147E 02	-1.390E 01	1.181E 01	-2.381E 01
75	3.750E 01	2.158E 02	-1.865E 01	1.081E 01	-2.481E 01
76	3.800E 01	2.167E 02	-2.476E 01	9.812E 00	-2.581E 01
77	3.850E 01	2.171E 02	-3.404E 01	0	-7.283E 01
78	3.900E 01	1.519E 02	-8.478E 01	0	-1.377E 02
79	3.950E 01	8.629E 01	-1.360E 02	0	-1.387E 02
80	4.000E 01	2.017E 01	-1.878E 02	0	-1.397E 02
81	4.050E 01	0	-2.400E 02	0	-1.407E 02
82	4.100E 01	0	-2.928E 02	0	-1.417E 02
83	4.150E 01	0	-3.460E 02	0	-1.427E 02
84	4.200E 01	0	-4.019E 02	0	-1.437E 02
85	4.250E 01	0	-4.605E 02	0	-1.447E 02
86	4.300E 01	0	-5.197E 02	3.642E 01	-2.139E 01
87	4.350E 01	0	-4.350E 02	1.818E 02	0
88	4.400E 01	0	-3.526E 02	1.808E 02	0
89	4.450E 01	0	-2.706E 02	1.798E 02	0
90	4.500E 01	0	-2.054E 02	1.788E 02	0
91	4.550E 01	0	-1.537E 02	1.778E 02	0
92	4.600E 01	4.339E 01	-1.101E 02	1.768E 02	0
93	4.650E 01	1.261E 02	-6.743E 01	1.758E 02	0
94	4.700E 01	2.082E 02	-2.530E 01	1.049E 02	0
95	4.750E 01	2.240E 02	-1.352E 01	4.080E 01	0
96	4.800E 01	2.406E 02	-2.237E 00	3.980E 01	0
97	4.850E 01	2.568E 02	0	3.880E 01	0
98	4.900E 01	2.726E 02	0	3.780E 01	0
99	4.950E 01	2.878E 02	0	3.680E 01	0
100	5.000E 01	3.026E 02	0	3.580E 01	0
101	5.050E 01	3.168E 02	0	3.480E 01	0
102	5.100E 01	3.306E 02	0	3.380E 01	0
103	5.150E 01	3.438E 02	0	3.280E 01	0
104	5.200E 01	3.566E 02	0	3.180E 01	0
105	5.250E 01	3.688E 02	0	3.080E 01	0
106	5.300E 01	3.806E 02	0	2.980E 01	-1.120E-01
107	5.350E 01	3.918E 02	0	2.880E 01	-1.112E 00
108	5.400E 01	4.026E 02	0	2.780E 01	-2.112E 00
109	5.450E 01	4.128E 02	0	2.680E 01	-3.112E 00
110	5.500E 01	4.226E 02	0	2.580E 01	-4.112E 00
111	5.550E 01	4.318E 02	0	0	-5.429E 01
112	5.600E 01	3.723E 02	0	0	-1.196E 02

113	5.650E 01	3.122E 02	0	0	-1.206E 02
114	5.700E 01	2.517E 02	0	0	-1.216E 02
115	5.750E 01	1.907E 02	-4.649E 01	0	-1.226E 02
116	5.800E 01	1.291E 02	-9.424E 01	0	-1.236E 02
117	5.850E 01	6.712E 01	-1.425E 02	0	-1.246E 02
118	5.900E 01	1.072E 01	-1.912E 02	0	-1.256E 02
119	5.950E 01	0	-2.405E 02	0	-1.266E 02
120	6.000E 01	0	-2.903E 02	0	-1.276E 02
121	6.050E 01	0	-3.405E 02	0	-1.286E 02
122	6.100E 01	0	-3.913E 02	1.555E 01	-2.168E 01
123	6.150E 01	0	-3.250E 02	1.321E 02	0
124	6.200E 01	0	-2.592E 02	1.311E 02	0
125	6.250E 01	0	-1.939E 02	1.301E 02	0
126	6.300E 01	0	-1.290E 02	1.293E 02	0
127	6.350E 01	0	-6.459E 01	1.285E 02	0
128	6.400E 01	0	-5.417E-01	6.447E 01	0
129	6.450E 01	0	-1.250E-01	5.417E-01	0
130	6.500E 01	4.547E-08	-4.547E-08	1.250E-01	0
131	6.550E 01	0	0	4.547E-08	-4.547E-08
132	6.600E 01	0	0	0	0
133	6.650E 01	0	0	0	0
134	6.700E 01	0	0	0	0
135	6.750E 01	0	0	0	0
136	6.800E 01	0	0	0	0
137	6.850E 01	0	0	0	0

TABLE 7 -- MAXIMUM SUPPORT REACTIONS

STA	DIST X FT	MAX + REACT K	MAX - REACT K
14	7.000E 00	2.492E 02	0
50	2.500E 01	2.952E 02	0
86	4.300E 01	2.952E 02	0
122	6.100E 01	2.492E 02	0

TIME = 5 MINUTES, 27 AND 11/60 SECONDS

TABLE 8 -- SCALES FOR PLOT OUTPUT

DISTANCE	10 INCHES =	100 FT
MOMENT	2 INCHES =	1000 FT-K
SHEAR	2 INCHES =	200 K

TIME = 5 MINUTES, 51 AND 43/60 SECONDS

PROGRAM CAP 14 - DECK 2 - MATLOCK - INGRAM REVISION DATE = 30AUG 66

PROB
SOL 2 EXAMPLE CAP - NO SKEW, SAME AS SOLUTION 1 EXCEPT
STRINGERS INPUT AT FRACTIONAL STATIONS

TABLE 1 -- PROGRAM-CONTROL DATA

	ENVELOPES OF MAXIMUMS	TABLE NUMBER 2	3	4
OPTIONS TO HOLD (IF=1) FROM PRECEDING PROB	0	0	0	0
NUMBER OF ADDITIONAL CARDS FOR CURRENT PROB		2	14	25

OPTION (IF=1) TO CLEAR ENVELOPES BEFORE LANE LOADINGS	0
OPTION (IF=1) TO PLOT DESIGN VARIABLE ENVELOPES	1
OPTION (IF=-1)TO OMIT OUTPUT TABLE 5	0
ANGLE OF SKEW, DEGREES	0

TABLE 2 -- CONSTANTS

NUMBER OF INCREMENTS FOR SLAB AND CAP	136
INCREMENT LENGTH, FT	5.000E-01
NUMBER OF INCREMENTS FOR MOVABLE LOAD	20
INITIAL POSITION OF MOVABLE-LOAD STA ZERO	4
FINAL POSITION OF MOVABLE LOAD STA ZERO	112
NUMBER OF INCREMENTS BETWEEN EACH POSITION OF MOVABLE LOAD	1
MAXIMUM NUMBER OF LANES TO BE LOADED SIMULTANEOUSLY	4

