

Computer education of influence lines for continuous beams
by Richard Andrew Ehlert

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Civil Engineering
Montana State University
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Abstract:
The education of fundamental engineering principles through increased use of general purpose analysis computer programs is a topic of concern among educators. The student must maximize learning efficiency if computer literacy and fundamental concepts are to be learned simultaneously.

A user-friendly, interactive, color-graphics computer program has been developed for teaching the fundamental concept of influence lines for continuous beams. The theorem of three moments and moment-area theorems are the fundamental principles presented, developed, and applied throughout the program.

Results of two types of problems using the computer program are presented. The two problems indicate the numerous capabilities for use of the program in teaching influence line concepts to students.

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Richard Andrew Ehlert

A thesis submitted in partial fulfillment
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of

Master of Science

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November 1985

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APPROVAL

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Richard Andrew Ehlert

This thesis has been read by each member of the thesis committee and has been found to be satisfactory regarding content, English usage, format, citation, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

Nov. 25, 1985
Date

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Date November 25, 1985

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NOMENCLATURE

A	point at which influence line is developed
A_n, A_{n+1}	elastic weight diagram area, spans n and n+1 respectively
${}_{n+1}A_o$	shear at left end of span n+1 when unit load occupies span n+1
${}_nB_o$	shear at right end of span n when unit load occupies span n
E	modulus of elasticity
I_n, I_{n+1}	moment of inertia, spans n and n+1 respectively
M	internal beam moment
M_ℓ	support moment at left end of span n
M_{n-1}, M_n, M_{n+1}	support moment, supports n-1, n, and n+1 respectively
M_o	single-span moment due to unit load, measured at point where influence line is developed
M_r	support moment at right end of span n
M_x	moment at point of unit load application
P	concentrated point load
R	sum of elastic weight diagram reactions on either side of a given support
$R_{\ell,n}$, $R_{\ell,n+1}$	left reaction of elastic weight diagram, spans n and n+1 respectively
R_n	beam reaction at support n
$R_{r,n}$, $R_{r,n+1}$	right reaction of elastic weight diagram, spans n and n+1 respectively
V	internal beam shear
V_ℓ	shear at left end of span n

$V_{\ell,n}$, $V_{\ell,n+1}$	shear left of supports n and n+1 respectively
V_o	simple-span shear due to unit load, measured at point where influence line is developed
V_r	shear at right end of span n
$V_{r,n-1}$, $V_{r,n}$	shear right of supports n-1 and n respectively
V_x	shear at point of unit load application
a_n, a_{n+1}	distance to unit load from left end of span, spans n and n+1 respectively
b_n, b_{n+1}	distance to unit load from right end of span, spans n and n+1 respectively
c_n, c_{n+1}	distance to elastic weight diagram centroid from left end of span, spans n and n+1 respectively
d_n, d_{n+1}	distance to elastic weight diagram centroid from right end of span, spans n and n+1 respectively
ℓ_n, ℓ_{n+1}	span length, spans n and n+1 respectively
n-1, n, n+1	span or support numbers
x	distance from left end of span to point where influence line is developed in that span
Δ_{n-1}, Δ_n, Δ_{n+1}	settlement at supports n-1, n, and n+1 respectively
Δ_o	simple-span deflection due to unit load, measured at point where influence line is developed
Δ_x	deflection at point of unit load application
θ_{n-1}	beam rotation to right of support n-1
θ_n	beam rotation to left of support n
θ'_n	beam rotation to right of support n
θ_{n+1}	beam rotation to left of support n+1

ABSTRACT

The education of fundamental engineering principles through increased use of general purpose analysis computer programs is a topic of concern among educators. The student must maximize learning efficiency if computer literacy and fundamental concepts are to be learned simultaneously.

A user-friendly, interactive, color-graphics computer program has been developed for teaching the fundamental concept of influence lines for continuous beams. The theorem of three moments and moment-area theorems are the fundamental principles presented, developed, and applied throughout the program.

Results of two types of problems using the computer program are presented. The two problems indicate the numerous capabilities for use of the program in teaching influence line concepts to students.

CHAPTER I

INTRODUCTION

The integration of computer usage into engineering curriculums presents educators and practicing engineers with an important question: How well do graduating engineers understand fundamental engineering concepts? Current engineering programs at universities throughout the country incorporate general purpose analysis computer codes as aids in teaching engineering principles [5,7,9,19]. This has led to what Yener and Ting refer to as the "black box approach" to educating engineers [21].

This "black box approach" has resulted in two diversions from quality engineering education. First, time normally spent on understanding fundamental engineering concepts is being spent on learning and using the software and hardware capabilities [12,13,15]. Knowing the capabilities allows the students to solve complex problems in minimal amounts of time. Secondly, students often accept computer solutions of complex problems without an ability to interpret and verify their validity. The combination of these two educational deficiencies can lead to a student misconception that knowledge of fundamental principles is unnecessary for engineering applications.

Influence Line Computer Program

The computer program listed in Table 8 (Appendix C) is an example of how the "black box" education of engineers can be reversed. The program was developed to serve as a teaching aid in the instruction of influence lines for continuous beams. Included within the program are three concepts fundamental to the education of influence lines:

(1) Presentation and application of theory.

(2) Interactive student computation of influence line ordinates.

(3) Application of influence lines.

History of Influence Lines

The analysis of continuous beams is believed to have been first published by Navier in his paper *Lecons* in 1826. Actual application of Navier's analysis came in 1850 with the design and construction of the Britannia Bridge over the Menai Straits by Robert Stephenson [6].

In 1857, Clapeyron reviewed continuous bridge development, citing Stephenson's Britannia Bridge as an example, in his work *Comptes Rendus*. Clapeyron is credited with being the first person to recognize that if the bending moments of the supports of a continuous beam were known, then all internal forces and deflections could be known. Even though Clapeyron first presented the theorem of three moments in 1848, it wasn't until 1855 that Bertot achieved priority for publishing the theorem [6].

Although work by Bresse in 1865 and Winkler in 1862 approached the concept of influence lines for continuous beams, it was not until 1906 that Mohr published the concept. Mohr also went on to develop theorems relating beam slope and deflection to elastic weight moment diagrams, known today as the moment-area theorems [6].

The theorem of three moments by Clapeyron and the moment-area theorems by Mohr provide the theoretical basis used in the computer program.

CHAPTER II

EQUATION DEVELOPMENT

Sign Convention

The internal force sign convention used for the development of all equations is shown in Figure 1. All externally applied loads and beam deflections are positive when acting downward. Beam reactions are positive when acting upward.

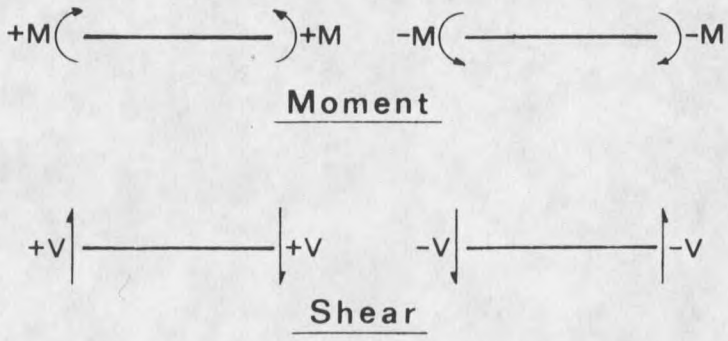


Figure 1. Sign convention.

Three-Moment Equation

The continuous beam shown in Figure 2 is a statically indeterminate structure. One method of reducing the beam in Figure 2 to a statically determinate structure is to solve for the moments at the two interior supports. Application of the general 3-moment equation (Eq. 12, Appendix A) yields:

$$2M_2 \left(\frac{\ell_1}{I_1} + \frac{\ell_2}{I_2}\right) + M_3 \left(\frac{\ell_2}{I_2}\right) = -6R_1 \qquad (1)$$

$$M_2 \left(\frac{\ell_2}{I_2}\right) + 2M_3 \left(\frac{\ell_2}{I_2} + \frac{\ell_3}{I_3}\right) = -6R_2 \qquad (2)$$

where R_1 and R_2 are dependent on the magnitude and location of concentrated load P. Equations 1 and 2 are solved simultaneously for unknown support moments M_2 and M_3, and the beam in Figure 2 is statically determinate. Each span of the beam is also statically determinate, and the internal forces and deflections can be computed at any point on the beam.

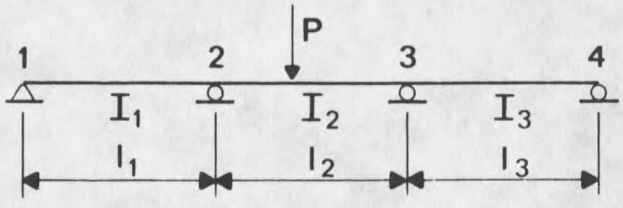


Figure 2. Three-span continuous beam.

Influence Line Equations

Influence lines can be developed for the beam in Figure 2 by setting the concentrated load P equal to unity and moving the load across the beam. Each new position of the unit load generates new values for internal support moments. Thus it is possible to develop expressions for the internal forces and deflections in a given span in terms of the support moments at each end of the span.

Every point on a continuous beam has a unique influence line for the moment, shear, and deflection at that point. Point A in Figure 3 defines the point, in an arbitrary span n, at which an influence line is to be developed. Equations have been developed in Appendix B for computing ordinates of influence lines at point A and are given in Equations 3, 4, and 5. These equations compute the influence line ordinates at the unit load position, assuming point A is located in span n.

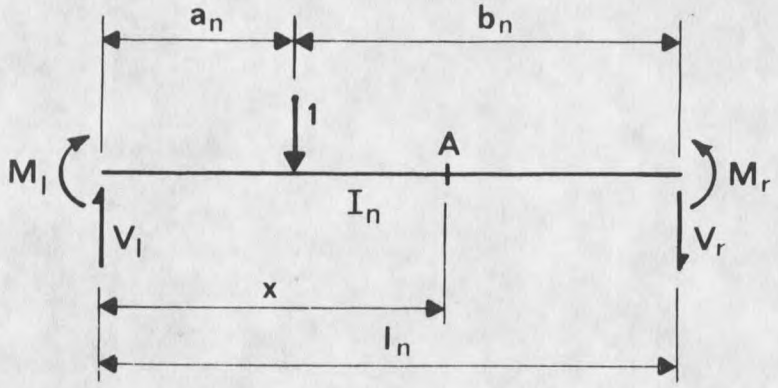


Figure 3. Free-body diagram of span n.

$$M_x = M_o + M_\ell\,(1 - \frac{x}{\ell_n}) + M_r(\frac{x}{\ell_n}) \tag{3}$$

$$V_x = V_o + \frac{M_r - M_\ell}{\ell_n} \tag{4}$$

$$\Delta_x = \Delta_o + \frac{x(\ell_n - x)}{6\,E\,I_n\,\ell_n}\,[M_\ell(2\ell_n - x) + M_r(\ell_n + x)] \tag{5}$$

A general equation for reaction influence lines is also developed in Appendix B, and given in Equation 6. R_n denotes that Equation 6 is used to compute influence line ordinates for a reaction influence line at support n.

$$R_n = {}_nB_o + {}_{n+1}A_o + M_{n-1}(\frac{1}{\ell_n}) - M_n(\frac{1}{\ell_n} + \frac{1}{\ell_{n+1}}) + M_{n+1}(\frac{1}{\ell_{n+1}}) \tag{6}$$

CHAPTER III

COMPUTER PROGRAM

Hardware and Software

The computer program is written in VAX FORTRAN programming language and uses the VAX/VMS operating system, version V4.1 [8]. The program currently operates on a DEC VAX 11/780 minicomputer, and uses a TEKTRONIX 4027 color graphics terminal. A software package called DISSPLA [11] was also implemented to take advantage of the TEKTRONIX 4027 graphics capabilities.

General Characteristics

The computer program in Appendix C was developed with two basic philosophies in mind: (1) to be user-friendly and (2) to be easy to modify. Thus, the program is menu-driven and the user can proceed throughout the program by responding with appropriate alphanumeric or numeric input. All user input is checked for correctness to eliminate problems arising from non-appropriate responses. The computer code contains several comment statements for increasing the readability of the program.

Upon actual running of the program, a main menu as shown in Figure 4 is displayed. Each topic in the main menu is independent of the others and has its own execution menu. Each main menu topic has a unique educational purpose, but all topics should be explored for a complete understanding of influence lines. The content of each main menu topic will now be presented.

MAIN MENU

(A) INTRODUCTION
(B) DEVELOPMENT OF INFLUENCE LINES
(C) APPLICATION OF INFLUENCE LINES
(D) END OF PROGRAM

PLEASE SELECT ONE OF THE ABOVE: _

Figure 4. Computer program main menu.

Introduction

The introduction segment of the program is intended to acquaint the user with all information necessary for program execution. This segment also serves as an introduction to concepts used later in the development and application segments. As shown in Figure 5, the user can choose from a variety of sub-topics. Each sub-topic contributes to a total understanding of program execution and continuous beam influence lines.

INTRODUCTION MENU

(A) Continuous presentation of all introductory material
(B) Program purpose
(C) Graphical definition of a continuous beam
(D) Graphic examples of influence lines
(E) Presentation of theory
(F) Limitations
(G) Nomenclature
(H) Return to Main Menu

PLEASE SELECT ONE OF THE ABOVE: _

Figure 5. Computer program introduction menu.

Development of Influence Lines

The purpose of this segment is two-fold in nature: (1) present to the user a development of influence line equations from fundamental theorems and (2) allow the user to apply the influence line equations and develop any particular influence line. Sub-topics

(A) and (B) in Figure 6 present the development of influence line equations for the user. Sub-topic (C) in Figure 6 is interactive, and allows the user to specify data for a 2, 3, or 4-span continuous beam. Sub-topic (D) in Figure 6 is also interactive and the user must correctly answer questions dealing with variables in the influence line equations. Any incorrect user input results in a repeat of the previous question. An example problem using sub-topics (C) and (D) is presented in Chapter IV.

DEVELOPMENT MENU

(A) Concept of influence lines
(B) Influence line equations
(C) Beam physical data input
(D) Computation of influence line ordinates
(E) Return to Main Menu

PLEASE SELECT ONE OF THE ABOVE: _

Figure 6. Computer program development menu.

Application of Influence Lines

The application segment of the program allows the user to define a particular continuous beam problem and use his knowledge of influence lines to determine maximum internal forces and deflections. Through an educated trial and error procedure, the user can determine which dead load and live load combination produces worst cases.

Figure 7 shows sub-topics available to the user in the application segment. Sub-topic (A) in Figure 7 allows user definition of a specific continuous beam. Sub-topic (B) in Figure 7 allows viewing of any influence line for the beam specified in sub-topic (A). Sub-topic (C) in Figure 7 allows the user to specify a variety of dead and live loads for the beam specified in sub-topic (A). Sub-topic (D) in Figure 7 allows the user to define or re-define the beam loads, and view moment, shear, or deflection curves for the beam. An example problem using the application segment is presented in Chapter IV.

APPLICATION MENU

(A) Beam physical data input
(B) Display of influence lines
(C) Beam load data input
(D) Application of DL & LL to influence lines
(E) Return to Main Menu

PLEASE SELECT ONE OF THE ABOVE: _

Figure 7. Computer program application menu.

Limitations

Graphical aesthetics and scope of work have resulted in imposing several limitations on types of continuous beams and loads. These limitations are provided for the user in the introduction segment of the computer program.

Computation of all influence lines and their respective ordinates is restricted to span tenth-points. Figure 8 shows the tenth-point numbering system used throughout the computer program. In addition, all moment envelope, shear envelope, and deflection curve ordinates are computed at span tenth-points.

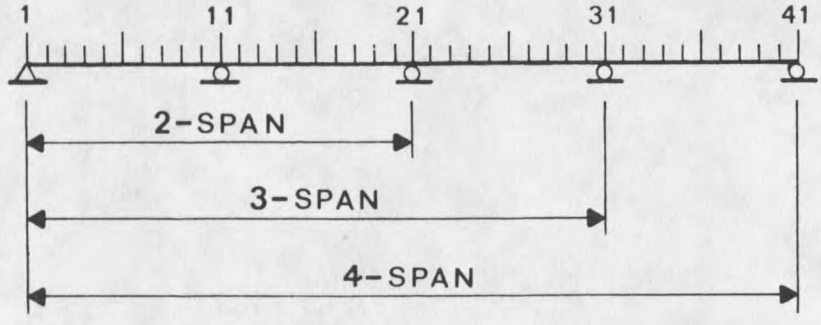


Figure 8. Span tenth-points.

CHAPTER IV

COMPUTER PROGRAM EXAMPLES

The following example problems exhibit the computer program capabilities within the development and application segments. All questions, prompts for user input, and graphical displays are as they actually appear during program execution. Unfortunately, the examples do not duplicate the color graphics and exact screen displays of the program. All user input in the examples has been double-underlined. The continuous beam shown in Figure 9 will serve as the model for both examples.

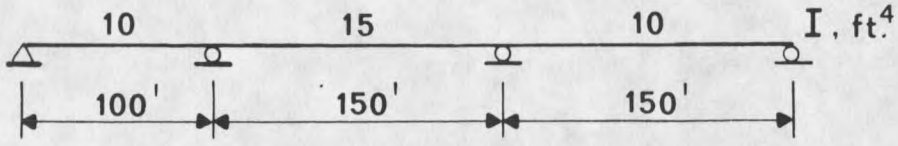


Figure 9. Application examples beam.

Development Example

The information provided in Figures 10, 11, and 12 indicates the general procedure for using the computer program to compute influence line ordinates. The shear equation in Figure 11 was developed from Equation 4. Development of Equation 4 is given in sub-topic (B) from Figure 6, and the user should view the shear equation derivation before using it to compute influence line ordinates. A hard copy of influence line ordinates requested in Figure 12 is given in Table 1.

MAIN MENU

(A) INTRODUCTION
(B) DEVELOPMENT OF INFLUENCE LINES
(C) APPLICATION OF INFLUENCE LINES
(D) END OF PROGRAM

PLEASE SELECT ONE OF THE ABOVE: B

DEVELOPMENT MENU

(A) Concept of influence lines
(B) Influence line equations
(C) Beam physical data input
(D) Computation of influence line ordinates
(E) Return to Main Menu

PLEASE SELECT ONE OF THE ABOVE: C

BEAM PHYSICAL DATA INPUT

Specify number of spans (2, 3, or 4): 3

SUPPORT COORDINATE INPUT

Support No. 1 coordinates are (0.0, 0.0)

Specify x, y for Support No. 2 (ft): 100.0, 0.0
Specify x, y for Support No. 3 (ft): 250.0, 0.0
Specify x, y for Support No. 4 (ft): 400.0, 0.0

MOMENT OF INERTIA INPUT

Moment of Inertia for Span No. 1 (ft.^4): 10.0
Moment of Inertia for Span No. 2 (ft.^4): 15.0
Moment of Inertia for Span No. 3 (ft.^4): 10.0

Modulus of Elasticity, E (ksi): 29000.

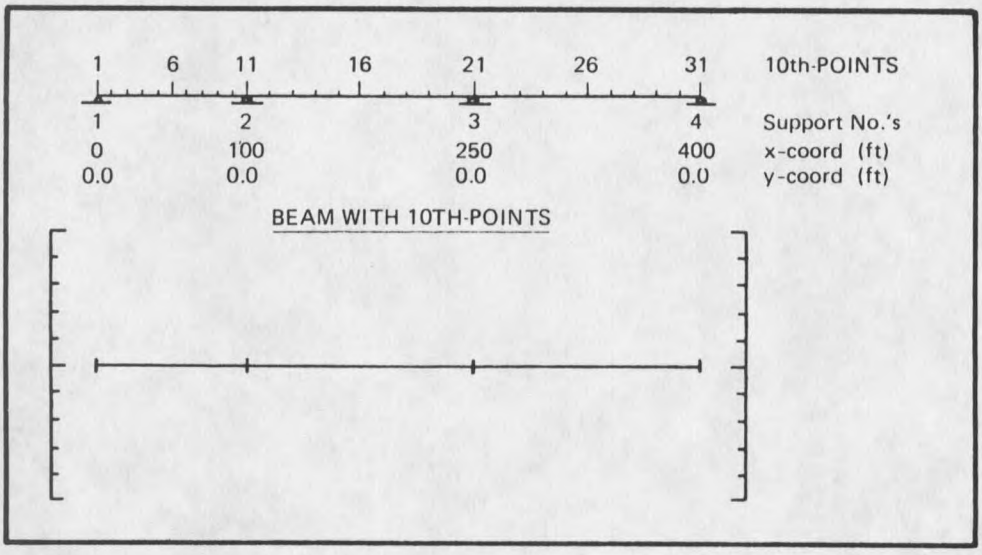
BEAM PHYSICAL DATA O.K. (Y/N): Y

DEVELOPMENT MENU

(A) Concept of influence lines
(B) Influence line equations
(C) Beam physical data input
(D) Computation of influence line ordinates
(E) Return to Main Menu

PLEASE SELECT ONE OF THE ABOVE: D

Figure 10. Development of influence lines, Phase I.



COMPUTATION MENU

(A) Support Moment I.L.
(B) Span Moment I.L.
(C) Shear I.L.
(D) Reaction I.L.
(E) Deflection I.L.
(F) Return to Development Menu

PLEASE SELECT ONE OF THE ABOVE: C

SHEAR I.L. ORDINATES

Please specify 10th-point for which the influence line will be developed: 18

Would you like to review the equations used for computing the ordinates (Y/N)? Y

SHEAR EQUATION

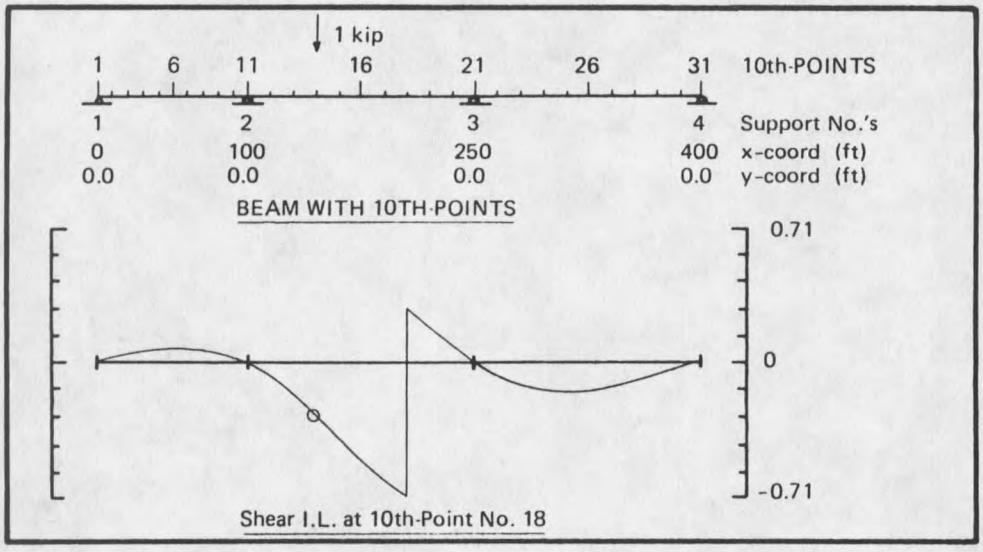
SPAN No. 2 $V_x = V_o + \frac{M_1 - M_2}{\ell_2}$

The "ℓ" term is independent of the unit load position and need be input only once.

Length of Span No. 2, ℓ (ft): 150.0

Specify 10th-point position of unit load: 14

Figure 11. Development of influence lines, Phase II.



With a unit load at 10th-point 14, the moments at the interior supports are:

Moment at Support No. 2 = -11.94 ft-kips
Moment at Support No. 3 = -5.80 ft-kips

Using a hand calculator and recalling equations given earlier for V_o, the student must now compute and enter the value for V_o.

$$V_o = -0.30$$

All terms in the equation(s) have now been defined, and solution for the I.L. ordinate is:

$$V_x = -0.26 \text{ kips at 10th-Point No. 14}$$

Note that the influence line ordinate has been plotted on the beam above.

Do you want to compute another ordinate (Y/N)? N

Plot the total influence line (Y/N)? Y

Hard copy of influence line ordinates (Y/N)? Y

Computation Menu

(A) Support Moment I.L.
(B) Span Moment I.L.
(C) Shear I.L.
(D) Reaction I.L.
(E) Deflection I.L.
(F) Return to Development Menu

PLEASE SELECT ONE OF THE ABOVE: F

Figure 12. Development of influence lines, Phase III.

Table 1. Shear Influence Line Ordinates.

Type: Shear

Location: 10th-Point No. 13

SPAN	10th-POINT	I.L. ORDINATE
1		
	1	0.000
	2	0.021
	3	0.040
	4	0.057
	5	0.071
	6	0.079
	7	0.081
	8	0.075
	9	0.061
	10	0.036
	11	0.000
2		
	11	0.000
	12	-0.072
	13	-0.160
	14	-0.259
	15	-0.367
	16	-0.480
	17	-0.595
	18	-0.708
	18	0.292
	19	0.185
	20	0.086
	21	0.000
3		
	21	0.000
	22	-0.068
	23	-0.114
	24	-0.141
	25	-0.152
	26	-0.148
	27	-0.133
	28	-0.108
	29	-0.076
	30	-0.039
	31	0.000

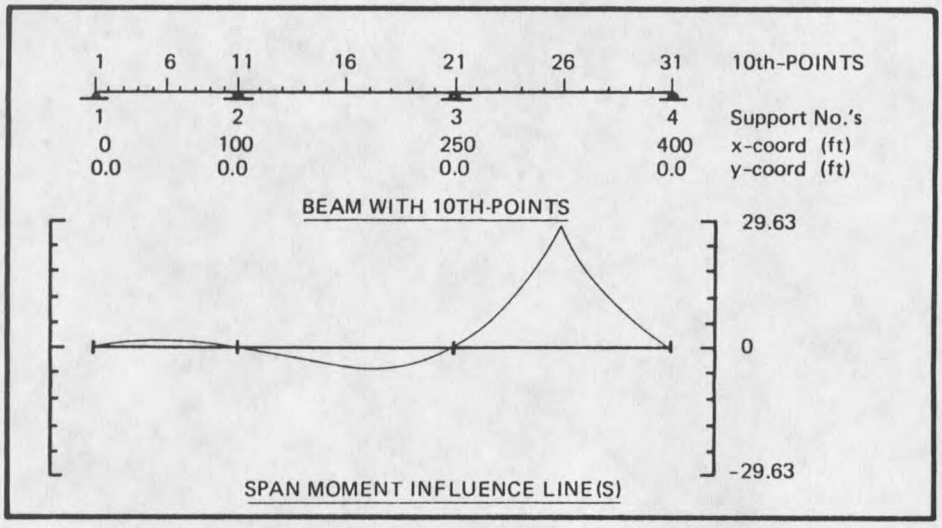
Application Example

Figure 13 provides the general procedure for viewing any type of influence line. Because the development and application segments of the computer program are independent of each other, the user must first specify beam physical data, as in Figure 10, before displaying any influence lines. A hard copy of influence line ordinates requested in Figure 13 is given in Table 2.

By viewing a variety of influence lines, the user can determine which dead load and live load combination will produce maximum moments, shears, or deflections. An example of specifying and revising beam DL and LL is provided in Figures 14, 15, and 16. Hard copies of data requested in Figures 15 and 16 is given in Tables 3, 4, 5, and 6.

Computer Analysis

Ordinates for moments, shears, reactions, and deflections were computed by directly applying dead and live loads to computed influence lines. As a result, the span tenth-point values for internal forces, reactions, or deflections may deviate slightly from exact values. Although an independent check was used to verify computer results, no guarantee is given that the method of analysis will work for all combinations of beam geometry and applied loadings.



MAIN MENU

(A) INTRODUCTION
(B) DEVELOPMENT
(C) APPLICATION OF INFLUENCE LINES
(D) END OF PROGRAM

PLEASE SELECT ONE OF THE ABOVE: C

APPLICATION MENU

(A) Beam physical data input
(B) Display of influence lines
(C) Beam load data input
(D) Application of DL & LL to influence lines
(E) Return to Main Menu

PLEASE SELECT ONE OF THE ABOVE: B

INFLUENCE LINE MENU

(A) Support Moment I.L.
(B) Span Moment I.L.
(C) Shear I.L.
(D) Reaction I.L.
(E) Deflection I.L.
(F) Return to Application Menu

PLEASE SELECT ONE OF THE ABOVE: B

Specify 10th-point from above: 26

Hard copy of influence line ordinates (Y/N)? Y

Press "D" to display another influence line or "R" to return to Influence Line Menu . . . R

INFLUENCE LINE MENU

(A) Support Moment I.L.
(B) Span Moment I.L.
(C) Shear I.L.
(D) Reaction I.L.
(E) Deflection I.L.
(F) Return to Application Menu

PLEASE SELECT ONE OF THE ABOVE: F

Figure 13. Application of influence lines, Phase I.

Table 2. Span Moment Influence Line Ordinates.

Type: Span Moment

Location: 10th-Point No. 26

SPAN	10th-POINT	I.L. ORDINATE
1		
	1	0.000
	2	0.261
	3	0.505
	4	0.718
	5	0.884
	6	0.987
	7	1.011
	8	0.939
	9	0.758
	10	0.450
	11	0.000
2		
	11	0.000
	12	-0.888
	13	-1.895
	14	-2.901
	15	-3.789
	16	-4.441
	17	-4.737
	18	-4.559
	19	-3.789
	20	-2.309
	21	0.000
3		
	21	0.000
	22	3.450
	23	8.179
	24	14.045
	25	20.905
	26	28.618
	27	22.042
	28	16.034
	29	10.453
	30	5.155
	31	0.000

APPLICATION MENU

(A) Beam physical data input
(B) Display of influence lines
(C) Beam load data input
(D) Application of DL & LL to influence lines
(E) Return to Main Menu

PLEASE SELECT ONE OF THE ABOVE: C

BEAM LOAD DATA INPUT

The student can now apply dead loads and live loads to the beam specified in part (A). For purposes of visualizing the effects of loads on a continuous beam, the application of one dead load, one live load, and a combination of DL & LL is sufficient.

DEAD LOAD INPUT

Dead loads will be assumed as being uniformly distributed and constant for all spans.

Specify uniform DL (k/ft): 1.00

LIVE LOAD INPUT

Although a continuous beam may experience several types of live loads, it is possible to illustrate live load effects on continuous beams by using either uniformly distributed loads or AASHTO truck loads.

Live load will be: (A) zero
(B) uniformly distributed
(C) AASHTO truck load

PLEASE SELECT ONE OF THE ABOVE: B

Specify uniform LL (k/ft): 0.50

APPLICATION MENU

(A) Beam physical data input
(B) Display of influence lines
(C) Beam load data input
(D) Application of DL & LL to influence lines
(E) Return to Main Menu

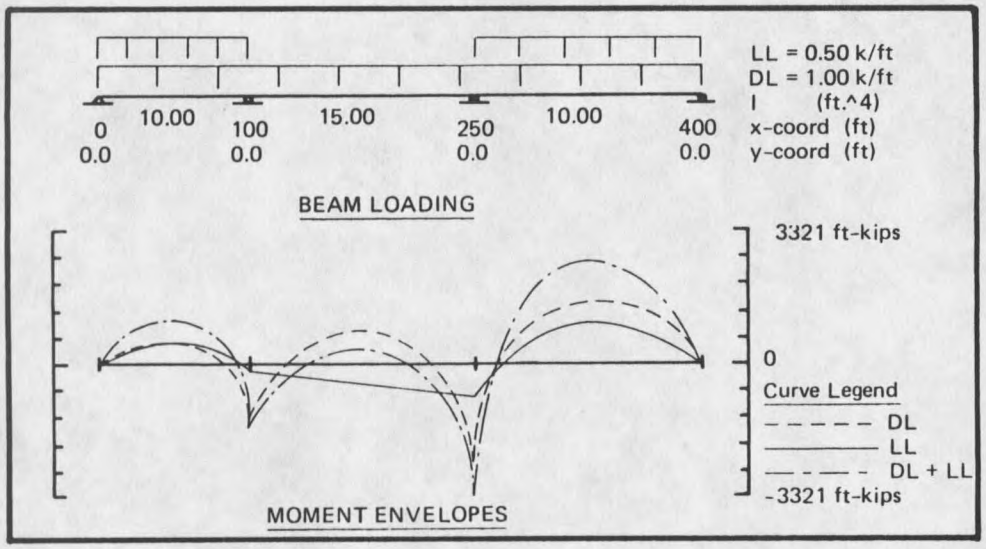
PLEASE SELECT ONE OF THE ABOVE: D

APPLICATIONS OF DL & LL TO INFLUENCE LINES

You have specified a uniformly distributed LL of 0.50 (k/ft) to be applied to various spans of the beam. Please specify which spans the LL will occupy:

LL will occupy Span No. 1 (Y/N)? Y
LL will occupy Span No. 2 (Y/N)? N
LL will occupy Span No. 3 (Y/N)? Y

Figure 14. Application of influence lines, Phase II



APPLICATION OPTIONS

(A) Display moment envelopes, shear envelopes, or deflections
(B) Revise DL or LL
(C) Return to Application Menu

PLEASE SELECT ONE OF THE ABOVE: A

DISPLAY OPTIONS

(A) Display moment envelopes (C) Display deflection curves
(B) Display shear envelopes (D) Return to Application Options

PLEASE SELECT ONE OF THE ABOVE: A

Press "C" to continue . . . C

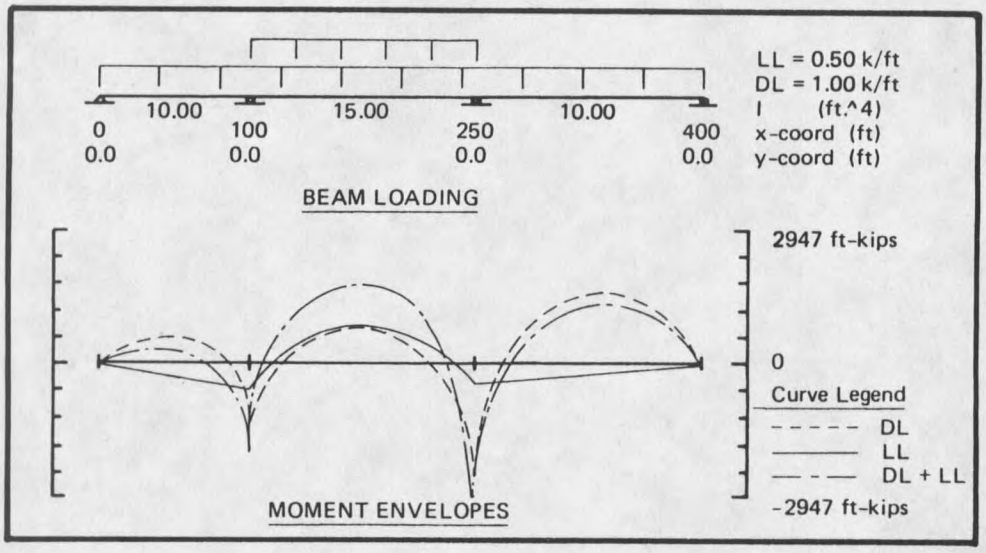
DISPLAY OPTIONS

(A) Display moment envelopes (C) Display deflection curves
(B) Display shear envelopes (D) Return to Application Options

PLEASE SELECT ONE OF THE ABOVE: D

Would you like a hard copy of all envelope ordinates and reactions for this beam (Y/N)? Y

Figure 15. Application of influence lines, Phase III.