LIST OF LOAD COEFFICIENTS CORRESPONDING TO NUMBER OF LANES LOADED

1	2	3	4	5
1.000E 00	1.000E 00	9.000E-01	7.500E-01	

TABLE 3 -- LISTS OF STATIONS

	NUM OF LANES	NUM OF STRINGERS	NUM OF SUPPORTS	NUM MOM CONTR PTS	NUM SHEAR CONTR PTS
TOTAL	4	8	4	10	11

	1	2	3	4	5	6	7	8	9	10
LANE LEFT	4	34	72	102						
LANE RIGHT	34	64	102	132						
STRINGERS	8.1	25.2	42.3	59.4	76.6	93.7	110.8	127.9		
SUPPORTS	14	50	86	122						
MOM CONTR	14	25	42	50	59	77	86	94	111	122
SHEAR CONTR	12	16	34	48	52	68	84	88	102	120
	124									

TABLE 4 -- CAP STIFFNESS, AND DATA FOR BOTH FIXED AND MOVABLE LOADS

FIXED-OR-MOVABLE			- - - - - FIXED-POSITION DATA - - - - -			MOVABLE-
STA FROM	STA TO	CONTD IF=1	CAP BENDING STIFFNESS (K-FT*FT)	SIDEWALK, SLAB LOADS (K)	STRINGER, CAP LOADS (K)	POSITION SLAB LOADS (K)
6		1	1.000E 05	0	-5.000E-01	0
	12	1	1.000E 06	0	-1.000E 00	0
	124	1	1.000E 06	0	-1.000E 00	0
	130	0	1.000E 05	0	-5.000E-01	0
8	8	0	0	0	-4.500E 01	0
9	9	0	0	0	-5.000E 00	0
25	25	0	0	0	-4.000E 01	0
26	26	0	0	0	-1.000E 01	0
42	42	0	0	0	-3.500E 01	0
43	43	0	0	0	-1.500E 01	0
59	59	0	0	0	-3.000E 01	0
60	60	0	0	0	-2.000E 01	0
76	76	0	0	0	-2.000E 01	0
77	77	0	0	0	-3.000E 01	0
93	93	0	0	0	-1.500E 01	0
94	94	0	0	0	-3.500E 01	0
110	110	0	0	0	-1.000E 01	0
111	111	0	0	0	-4.000E 01	0
127	127	0	0	0	-5.000E 00	0
128	128	0	0	0	-4.500E 01	0
0	136	0	0	-5.000E-01	0	0
0	4	0	0	-5.000E-01	0	0
64	72	0	0	-5.000E-01	0	0
132	136	0	0	-5.000E-01	0	0
0	20	0	0	0	0	-5.000E 00

PROB (CONTD)
SOL 2 EXAMPLE CAP - NO SKEW, SAME AS SOLUTION 1 EXCEPT
STRINGERS INPUT AT FRACTIONAL STATIONS

TABLE 5 -- MULTI-LANE LOADING SUMMARY (*--CRITICAL NUMBER OF LANE LOADS)

MOMENT (FT-K)

AT STA	DEAD LD EFFECT	LANE ORDER	POSITIVE MAXIMUM	LOAD LANE	AT STA	LANE ORDER	NEGATIVE MAXIMUM	LOAD LANE	AT STA
14	-1.944E 02								
		0	0			0	-1.932E 02	1	4
		1	0			1	-1.932E 02	1	4
		2	0			2	0		
		3	0			3	0		
		4	0			4	0		
		0*				0*			
25	1.348E 02								
		0	2.350E 02	0	18	0	-3.162E 01	0	57
		1	2.125E 02	1	14	1	-1.198E 01	3	72
		2	7.752E 01	2	34	2	-1.933E 00	1	4
		3	7.372E 00	4	102	3	-3.788E-01	4	112
		4	4.022E 00	3	82	4	-1.652E-01	2	44
		2*				0*			
42	4.682E 01								
		0	1.251E 02	0	30	0	-6.049E 01	0	57
		1	1.125E 02	2	34	1	-3.049E 01	3	72
		2	3.426E 01	1	14	2	-9.641E-01	4	112
		3	1.876E 01	4	102	3	-4.206E-01	2	44
		4	1.024E 01	3	82	4	0		
		3*				0*			
50	-2.727E 02								
		0	3.420E 01	0	93	0	-1.408E 02	0	31
		1	2.413E 01	4	102	1	-1.405E 02	2	34
		2	1.316E 01	3	82	2	-9.662E 01	1	14
		3	4.964E 00	1	4	3	-3.920E 01	3	72
		4	0			4	-1.240E 00	4	112
		3*				3*			
59	6.064E 01								
		0	1.461E 02	0	52	0	-9.416E 01	0	23
		1	9.999E 01	2	44	1	-6.643E 01	1	14
		2	2.046E 01	3	72	2	-3.544E 01	2	34
		3	3.413E 00	1	4	3	-6.060E 00	4	102
		4	3.113E-01	4	112	4	-1.704E 00	3	82
		0*				2*			
77	6.064E 01								
		0	1.461E 02	0	64	0	-9.416E 01	0	93
		1	9.999E 01	3	72	1	-6.643E 01	4	102
		2	2.046E 01	2	44	2	-3.544E 01	3	82
		3	3.413E 00	4	112	3	-6.060E 00	1	14

		4	3.113E-01	1	4	4	-1.704E 00	2	34
		0*				2*			
86	-2.727E 02								
		0	3.420E 01	0	23	0	-1.408E 02	0	85
		1	2.413E 01	1	14	1	-1.405E 02	3	82
		2	1.316E 01	2	34	2	-9.662E 01	4	102
		3	4.964E 00	4	112	3	-3.920E 01	2	44
		4	0			4	-1.240E 00	1	4
		3*				3*			
94	4.682E 01								
		0	1.251E 02	0	86	0	-8.049E 01	0	59
		1	1.125E 02	3	82	1	-3.049E 01	2	44
		2	3.426E 01	4	102	2	-9.841E-01	1	4
		3	1.876E 01	1	14	3	-4.206E-01	3	72
		4	1.024E 01	2	34	4	0		
		3*				0*			
111	1.348E 02								
		0	2.350E 02	0	98	0	-3.162E 01	0	59
		1	2.125E 02	4	102	1	-1.198E 01	2	44
		2	7.752E 01	3	82	2	-1.933E 00	4	112
		3	7.372E 00	1	14	3	-3.788E-01	1	4
		4	4.022E 00	2	34	4	-1.652E-01	3	72
		2*				0*			
122	-1.944E 02								
		0	0			0	-1.932E 02	4	112
		1	0			1	-1.932E 02	4	112
		2	0			2	0		
		3	0			3	0		
		4	0			4	0		
		0*				0*			