APPLICATION OPTIONS

(A) Display moment envelopes, shear envelopes, or deflections
(B) Revise DL or LL
(C) Return to Application Menu

PLEASE SELECT ONE OF THE ABOVE: B

DL O.K. (Y/N)? Y

LL O.K. (Y/N)? N

Revise uniform LL to AASHTO truck LL (Y/N)? N

Revise uniform LL magnitude (Y/N)? N

Revise spans occupied by uniform LL (Y/N)? Y

LL will occupy Span No. 1 (Y/N)? N
LL will occupy Span No. 2 (Y/N)? Y
LL will occupy Span No. 3 (Y/N)? N

APPLICATION OPTIONS

(A) Display moment envelopes, shear envelopes, or deflections
(B) Revise DL or LL
(C) Return to Application Menu

PLEASE SELECT ONE OF THE ABOVE: A

DISPLAY OPTIONS

(A) Display moment envelopes (C) Display deflection curves
(B) Display shear envelopes (D) Return to Application Options

PLEASE SELECT ONE OF THE ABOVE: A

Figure 16. Application of influence lines, Phase IV.

Table 3. Data for Beam Loading in Figure 15.

>>>>> BEAM LOAD DATA <<<<<

SPAN	DL	LL	
		UNIFORM	AASHTO TRUCK
	(k/ft)	(k/ft)	(TYPE : DOT : DLS : RAS)**
1	1.00	0.50	---
2	1.00	0.00	---
3	1.00	0.50	---

** TYPE: H10-44, H15-44, H20-44, HS15-44, OR HS20-44

DOT : direction of truck travel

DLS : distance to front wheels from Support No. 1, feet

RAS : rear axle spacing, feet (HS15-44 & HS20-44 only)

>>>>> SUPPORT REACTIONS (kips) <<<<<

SUPPORT	DL	LL	DL+LL
1	36.16	23.94	60.10
2	131.35	21.34	152.69
3	174.21	47.65	221.86
4	58.28	32.07	90.36

>>>>> DL ENVELOPE ORDINATES <<<<<

SPAN	10th-POINT	MOMENT (ft-kip)	SHEAR (kip)	DEFLECTION++ (ft)
1				
	1	0.00	36.16	0.000000
	2	311.60	26.16	0.004230
	3	523.19	16.16	0.007753
	4	634.79	6.16	0.010064
	5	646.38	-3.84	0.010894
	6	557.98	-13.84	0.010216
	7	369.57	-23.84	0.008243
	8	81.17	-33.84	0.005424
	9	-307.24	-43.84	0.002450
	10	-795.64	-53.84	0.000253
	11	-1384.05	-63.84	0.000000
2				
	11	-1384.05	67.51	0.000000
	12	-483.90	52.51	0.003701
	13	191.25	37.51	0.009276
	14	641.40	22.51	0.014298
	15	866.55	7.51	0.017151
	16	866.69	-7.49	0.017026
	17	641.84	-22.49	0.013922
	18	191.99	-37.49	0.008648
	19	-482.86	-52.49	0.002819
	20	-1382.71	-67.49	-0.001141
	21	-2507.57	-82.49	0.000000
3				
	21	-2507.57	91.72	0.000000
	22	-1244.31	76.72	0.010592
	23	-206.05	61.72	0.028091
	24	607.20	46.72	0.046902
	25	1195.46	31.72	0.062643
	26	1558.72	16.72	0.072146
	27	1696.97	1.72	0.073452
	28	1610.23	-13.28	0.065817
	29	1298.49	-28.28	0.049708
	30	761.74	-43.28	0.026805
	31	0.00	-58.28	0.000000

++ Deflection is (+) measured downward.

Table 4. Data for Beam Loading in Figure 15.

>>>>> LL ENVELOPE ORDINATES <<<<<

SPAN	10th-POINT	MOMENT (ft-kip)	SHEAR (kip)	DEFLECTION++ (ft)
1				
	1	0.00	23.94	0.000000
	2	214.42	18.94	0.004431
	3	378.83	13.94	0.008368
	4	493.25	8.94	0.011419
	5	557.66	3.94	0.013308
	6	572.08	-1.06	0.013881
	7	536.50	-6.06	0.013105
	8	450.91	-11.06	0.011064
	9	315.33	-16.06	0.007963
	10	129.75	-21.06	0.004127
	11	-105.84	-26.06	0.000000
2				
	11	-105.84	-4.72	0.000000
	12	-176.67	-4.72	-0.005909
	13	-247.50	-4.72	-0.011183
	14	-318.33	-4.72	-0.015568
	15	-389.16	-4.72	-0.018810
	16	-459.99	-4.72	-0.020653
	17	-530.82	-4.72	-0.020845
	18	-601.65	-4.72	-0.019130
	19	-672.48	-4.72	-0.015254
	20	-743.31	-4.72	-0.008962
	21	-814.14	-4.72	0.000000
3				
	21	-814.14	42.93	0.000000
	22	-226.48	35.43	0.012047
	23	248.68	27.93	0.025415
	24	611.35	20.43	0.037545
	25	861.51	12.93	0.046482
	26	999.18	5.43	0.050877
	27	1024.34	-2.07	0.049991
	28	937.01	-9.57	0.043686
	29	737.17	-17.07	0.032434
	30	424.84	-24.57	0.017311
	31	0.00	-32.07	0.000000

++ Deflection is (+) measured downward.

>>>>> DL+LL ENVELOPE ORDINATES <<<<<

SPAN	10th-POINT	MOMENT (ft-kip)	SHEAR (kip)	DEFLECTION++ (ft)
1				
	1	0.00	60.10	0.000000
	2	526.01	45.10	0.008661
	3	902.02	30.10	0.016122
	4	1128.03	15.10	0.021482
	5	1204.05	0.10	0.024202
	6	1130.06	-14.90	0.024098
	7	906.07	-29.90	0.021348
	8	532.08	-44.90	0.016488
	9	8.09	-59.90	0.010413
	10	-665.90	-74.90	0.004379
	11	-1489.88	-89.90	0.000000
2				
	11	-1489.88	62.79	0.000000
	12	-660.57	47.79	-0.002207
	13	-56.25	32.79	-0.001907
	14	323.07	17.79	-0.001270
	15	477.38	2.79	-0.001659
	16	406.70	-12.21	-0.003628
	17	111.02	-27.21	-0.006923
	18	-409.66	-42.21	-0.010482
	19	-1155.35	-57.21	-0.012435
	20	-2126.03	-72.21	-0.010103
	21	-3321.71	-87.21	0.000000
3				
	21	-3321.71	134.64	0.000000
	22	-1470.79	112.14	0.022639
	23	42.63	89.64	0.053506
	24	1218.55	67.14	0.084447
	25	2056.97	44.64	0.109125
	26	2557.89	22.14	0.123023
	27	2721.32	-0.36	0.123442
	28	2547.24	-22.86	0.109503
	29	2035.66	-45.36	0.082142
	30	1186.58	-67.86	0.044116
	31	0.00	-90.36	0.000000

++ Deflection is (+) measured downward.

Table 5. Data for Beam Loading in Figure 16.

>>>>> BEAM LOAD DATA <<<<<

SPAN	DL	LL	
		UNIFORM	AASHTO TRUCK
	(k/ft)	(k/ft)	(TYPE : DOT : DLS : RAS)**
1	1.00	0.00	---
2	1.00	0.50	---
3	1.00	0.00	---

** TYPE: H10-44, H15-44, H20-44, HS15-44, OR HS20-44

DOT : direction of truck travel

DLS : distance to front wheels from Support No. 1, feet

RAS : rear axle spacing, feet (HS15-44 & HS20-44 only)

>>>>> SUPPORT REACTIONS (kips) <<<<<

SUPPORT	DL	LL	DL+LL
1	36.16	-5.86	30.30
2	131.35	44.34	175.69
3	174.21	39.45	213.66
4	55.28	-2.93	55.35

>>>>> DL ENVELOPE ORDINATES <<<<<

SPAN	10th-POINT	MOMENT (ft-kip)	SHEAR (kip)	DEFLECTION++ (ft)
1				
	1	0.00	36.16	0.000000
	2	311.60	26.16	0.004230
	3	523.19	16.16	0.007753
	4	634.79	6.16	0.010064
	5	646.38	-3.84	0.010894
	6	557.98	-13.84	0.010216
	7	369.57	-23.84	0.008243
	8	81.17	-33.84	0.005424
	9	-307.24	-43.84	0.002450
	10	-795.64	-53.84	0.000253
	11	-1384.05	-63.84	0.000000
2				
	11	-1384.05	67.51	0.000000
	12	-483.90	52.51	0.003701
	13	191.25	37.51	0.009276
	14	641.40	22.51	0.014298
	15	866.55	7.51	0.017151
	16	866.69	-7.49	0.017026
	17	641.84	-22.49	0.013922
	18	191.99	-37.49	0.008648
	19	-482.86	-52.49	0.002819
	20	-1382.71	-67.49	-0.001141
	21	-2507.57	-82.49	0.000000
3				
	21	-2507.57	91.72	0.000000
	22	-1244.31	76.72	0.010592
	23	-206.05	61.72	0.028091
	24	607.20	46.72	0.046902
	25	1195.46	31.72	0.062643
	26	1558.72	16.72	0.072146
	27	1696.97	1.72	0.073452
	28	1610.23	-13.28	0.065817
	29	1298.49	-28.28	0.049708
	30	761.74	-43.28	0.026805
	31	0.00	-58.28	0.000000

++ Deflection is (+) measured downward.

Table 6. Data for Beam Loading in Figure 16.

>>>>> LL ENVELOPE ORDINATES <<<<<

SPAN	10th-POINT	MOMENT (ft-kip)	SHEAR (kip)	DEFLECTION++ (ft)
1				
	1	0.00	-5.86	0.000000
	2	-58.62	-5.86	-0.002316
	3	-117.24	-5.86	-0.004492
	4	-175.86	-5.86	-0.006387
	5	-234.47	-5.86	-0.007861
	6	-293.09	-5.86	-0.008773
	7	-351.71	-5.86	-0.008984
	8	-410.33	-5.86	-0.008352
	9	-468.95	-5.86	-0.006738
	10	-527.57	-5.86	-0.004001
	11	-586.18	-5.86	0.000000
2				
	11	-586.18	38.48	0.000000
	12	-65.28	30.98	0.007759
	13	343.13	23.48	0.015821
	14	639.03	15.98	0.022717
	15	822.43	8.48	0.027385
	16	893.34	0.98	0.029166
	17	851.74	-6.52	0.027806
	18	697.65	-14.02	0.023454
	19	431.05	-21.52	0.016663
	20	51.96	-29.02	0.008391
	21	-439.64	-36.52	0.000000
3				
	21	-439.64	2.93	0.000000
	22	-395.67	2.93	-0.006751
	23	-351.71	2.93	-0.011370
	24	-307.75	2.93	-0.014094
	25	-263.78	2.93	-0.015160
	26	-219.82	2.93	-0.014805
	27	-175.86	2.93	-0.013265
	28	-131.89	2.93	-0.010778
	29	-87.93	2.93	-0.007580
	30	-43.96	2.93	-0.003908
	31	0.00	2.93	0.000000

++ Deflection is (+) measured downward.

>>>>> DL+LL ENVELOPE ORDINATES <<<<<

SPAN	10th-POINT	MOMENT (ft-kip)	SHEAR (kip)	DEFLECTION++ (ft)
1				
	1	0.00	30.30	0.000000
	2	252.98	20.30	0.001914
	3	405.95	10.30	0.003261
	4	458.93	0.30	0.003677
	5	411.91	-9.70	0.003033
	6	264.88	-19.70	0.001443
	7	17.86	-29.70	-0.000741
	8	-329.16	-39.70	-0.002928
	9	-776.18	-49.70	-0.004287
	10	-1323.21	-59.70	-0.003748
	11	-1970.23	-69.70	0.000000
2				
	11	-1970.23	105.99	0.000000
	12	-549.18	83.49	0.011461
	13	534.38	60.99	0.025096
	14	1280.43	38.49	0.037015
	15	1688.98	15.99	0.044536
	16	1760.03	-6.51	0.046192
	17	1493.59	-29.01	0.041728
	18	889.64	-51.51	0.032102
	19	-51.81	-74.01	0.019482
	20	-1330.76	-96.51	0.007250
	21	-2947.20	-119.01	0.000000
3				
	21	-2947.20	94.65	0.000000
	22	-1639.98	79.65	0.003841
	23	-557.76	64.65	0.016721
	24	299.46	49.65	0.032808
	25	931.68	34.65	0.047483
	26	1338.90	19.65	0.057341
	27	1521.12	4.65	0.060187
	28	1478.34	-10.35	0.05503
	29	1210.56	-25.35	0.042128
	30	717.78	-40.35	0.022897
	31	0.00	-55.35	0.000000

++ Deflection is (+) measured downward.

CHAPTER V

SUMMARY

The trend toward using general purpose analysis computer programs for educating civil engineers can create a false sense of student understanding of fundamental engineering principles. Education of fundamental principles cannot be neglected if the integrity of the engineering profession is to be maintained.

A computer program has been developed for use as an aid in teaching the fundamental concept of influence lines for continuous beams. The speed of the computer and the user-friendly nature of the color graphics computer program follows Albert Einstein's view of teaching: ". . . Teaching should be such that what is offered is perceived as a valuable gift, and not as a hard duty" [20].

It is not possible for a student to understand the total influence line concept from use of this computer program alone. However, it does provide a good supplement to material presented in the classroom. The capability of presenting and understanding fundamental principles for all types of continuous beams is beyond the scope of the computer program and this paper. Benefits derived from use of this program would serve as an interesting topic for future research.

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APPENDICES

APPENDIX A

THREE-MOMENT EQUATION

Two adjacent spans, n and n+1, of a transversely loaded continuous beam are shown in Figure 17. Free-body diagrams of spans n and n+1 are shown in Figure 18.

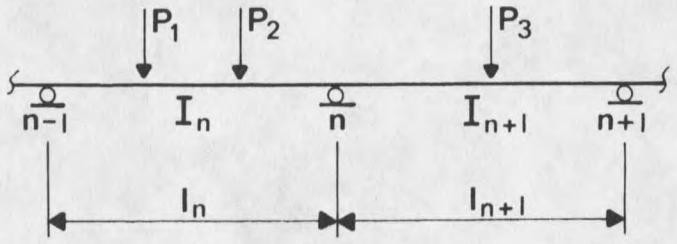


Figure 17. Two adjacent spans of a continuous beam.

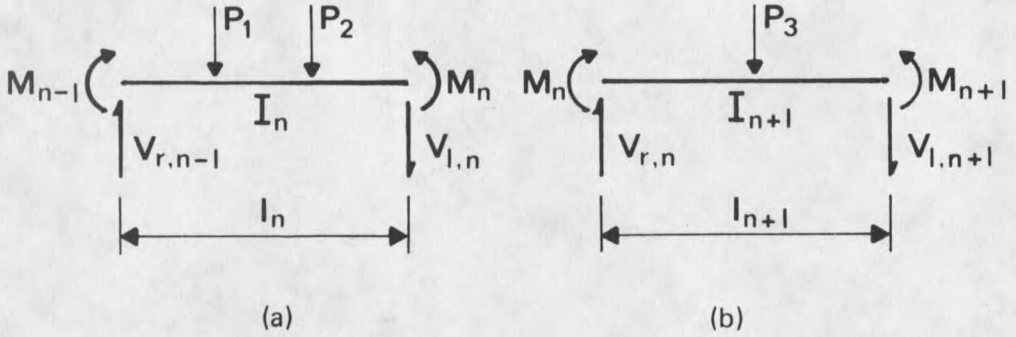


Figure 18. Free-body diagrams, spans n and n+1.

Slope-deflection relationships are applied to the elastic weight diagrams of each span to yield expressions for beam slope at supports n-1, n, and n+1. For span n, the slopes θ_{n-1} and θ_n at supports n-1 and n, respectively, are:

$$\theta_{n-1} = \frac{M_{n-1}\,\ell_n}{3\,E\,I_n} + \frac{A_n\,d_n}{E\,I_n\,\ell_n} + \frac{M_n\,\ell_n}{6\,E\,I_n} \tag{7}$$

$$\theta_n = \frac{M_{n-1}\,\ell_n}{6\,E\,I_n} + \frac{A_n\,c_n}{E\,I_n\,\ell_n} + \frac{M_n\,\ell_n}{3\,E\,I_n} \tag{8}$$

For span n+1, the slopes θ'_n and θ_{n+1} at supports n and n+1, respectively, are:

$$\theta'_n = \frac{M_n\,\ell_{n+1}}{3\,E\,I_{n+1}} + \frac{A_{n+1}\,d_{n+1}}{E\,I_{n+1}\,\ell_{n+1}} + \frac{M_{n+1}\,\ell_{n+1}}{6\,E\,I_{n+1}} \tag{9}$$

$$\theta_{n+1} = \frac{M_n \ell_{n+1}}{6 E I_{n+1}} + \frac{A_{n+1} c_{n+1}}{E I_{n+1} \ell_{n+1}} + \frac{M_{n+1} \ell_{n+1}}{3 E I_{n+1}} \tag{10}$$

Slope compatability at support n requires:

$$\theta_n = -\theta'_n \tag{11}$$

and the resulting 3-moment equation for a straight continuous beam is:

$$M_{n-1}\left(\frac{\ell_n}{I_n}\right) + 2M_n\left(\frac{\ell_n}{I_n} + \frac{\ell_{n+1}}{I_{n+1}}\right) + M_{n+1}\left(\frac{\ell_{n+1}}{I_{n+1}}\right) = -6R \tag{12}$$

where

$$R = \frac{A_n c_n}{I_n \ell_n} + \frac{A_{n+1} d_{n+1}}{I_{n+1} \ell_{n+1}} \tag{13}$$

and $\frac{A_n c_n}{I_n \ell_n}$ = right reaction of transverse loading elastic weight diagram in span n,

and $\frac{A_{n+1} d_{n+1}}{I_{n+1} \ell_{n+1}}$ = left reaction of transverse loading elastic weight diagram in span n+1.

Equation 12 assumes that the modulus of elasticity, E, is constant for the entire beam and therefore does not appear.

If supports n-1, n, and n+1 in Figure 17 undergo vertical displacements, Δ_{n-1}, Δ_n, and Δ_{n+1}, then the rotations at support n become:

$$\theta_n = \frac{M_{n-1} \ell_n}{6 E I_n} + \frac{A_n c_n}{E I_n \ell_n} + \frac{M_n \ell_n}{3 E I_n} - \frac{\Delta_n - \Delta_{n-1}}{\ell_n} \tag{14}$$

and

$$\theta'_n = \frac{M_n \ell_{n+1}}{3 E I_{n+1}} + \frac{A_{n+1} d_{n+1}}{E I_{n+1} \ell_{n+1}} + \frac{M_{n+1} \ell_{n+1}}{6 E I_{n+1}} + \frac{\Delta_{n+1} - \Delta_n}{\ell_{n+1}} \tag{15}$$

Satisfying slope compatability at support n yields the 3-moment equation for a continuous beam with uneven supports:

$$M_{n-1}\left(\frac{\ell_n}{I_n}\right) + 2M_n\left(\frac{\ell_n}{I_n} + \frac{\ell_{n+1}}{I_{n+1}}\right) + M_{n+1}\left(\frac{\ell_{n+1}}{I_{n+1}}\right)$$

$$= -6R + 6E\left(\frac{\Delta_n - \Delta_{n-1}}{\ell_n} - \frac{\Delta_{n+1} - \Delta_n}{\ell_{n+1}}\right) \qquad (16)$$

APPENDIX B

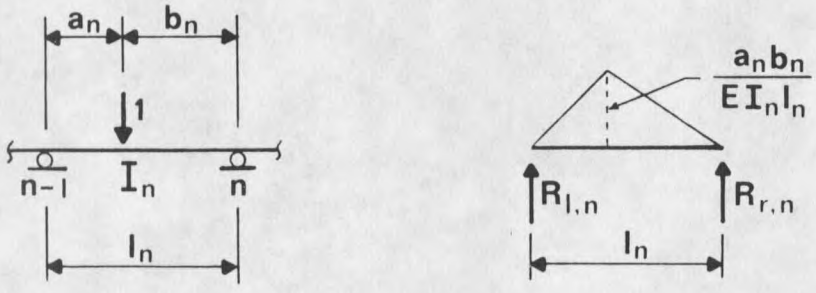
INFLUENCE LINE EQUATIONS

The principal philosophy behind developing influence lines involves positioning a unit load on a structure, and determining internal forces and deflections at all points within the structure. For each unit load position on a continuous beam, moments are generated at the supports. If the support moments are known, each span is statically determinate, and equations can be developed for computing internal forces and deflections at any point within a given span. These equations are then used to compute influence line ordinates for various types of influence lines.

Computation of Support Moments

The 3-moment equation given in Equation 12 is used to determine support moments for a beam subjected to a unit load. A continuous beam having n spans will generate n-1 equations when the 3-moment equation is applied. Moment coefficient terms on the left side of Equation 12 are functions of beam geometry and constant for any given beam.

The R term on the right side of Equation 12 is a function of unit load position and can be defined in terms of unit load position from Figure 19. The left and right reactions



(a) unit load span n (b) elastic weight diagram

Figure 19. Unit load elastic weight diagram.

of the unit load elastic weight diagram are:

$$R_{\ell,n} = \frac{b_n (\ell_n^2 - b_n^2)}{6 E I_n \ell_n} \qquad R_{r,n} = \frac{a_n (\ell_n^2 - a_n^2)}{6 E I_n \ell_n}$$

A unit load positioned in span n+1 yields:

$$R_{\ell,n+1} = \frac{b_{n+1}\,(\ell_{n+1}^2 - b_{n+1}^2)}{6\,E\,I_{n+1}\,\ell_{n+1}} \qquad R_{r,n+1} = \frac{a_{n+1}\,(\ell_{n+1}^2 - a_{n+1}^2)}{6\,E\,I_{n+1}\,\ell_{n+1}}$$

Therefore, the sum of elastic weight diagram reactions left and right of support n in a continuous beam is:

$$R = R_{r,n} + R_{\ell,n+1} \tag{17}$$

Equation 17 can be substituted directly for R in Equation 12 if E is eliminated from the $R_{r,n}$ and $R_{\ell,n+1}$ expressions.

Thus, for each unit load position on a continuous beam having n spans, a series of n-1 equations are solved simultaneously to yield the interior support moments. Equations can now be developed for internal forces and deflections within each span in terms of the support moments.

Moment Influence Line Equation

Cutting the beam in Figure 3 at the unit load introduces the internal forces and deflection at distance a_n as shown in Figure 20. End-moments M_ℓ and M_r in Figure 3 are the moments at supports n-1 and n resulting from a unit load positioned anywhere on a continuous beam. V_ℓ and V_r in Figure 3 are shears at the ends of span n if the unit load is in span n. The distance x denotes the location of the point at which the influence line is developed, and is measured from the left end of span n.

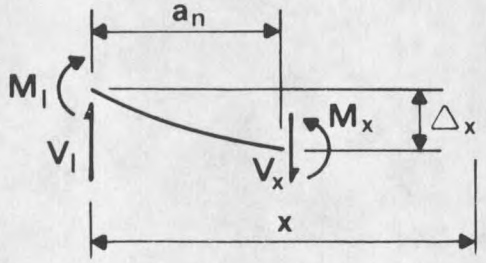


Figure 20. Partial free-body diagram of span n.

Applying static equilibrium to the partial beam in Figure 20 yields the general equation for the moment at a distance a_n:

$$M_x = M_o + M_\ell \left(1 - \frac{x}{\ell_n}\right) + M_r \left(\frac{x}{\ell_n}\right) \qquad (18)$$

where $M_o = 0$ if unit load is not in span n

$$M_o = a_n - x + \frac{b_n x}{\ell_n} \qquad \text{if } a_n \leq x$$

$$M_o = \frac{b_n x}{\ell_n} \qquad \text{if } a_n > x$$

Shear Influence Line Equation

Figure 20 is also used to develop a general equation for the shear at a distance a_n. Applying static equilibrium to span n in Figure 20 yields:

$$V_x = V_o + \frac{M_r - M_\ell}{\ell_n} \qquad (19)$$

where $V_o = 0$ if unit load is not in span n

$$V_o = \frac{-a_n}{\ell_n} \qquad \text{if } a_n \leq x$$

$$V_o = 1 - \frac{a_n}{\ell_n} \qquad \text{if } a_n > x$$

Reaction Influence Line Equation

Figure 21 shows a free-body diagram of support n in a continuous beam. Application of static equilibrium at support n yields:

$$R_n = V_{r,n} - V_{\ell,n} \qquad (20)$$

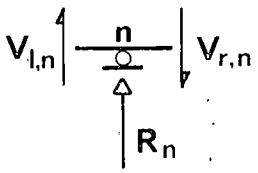


Figure 21. Free-body diagram of support n.

Assuming a unit load is positioned in span n left of support n:

$$V_{\ell,n} = -\frac{a_n}{\ell_n} + \frac{M_n - M_{n-1}}{\ell_n} \tag{21}$$

and assuming a unit load is positioned in span n+1 right of support n:

$$V_{r,n} = 1 - \frac{a_{n+1}}{\ell_{n+1}} + \frac{M_{n+1} - M_n}{\ell_{n+1}} \tag{22}$$

Substitution of Equations 21 and 22 into Equation 20 yields the general equation for the reaction of support n:

$$R_n = {}_nB_o + {}_{n+1}A_o + M_{n-1}\left(\frac{1}{\ell_n}\right) - M_n\left(\frac{1}{\ell_n} + \frac{1}{\ell_{n+1}}\right) + M_{n+1}\left(\frac{1}{\ell_{n+1}}\right) \tag{23}$$

where ${}_nB_o = 0$ if unit load is not in span n

${}_nB_o = \frac{a_n}{\ell_n}$ if unit load is in span n

${}_{n+1}A_o = 0$ if unit load is not in span n+1

${}_{n+1}A_o = 1 - \frac{a_{n+1}}{\ell_{n+1}}$ if unit load is in span n+1

Deflection Influence Line Equation

The free-body diagram in Figure 20 is again used to develop a general equation for the deflection at a distance a_n. Application of equilibrium and slope-deflection relationships to span n in Figure 20 yields:

$$\Delta_x = \Delta_o + \frac{x\,(\ell_n - x)}{6\,E\,I_n\,\ell_n}\,[M_\ell\,(2\,\ell_n - x) + M_r\,(\ell_n + x)] \qquad (24)$$

where $\Delta_o = 0$ if unit load is not in span n

$$\Delta_o = \frac{a_n\,(\ell_n - x)}{6\,E\,I_n\,\ell_n}\,[b_n^2 + 2a_n b_n - (\ell_n - x)^2] \qquad \text{if } a_n \leq x$$

$$\Delta_o = \frac{b_n\,x}{6\,E\,I_n\,\ell_n}\,[a_n^2 + 2a_n b_n - x^2] \qquad \text{if } a_n > x$$

APPENDIX C

COMPUTER PROGRAM LISTINGS

Table 7. Tektronix 4027 Initialization Program.

```
      C
      C PROGRAM TO INITIALIZE TK4027 MONITOR
      C
            TYPE 100
100   FORMAT(' !WOR 0 H')
            TYPE 101
101   FORMAT(' !MAR')
            TYPE 102
102   FORMAT(' !DUP')
            TYPE 103
103   FORMAT(' !ECH R')
            TYPE 104
104   FORMAT(' !BUF N')
            TYPE 105
105   FORMAT(' !MAP C0   0,100,100')
            TYPE 106
106   FORMAT(' !MAP C1 110, 50,100')
            TYPE 107
107   FORMAT(' !MAP C2 240, 50,100')
            TYPE 108
108   FORMAT(' !MAP C3  30, 60,100')
            TYPE 109
109   FORMAT(' !MAP C4 180, 50,100')
            TYPE 110
110   FORMAT(' !MAP C5 320, 50,100')
            TYPE 111
111   FORMAT(' !MAP C6  70, 50,100')
            TYPE 112
112   FORMAT(' !MAP C7   0,  0,100')
            TYPE 113
113   FORMAT(' !BEL')
            TYPE 114
114   FORMAT(' !BAU 9600')
            TYPE 115
115   FORMAT(' !MON 34 H K')
            END
```