SHEAR (K)

AT STA	DEAD LD EFFECT	LANE ORDER	POSITIVE MAXIMUM	LOAD LANE	AT STA	LANE ORDER	NEGATIVE MAXIMUM	LOAD LANE	AT STA
12	-6.650E 01								
		0	0			0	-6.550E 01	1	4
		1	0			1	-6.550E 01	1	4
		2	0			2	0		
		3	0			3	0		
		4	0			4	0		
		0*				0*			
16	6.335E 01								
		0	4.849E 01	1	14	0	-5.749E 00	0	57
		1	4.849E 01	1	14	1	-2.178E 00	3	72
		2	1.409E 01	2	34	2	-6.886E-02	4	112
		3	1.340E 00	4	102	3	-3.004E-02	2	44
		4	7.312E-01	3	82	4	0		
		2*				0*			
34	-1.152E 01								
		0	4.696E 00	2	37	0	-2.236E 01	0	16
		1	4.696E 00	2	37	1	-2.180E 01	1	14
		2	1.340E 00	4	102	2	-2.178E 00	3	72
		3	7.312E-01	3	82	3	-6.887E-02	4	112

		4	2.758E-01	1	4	4	-3.004E-02	2	44
		3*				2*			
48	-8.407E 01								
		0	1.900E 00	0	93	0	-6.907E 01	0	30
		1	1.340E 00	4	102	1	-6.586E 01	2	34
		2	7.312E-01	3	82	2	-3.315E 01	1	14
		3	2.758E-01	1	4	3	-2.178E 00	3	72
		4	0			4	-6.887E-02	4	112
		3*				2*			
52	7.657E 01								
		0	5.946E 01	0	51	0	-9.507E 00	0	93
		1	5.203E 01	2	44	1	-6.708E 00	4	102
		2	1.326E 01	3	72	2	-3.304E 00	3	82
		3	6.708E 00	1	14	3	-3.446E-01	1	4
		4	3.446E-01	4	112	4	0		
		2*				2*			
68	0								
		0	1.179E 01	0	68	0	-1.179E 01	0	48
		1	1.015E 01	3	72	1	-1.015E 01	2	44
		2	6.708E 00	1	14	2	-6.708E 00	4	102
		3	3.304E 00	2	34	3	-3.304E 00	3	82
		4	3.446E-01	4	112	4	-3.446E-01	1	4
		3*				3*			
84	-7.657E 01								
		0	9.507E 00	0	23	0	-5.946E 01	0	65
		1	6.708E 00	1	14	1	-5.203E 01	3	72
		2	3.304E 00	2	34	2	-1.326E 01	2	44
		3	3.446E-01	4	112	3	-6.708E 00	4	102
		4	0			4	-3.446E-01	1	4
		2*				2*			
88	8.407E 01								
		0	6.907E 01	0	86	0	-1.900E 00	0	23
		1	6.586E 01	3	82	1	-1.340E 00	1	14
		2	3.315E 01	4	102	2	-7.312E-01	2	34
		3	2.178E 00	2	44	3	-2.758E-01	4	112
		4	6.887E-02	1	4	4	0		
		2*				3*			
102	1.152E 01								
		0	2.236E 01	0	100	0	-4.696E 00	3	79
		1	2.180E 01	4	102	1	-4.696E 00	3	79
		2	2.178E 00	2	44	2	-1.340E 00	1	14
		3	6.887E-02	1	4	3	-7.312E-01	2	34
		4	3.004E-02	3	72	4	-2.758E-01	4	112
		2*				3*			
120	-6.335E 01								
		0	5.749E 00	0	59	0	-4.849E 01	4	102
		1	2.178E 00	2	44	1	-4.849E 01	4	102
		2	6.886E-02	1	4	2	-1.409E 01	3	82
		3	3.004E-02	3	72	3	-1.340E 00	1	14
		4	0			4	-7.312E-01	2	34
		0*				2*			
124	6.650E 01								

0	6.550E 01	4	112	0	0		
1	6.550E 01	4	112	1	0		
2	0			2	0		
3	0			3	0		
4	0			4	0		
0*				0*			

REACTION (K)

AT STA	DEAD LD EFFECT	LANE ORDER	POSITIVE MAXIMUM	LOAD LANE	AT STA	LANE ORDER	NEGATIVE MAXIMUM	LOAD LANE	AT STA
14	1.339E 02								
		0	1.003E 02	1	4	0	-5.749E 00	0	57
		1	1.003E 02	1	4	1	-2.178E 00	3	72
		2	1.409E 01	2	34	2	-6.886E-02	4	112
		3	1.340E 00	4	102	3	-3.004E-02	2	44
		4	7.312E-01	3	82	4	0		
		2*				0*			
50	1.646E 02								
		0	9.082E 01	2	38	0	-1.141E 01	0	93
		1	9.082E 01	2	38	1	-6.048E 00	4	102
		2	3.985E 01	1	14	2	-4.035E 00	3	82
		3	1.544E 01	3	72	3	-6.204E-01	1	4
		4	4.135E-01	4	112	4	0		
		3*				2*			
66	1.646E 02								
		0	9.082E 01	3	78	0	-1.141E 01	0	23
		1	9.082E 01	3	78	1	-6.048E 00	1	14
		2	3.985E 01	4	102	2	-4.035E 00	2	34
		3	1.544E 01	2	44	3	-6.204E-01	4	112
		4	4.135E-01	1	4	4	0		
		3*				2*			
122	1.339E 02								
		0	1.003E 02	4	112	0	-5.749E 00	0	59
		1	1.003E 02	4	112	1	-2.178E 00	2	44
		2	1.409E 01	3	82	2	-6.886E-02	1	4
		3	1.340E 00	1	14	3	-3.004E-02	3	72
		4	7.312E-01	2	34	4	0		
		2*				0*			