Table 8. Influence Line Program.

```
C-----------------------------------------------------------------------C
C                                                                       C
C  PROGRAM INFORMATION                                                  C
C  ===================                                                  C
C                                                                       C
C     THE FOLLOWING PROGRAM IS AN INTERACTIVE GRAPHICS PROGRAM WHOSE    C
C     PRIMARY PURPOSE IS TO SERVE AS AN AID IN TEACHING THE THEORIES    C
C     OF INFLUENCE LINES AS THEY APPLY TO CONTINUOUS BEAMS. THE FUN-    C
C     DAMENTAL STRUCTURAL THEOREMS ARE PRESENTED, AND INFLUENCE LINE    C
C     EQUATIONS ARE DEVELOPED FOR MOMENTS, SHEARS, REACTIONS, AND       C
C     DEFLECTIONS.                                                      C
C                                                                       C
C     THE INFLUENCE LINE EQUATIONS ARE USED TO COMPUTE THE INFLUENCE    C
C     LINE ORDINATES AT THE 10TH-POINTS IN EACH SPAN FOR 2, 3, AND 4    C
C     SPAN CONTINUOUS BEAMS. DEAD AND LIVE LOADS MAY THEN BE APPLIED    C
C     TO A USER-DEFINED CONTINUOUS BEAM AND THE USER MAY VIEW MOMENT    C
C     ENVELOPES, SHEAR ENVELOPES, OR BEAM DEFLECTIONS.                  C
C                                                                       C
C                                                                       C
C  TECHNICAL INFORMATION                                                C
C  =====================                                                C
C                                                                       C
C     THE PROGRAM IS WRITTEN IN VAX FORTRAN AND OPERATES ON A VAX/VMS   C
C     SYSTEM, VERSION V4.1. HARDWARE REQUIREMENTS INCLUDE A VAX MINI-   C
C     COMPUTER, MODEL 11/780, AND A TEKTRONIX 4027 COLOR GRAPHICS       C
C     TERMINAL. THE PROGRAM IMPLEMENTS A LIBRARY OF SUBROUTINES CALL-   C
C     ED "DISSPLA", A SOFTWARE PRODUCT FROM THE 'INTEGRATED SOFTWARE    C
C     SYSTEMS CORPORATION', SAN DIEGO, CALIFORNIA.                      C
C                                                                       C
C-----------------------------------------------------------------------C
      IMPLICIT REAL*8 (A-H,O-Z)
      DIMENSION A(5),B(5),D(5),D1(5),BEAM(5,3),SUPPM(41,3),SPANM(41,41),
     *SHEAR(42,44),REACT(41,5),DELTA(41,41),SC(5,2),ABC(41,3),NORD(3,2),
     *AREAM(41,4),AREAV(44,4),AREAD(41,4),VORD(40),AREAR(5,4),UNIDL(4),
     *UNILL(4),ENVEM(41,3),ENVEV(44,3),ENVED(41,3),ENVER(5,3),DX(5),
     *CONLL(3,2),AASHTO(3),YL1(30),YL2(30),YL3(30),YL4(30),YL5(31),
     *YL6(31),YL7(31),YL8(30),YL9(30),YL10(30),YL11(30),XL1(30),XL2(30),
     *NORDV(3,2),TRLLV(3,2),UDLV(3,2),TRWV(3,2),WORD(3,2),DELSM(3),
     *DELM(41),DELV(44),DELD(41),DELX(41),EDT(41,3)
      CHARACTER MM,IM,DM,EM,CMI,AM,DI,ZZ,TLL,ALL,AASHTL*7,RM,AO,DO,CIL,
     *VSP,VSUL,DOT*5,TYPE*14,LOCA*15,TITL*12,ZZDL,ZZLL,ZZLLO
C
C GRAPHICAL DATA POINTS FOR VARIOUS INFLUENCE LINES IN THE
C INTRODUCTION AND DEVELOPMENT SEGMENTS OF THE PROGRAM
C
      DATA XL1 /1.30,1.60,1.90,2.20,2.50,2.80,3.10,3.40,3.70,4.00,
     *          4.45,4.90,5.35,5.80,6.25,6.70,7.15,7.60,8.05,8.50,
     *          9.10,9.70,10.3,10.9,11.5,12.1,12.7,13.3,13.9,14.5/
      DATA XL2 /1.40,1.80,2.20,2.60,3.00,3.40,3.80,4.20,4.60,5.00,
     *          5.52,6.04,6.56,7.08,7.60,8.12,8.64,9.16,9.68,10.2,
     *          10.6,11.0,11.4,11.8,12.2,12.6,13.0,13.4,13.8,14.2/
      DATA YL1 /2.21,2.13,2.05,1.99,1.96,1.95,1.97,2.04,2.14,2.30,
     *          1.99,1.79,1.69,1.66,1.70,1.78,1.90,2.03,2.17,2.30,
     *          2.43,2.53,2.58,2.60,2.59,2.56,2.51,2.45,2.38,2.30/
      DATA YL2 /2.32,2.34,2.35,2.37,2.37,2.38,2.37,2.36,2.33,2.30,
     *          2.23,2.15,2.06,1.98,1.92,1.89,1.90,1.96,2.09,2.30,
     *          1.85,1.55,1.37,1.30,1.32,1.42,1.59,1.80,2.04,2.30/
      DATA YL3 /1.88,1.78,1.68,1.61,1.56,1.55,1.59,1.67,1.80,2.00,
     *          1.72,1.54,1.45,1.43,1.47,1.55,1.66,1.78,1.90,2.00,
     *          2.06,2.09,2.12,2.13,2.12,2.11,2.09,2.06,2.03,2.00/
      DATA YL4 /1.94,1.89,1.85,1.81,1.79,1.78,1.80,1.84,1.90,2.00,
     *          2.18,2.40,2.69,3.00,2.75,2.53,2.34,2.20,2.08,2.00,
     *          1.95,1.92,1.90,1.90,1.90,1.91,1.93,1.95,1.97,2.00/
      DATA YL5 /1.88,1.75,1.64,1.52,1.41,2.41,2.31,2.22,2.13,2.06,2.00,
     *          1.94,1.91,1.89,1.88,1.89,1.91,1.93,1.96,1.98,2.00,
     *          2.01,2.02,2.02,2.03,2.03,2.02,2.02,2.01,2.01,2.00/
      DATA YL6 /2.02,2.04,2.06,2.08,2.09,2.09,2.08,2.07,2.04,2.00,
     *          1.93,1.84,1.73,1.62,1.50,1.38,1.27,1.16,1.07,1.00,2.00,
     *          1.96,1.93,1.92,1.91,1.91,1.92,1.94,1.96,1.98,2.00/
      DATA YL7 /1.99,1.99,1.98,1.98,1.97,1.97,1.98,1.98,1.99,2.00,
     *          2.02,2.04,2.07,2.09,2.11,2.12,2.11,2.09,2.06,2.00,
     *          3.00,2.94,2.87,2.78,2.69,2.59,2.48,2.36,2.25,2.12,2.00/
      DATA YL8 /2.88,2.75,2.64,2.52,2.41,2.31,2.22,2.13,2.06,2.00,
     *          1.94,1.91,1.89,1.88,1.89,1.91,1.93,1.96,1.98,2.00,
     *          2.01,2.02,2.02,2.03,2.03,2.02,2.02,2.01,2.01,2.00/
      DATA YL9 /1.97,1.94,1.92,1.90,1.89,1.88,1.89,1.91,1.95,2.00,
     *          2.09,2.21,2.34,2.47,2.61,2.73,2.84,2.93,2.99,3.00,
     *          2.98,2.94,2.87,2.78,2.68,2.56,2.43,2.29,2.15,2.00/
      DATA YL10/2.08,2.15,2.21,2.26,2.29,2.30,2.28,2.22,2.13,2.00,
     *          1.77,1.50,1.26,1.07,1.00,1.07,1.26,1.50,1.77,2.00,
     *          2.13,2.22,2.28,2.30,2.29,2.26,2.21,2.15,2.08,2.00/
      DATA YL11/1.98,1.97,1.95,1.94,1.93,1.93,1.94,1.95,1.97,2.00,
     *          2.05,2.11,2.17,2.22,2.26,2.28,2.27,2.23,2.14,2.00,
     *          1.85,1.68,1.52,1.40,1.35,1.37,1.47,1.61,1.80,2.00/
C
C CF1 = MODULUS OF ELASTICITY CONVERSION CONSTANT, ksi-->ksf
C CF2 = MOMENT OF INERTIA CONVERSION CONSTANT, ksf-->ksf
C CF3 = LOWER ERROR BOUND CONSTANT
```

```
C CF4 = UPPER ERROR BOUND CONSTANT
C N9 = NUMBER OF ORDINATE DIVISIONS PER SPAN
C
      CF1=144.
      CF2=1.
      CF3=0.98
      CF4=1.02
      N1=0
      N9=10
      RN9=N9*1.
C
C COMMONLY USED FORMAT STATEMENTS
C
48    FORMAT(A1)
754   FORMAT(A12)
822   FORMAT(A21)
104   FORMAT(T15,A54)
646   FORMAT(F3.0)
830   FORMAT(F4.0)
842   FORMAT(F4.1)
463   FORMAT(F5.1)
943   FORMAT(F5.2)
666   FORMAT(F6.0)
889   FORMAT(F6.1)
576   FORMAT(F6.2)
552   FORMAT(F6.3)
836   FORMAT(F7.0)
855   FORMAT(F7.1)
794   FORMAT(F7.2)
386   FORMAT(F7.1,F5.2)
663   FORMAT(F8.1)
798   FORMAT(F13.7)
790   FORMAT(I1)
849   FORMAT(I2)
643   FORMAT(I4)
227   FORMAT(I5)
760   FORMAT(I6)
823   FORMAT(/)
529   FORMAT(//)
583   FORMAT(///)
C
C COLOR CODES:  C0 = WHITE     C1 = RED       C2 = GREEN     C3 = BLUE
C               C4 = YELLOW    C5 = CYAN      C6 = MAGENTA   C7 = BLACK
C
C
748   FORMAT(' !COL C0')
722   FORMAT(' !COL C1')
740   FORMAT(' !COL C2')
744   FORMAT(' !COL C3')
708   FORMAT(' !COL C4')
729   FORMAT(' !COL C5')
703   FORMAT(' !COL C6')
700   FORMAT(' !COL C7')
723   FORMAT(' !LIN 1')
701   FORMAT(' !MON 8 H K')
326   FORMAT(' !MON 34 H K')
151   FORMAT(' !MON')
155   FORMAT(' !WOR')
785   FORMAT(' !ERA M')
634   FORMAT(' !JUM 12,63')
595   FORMAT(' !JUM 18,63')
695   FORMAT(' !JUM 24,63')
C
C INITIALIZE "DISSPLA" COMMANDS TO TEKTRONIX 4027 TERMINAL
C
      CALL TK4027
      CALL SETDEV(0,0)
      CALL PAGE(11.,8.5)
      CALL NOBRDR
      CALL LINESP(1.5)
      CALL BASALF('L/CSTD')
      CALL MIXALF('STAND')
      CALL MX3ALF('INSTR',',>')
      CALL MX4ALF('MATHE',',:')
      CALL MX5ALF('GREEK',',*')
C
C MAIN MENU
C
      TYPE 326
      TYPE 723
      TYPE 104,'  **  **  **  **  **  **  **  **  **  **  **  **  **  **  **  '
      TYPE 104,' **                                                      **  '
      TYPE 104,'**    ANALYSIS AND BEHAVIOR OF THE CONTINUOUS BEAM        **'
      TYPE 104,' **        THROUGH THE USE OF INFLUENCE LINES            **  '
      TYPE 104,'  **                                                    **   '
      TYPE 104,'   **  **  **  **          BY          **  **  **  **     '
      TYPE 104,'                 **   RICK  EHLERT   **                    '
      TYPE 104,'                  **                 **                    '
      TYPE 104,'                    **  **  **  **  **                     '
```

```
177           TYPE 529
178           TYPE 14
179     14    FORMAT(T6,'The analysis of transversely loaded beams which are con
180          *tinuous over three')
181           TYPE 16
182     16    FORMAT(T6,'or more supports is rather tedious.  A complete analysi
183          *s requires the de-')
184           TYPE 18
185     18    FORMAT(T6,'signer to understand basic theories of continuous, inde
186          *terminate struc-')
187           TYPE 20
188     20    FORMAT(T6,'tures.  One means of studying continuous beam behavior
189          *is through the ap-')
190           TYPE 22
191     22    FORMAT(T6,'plication of influence lines.  The following interactiv
192          *e program will let')
193           TYPE 24
194     24    FORMAT(T6,'the student study continuous beam behavior by developin
195          *g and then apply-')
196           TYPE 26
197     26    FORMAT(T6,'ing various types of influence lines.'/)
198           TYPE 28
199     28    FORMAT(T6,'The program is divided into 3 main sections.  The main
200          *menu is given be-')
201           TYPE 30
202     30    FORMAT(T6,'low and all first time users are urged to view the INTR
203          *ODUCTION before')
204           TYPE 32
205     32    FORMAT(T6,'proceeding into later sections.'/)
206     33    TYPE 34
207     34    FORMAT(T6,'MAIN MENU')
208           TYPE 36
209     36    FORMAT(T6,'=========='/)
210           TYPE 38
211     38    FORMAT(T11,'(A) INTRODUCTION')
212           TYPE 40
213     40    FORMAT(T11,'(B) DEVELOPMENT OF INFLUENCE LINES')
214           TYPE 42
215     42    FORMAT(T11,'(C) APPLICATION OF INFLUENCE LINES')
216           TYPE 44
217     44    FORMAT(T11,'(D) END OF PROGRAM'//)
218     45    TYPE 46
219     46    FORMAT(T5,' PLEASE SELECT ONE OF THE ABOVE: ',$)
220           ACCEPT 48, MM
221           IF(MM.LT.'A' .OR. MM.GT.'D') GO TO 45
222           IF(MM.EQ.'A') GO TO 300
223           IF(MM.EQ.'B') GO TO 400
224           IF(MM.EQ.'C') GO TO 500
225           GO TO 9999
226     C
227     C INTRODUCTION SEGMENT FROM MAIN MENU
228     C
229     300   TYPE 326
230           TYPE 785
231           TYPE 302
232     302   FORMAT(' INTRODUCTION')
233           TYPE 303
234     303   FORMAT(' ------------'/)
235           TYPE 304
236     304   FORMAT(T6,'The inroductory phase of this program is intended to ac
237          *quaint the user')
238           TYPE 305
239     305   FORMAT(T6,'with all information necessary for program operation.
240          *The information is')
241           TYPE 306
242     306   FORMAT(T6,'quite substantial and the user is encouraged to make no
243          *tes for future re-')
244           TYPE 307
245     307   FORMAT(T6,'ference throughout the remainder of the program.'/)
246     282   TYPE 319
247     319   FORMAT(T6,'INTRODUCTION MENU')
248           TYPE 320
249     320   FORMAT(T6,'================='/)
250           TYPE 308
251     308   FORMAT(T11,'(A) Continuous presentation of all introductory materi
252          *al')
253           TYPE 309
254     309   FORMAT(T11,'(B) Program purpose')
255           TYPE 310
256     310   FORMAT(T11,'(C) Graphical definition of a continuous beam')
257           TYPE 311
258     311   FORMAT(T11,'(D) Graphic examples of influence lines')
259           TYPE 312
260     312   FORMAT(T11,'(E) Presentation of theory')
261           TYPE 313
262     313   FORMAT(T11,'(F) Limitations')
263           TYPE 314
264     314   FORMAT(T11,'(G) Nomenclature')
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      TYPE 315
315   FORMAT(T11,'(H) Return to Main Menu'//)
316   TYPE 46
      ACCEPT 48, IM
      IF(IM.LT.'A' .OR. IM.GT.'H') GO TO 316
      IF(IM.EQ.'H') THEN
        TYPE 785
        GO TO 33
      END IF
      IF(IM.EQ.'A' .OR. IM.EQ.'B') GO TO 321
      IF(IM.EQ.'C') GO TO 330
      IF(IM.EQ.'D') GO TO 340
      IF(IM.EQ.'E') GO TO 350
      IF(IM.EQ.'F') GO TO 360
      IF(IM.EQ.'G') GO TO 370
321   CALL TABLET('CENTER','LONG')
      CALL LTLINE('(PROGRAM PURPOSE)$')
      CALL LTLINE('(---------------)$')
      CALL CTLINE('$')
      CALL LTLINE('(U)NDOUBTEDLY, THE MOST POWERFUL TOOL AVAILABLE FOR U
     *SE BY THE ENGINEER IS$')
      CALL LTLINE('THE COMPUTER.  (T)HE ACTUAL ANALYSIS OF THE MOST COMP
     *LEX STRUCTURES HAS$')
      CALL LTLINE('BEEN REDUCED TO NOTHING MORE THAN A FEW PAGES OF COMP
     *UTER OUTPUT.  (U)NFOR-$')
      CALL LTLINE('TUNATELY, THE STRUCTURAL ENGINEER IS STILL LEFT WITH
     *THE TASK OF INTER-$')
      CALL LTLINE('PRETTING RESULTS OF COMPUTER ANALYSIS, AND APPLYING T
     *HOSE RESULTS TOWARD$')
      CALL LTLINE('THE FINAL DESIGN.  (H)EREIN ARISES AN IMPORTANT QUEST
     *ION--(H)AS THE JUDGEMENT$')
      CALL LTLINE('MAKING ABILITY OF THE STRUCTURAL ENGINEER BEEN ADEQUA
     *TELY DEVELOPED?$')
      CALL CTLINE('$')
      CALL LTLINE('(T)HIS PROGRAM WILL DEAL WITH 2 IMPORTANT COMPONENTS
     *OF DEVELOPING SOUND$')
      CALL LTLINE('JUDGEMENT-MAKING ABILITIES :0)1:1) KNOWLEDGE OF FUNDA
     *MENTAL STRUCTURAL THEOR-$')
      CALL LTLINE('EMS AND :0)2:1) "FEEL" OF A STRUCTURE.  (T)HE PROGRAM
     * WILL USE THE CONTINUOUS$')
      CALL LTLINE('BEAM AND ASSOCIATED THEOREMS TO ILLUSTRATE THESE 2 CO
     *MPONENTS.  (T)HUS, IT$')
      CALL LTLINE('IS THE PURPOSE OF THIS PROGRAM TO PROVIDE FOR THE STU
     *DENT A QUICK MEANS OF$')
      CALL LTLINE('STUDYING THE FUNDAMENTAL THEOREMS ASSOCIATED WITH CON
     *TINUOUS BEAM ANALYSIS,$')
      CALL LTLINE('AND APPLYING THE THEOREMS SO AS TO DEVELOP A "FEEL" F
     *OR THE STRUCTURE UN-$')
      CALL LTLINE('DER VARIOUS LOADING CONDITIONS.$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
      CALL ENDTAB()
      CALL ENDPL(0)
      CALL TABLET('CENTER','LONG')
      CALL LTLINE('(T)HE (DEVELOPMENT) SEGMENT OF THIS PROGRAM IS TWO-FO
     *LD IN NATURE.  (F)IRST, THE$')
      CALL LTLINE('STUDENT WILL HAVE THE OPPORTUNITY TO EXAMINE THE DEVE
     *LOPMENT OF INFLUENCE$')
      CALL LTLINE('LINE EQUATIONS FROM FUNDAMENTAL STRUCTURAL THEOREMS.
     * (I)T IS THESE EQUA-$')