TABLE 6 -- ENVELOPES OF MAXIMUM VALUES

STA	DIST X (FT)	MAX + MOM (FT-K)	MAX - MOM (FT-K)	MAX + SHEAR (K)	MAX - SHEAR (K)
-1	-5.000E-01	0	0	0	0
0	0	0	0	0	0
1	5.000E-01	0	0	0	0
2	1.000E 00	0	0	0	0
3	1.500E 00	0	0	0	0
4	2.000E 00	0	0	0	0
5	2.500E 00	0	0	3.411E-08	-9.095E-08
6	3.000E 00	3.411E-08	-9.095E-08	0	-1.250E-01
7	3.500E 00	0	-1.250E-01	0	-5.417E-01
8	4.000E 00	0	-5.417E-01	0	-5.854E 01
9	4.500E 00	0	-5.867E 01	0	-1.230E 02
10	5.000E 00	0	-1.235E 02	0	-1.302E 02
11	5.500E 00	0	-1.888E 02	0	-1.310E 02
12	6.000E 00	0	-2.546E 02	0	-1.320E 02
13	6.500E 00	0	-3.208E 02	0	-1.330E 02
14	7.000E 00	0	-3.876E 02	2.054E 01	-1.693E 01
15	7.500E 00	0	-3.378E 02	1.269E 02	0
16	8.000E 00	0	-2.884E 02	1.259E 02	0
17	8.500E 00	0	-2.396E 02	1.249E 02	0
18	9.000E 00	1.029E 01	-1.913E 02	1.239E 02	0
19	9.500E 00	6.507E 01	-1.435E 02	1.229E 02	0
20	1.000E 01	1.263E 02	-9.618E 01	1.219E 02	0
21	1.050E 01	1.870E 02	-4.937E 01	1.209E 02	0
22	1.100E 01	2.472E 02	-3.051E 00	1.199E 02	0
23	1.150E 01	3.069E 02	0	1.189E 02	0
24	1.200E 01	3.662E 02	0	1.179E 02	0
25	1.250E 01	4.249E 02	0	6.263E 01	0
26	1.300E 01	4.282E 02	0	1.089E 01	-1.478E 01
27	1.350E 01	4.173E 02	0	1.567E 00	-2.850E 01
28	1.400E 01	4.059E 02	0	5.670E-01	-2.950E 01
29	1.450E 01	3.939E 02	0	0	-3.050E 01
30	1.500E 01	3.815E 02	0	0	-3.150E 01
31	1.550E 01	3.686E 02	0	0	-3.250E 01
32	1.600E 01	3.552E 02	0	0	-3.350E 01
33	1.650E 01	3.413E 02	0	0	-3.450E 01
34	1.700E 01	3.269E 02	0	0	-3.550E 01
35	1.750E 01	3.120E 02	0	0	-3.650E 01
36	1.800E 01	2.965E 02	0	0	-3.750E 01
37	1.850E 01	2.806E 02	0	0	-3.850E 01
38	1.900E 01	2.642E 02	0	0	-3.950E 01
39	1.950E 01	2.473E 02	0	0	-4.050E 01
40	2.000E 01	2.299E 02	-9.400E 00	0	-4.150E 01
41	2.050E 01	2.127E 02	-2.129E 01	0	-4.250E 01
42	2.100E 01	1.958E 02	-3.367E 01	0	-8.624E 01
43	2.150E 01	1.323E 02	-6.736E 01	0	-1.571E 02
44	2.200E 01	4.853E 01	-1.109E 02	0	-1.791E 02
45	2.250E 01	0	-1.550E 02	0	-1.801E 02
46	2.300E 01	0	-2.041E 02	0	-1.811E 02
47	2.350E 01	0	-2.691E 02	0	-1.821E 02
48	2.400E 01	0	-3.523E 02	0	-1.831E 02
49	2.450E 01	0	-4.360E 02	0	-1.841E 02
50	2.500E 01	0	-5.214E 02	2.004E 01	-3.823E 01
51	2.550E 01	0	-4.629E 02	1.429E 02	0
52	2.600E 01	0	-4.048E 02	1.419E 02	0

53	2.650E 01	0	-3.491E 02	1.409E 02	0
54	2.700E 01	0	-2.966E 02	1.399E 02	0
55	2.750E 01	0	-2.445E 02	1.389E 02	0
56	2.800E 01	1.173E 01	-1.929E 02	1.379E 02	0
57	2.850E 01	7.708E 01	-1.419E 02	1.369E 02	0
58	2.900E 01	1.422E 02	-9.130E 01	1.359E 02	0
59	2.950E 01	2.068E 02	-4.123E 01	9.711E 01	0
60	3.000E 01	2.320E 02	-1.585E 01	4.243E 01	0
61	3.050E 01	2.309E 02	-9.803E 00	2.514E 01	-1.114E 01
62	3.100E 01	2.298E 02	-5.067E 00	2.414E 01	-1.214E 01
63	3.150E 01	2.282E 02	-8.302E-01	2.314E 01	-1.314E 01
64	3.200E 01	2.267E 02	0	2.214E 01	-1.414E 01
65	3.250E 01	2.251E 02	0	2.114E 01	-1.514E 01
66	3.300E 01	2.255E 02	0	2.014E 01	-1.614E 01
67	3.350E 01	2.263E 02	0	1.914E 01	-1.714E 01
68	3.400E 01	2.265E 02	0	1.814E 01	-1.814E 01
69	3.450E 01	2.263E 02	0	1.714E 01	-1.914E 01
70	3.500E 01	2.255E 02	0	1.614E 01	-2.014E 01
71	3.550E 01	2.251E 02	0	1.514E 01	-2.114E 01
72	3.600E 01	2.267E 02	0	1.414E 01	-2.214E 01
73	3.650E 01	2.282E 02	-8.301E-01	1.314E 01	-2.314E 01
74	3.700E 01	2.298E 02	-5.067E 00	1.214E 01	-2.414E 01
75	3.750E 01	2.309E 02	-9.803E 00	1.114E 01	-2.514E 01
76	3.800E 01	2.320E 02	-1.585E 01	0	-4.243E 01
77	3.850E 01	2.068E 02	-4.123E 01	0	-9.711E 01
78	3.900E 01	1.422E 02	-9.130E 01	0	-1.359E 02
79	3.950E 01	7.708E 01	-1.419E 02	0	-1.369E 02
80	4.000E 01	1.173E 01	-1.929E 02	0	-1.379E 02
81	4.050E 01	0	-2.445E 02	0	-1.389E 02
82	4.100E 01	0	-2.966E 02	0	-1.399E 02
83	4.150E 01	0	-3.491E 02	0	-1.409E 02
84	4.200E 01	0	-4.048E 02	0	-1.419E 02
85	4.250E 01	0	-4.629E 02	0	-1.429E 02
86	4.300E 01	0	-5.214E 02	3.823E 01	-2.004E 01
87	4.350E 01	0	-4.360E 02	1.841E 02	0
88	4.400E 01	0	-3.523E 02	1.831E 02	0
89	4.450E 01	0	-2.691E 02	1.821E 02	0
90	4.500E 01	0	-2.041E 02	1.811E 02	0
91	4.550E 01	0	-1.550E 02	1.801E 02	0
92	4.600E 01	4.853E 01	-1.109E 02	1.791E 02	0
93	4.650E 01	1.323E 02	-6.736E 01	1.571E 02	0
94	4.700E 01	1.958E 02	-3.367E 01	8.624E 01	0
95	4.750E 01	2.127E 02	-2.129E 01	4.250E 01	0
96	4.800E 01	2.299E 02	-9.400E 00	4.150E 01	0
97	4.850E 01	2.473E 02	0	4.050E 01	0
98	4.900E 01	2.642E 02	0	3.950E 01	0
99	4.950E 01	2.806E 02	0	3.850E 01	0
100	5.000E 01	2.965E 02	0	3.750E 01	0
101	5.050E 01	3.120E 02	0	3.650E 01	0
102	5.100E 01	3.269E 02	0	3.550E 01	0
103	5.150E 01	3.413E 02	0	3.450E 01	0
104	5.200E 01	3.552E 02	0	3.350E 01	0
105	5.250E 01	3.686E 02	0	3.250E 01	0
106	5.300E 01	3.815E 02	0	3.150E 01	0
107	5.350E 01	3.939E 02	0	3.050E 01	0
108	5.400E 01	4.059E 02	0	2.950E 01	-5.670E-01
109	5.450E 01	4.173E 02	0	2.850E 01	-1.567E 00
110	5.500E 01	4.282E 02	0	1.478E 01	-1.089E 01
111	5.550E 01	4.249E 02	0	0	-6.263E 01
112	5.600E 01	3.662E 02	0	0	-1.179E 02

113	5.650E 01	3.069E 02	0	0	-1.189E 02
114	5.700E 01	2.472E 02	-3.051E 00	0	-1.199E 02
115	5.750E 01	1.870E 02	-4.937E 01	0	-1.209E 02
116	5.800E 01	1.263E 02	-9.618E 01	0	-1.219E 02
117	5.850E 01	6.507E 01	-1.435E 02	0	-1.229E 02
118	5.900E 01	1.029E 01	-1.913E 02	0	-1.239E 02
119	5.950E 01	0	-2.396E 02	0	-1.249E 02
120	6.000E 01	0	-2.884E 02	0	-1.259E 02
121	6.050E 01	0	-3.378E 02	0	-1.269E 02
122	6.100E 01	0	-3.876E 02	1.693E 01	-2.054E 01
123	6.150E 01	0	-3.208E 02	1.330E 02	0
124	6.200E 01	0	-2.546E 02	1.320E 02	0
125	6.250E 01	0	-1.888E 02	1.310E 02	0
126	6.300E 01	0	-1.235E 02	1.302E 02	0
127	6.350E 01	0	-5.867E 01	1.230E 02	0
128	6.400E 01	0	-5.417E-01	5.854E 01	0
129	6.450E 01	0	-1.250E-01	5.417E-01	0
130	6.500E 01	2.274E-08	-9.095E-08	1.250E-01	0
131	6.550E 01	0	0	9.095E-08	-2.274E-08
132	6.600E 01	0	0	0	0
133	6.650E 01	0	0	0	0
134	6.700E 01	0	0	0	0
135	6.750E 01	0	0	0	0
136	6.800E 01	0	0	0	0
137	6.850E 01	0	0	0	0

TABLE 7 -- MAXIMUM SUPPORT REACTIONS

STA	DIST X FT	MAX + REACT K	MAX - REACT K
14	7.000E 00	2.482E 02	0
50	2.500E 01	2.961E 02	0
86	4.300E 01	2.961E 02	0
122	6.100E 01	2.482E 02	0

TIME = 8 MINUTES, 20 AND 23/60 SECONDS

TABLE 8 -- SCALES FOR PLOT OUTPUT

DISTANCE	10 INCHES =	100 FT
MOMENT	2 INCHES =	1000 FT-K
SHEAR	2 INCHES =	200 K

TIME = 8 MINUTES, 41 AND 43/60 SECONDS

PROGRAM CAP 14 - DECK 2 - MATLCCK - INGRAM REVISION DATE = 30AUG 66

PROB
SCL 3 EXAMPLE CAP - SAME AS SOLUTION 2 EXCEPT
SKEW = 3C.0 CEGREES

TABLE 1 -- PRCGRAM-CCNTROL DATA

	ENVELOPES OF MAXIMUMS	TABLE NUMBER 2	3	4
OPTIONS TC HOLD (IF=1) FRCM PRECEDING PROB	0	1	1	1
NUMBER CF ADDITICNAL CARCS FCR CURRENT PRCB		0	0	0
CPTICN (IF=1) TC CLEAR ENVELCPES BEFCRE LANE LCADINGS				0
CPTICN (IF=1) TC PLCT DESIGN VARIABLE ENVELOPES				1
OPTICN (IF=-1)TC CMIT CUTPLT TABLE 5				0
ANGLE CF SKEW, DEGREES				3.000E 01

TABLE 2 -- CCNSTANTS

USING CATA FROM THE PREVIOLS PROBLEM

TABLE 3 -- LISTS OF STATIONS

USING CATA FROM THE PREVIOLS PRCBLEM

TABLE 4 -- CAP STIFFNESS, AND DATA FOR BOTH FIXED AND MOVABLE LOADS

USING CATA FROM THE PREVICLS PROBLEM PLUS

NONE

PROB (CONTD)
SOL 3 EXAMPLE CAP - SAME AS SOLUTION 2 EXCEPT
SKEW = 30.0 DEGREES

TABLE 5 -- MULTI-LANE LOADING SUMMARY (*--CRITICAL NUMBER OF LANE LOADS)

MOMENT (FT-K)