      CALL LTLINE('TIONS WHICH ARE USED TO COMPUTE INFLUENCE LINE ORDINA
     *TES.  (S)ECONDLY, SO AS$')
      CALL LTLINE('TO ASSURE THE STUDENT UNDERSTANDS THE INFLUENCE LINE
     *EQUATIONS, HE OR SHE$')
      CALL LTLINE('WILL BE ABLE TO COMPUTE ORDINATES FOR A SPECIFIC INFL
     *UENCE LINE.  (T)HIS WILL$')
      CALL LTLINE('REQUIRE STUDENT SPECIFICATION OF VARIOUS TERMS IN THE
     * INFLUENCE LINE EQUA-$')
      CALL LTLINE('TIONS.$')
      CALL CTLINE('$')
      CALL LTLINE('(T)HE (APPLICATION) SEGMENT OF THIS PROGRAM PROVIDES
     *AN IMPORTANT APPLICATION$')
      CALL LTLINE('OF INFLUENCE LINES.  (D)EAD AND LIVE LOADS CAN BE APP
     *LIED TO A SPECIFIED CON-$')
      CALL LTLINE('TINUOUS BEAM AND THE STUDENT MAY VIEW MOMENT ENVELOPE
     *S, SHEAR ENVELOPES, OR$')
      CALL LTLINE('BEAM DEFLECTION CURVES.  (O)F PARTICULAR IMPORTANCE,
     *THE STUDENT WILL BE AL-$')
      CALL LTLINE('LOWED TO RE-DEFINE OR RE-POSITION THE LIVE LOAD AND T
     *HUS DETERMINE WHICH LIVE$')
      CALL LTLINE('LOADING PRODUCES MAXIMUM MOMENTS, SHEARS, AND DEFLECT
     *IONS.$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      IF(IM.EQ.'B') THEN
        CALL LTLINE('(P)RESS (RETURN) TO RETURN TO (I)NTRODUCTION (M)ENU
     *...$')
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      ELSE
        CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
      END IF
      CALL ENDTAB(0)
      CALL ENDPL(0)
      IF(IM.EQ.'B') GO TO 385
330   CALL TABLET('CENTER','LONG')
      CALL LTLINE('(GRAPHICAL DEFINITION OF A CONTINUOUS BEAM)$')
      CALL LTLINE('(-----------------------------------------)$')
      CALL CTLINE('$')
      CALL LTLINE('(I)T IS NOW POSSIBLE WITH THE AID OF TODAY"S COMPUTER
     * PROGRAMS TO CREATE, ANA-$')
      CALL LTLINE('LYZE, AND DESIGN THE MOST COMPLEX CONTINUOUS BEAM.  (
     *C)OMPLEX CONTINUOUS BEAMS$')
      CALL LTLINE('HOWEVER, MAY BE VIEWED AS A COMBINATION OF SIMPLE CON
     *TINUOUS BEAMS AND VAR-$')
      CALL LTLINE('IOUS PARAMETERS FUNDAMENTALLY KNOWN TO THE STRUCTURAL
     * ENGINEER.  (T)HUS, IT IS$')
      CALL LTLINE('POSSIBLE FOR THE ENGINEER TO UNDERSTAND SIMPLE CONTIN
     *UOUS BEAM BEHAVIOR AND$')
      CALL LTLINE('ANALYZE MORE COMPLEX BEAM CONFIGURATIONS.  (T)HIS PRO
     *GRAM WILL BE LIMITED TO$')
      CALL LTLINE('DISCUSSION OF RELATIVELY SIMPLE CONTINUOUS BEAMS SUCH
     * AS THE 3-SPAN BEAM$')
      CALL LTLINE('SHOWN BELOW...$')
      CALL CTSET(1)
      CALL LTLINE('(I)N GENERAL, ALL CONTINUOUS BEAMS IN THIS PROGRAM WI
     *LL HAVE THE FOLLOWING$')
      CALL LTLINE('PARAMETERS...$')
      CALL CTLINE('$')
      CALL LTLINE('              :8)1:9) (O)NLY 2, 3, OR 4-SPAN BEAMS WILL
     *BE USED$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('              :8)2:9) (M)OMENTS OF INERTIA MAY VARY FROM
     * SPAN TO SPAN,$')
      CALL LTLINE('                  BUT SHALL BE CONSTANT THROUGHOUT A GIV
     *EN SPAN$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
      CALL ENDTAB(0)
      CALL INSERT(1)
      CALL AREA2D(16,2.5)
      CALL HEIGHT(.25)
      CALL BEAM1
      CALL MESSAG('(I>L.2H.8)1',11,2.8,1.6)
      CALL MESSAG('(I>L.2H.8)2',11,7.4,1.6)
      CALL MESSAG('(I>L.2H.8)3',11,12.,1.6)
      CALL SETCLR('YELLOW')
      CALL VECTOR(1.,.5,1.,1.5,0)
      CALL VECTOR(5.,.5,5.,1.5,0)
      CALL VECTOR(10.2,.5,10.2,1.5,0)
      CALL VECTOR(14.2,.5,14.2,1.5,0)
      CALL VECTOR(1.,.7,5.,.7,1402)
      CALL VECTOR(5.,.7,10.2,.7,1402)
      CALL VECTOR(10.2,.7,14.2,.7,1402)
      CALL MESSAG('(SPAN 1)',8,2.3,.8)
      CALL MESSAG('(SPAN 2)',8,6.9,.8)
      CALL MESSAG('(SPAN 3)',8,11.5,.8)
      CALL RESET('HEIGHT')
      CALL ENDGR(0)
      CALL ENDPL(0)
      CALL TABLET('CENTER','LONG')
      CALL LTLINE('              :8)3:9) (N)O INTERNAL HINGES WILL BE USED$
     *')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('              :8)4:9) (S)UPPORTS SHALL BE EITHER PINNED
     *OR ROLLER TYPE$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('              :8)5:9) (S)UPPORTS MAY UNDERGO VERTICAL DI
     *SPLACEMENTS$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('(SIGN CONVENTION)$')
      CALL LTLINE('(---------------)$')
      CALL CTLINE('$')
      CALL LTLINE('(S)O AS TO AID THE STUDENT IN UNDERSTANDING ANY OUTPU
     *T OR DISPLAYS THROUGHOUT$')
      CALL LTLINE('THE PROGRAM, THE FOLLOWING SIGN CONVENTION HAS BEEN A
     *DOPTED...$')
      CALL CTSET(2)
      IF(IM.EQ.'C') THEN
        CALL LTLINE('(P)RESS (RETURN) TO RETURN TO (I)NTRODUCTION (M)ENU
     *...$')
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441         ELSE
442           CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
443         END IF
444         CALL ENDTAB(0)
445         CALL INSERT(2)
446         CALL AREA2D(16.,4.)
447         CALL HEIGHT(.25)
448         CALL SETCLR('WHITE')
449         CALL MESSAG('>PE.4)(MOMENT)>EXU)',19,2.0,4.0)
450         CALL MESSAG('>PE.4)(SHEAR)>EXU)',18,2.0,2.5)
451         CALL MESSAG('>PE.4)(DEFLECTION)>EXU)',23,2.0,1.0)
452         CALL MESSAG('*D) IS :8)+:9) MEASURED DOWNWARD',32,5.0,1.0)
453         CALL MESSAG('*D) IS :8)-:9) MEASURED UPWARD',30,5.0,.1)
454         CALL SETCLR('CYAN')
455         CALL VECTOR(5.,4.,8.,4.,0)
456         CALL VECTOR(11.,4.,14.,4.,0)
457         CALL VECTOR(5.,2.5,8.,2.5,0)
458         CALL VECTOR(11.,2.5,14.,2.5,0)
459         CALL SETCLR('RED')
460         X=5.
461         Y=4.
462         CALL ARC1(X,Y)
463         X=8.
464         CALL ARC2(X,Y)
465         X=11.
466         CALL ARC3(X,Y)
467         X=14.
468         CALL ARC4(X,Y)
469         CALL VECTOR(4.8,2.,4.8,3.,0)
470         CALL VECTOR(4.8,3.,4.7,2.8,0)
471         CALL VECTOR(8.2,3.,8.2,2.,0)
472         CALL VECTOR(8.2,2.,8.3,2.2,0)
473         CALL VECTOR(10.8,3.,10.8,2.,0)
474         CALL VECTOR(10.8,2.,10.7,2.2,0)
475         CALL VECTOR(14.2,2.,14.2,3.,0)
476         CALL VECTOR(14.2,3.,14.3,2.8,0)
477         CALL SETCLR('WHITE')
478         CALL MESSAG('(+M)',4,3.9,3.8)
479         CALL MESSAG('(+M)',4,8.6,3.8)
480         CALL MESSAG('(-M)',4,9.9,3.8)
481         CALL MESSAG('(-M)',4,14.6,3.8)
482         CALL MESSAG('TENSION BOTTOM',14,5.0,3.4)
483         CALL MESSAG('TENSION TOP',11,11.4,3.4)
484         CALL MESSAG('(+V)',4,4.2,2.3)
485         CALL MESSAG('(+V)',4,8.4,2.3)
486         CALL MESSAG('(-V)',4,10.2,2.3)
487         CALL MESSAG('(-V)',4,14.4,2.3)
488         CALL RESET('HEIGHT')
489         CALL ENDGR(0)
490         CALL ENDPL(0)
491         IF(IM.EQ.'C') GO TO 385
492 340     CALL TABLET('CENTER','LONG')
493         CALL LTLINE('(GRAPHIC EXAMPLES OF INFLUENCE LINES)$')
494         CALL LTLINE('(-----------------------------------)$')
495         CALL CTLINE('$')
496         CALL LTLINE('(F)OR ANY GIVEN CONTINUOUS BEAM, IT IS POSSIBLE TO CO
497        *MPUTE INFLUENCE LINES$')
498         CALL LTLINE('ORDINATES AT ANY FINITE POINT ON THE BEAM.  (B)UT TO
499        *COMPUTE ORDINATES AT$')
500         CALL LTLINE('EVERY FINITE POINT FOR PURPOSES OF SKETCHING THE INFL
501        *UENCE LINE IS TIME$')
502         CALL LTLINE('CONSUMING, NOT TO MENTION, RIDICULOUS.  (A) COMMONLY
503        *ACCEPTED MEANS OF COM-$')
504         CALL LTLINE('PUTING INFLUENCE LINE ORDINATES IS TO COMPUTE THE ORD
505        *INATES AT THE 10TH-$')
506         CALL LTLINE('POINTS OF EACH SPAN.  (T)HIS PROVIDES AN ADEQUATE NUM
507        *BER OF POINTS FROM$')
508         CALL LTLINE('WHICH THE INFLUENCE LINE CAN THEN BE DRAWN.  (T)HE 10
509        *TH-POINT NUMBERS AND$')
510         CALL LTLINE('SUPPORT NUMBERS WHICH THE STUDENT WILL USE THROUGHOUT
511        * THE PROGRAM ARE$')
512         CALL LTLINE('SHOWN BELOW...$')
513         CALL CTSET(3)
514         CALL CTLINE('$')
515         CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
516         CALL ENDTAB(0)
517         CALL INSERT(3)
518         CALL AREA2D(16.,4.5)
519         CALL HEIGHT(.25)
520         CALL SETCLR('CYAN')
521         CALL VECTOR(1.,4.,13.,4.,0)
522         CALL VECTOR(.8,3.8,1.2,3.8,0)
523         CALL VECTOR(.9,3.8,1.,4.,0)
524         CALL VECTOR(1.,4.,1.1,3.8,0)
525         CALL VECTOR(3.8,3.8,4.2,3.8,0)
526         CALL VECTOR(6.8,3.8,7.2,3.8,0)
527         CALL VECTOR(9.8,3.8,10.2,3.8,0)
528         CALL VECTOR(12.8,3.8,13.2,3.8,0)
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529           CALL BLCIR(4.,3.9,.1,.01)
530           CALL BLCIR(7.,3.9,.1,.01)
531           CALL BLCIR(10.,3.9,.1,.01)
532           CALL BLCIR(13.,3.9,.1,.01)
533           DO 260 X=1.,13.,.3
534       260 CALL VECTOR(X,4.1,X,4.,0)
535           DO 261 X=1.,13.,1.5
536       261 CALL VECTOR(X,4.2,X,4.,0)
537           CALL MESSAG('1',1.,4.4)
538           CALL MESSAG('11',2,3.8,4.4)
539           CALL MESSAG('21',2,6.8,4.4)
540           CALL MESSAG('31',2,9.8,4.4)
541           CALL MESSAG('41',2,12.8,4.4)
542           CALL MESSAG('(10TH-POINTS)',13,13.5,4.4)
543           CALL MESSAG('1',1,0.9,3.3)
544           CALL MESSAG('2',1,3.9,3.3)
545           CALL MESSAG('3',1,6.9,3.3)
546           CALL MESSAG('4',1,9.9,3.3)
547           CALL MESSAG('5',1,12.9,3.3)
548           CALL MESSAG('(SUPPORT NUMBERS)',17,13.5,3.3)
549           CALL SETCLR('YELLOW')
550           CALL VECTOR(1.,3.,1.,3,0)
551           CALL VECTOR(7.,3.,7.,1.9,0)
552           CALL VECTOR(10.,3.,10.,1.1,0)
553           CALL VECTOR(13.,3.,13.,.3,0)
554           CALL VECTOR(1.,2.1,7.,2.1,1402)
555           CALL VECTOR(1.,1.3,10.,1.3,1402)
556           CALL VECTOR(1.,.5,13.,.5,1402)
557           CALL MESSAG('(2-SPAN BEAM)',13,3.0,2.2)
558           CALL MESSAG('(3-SPAN BEAM)',13,4.5,1.4)
559           CALL MESSAG('(4-SPAN BEAM)',13,6.0,0.6)
560           CALL RESET('HEIGHT')
561           CALL ENDGR(0)
562           CALL ENDPL(0)
563           CALL TABLET('CENTER','LONG')
564           CALL LTLINE('(T)HERE ARE 4 BASIC TYPES OF INFLUENCE LINES WHICH AR
565          *E OF PARTICULAR IN-$')
566           CALL LTLINE('TEREST TO THE STRUCTURAL ENGINEER.  (G)RAPHIC EXAMPLE
567          *S OF THESE 4 TYPES$')
568           CALL LTLINE('ARE SHOWN BELOW ON A 3-SPAN BEAM.$')
569           CALL CTLINE('$')
570           CALL LTLINE('(1. MOMENT INFLUENCE LINES)$')
571           CALL LTLINE('(-------------------------)$')
572           CALL CTSET(4)
573           CALL NEWSET
574           CALL LTLINE('(2. SHEAR INFLUENCE LINES)$')
575           CALL LTLINE('(-------------------------)$')
576           CALL CTSET(5)
577           CALL CTLINE('$')
578           CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
579           CALL ENDTAB(0)
580           CALL INSERT(4)
581           CALL AREA2D(16.,3.)
582           CALL HEIGHT(.25)
583           CALL BEAM1
584           CALL SETCLR('GREEN')
585           CALL STRTPT(1.,2.)
586           DO 251 I=1,30
587       251 CALL CONNPT(XL2(I),YL3(I))
588           CALL VECTOR(4.,6.,6.,0)
589           CALL MESSAG('-(M I.L.) AT (S)UPPORT (N)O. 2',30,6.5,.5)
590           CALL SETCLR('YELLOW')
591           CALL STRTPT(1.,2.)
592           DO 252 I=1,30
593       252 CALL CONNPT(XL2(I),YL4(I))
594           CALL VECTOR(4.,1.6.,1,0)
595           CALL MESSAG('+(M I.L.) AT 10TH-POINT (N)O. 15',32,6.5,0.0)
596           CALL RESET('HEIGHT')
597           CALL ENDGR(0)
598           CALL INSERT(5)
599           CALL AREA2D(16.,3.)
600           CALL HEIGHT(.25)
601           CALL BEAM1
602           CALL SETCLR('GREEN')
603           CALL STRTPT(1.,2.)
604           DO 253 I=1,31
605           IF(I.LT.6) THEN
606             CALL CONNPT(XL2(I),YL5(I))
607           ELSE
608             CALL CONNPT(XL2(I-1),YL5(I))
609           END IF
610       253 CONTINUE
611           CALL VECTOR(3.,6.5,.6,0)
612           CALL MESSAG('(V I.L.) AT 10TH-POINT (N)O. 6',30,5.5,.5)
613           CALL SETCLR('YELLOW')
614           CALL STRTPT(1.,2.)
615           DO 254 I=1,31
616           IF(I.LT.21) THEN
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617           CALL CONNPT(XL2(I),YL6(I))
618         ELSE
619           CALL CONNPT(XL2(I-1),YL6(I))
620         END IF
621   254   CONTINUE
622         CALL VECTOR(3.,.1,5.,.1,0)
623         CALL MESSAG('(V I.L.) LEFT OF 10TH-POINT (N)0. 21',36,5.5,0.0)
624         CALL SETCLR('MAGENTA')
625         CALL STRTPT(1.,2.)
626         DO 255 I=1,31
627         IF(I.LT.21) THEN
628           CALL CONNPT(XL2(I),YL7(I))
629         ELSE
630           CALL CONNPT(XL2(I-1),YL7(I))
631         END IF
632   255   CONTINUE
633         CALL VECTOR(3.,-.4,5.,-.4,0)
634         CALL MESSAG('(V I.L.) RIGHT OF 10TH-POINT (N)0. 21',37,5.5,-.5)
635         CALL RESET('HEIGHT')
636         CALL ENDGR(0)
637         CALL ENDPL(0)
638         CALL TABLET('CENTER','LONG')
639         CALL LTLINE('(3. REACTION INFLUENCE LINES)$')
640         CALL LTLINE('(--------------------------)$')
641         CALL CTSET(6)
642         CALL NEWSET
643         CALL LTLINE('(4. DEFLECTION INFLUENCE LINES)$')
644         CALL LTLINE('(----------------------------)$')
645         CALL CTSET(7)
646         CALL LTLINE('(T)HE STUDENT WILL HAVE AN OPPORTUNITY TO COMPUTE ORD
647        *INATES FOR EACH OF$')
648         CALL LTLINE('THESE INFLUENCE LINE TYPES IN THE (DEVELOPMENT) SEGME
649        *NT OF THIS PROGRAM.$')
650         CALL LTLINE('(I)T WILL PROVE USEFUL TO THE STUDENT THROUGHOUT THE
651        *PROGRAM TO KEEP IN$')
652         CALL LTLINE('MIND THE GENERAL SHAPE OF EACH INLFLUENCE LINE TYPE.$
653        *')
654         CALL CTLINE('$')
655         IF(IM.EQ.'D') THEN
656           CALL LTLINE('(P)RESS (RETURN) TO RETURN TO (I)NTRODUCTION (M)ENU
657        *...$')
658         ELSE
659           CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
660         END IF
661         CALL ENDTAB(0)
662         CALL INSERT(6)
663         CALL AREA2D(16.,3.)
664         CALL HEIGHT(.25)
665         CALL BEAM1
666         CALL SETCLR('GREEN')
667         CALL VECTOR(1.,2.,1.,3.,0)
668         CALL STRTPT(1.,3.)
669         DO 256 I=1,30
670   256   CALL CONNPT(XL2(I),YL8(I))
671         CALL VECTOR(4.,.6,6.,.6,0)
672         CALL MESSAG('(R I.L.) AT (S)UPPORT (N)0. 1',29,6.5,.5)
673         CALL SETCLR('YELLOW')
674         CALL STRTPT(1.,2.)
675         DO 257 I=1,30
676   257   CALL CONNPT(XL2(I),YL9(I))
677         CALL VECTOR(4.,.1,6.,.1,0)
678         CALL MESSAG('(R I.L.) AT (S)UPPORT (N)0. 3',29,6.5,0.0)