AT STA	DEAD LD EFFECT	LANE ORDER	POSITIVE MAXIMUM	LOAD LANE	AT STA	LANE ORDER	NEGATIVE MAXIMUM	LOAD LANE	AT STA
14	-2.265E 02								
		0	0			0	-2.231E 02	1	4
		1	0			1	-2.231E 02	1	4
		2	0			2	0		
		3	0			3	0		
		4	0			4	0		
		0*				0*			
25	1.631E 02								
		0	2.713E 02	0	18	0	-3.651E 01	0	57
		1	2.454E 02	1	14	1	-1.383E 01	3	72
		2	8.951E 01	2	34	2	-2.233E 00	1	4
		3	6.512E 00	4	102	3	-4.374E-01	4	112
		4	4.644E 00	3	82	4	-1.908E-01	2	44
		2*				0*			
42	5.493E 01								
		0	1.445E 02	0	30	0	-9.294E 01	0	57
		1	1.299E 02	2	34	1	-3.521E 01	3	72
		2	3.956E 01	1	14	2	-1.113E 00	4	112
		3	2.167E 01	4	102	3	-4.857E-01	2	44
		4	1.182E 01	3	82	4	0		
		3*				0*			
50	-3.260E 02								
		0	3.949E 01	0	93	0	-1.626E 02	0	31
		1	2.786E 01	4	102	1	-1.622E 02	2	34
		2	1.520E 01	3	82	2	-1.116E 02	1	14
		3	5.732E 00	1	4	3	-4.527E 01	3	72
		4	0			4	-1.431E 00	4	112
		3*				3*			
59	6.972E 01								
		0	1.687E 02	0	52	0	-1.087E 02	0	23
		1	1.155E 02	2	44	1	-7.671E 01	1	14
		2	2.363E 01	3	72	2	-4.093E 01	2	34
		3	3.541E 00	1	4	3	-6.997E 00	4	102
		4	3.595E-01	4	112	4	-1.967E 00	3	82
		0*				2*			
77	6.972E 01								
		0	1.687E 02	0	64	0	-1.087E 02	0	93
		1	1.155E 02	3	72	1	-7.671E 01	4	102
		2	2.363E 01	2	44	2	-4.093E 01	3	82
		3	3.541E 00	4	112	3	-6.997E 00	1	14

		4	3.595E-01	1	4	4	-1.967E 00	2	34
		0*				2*			
86	-3.260E 02								
		0	3.949E 01	0	23	0	-1.626E 02	0	85
		1	2.786E 01	1	14	1	-1.622E 02	3	82
		2	1.520E 01	2	34	2	-1.116E 02	4	102
		3	5.732E 00	4	112	3	-4.527E 01	2	44
		4	0			4	-1.431E 00	1	4
		3*				3*			
94	5.493E 01								
		0	1.445E 02	0	86	0	-9.294E 01	0	59
		1	1.299E 02	3	82	1	-3.521E 01	2	44
		2	3.956E 01	4	102	2	-1.113E 00	1	4
		3	2.167E 01	1	14	3	-4.857E-01	3	72
		4	1.182E 01	2	34	4	0		
		3*				0*			
111	1.631E 02								
		0	2.713E 02	0	98	0	-3.651E 01	0	59
		1	2.454E 02	4	102	1	-1.383E 01	2	44
		2	8.951E 01	3	82	2	-2.233E 00	4	112
		3	8.512E 00	1	14	3	-4.374E-01	1	4
		4	4.644E 00	2	34	4	-1.908E-01	3	72
		2*				0*			
122	-2.265E 02								
		0	0			0	-2.231E 02	4	112
		1	0			1	-2.231E 02	4	112
		2	0			2	0		
		3	0			3	0		
		4	0			4	0		
		0*				0*			

SHEAR (K)

AT STA	DEAD LD EFFECT	LANE ORDER	POSITIVE MAXIMUM	LOAD LANE	AT STA	LANE ORDER	NEGATIVE MAXIMUM	LOAD LANE	AT STA
12	-6.720E 01								
		0	0			0	-6.550E 01	1	4
		1	0			1	-6.550E 01	1	4
		2	0			2	0		
		3	0			3	0		
		4	0			4	0		
		0*				0*			
16	6.539E 01								
		0	4.849E 01	1	14	0	-5.749E 00	0	57
		1	4.849E 01	1	14	1	-2.178E 00	3	72
		2	1.409E 01	2	34	2	-6.886E-02	4	112
		3	1.340E 00	4	102	3	-3.004E-02	2	44
		4	7.312E-01	3	82	4	0		
		2*				0*			
34	-1.227E 01								
		0	4.696E 00	2	37	0	-2.236E 01	0	16
		1	4.696E 00	2	37	1	-2.180E 01	1	14
		2	1.340E 00	4	102	2	-2.178E 00	3	72
		3	7.312E-01	3	82	3	-6.886E-02	4	112

		4	2.758E-01	1	4	4	-3.004E-02	2	44
		3*				2*			
48	-8.699E 01								
		0	1.900E 00	0	93	0	-6.907E 01	0	30
		1	1.340E 00	4	102	1	-6.586E 01	2	34
		2	7.312E-01	3	82	2	-3.315E 01	1	14
		3	2.758E-01	1	4	3	-2.178E 00	3	72
		4	0			4	-6.887E-02	4	112
		3*				2*			
52	7.905E 01								
		0	5.946E 01	0	51	0	-9.507E 00	0	93
		1	5.203E 01	2	44	1	-6.708E 00	4	102
		2	1.326E 01	3	72	2	-3.304E 00	3	82
		3	6.708E 00	1	14	3	-3.446E-01	1	4
		4	3.446E-01	4	112	4	0		
		2*				2*			
68	0								
		0	1.179E 01	0	68	0	-1.179E 01	0	48
		1	1.015E 01	3	72	1	-1.015E 01	2	44
		2	6.708E 00	1	14	2	-6.708E 00	4	102
		3	3.304E 00	2	34	3	-3.304E 00	3	82
		4	3.446E-01	4	112	4	-3.446E-01	1	4
		3*				3*			
84	-7.905E 01								
		0	9.507E 00	0	23	0	-5.946E 01	0	65
		1	6.708E 00	1	14	1	-5.203E 01	3	72
		2	3.304E 00	2	34	2	-1.326E 01	2	44
		3	3.446E-01	4	112	3	-6.708E 00	4	102
		4	0			4	-3.446E-01	1	4
		2*				2*			
88	8.699E 01								
		0	6.907E 01	0	86	0	-1.900E 00	0	23
		1	6.586E 01	3	82	1	-1.340E 00	1	14
		2	3.315E 01	4	102	2	-7.312E-01	2	34
		3	2.178E 00	2	44	3	-2.758E-01	4	112
		4	6.887E-02	1	4	4	0		
		2*				3*			
102	1.227E 01								
		0	2.236E 01	0	100	0	-4.696E 00	3	79
		1	2.180E 01	4	102	1	-4.696E 00	3	79
		2	2.178E 00	2	44	2	-1.340E 00	1	14
		3	6.887E-02	1	4	3	-7.312E-01	2	34
		4	3.004E-02	3	72	4	-2.758E-01	4	112
		2*				3*			
120	-6.539E 01								
		0	5.749E 00	0	59	0	-4.849E 01	4	102
		1	2.178E 00	2	44	1	-4.849E 01	4	102
		2	6.886E-02	1	4	2	-1.409E 01	3	82
		3	3.004E-02	3	72	3	-1.340E 00	1	14
		4	0			4	-7.312E-01	2	34
		0*				2*			
124	6.720E 01								