679         CALL RESET('HEIGHT')
680         CALL ENDGR(0)
681         CALL INSERT(7)
682         CALL AREA2D(16.,2.5)
683         CALL HEIGHT(.25)
684         CALL BEAM1
685         CALL SETCLR('GREEN')
686         CALL STRTPT(1.,2.)
687         DO 258 I=1,30
688   258   CALL CONNPT(XL2(I),YL10(I))
689         CALL VECTOR(3.,.6,5.,.6,0)
690         CALL MESSAG('*D) (I.L.) AT 10TH-POINT (N)0. 16',33,5.5,.5)
691         CALL SETCLR('YELLOW')
692         CALL STRTPT(1.,2.)
693         DO 259 I=1,30
694   259   CALL CONNPT(XL2(I),YL11(I))
695         CALL VECTOR(3.,.1,5.,.1,0)
696         CALL MESSAG('*D) (I.L.) AT 10TH-POINT (N)0. 26',33,5.5,0.0)
697         CALL RESET('HEIGHT')
698         CALL ENDGR(0)
699         CALL ENDPL(0)
700         IF(IM.EQ.'D') GO TO 385
701   350   CALL TABLET('CENTER','LONG')
702         CALL LTLINE('(PRESENTATION OF THEORY)$')
703         CALL LTLINE('(----------------------)$')
704         CALL CTLINE('$')
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      CALL LTLINE('(T)HE FUNDAMENTAL THEOREM, FROM WHICH THE CONCEPT OF
     *INFLUENCE LINES IS DE-$')
      CALL LTLINE('VELOPED, IS THE PRINCIPLE OF VIRTUAL WORK.  (I)N THE
     *SIMPLEST FORM, THE$')
      CALL LTLINE('PRINCIPLE STATES...$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('          (F)OR A STRUCTURE WHICH HAS DEFORMED INTO A
     *SHAPE HAVING EX-$')
      CALL LTLINE('          TERNAL AND INTERNAL DISPLACEMENTS, THE MAGNI
     *TUDE OF WORK$')
      CALL LTLINE('          DONE BY THE EXTERNAL FORCES ACTING THROUGH T
     *HEIR RESPEC-$')
      CALL LTLINE('          TIVE EXTERNAL DISPLACEMENTS IS EQUAL TO THE
     *MAGNITUDE OF$')
      CALL LTLINE('          WORK DONE BY THE INTERNAL FORCES ACTING THRO
     *UGH THEIR RE-$')
      CALL LTLINE('          SPECTIVE DISPLACEMENTS.$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('(F)ROM THE PRINCIPLE OF VIRTUAL WORK FOLLOW TWO ADDIT
     *IONAL FUNDAMENTAL THE-$')
      CALL LTLINE('OREMS--THE (M)OMENT-(A)REA THEOREMS, AND THEY STATE..
     *.$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('(M)OMENT-(A)REA (T)HEOREM (N)O. 1$')
      CALL LTLINE('(-------------------------)$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('          (T)HE CHANGE IN SLOPE BETWEEN ANY 2 POINTS O
     *N THE ELASTIC$')
      CALL LTLINE('          CURVE OF A BEAM, IS EQUAL TO THE AREA OF THE
     * (M/EI) DIA-$')
      CALL LTLINE('          GRAM BETWEEN THOSE 2 POINTS.$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
      CALL ENDTAB(0)
      CALL ENDPL(0)
      CALL TABLET('CENTER','LONG')
      CALL LTLINE('(M)OMENT-(A)REA (T)HEOREM (N)O. 2$')
      CALL LTLINE('(-------------------------)$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('          (T)HE TANGENTIAL DEVIATION OF ANY POINT (P)
     *ON THE ELASTIC$')
      CALL LTLINE('          CURVE OF A BEAM, FROM A TANGENT DRAWN AT ANY
     * OTHER POINT$')
      CALL LTLINE('          ON THE ELASTIC CURVE, IS EQUAL TO THE 1ST MO
     *MENT OF THE$')
      CALL LTLINE('          AREA OF THE (M/EI) DIAGRAM BETWEEN THOSE 2 P
     *OINTS TAKEN$')
      CALL LTLINE('          ABOUT POINT (P).$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('(T)HESE (M)OMENT-(A)REA THEOREMS ARE THEN APPLIED TO
     *2 ADJACENT SPANS OF A CON-$')
      CALL LTLINE('TINUOUS BEAM TO YIELD THE GENERAL FORM OF THE 3-MOMEN
     *T EQUATION AS GIVEN$')
      CALL LTLINE('BELOW...$')
      CALL REQ1
      CALL CTLINE('$')
      CALL LTLINE('(F)ROM THIS EQUATION, THE MOMENTS AT THE 3 CONSECUTIV
     *E SUPPORTS CAN BE COM-$')
      CALL LTLINE('PUTED, THUS REDUCING A STATICALLY INDETERMINATE STRUC
     *TURE TO A STATICALLY$')
      CALL LTLINE('DETERMINATE STRUCTURE.  (K)NOWING THE SUPPORT MOMENTS
     * ALLOWS FOR DEVELOPMENT$')
      CALL LTLINE('OF EQUATIONS WHICH DEFINE MOMENTS, SHEARS, AND DEFLEC
     *TIONS AT ANY POINT ON$')
      CALL LTLINE('A CONTINUOUS BEAM.  (T)HESE, IN EFFECT, ARE INFLUENCE
     * LINE EQUATIONS, AND$')
      CALL LTLINE('ARE DEVELOPED IN THE (DEVELOPMENT) SEGMENT OF THIS PR
     *OGRAM.$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      IF(IM.EQ.'E') THEN
        CALL LTLINE('(P)RESS (RETURN) TO RETURN TO (I)NTRODUCTION (M)ENU
     *...$')
      ELSE
        CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
      END IF
      CALL ENDTAB(0)
      CALL ENDPL(0)
      IF(IM.EQ.'E') GO TO 385
360   CALL TABLET('CENTER','LONG')
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      CALL LTLINE('(LIMITATIONS)$')
      CALL LTLINE('(-----------)$')
      CALL CTLINE('$')
      CALL LTLINE('(F)OR A VARIETY OF REASONS, SEVERAL LIMITATIONS REGAR
     *DING STUDENT INPUT AND$')
      CALL LTLINE('PROGRAM EXECUTION HAVE BEEN INCORPORATED.$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('(BEAM PHYSICAL DATA)$')
      CALL LTLINE('(------------------)$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('     (N)UMBER OF (S)PANS..................... 2 MINIMUM$')
      CALL LTLINE('                                                4 MAXIMUM$')
      CALL CTLINE('$')
      CALL LTLINE('     (S)PAN (L)ENGTH........................ 100 FEET MINI
     *MUM$')
      CALL LTLINE('
     *')                                                        300 FEET MAXIMUM$
      CALL CTLINE('$')
      CALL LTLINE('     (V)ERTICAL (S)UPPORT (L)OCATION........ 0.01 FEET M
     *INIMUM$')
      CALL LTLINE('
     *$')                                                       1.00 FEET MAXIMUM
      CALL CTLINE('$')
      CALL LTLINE('     (M)OMENT OF (I)NERTIA................    1.00 FT>E.6
     *H.8)4>EXHX) MINIMUM$')
      CALL LTLINE('
     *4>EXHX) MAXIMUM$')                                        999.99 FT>E.6H.8)
      CALL CTLINE('$')
      CALL LTLINE('     (M)ODULUS OF (E)LASTICITY.......... 10000 KSI MIN
     *IMUM$')
      CALL LTLINE('
     *$')                                                       99999 KSI MAXIMUM
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE(' (P)RESS (RETURN) TO CONTINUE...$')
      CALL ENDTAB(0)
      CALL ENDPL(0)
      CALL TABLET('CENTER','LONG')
      CALL LTLINE('(BEAM LOAD DATA)$')
      CALL LTLINE('(---------------)$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('     (U)NIFORM (DL)...................... 0.01 K/FT MIN
     *IMUM$')
      CALL LTLINE('
     *$')                                                       9.99 K/FT MAXIMUM
      CALL CTLINE('$')
      CALL LTLINE('     (U)NIFORM (LL)...................... 0.01 K/FT MIN
     *IMUM$')
      CALL LTLINE('
     *$')                                                       9.99 K/FT MAXIMUM
      CALL CTLINE('$')
      CALL LTLINE('     (AASHTO T)RUCK (LL).................    (H10-44)$')
      CALL LTLINE('                                                (H15-44)$')
      CALL LTLINE('                                                (H20-44)$')
      CALL LTLINE('                                               (HS15-44)$')
      CALL LTLINE('                                               (HS20-44)$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('(A)LL NUMERICAL INPUT SHALL BE DECIMAL IN NATURE WITH
     * THE FOLLOWING EX-$')
      CALL LTLINE('CEPTIONS WHICH SHALL BE INTEGERS...$')
      CALL CTLINE('$')
      CALL LTLINE('     1. (N)UMBER OF SPANS          3. (S)UPPORT NUMBER
     *S$')
      CALL LTLINE('     2. (S)PAN NUMBERS             4. 10TH-POINT NUMBE
     *RS$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('(A)LL ALPHANUMERIC INPUT SHALL BE UPPER CASE.$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      IF(IM.EQ.'F') THEN
        CALL LTLINE('(P)RESS (RETURN) TO RETURN TO (I)NTRODUCTION (M)ENU
     *...$')
      ELSE
        CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
      END IF
      CALL ENDTAB(0)
      CALL ENDPL(0)
      IF(IM.EQ.'F') GO TO 385
  370 CALL TABLET('CENTER','LONG')
      CALL LTLINE('(NOMENCLATURE)$')
      CALL LTLINE('(-------------)$')
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      CALL CTLINE('$')
      CALL LTLINE('    (A)..... REACTION AT (S)UPPORT (N)O. 2
     * OF ELASTIC WEIGHT DIA-$')
      CALL LTLINE('                                GRAMS FROM SPANS 1 AND 2$')
      CALL CTLINE('$')
      CALL LTLINE('    (A>L.2)N>LX), (A>L.2)N>H.8)+1>LXHX)..... AREA
     *S OF ELASTIC WEIGHT DIAGRAMS, SPANS N AND N>H.8)+1>HX$')
      CALL CTLINE('$')
      CALL LTLINE('    >L.2)N>LX)(A>L.2)O>LX)..... SHEAR AT LEF
     *T END OF SIMPLY-SUPPORTED BEAM SUB-$')
      CALL LTLINE('                                JECTED TO UNIT LOAD, SPAN N$')
      CALL CTLINE('$')
      CALL LTLINE('    (B)..... REACTION AT (S)UPPORT (N)O. 3
     * OF ELASTIC WEIGHT DIA-$')
      CALL LTLINE('                                GRAMS FROM SPANS 2 AND 3$')
      CALL CTLINE('$')
      CALL LTLINE('    >L.2)N>LX)(B>L.2)O>LX)..... SHEAR AT RIG
     *HT END OF SIMPLY-SUPPORTED BEAM SUB-$')
      CALL LTLINE('                                JECTED TO UNIT LOAD, SPAN N$')
      CALL CTLINE('$')
      CALL LTLINE('    (C)..... REACTION AT (S)UPPORT (N)O. 4
     * OF ELASTIC WEIGHT DIA-$')
      CALL LTLINE('                                GRAMS FROM SPANS 3 AND 4$')
      CALL CTLINE('$')
      CALL LTLINE('    (E)..... MODULUS OF ELASTICITY, KSI$')
      CALL CTLINE('$')
      CALL LTLINE('    (I>L.2)N>LX), (I>L.2)N>H.8)+1>HXLX)..... MOME
     *NTS OF INERTIA, SPANS N AND N>H.8)+1>HX), FT>E.6H.8)4>EXHX)$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
      CALL ENDTAB(0)
      CALL ENDPL(0)
      CALL TABLET('CENTER','LONG')
      CALL LTLINE('    (L>L.2)N>LX)..... LEFT REACTION OF ELAS
     *TIC WEIGHT DIAGRAM, SPAN N$')
      CALL CTLINE('$')
      CALL LTLINE('    (M>L.2)L>LX)..... SUPPORT MOMENT AT LEF
     *T END OF SPAN N$')
      CALL CTLINE('$')
      CALL LTLINE('    (M>L.2)N>H.8)-1>HXLX), (M>L.2)N>LX), (M>L.2)N>H.8
     *)+1>HXLX).... SUPPORT MOMENTS AT 3 CONSECUTIVE SUPPORTS N>H.8)-1>H
     *X),$')
      CALL LTLINE('                                N, AND N>H.8)+1>HX)$')
      CALL CTLINE('$')
      CALL LTLINE('    (M>L.2)O>LX)..... SIMPLE-SPAN MOMENT AT
     * POINT WHERE INFLUENCE LINE$')
      CALL LTLINE('                                IS BEING DEVELOPED$')
      CALL CTLINE('$')
      CALL LTLINE('    (M>L.2)R>LX)..... SUPPORT MOMENT AT RIG
     *HT END OF SPAN N$')
      CALL CTLINE('$')
      CALL LTLINE('    (M>L.2)X>LX)..... MOMENT AT A POINT OF
     *APPLIED UNIT LOAD$')
      CALL CTLINE('$')
      CALL LTLINE('    (P>L.2H.8)1>HXLX), (P>L.2H.8)2>HXLX), (P>L.2H.8)3
     *>HXLX)..... APPLIED POINT LOADS$')
      CALL CTLINE('$')
      CALL LTLINE('    (R)..... TOTAL REACTION OF ELASTIC WEI
     *GHT DIAGRAMS OF TWO$')
      CALL LTLINE('                                ADJACENT SPANS$')
      CALL CTLINE('$')
      CALL LTLINE('    (R>L.2)N>LX)..... SUPPORT REACTION AT S
     *UPPORT N$')
      CALL CTLINE('$')
      CALL LTLINE('    (V>L.2)L>LX)..... SHEAR AT LEFT END OF
     *SPAN LOADED WITH UNIT LOAD$')
      CALL CTLINE('$')
      CALL LTLINE('    (V>L.2)O>LX)..... SIMPLE-SPAN SHEAR AT
     *POINT WHERE INFLUENCE LINE$')
      CALL LTLINE('                                IS BEING DEVELOPED$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
      CALL ENDTAB(0)
      CALL ENDPL(0)
      CALL TABLET('CENTER','LONG')
      CALL LTLINE('    (V>L.2)R>LX)..... SHEAR AT RIGHT END OF
     * SPAN LOADED WITH UNIT LOAD$')
      CALL CTLINE('$')
      CALL LTLINE('    (V>L.2)X>LX)..... SHEAR AT A POINT OF A
     *PPLIED UNIT LOAD$')
      CALL CTLINE('$')
      CALL LTLINE('    >L.2)L>LX)(V>L.2)N>LX), >L.2)L>LX)(V>L.2)N>H.8)+1
     *>HXLX)..... SHEARS LEFT OF SUPPORTS N AND N>H.8)+1>HX)$')
      CALL CTLINE('$')
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      CALL LTLINE('    >L.2)R>LX)(V>L.2)N>H.8)-1>HXLX), >L.2)R>LX)(V>L.2
     *)N>LX)..... SHEARS RIGHT OF SUPPORTS N>H.8)-1>HX) AND N$')
      CALL CTLINE('$')
      CALL LTLINE('    A>L.2)N>LX)..... DISTANCE FROM LEFT END
     * OF SPAN N TO UNIT LOAD$')
      CALL CTLINE('$')
      CALL LTLINE('    B>L.2)N>LX)..... DISTANCE FROM RIGHT EN
     *D OF SPAN N TO UNIT LOAD$')
      CALL CTLINE('$')
      CALL LTLINE('    C>L.2)N>LX), C>L.2)N>H.8)+1>HXLX)..... DISTAN
     *CE FROM LEFT END OF SPAN N OR N>H.8)+1>HX) TO CEN-$')
      CALL LTLINE('                                TROID OF ELASTIC WEIGHT DIAGRAM
     *$')
      CALL CTLINE('$')
      CALL LTLINE('    D>L.2)N>LX), D>L.2)N>H.8)+1>HXLX)..... DISTAN
     *CE FROM RIGHT END OF SPAN N OR N>H.8)+1>HX) TO CEN-$')
      CALL LTLINE('                                TROID OF ELASTIC WEIGHT DIAGRAM
     *$')
      CALL CTLINE('$')
      CALL LTLINE('    L>L.2)N>LX), L>L.2)N>H.8)+1>HXLX)..... LENGTH
     * OF SPANS N AND N>H.8)+1>HX)$')
      CALL CTLINE('$')
      CALL LTLINE('    N>H.8)-1>HX), N, N>H.8)+1>HX)..... SPAN OR SUPPO
     *RT NUMBERS$')
      CALL CTLINE('$')
      CALL LTLINE('    W>L.2)N>LX), W>L.2)N>H.8)+1>HXLX)..... UNIFOR
     *M LIVE LOAD IN SPAN N AND N>H.8)+1>HX)$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
      CALL ENDTAB(0)
      CALL ENDPL(0)
      CALL TABLET('CENTER','LONG')
      CALL LTLINE('    X..... DISTANCE FROM LEFT END OF SPAN
     *N TO THE POINT AT$')
      CALL LTLINE('                                WHICH THE INFLUENCE LINE IS BEI
     *NG DEVELOPED$')
      CALL CTLINE('$')
      CALL LTLINE('    *D)>L.2)N>H.8)-1>HXLX), *D)>L.2)N>LX), *D)>L.2)N>
     *H.8)+1>HXLX).... INITIAL VERTICAL DISPLACEMENT OF 3 ADJACENT$')
      CALL LTLINE('                                SUPPORTS N>H.8)-1>HX), N, AND N
     *>H.8)+1>HX)$')
      CALL CTLINE('$')
      CALL LTLINE('    *D)>L.2)O>LX)..... SIMPLE-SPAN DEFLECTI
     *ON AT POINT WHERE$')
      CALL LTLINE('                                INFLUENCE LINE IS BEING DEVELOP
     *ED$')
      CALL CTLINE('$')
      CALL LTLINE('    *D)>L.2)X>LX)..... DEFLECTION AT A POIN
     *T OF APPLIED UNIT LOAD$')
      CALL CTLINE('$')
      CALL LTLINE('    *Q)>L.2)N>H.8)-1>HXLX)..... BEAM ROTATION
     * TO RIGHT OF SUPPORT N>H.8)-1>HX)$')
      CALL CTLINE('$')
      CALL LTLINE('    *Q)>L.2)N>LX)..... BEAM ROTATION TO LEF
     *T OF SUPPORT N$')
      CALL CTLINE('$')
      CALL LTLINE('    *Q)>PL.2)N>LXGE1.1),>EX)..... BEAM ROTA
     *TION TO RIGHT OF SUPPORT N$')
      CALL CTLINE('$')