AT STA	DEAD LD EFFECT	LANE ORDER	POSITIVE MAXIMUM	LOAD LANE	AT STA	LANE ORDER	NEGATIVE MAXIMUM	LOAD LANE	AT STA
		0	6.550E 01	4	112	0	0		
		1	6.550E 01	4	112	1	0		
		2	0			2	0		
		3	0			3	0		
		4	0			4	0		
		0*				0*			

REACTION (K)

AT STA	DEAD LD EFFECT	LANE ORDER	POSITIVE MAXIMUM	LOAD LANE	AT STA	LANE ORDER	NEGATIVE MAXIMUM	LOAD LANE	AT STA
14	1.372E 02								
		0	1.003E 02	1	4	0	-5.749E 00	0	57
		1	1.003E 02	1	4	1	-2.178E 00	3	72
		2	1.409E 01	2	34	2	-6.886E-02	4	112
		3	1.340E 00	4	102	3	-3.004E-02	2	44
		4	7.312E-01	3	82	4	0		
		2*				0*			
50	1.707E 02								
		0	9.082E 01	2	38	0	-1.141E 01	0	93
		1	9.082E 01	2	38	1	-8.048E 00	4	102
		2	3.985E 01	1	14	2	-4.035E 00	3	82
		3	1.544E 01	3	72	3	-6.204E-01	1	4
		4	4.135E-01	4	112	4	0		
		3*				2*			
86	1.707E 02								
		0	9.082E 01	3	78	0	-1.141E 01	0	23
		1	9.082E 01	3	78	1	-8.048E 00	1	14
		2	3.985E 01	4	102	2	-4.035E 00	2	34
		3	1.544E 01	2	44	3	-6.204E-01	4	112
		4	4.135E-01	1	4	4	0		
		3*				2*			
122	1.372E 02								
		0	1.003E 02	4	112	0	-5.749E 00	0	59
		1	1.003E 02	4	112	1	-2.178E 00	2	44
		2	1.409E 01	3	82	2	-6.887E-02	1	4
		3	1.340E 00	1	14	3	-3.004E-02	3	72
		4	7.312E-01	2	34	4	0		
		2*				0*			

TABLE 6 -- ENVELOPES OF MAXIMUM VALUES

STA	DIST X (FT)	MAX + MOM (FT-K)	MAX - MOM (FT-K)	MAX + SHEAR (K)	MAX - SHEAR (K)
-1	-5.774E-01	0	0	0	0
0	0	0	0	0	0
1	5.774E-01	0	0	0	0
2	1.155E 00	0	0	0	0
3	1.732E 00	0	0	0	0
4	2.309E 00	0	0	0	0
5	2.887E 00	0	0	5.907E-08	-1.181E-07
6	3.464E 00	6.821E-08	-1.364E-07	0	-1.443E-01
7	4.041E 00	0	-1.667E-01	0	-6.255E-01
8	4.619E 00	0	-7.222E-01	0	-5.872E 01
9	5.196E 00	0	-6.797E 01	0	-1.233E 02
10	5.774E 00	0	-1.431E 02	0	-1.306E 02
11	6.351E 00	0	-2.187E 02	0	-1.316E 02
12	6.928E 00	0	-2.950E 02	0	-1.327E 02
13	7.506E 00	0	-3.720E 02	0	-1.338E 02
14	8.083E 00	0	-4.496E 02	2.121E 01	-1.626E 01
15	8.660E 00	0	-3.907E 02	1.291E 02	0
16	9.238E 00	0	-3.326E 02	1.280E 02	0
17	9.815E 00	0	-2.751E 02	1.268E 02	0
18	1.039E 01	1.454E 01	-2.183E 02	1.257E 02	0
19	1.097E 01	7.874E 01	-1.621E 02	1.245E 02	0
20	1.155E 01	1.503E 02	-1.066E 02	1.234E 02	0
21	1.212E 01	2.212E 02	-5.176E 01	1.222E 02	0
22	1.270E 01	2.914E 02	0	1.210E 02	0
23	1.328E 01	3.610E 02	0	1.199E 02	0
24	1.386E 01	4.298E 02	0	1.187E 02	0
25	1.443E 01	4.981E 02	0	6.328E 01	0
26	1.501E 01	5.022E 02	0	1.138E 01	-1.429E 01
27	1.559E 01	4.898E 02	0	1.902E 00	-2.817E 01
28	1.617E 01	4.768E 02	0	7.476E-01	-2.932E 01
29	1.674E 01	4.631E 02	0	0	-3.048E 01
30	1.732E 01	4.488E 02	0	0	-3.163E 01
31	1.790E 01	4.337E 02	0	0	-3.279E 01
32	1.848E 01	4.180E 02	0	0	-3.394E 01
33	1.905E 01	4.017E 02	0	0	-3.509E 01
34	1.963E 01	3.846E 02	0	0	-3.625E 01
35	2.021E 01	3.669E 02	0	0	-3.740E 01
36	2.078E 01	3.486E 02	0	0	-3.856E 01
37	2.136E 01	3.295E 02	0	0	-3.971E 01
38	2.194E 01	3.098E 02	0	0	-4.087E 01
39	2.252E 01	2.895E 02	0	0	-4.202E 01
40	2.309E 01	2.684E 02	-7.869E 00	0	-4.318E 01
41	2.367E 01	2.476E 02	-2.261E 01	0	-4.433E 01
42	2.425E 01	2.269E 02	-3.801E 01	0	-8.823E 01
43	2.483E 01	1.524E 02	-7.810E 01	0	-1.593E 02
44	2.540E 01	5.444E 01	-1.296E 02	0	-1.814E 02
45	2.598E 01	0	-1.819E 02	0	-1.825E 02
46	2.656E 01	0	-2.401E 02	0	-1.837E 02
47	2.714E 01	0	-3.168E 02	0	-1.848E 02
48	2.771E 01	0	-4.145E 02	0	-1.860E 02
49	2.829E 01	0	-5.128E 02	0	-1.871E 02
50	2.887E 01	0	-6.132E 02	1.982E 01	-3.844E 01
51	2.944E 01	0	-5.441E 02	1.455E 02	0
52	3.002E 01	0	-4.756E 02	1.443E 02	0

53	3.060E 01	0	-4.099E 02	1.432E 02	0
54	3.118E 01	0	-3.479E 02	1.420E 02	0
55	3.175E 01	0	-2.866E 02	1.409E 02	0
56	3.233E 01	1.043E 01	-2.259E 02	1.397E 02	0
57	3.291E 01	8.691E 01	-1.659E 02	1.386E 02	0
58	3.349E 01	1.630E 02	-1.066E 02	1.374E 02	0
59	3.406E 01	2.384E 02	-4.792E 01	9.850E 01	0
60	3.464E 01	2.684E 02	-1.785E 01	4.366E 01	0
61	3.522E 01	2.678E 02	-1.019E 01	2.623E 01	-1.006E 01
62	3.580E 01	2.670E 02	-4.145E 00	2.507E 01	-1.122E 01
63	3.637E 01	2.657E 02	0	2.392E 01	-1.237E 01
64	3.695E 01	2.643E 02	0	2.276E 01	-1.353E 01
65	3.753E 01	2.628E 02	0	2.161E 01	-1.468E 01
66	3.811E 01	2.635E 02	0	2.045E 01	-1.583E 01
67	3.868E 01	2.645E 02	0	1.930E 01	-1.699E 01
68	3.926E 01	2.649E 02	0	1.814E 01	-1.814E 01
69	3.984E 01	2.645E 02	0	1.699E 01	-1.930E 01
70	4.041E 01	2.635E 02	0	1.583E 01	-2.045E 01
71	4.099E 01	2.628E 02	0	1.468E 01	-2.161E 01
72	4.157E 01	2.643E 02	0	1.353E 01	-2.276E 01
73	4.215E 01	2.657E 02	0	1.237E 01	-2.392E 01
74	4.272E 01	2.670E 02	-4.145E 00	1.122E 01	-2.507E 01
75	4.330E 01	2.678E 02	-1.019E 01	1.006E 01	-2.623E 01
76	4.388E 01	2.684E 02	-1.785E 01	0	-4.366E 01
77	4.446E 01	2.384E 02	-4.792E 01	0	-9.850E 01
78	4.503E 01	1.630E 02	-1.066E 02	0	-1.374E 02
79	4.561E 01	8.691E 01	-1.659E 02	0	-1.386E 02
80	4.619E 01	1.043E 01	-2.259E 02	0	-1.397E 02
81	4.677E 01	0	-2.866E 02	0	-1.409E 02
82	4.734E 01	0	-3.479E 02	0	-1.420E 02
83	4.792E 01	0	-4.099E 02	0	-1.432E 02
84	4.850E 01	0	-4.756E 02	0	-1.443E 02
85	4.907E 01	0	-5.441E 02	0	-1.455E 02
86	4.965E 01	0	-6.132E 02	3.844E 01	-1.982E 01
87	5.023E 01	0	-5.128E 02	1.871E 02	0
88	5.081E 01	0	-4.145E 02	1.860E 02	0
89	5.138E 01	0	-3.168E 02	1.848E 02	0
90	5.196E 01	0	-2.401E 02	1.837E 02	0
91	5.254E 01	0	-1.819E 02	1.825E 02	0
92	5.312E 01	5.444E 01	-1.296E 02	1.814E 02	0
93	5.369E 01	1.524E 02	-7.810E 01	1.593E 02	0
94	5.427E 01	2.269E 02	-3.801E 01	8.823E 01	0
95	5.485E 01	2.476E 02	-2.261E 01	4.433E 01	0
96	5.543E 01	2.684E 02	-7.869E 00	4.318E 01	0
97	5.600E 01	2.895E 02	0	4.202E 01	0
98	5.658E 01	3.098E 02	0	4.087E 01	0
99	5.716E 01	3.295E 02	0	3.971E 01	0
100	5.774E 01	3.486E 02	0	3.856E 01	0
101	5.831E 01	3.669E 02	0	3.740E 01	0
102	5.889E 01	3.846E 02	0	3.625E 01	0
103	5.947E 01	4.017E 02	0	3.509E 01	0
104	6.004E 01	4.180E 02	0	3.394E 01	0
105	6.062E 01	4.337E 02	0	3.279E 01	0
106	6.120E 01	4.488E 02	0	3.163E 01	0
107	6.178E 01	4.631E 02	0	3.048E 01	0
108	6.235E 01	4.768E 02	0	2.932E 01	-7.476E-01
109	6.293E 01	4.898E 02	0	2.817E 01	-1.902E 00
110	6.351E 01	5.022E 02	0	1.429E 01	-1.138E 01
111	6.409E 01	4.981E 02	0	0	-6.328E 01
112	6.466E 01	4.298E 02	0	0	-1.187E 02

113	6.524E 01	3.610E 02	0	0	-1.199E 02
114	6.582E 01	2.914E 02	0	0	-1.210E 02
115	6.640E 01	2.212E 02	-5.176E 01	0	-1.222E 02
116	6.697E 01	1.503E 02	-1.066E 02	0	-1.234E 02
117	6.755E 01	7.874E 01	-1.621E 02	0	-1.245E 02
118	6.813E 01	1.454E 01	-2.183E 02	0	-1.257E 02
119	6.870E 01	0	-2.751E 02	0	-1.268E 02
120	6.928E 01	0	-3.326E 02	0	-1.280E 02
121	6.986E 01	0	-3.907E 02	0	-1.291E 02
122	7.044E 01	0	-4.496E 02	1.626E 01	-2.121E 01
123	7.101E 01	0	-3.720E 02	1.338E 02	0
124	7.159E 01	0	-2.950E 02	1.327E 02	0
125	7.217E 01	0	-2.187E 02	1.316E 02	0
126	7.275E 01	0	-1.431E 02	1.306E 02	0
127	7.332E 01	0	-6.797E 01	1.233E 02	0
128	7.390E 01	0	-7.222E-01	5.872E 01	0
129	7.448E 01	0	-1.667E-01	6.255E-01	0
130	7.506E 01	3.411E-08	-1.023E-07	1.443E-01	0
131	7.563E 01	0	0	8.861E-08	-2.954E-08
132	7.621E 01	0	0	0	0
133	7.679E 01	0	0	0	0
134	7.736E 01	0	0	0	0
135	7.794E 01	0	0	0	0
136	7.852E 01	0	0	0	0
137	7.910E 01	0	0	0	0

TABLE 7 -- MAXIMUM SUPPCRT REACTICNS

STA	DIST X FT	MAX + REACT K	MAX - REACT K
14	8.083E 00	2.516E C2	0
50	2.887E 01	3.022E C2	0
86	4.965E 01	3.022E C2	0
122	7.044E 01	2.516E C2	0

TIME = 11 MINUTES, 8 ANC 46/60 SECONDS

TABLE 8 -- SCALES FOR PLCT CUTPUT

CISTANCE	10 INCHES =	100 FT
MCMENT	2 INCHES =	1C00 FT-K
SHEAR	2 INCHES =	200 K

TIME = 11 MINUTES, 30 ANC 46/60 SECONDS

TIME = 11 MINUTES, 31 ANC 2C/60 SECONDS
00 HCURS, 12 MINUTES, C9 SECONDS.
END JCB 08C64. 14.05.00

TOTAL NUMBER OF PAGES 051