      CALL LTLINE('    *Q)>L.2)N>H.8)+1>HXLX)..... BEAM ROTATION
     * TO LEFT OF SUPPORT N>H.8)+1>HX)$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('(P)RESS (RETURN) TO RETURN TO (I)NTRODUCTION (M)ENU..
     *.$')
      CALL ENDTAB(0)
      CALL ENDPL(0)
385   TYPE 735
      GO TO 232
C
C DEVELOPMENT SEGMENT FROM MAIN MENU
C
400   TYPE 326
      TYPE 735
      TYPE 402
402   FORMAT(' DEVELOPMENT OF INFLUENCE LINES')
      TYPE 403
403   FORMAT(' ------------------------------'/)
      TYPE 404
404   FORMAT(T6,'It is essential for a student to fully understand how i
     *nfluence line ordi-')
      TYPE 405
405   FORMAT(T6,'inates are computed before proceeding to a particular a
     *pplication.  This')
      TYPE 406
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1057    406   FORMAT(T6,'segment of the program will present the development of
1058         *the general 3-mo-')
1059          TYPE 407
1060    407   FORMAT(T6,'ment equation and other equations which are used for co
1061         *mputing influence')
1062          TYPE 408
1063    408   FORMAT(T6,'line ordinates.'/)
1064          TYPE 409
1065    409   FORMAT(T6,'The student will then use the equations to develop infl
1066         *uence lines for a')
1067          TYPE 410
1068    410   FORMAT(T6,'given beam.  Completion of this segment will enable the
1069         * student to apply')
1070          TYPE 411
1071    411   FORMAT(T6,'the general principles of influence lines when using th
1072         *e application seg-')
1073          TYPE 412
1074    412   FORMAT(T6,'ment of this program.'/)
1075          INFLAG1=1
1076    470   TYPE 421
1077    421   FORMAT(T6,'DEVELOPMENT MENU')
1078          TYPE 422
1079    422   FORMAT(T6,'================'/)
1080          TYPE 413
1081    413   FORMAT(T11,'(A) Concept of influence lines')
1082          TYPE 414
1083    414   FORMAT(T11,'(B) Influence line equations')
1084          TYPE 415
1085    415   FORMAT(T11,'(C) Beam physical data input')
1086          TYPE 416
1087    416   FORMAT(T11,'(D) Computation of influence line ordinates')
1088          TYPE 417
1089    417   FORMAT(T11,'(E) Return to Main Menu'//)
1090    418   TYPE 46
1091          ACCEPT 48, DM
1092          IF(DM.LT.'A' .OR. DM.GT.'E') GO TO 418
1093          IF(DM.EQ.'A') GO TO 430
1094          IF(DM.EQ.'B') GO TO 440
1095          IF(DM.EQ.'C') GO TO 471
1096          IF(DM.EQ.'D') THEN
1097            IF(INFLAG1.EQ.1) THEN
1098              TYPE 529
1099              TYPE 720
1100    720       FORMAT('--> INPUT LOGIC ERROR--PLEASE SPECIFY BEAM PHYSICAL DA
1101         *TA <--'//)
1102    721       TYPE 825
1103              ACCEPT 43, ZZ
1104              IF(ZZ.NE.'C') GO TO 721
1105              TYPE 785
1106              GO TO 470
1107            END IF
1108            GO TO 482
1109          END IF
1110          TYPE 785
1111          GO TO 33
1112    430   CALL TABLET('CENTER','LONG')
1113          CALL LTLINE('(CONCEPT OF INFLUENCE LINES)$')
1114          CALL LTLINE('(-------------------------)$')
1115          CALL CTLINE('$')
1116          CALL LTLINE('(A)LTHOUGH INFLUENCE LINES MAY BE DEVELOPED FOR MOST
1117         *ANY TYPE OF STRUCTURE,$')
1118          CALL LTLINE('THIS DISCUSSION WILL BE LIMITED TO THOSE FOR CONTINUO
1119         *US BEAMS.  (N)O MATTER$')
1120          CALL LTLINE('WHAT THE STRUCTURE TYPE, THE BASIC PRINCIPLE IS STILL
1121         * THE SAME--A LOAD POSI-$')
1122          CALL LTLINE('TIONED AT SOME POINT ON THE STRUCTURE WILL "INFLUENCE
1123         *" THE INTERNAL FORCES$')
1124          CALL LTLINE('AT ALL OTHER POINTS WITHIN THE STRUCTURE.  (T)HE PROB
1125         *LEM FACING THE ENGINEER$')
1126          CALL LTLINE('IS IN DETERMINING WHERE TO POSITION A GIVEN LOAD SO A
1127         *S TO CREATE MAXIMUM$')
1128          CALL LTLINE('EFFECTS, SAY SHEARS OR MOMENTS, WITHIN THE STRUCTURE.
1129         *  (T)HE USE OF INFLUENCE$')
1130          CALL LTLINE('LINES GREATLY SIMPLIFIES THIS PROBLEM.$')
1131          CALL CTLINE('$')
1132          CALL LTLINE('(F)OR THE CONTINUOUS BEAM, INFLUENCE LINES ARE DEVELO
1133         *PED BY POSITIONING A$')
1134          CALL LTLINE('UNIT LOAD AT SOME POINT ON THE BEAM AND DETERMINING T
1135         *HE INFLUENCE IT HAS$')
1136          CALL LTLINE('ON MOMENTS, SHEARS, & DEFLECTIONS AT OTHER POINTS ON
1137         *THE BEAM.  (F)OR EX-$')
1138          CALL LTLINE('AMPLE, LET US CONSIDER THE 3-SPAN BEAM AS SHOWN BELOW
1139         *...$')
1140          CALL CTSET(8)
1141          CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
1142          CALL ENDTAB(0)
1143          CALL INSERT(8)
1144          CALL AREA2D(16.,3.)
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1145          CALL HEIGHT(.25)
1146          CALL SETCLR('CYAN')
1147          CALL VECTOR(1.,2.,14.5,2.,0)
1148          CALL VECTOR(.8,1.8,1.2,1.8,0)
1149          CALL VECTOR(.9,1.8,1.,2.,0)
1150          CALL VECTOR(1.,2.,1.1,1.8,0)
1151          CALL VECTOR(3.8,1.8,4.2,1.8,0)
1152          CALL VECTOR(8.3,1.8,8.7,1.8,0)
1153          CALL VECTOR(14.3,1.8,14.7,1.8,0)
1154          CALL BLCIR(4.,1.9,.1,.01)
1155          CALL BLCIR(8.5,1.9,.1,.01)
1156          CALL BLCIR(14.5,1.9,.1,.01)
1157          CALL MESSAG('(I)',3,2.2,1.6)
1158          CALL MESSAG('(I)',3,6.2,1.6)
1159          CALL MESSAG('(I)',3,11.2,1.6)
1160          CALL MESSAG('1',1.,1.9,2.2)
1161          CALL MESSAG('2',1,3.9,2.2)
1162          CALL MESSAG('3',1,8.4,2.2)
1163          CALL MESSAG('4',1,14.4,2.2)
1164          CALL SETCLR('GREEN')
1165          CALL VECTOR(2.5,3.,2.5,2.1,1401)
1166          CALL MESSAG('1 KIP',5,2.7,2.7)
1167          CALL SETCLR('YELLOW')
1168          CALL VECTOR(1.,.5,1.,1.5,0)
1169          CALL VECTOR(4.,.5,4.,1.5,0)
1170          CALL VECTOR(8.5,.5,8.5,1.5,0)
1171          CALL VECTOR(14.5,.5,14.5,1.5,0)
1172          CALL VECTOR(1.,.7,4.,.7,1402)
1173          CALL VECTOR(4.,.7,8.5,.7,1402)
1174          CALL VECTOR(8.5,.7,14.5,.7,1402)
1175          CALL MESSAG('100',3,2.,.8)
1176          CALL MESSAG('150',3,6.,.8)
1177          CALL MESSAG('200',3,11.,.8)
1178          CALL MESSAG('(S)PAN 1',8,1.7,0.3)
1179          CALL MESSAG('(S)PAN 2',8,5.6,0.3)
1180          CALL MESSAG('(S)PAN 3',8,10.7,0.3)
1181          CALL SETCLR('WHITE')
1182          CALL RESET('HEIGHT')
1183          CALL ENDGR(0)
1184          CALL ENDPL(0)
1185          CALL TABLET('CENTER','LONG')
1186          CALL LTLINE('(A)S THE UNIT LOAD IS APPLIED SEPARATELY TO THE MIDPO
1187         *INTS OF EACH SPAN,$')
1188          CALL LTLINE('MOMENTS ARE GENERATED AT THE INTERIOR SUPPORTS, AND A
1189         *RE SHOWN TO BE...$')
1190          CALL CTLINE('$')
1191          CALL CTLINE('$')
1192          CALL LTLINE('>T1.5)  (UNIT LOAD POSITION    MOMENT AT    MOMENT AT
1193         *)$')
1194          CALL LTLINE('>T1.5)  (                      SUPPORT 2    SUPPORT 3
1195         *)$')
1196          CALL LTLINE('>T1.5)-----------------------------------------------
1197         *-$')
1198          CALL LTLINE('>T1.5)   (M)IDPOINT (S)PAN 1        - 8.02       + 1.
1199         *71$')
1200          CALL LTLINE('>T1.5)   (M)IDPOINT (S)PAN 2        -14.17       - 9.
1201         *01$')
1202          CALL LTLINE('>T1.5)   (M)IDPOINT (S)PAN 3        + 6.87       -22.
1203         *91$')
1204          CALL LTLINE('>T1.5)-----------------------------------------------
1205         *-$')
1206          CALL CTLINE('$')
1207          CALL CTLINE('$')
1208          CALL LTLINE('(I)N EFFECT, THE ABOVE TABULATED RESULTS REPRESENT IN
1209         *FLUENCE LINE ORDI-$')
1210          CALL LTLINE('NATES FOR THE TWO INTERIOR SUPPORTS AT THREE SPECIFIC
1211         * POINTS ON THE BEAM,$')
1212          CALL LTLINE('THOSE POINTS BEING THE MIDPOINT OF EACH SPAN.  (P)LAC
1213         *EMENT OF THE UNIT$')
1214          CALL LTLINE('LOAD AT OTHER POINTS WILL GENERATE ADDITIONAL VALUES
1215         *FOR THE MOMENTS AT$')
1216          CALL LTLINE('THE INTERIOR SUPPORTS AND THUS THE ENTIRE INFLUENCE L
1217         *INE IS DEVELOPED.$')
1218          CALL LTLINE('(T)HE NEGATIVE MOMENT INFLUENCE LINES FOR THE INTERIO
1219         *R SUPPORTS ARE SHOWN$')
1220          CALL LTLINE('BELOW...$')
1221          CALL CTSET(9)
1222          CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
1223          CALL ENDTAB(0)
1224          CALL INSERT(9)
1225          CALL AREA2D(16.,3.)
1226          CALL HEIGHT(.25)
1227          CALL SETCLR('CYAN')
1228          CALL VECTOR(1.,2.3,14.5,2.3,0)
1229          CALL VECTOR(.8,2.1,1.2,2.1,0)
1230          CALL VECTOR(.9,2.1,1.,2.3,0)
1231          CALL VECTOR(1.,2.3,1.1,2.1,0)
1232          CALL VECTOR(3.8,2.1,4.2,2.1,0)
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      CALL VECTOR(8.3,2.1,8.7,2.1,0)
      CALL VECTOR(14.3,2.1,14.7,2.1,0)
      CALL BLCIR(4.,2.2,.1,.01)
      CALL BLCIR(8.5,2.2,.1,.01)
      CALL BLCIR(14.5,2.2,.1,.01)
      CALL SETCLR('GREEN')
      CALL STRTPT(1.,2.3)
      DO 904 I=1,30
904   CALL CONNPT(XL1(I),YL1(I))
      CALL BLCIR(2.5,1.96,.04,.01)
      CALL BLCIR(6.25,1.7,.04,.01)
      CALL BLCIR(11.5,2.59,.04,.01)
      CALL MESSAG('-8.02',5,2.2,1.46)
      CALL MESSAG('-14.17',6,5.95,1.2)
      CALL MESSAG('+6.87',5,11.2,2.8)
      CALL VECTOR(4.,.6,6.,.6,0)
      CALL MESSAG('-(M) AT (S)UPPORT #2',20,6.5,.5)
      CALL SETCLR('YELLOW')
      CALL STRTPT(1.,2.2)
      DO 905 I=1,30
905   CALL CONNPT(XL1(I),YL2(I))
      CALL BLCIR(2.5,2.37,.04,.01)
      CALL BLCIR(6.25,1.92,.04,.01)
      CALL BLCIR(11.5,1.32,.04,.01)
      CALL MESSAG('+1.71',5,2.3,2.5)
      CALL MESSAG('-9.01',5,5.95,2.5)
      CALL MESSAG('-22.91',6,11.1,.82)
      CALL VECTOR(4.,.1,6.,.1,0)
      CALL MESSAG('-(M) AT (S)UPPORT #3',20,6.5,0)
      CALL RESET('HEIGHT')
      CALL ENDGR(0)
      CALL ENDPL(0)
      CALL TABLET('CENTER','LONG')
      CALL LTLINE('(S)EVERAL CONCLUSIONS CAN BE DRAWN FROM A QUICK INSPE
     *CTION OF THE ABOVE$')
      CALL LTLINE('INFLUENCE LINES.  (A)SSUMING A CONSTANT MOMENT OF INE
     *RTIA FOR THE BEAM,$')
      CALL LTLINE('TWO CONCLUSIONS OF SPECIAL IMPORTANCE ARE-:0)1:1) THE
     * MOMENT AT A SUPPORT$')
      CALL LTLINE('IS GREATEST WHEN THE LONGER OF ADJACENT SPANS IS LOAD
     *ED AND :0)2:1) THE MO-$')
      CALL LTLINE('MENT AT A SUPPORT MAY BE REDUCED BY LOADING APPROPRIA
     *TE NON-ADJACENT$')
      CALL LTLINE('SPANS.  (T)HE STUDENT IS ENCOURAGED TO RECOGNIZE ADDI
     *TIONAL SUCH RELATION-$')
      CALL LTLINE('SHIPS WHICH EXIST BETWEEN APPLIED LOADING AND INFLUEN
     *CE LINES.$')
      CALL CTLINE('$')
      CALL LTLINE('(A)S ONE MIGHT GUESS, THE POSITIONING OF A UNIT LOAD
     *AT SOME POINT AFFECTS$')
      CALL LTLINE('NOT ONLY THE SUPPORT MOMENTS, BUT SPAN MOMENTS, SHEAR
     *S, REACTIONS, AND DE-$')
      CALL LTLINE('FLECTIONS.  (T)HUS IT IS POSSIBLE TO DEVELOP THESE VA
     *RIOUS TYPES OF INFLU-$')
      CALL LTLINE('ENCE LINES FOR ANY SINGLE POINT ON THE BEAM.  (E)XAMP
     *LES OF THESE HAVE BEEN$')
      CALL LTLINE('SHOWN PREVIOUSLY IN THE (INTRODUCTION).$')
      CALL CTLINE('$')
      CALL LTLINE('(T)HE OBVIOUS QUESTION NOW IS--(H)OW ARE THE INFLUENC
     *E LINE ORDINATES COM-$')
      CALL LTLINE('PUTED?  (T)HE ORDINATES ARE COMPUTED USING A SYSTEM O
     *F EQUATIONS WHICH ARE$')
      CALL LTLINE('DERIVED FROM (M)OMENT (A)REA THEOREMS.  (A) BRIEF DEV
     *ELOPMENT AND PRESENTATION$')
      CALL LTLINE('OF THE EQUATIONS IS GIVEN IN PART (B) OF THIS SEGMENT
     *.$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('(P)RESS (RETURN) TO RETURN TO (D)EVELOPMENT (M)ENU...
     *$')
      CALL ENDTAB(0)
      CALL ENDPL(0)
      TYPE 785
      GO TO 470
440   TYPE 785
      TYPE 441
441   FORMAT(' INFLUENCE LINE EQUATIONS')
      TYPE 442
442   FORMAT(' ------------------------'/)
      TYPE 443
443   FORMAT(T6,'Although it is relatively simple to sketch the general
     *shape of an in-')
      TYPE 444
444   FORMAT(T6,'fluence line, the means by which influence line ordinat
     *es are computed')
      TYPE 445
445   FORMAT(T6,'is somewhat more involved.  Influence line ordinates ar
     *e computed using')
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1321            TYPE 446
1322      446   FORMAT(T6,'equations which have been developed from the fundamenta
1323           *l Moment Area')
1324            TYPE 447
1325      447   FORMAT(T6,'theorems and equations of static equilibrium.  A brief
1326           *derivation of')
1327            TYPE 448
1328      448   FORMAT(T6,'the equations is presented for the student and will ser
1329           *ve as background')
1330            TYPE 449
1331      449   FORMAT(T6,'material to be used later by the student.'/)
1332      450   TYPE 451
1333      451   FORMAT(T6,'EQUATION MENU')
1334            TYPE 452
1335      452   FORMAT(T6,'-------------'/)
1336            TYPE 453
1337      453   FORMAT(T11,'(A) 3-Moment equation')
1338            TYPE 454
1339      454   FORMAT(T11,'(B) Support moment equations')
1340            TYPE 455
1341      455   FORMAT(T11,'(C) Span moment equations')
1342            TYPE 456
1343      456   FORMAT(T11,'(D) Shear equations')
1344            TYPE 457
1345      457   FORMAT(T11,'(E) Reaction equations')
1346            TYPE 458
1347      458   FORMAT(T11,'(F) Deflection equations')
1348            TYPE 459
1349      459   FORMAT(T11,'(G) Return to Development Menu'//)
1350      460   TYPE 46
1351            ACCEPT 48, EM
1352            IF(EM.LT.'A' .OR. EM.GT.'G') GO TO 460
1353            IF(EM.EQ.'G') THEN
1354              TYPE 785
1355              GO TO 470
1356            END IF
1357            IF(EM.EQ.'A') GO TO 464
1358            IF(EM.EQ.'B') GO TO 465
1359            IF(EM.EQ.'C') GO TO 466
1360            IF(EM.EQ.'D') GO TO 467
1361            IF(EM.EQ.'E') GO TO 468
1362            IF(EM.EQ.'F') GO TO 469
1363      464   CALL TABLET('CENTER','LONG')
1364            CALL LTLINE('(3-MOMENT EQUATION)$')
1365            CALL LTLINE('(----------------)$')
1366            CALL CTLINE('$')
1367            CALL LTLINE('(A) BEAM WHICH IS CONTINUOUS OVER THREE OR MORE SUPPO
1368           *RTS AND LOADED AS SHOWN$')
1369            CALL LTLINE('IN (F)IGURE 1 CAN BE CLASSIFIED AS A STATICALLY INDET
1370           *ERMINATE STRUCTURE.$')
1371            CALL CTSET(10)
1372            CALL CTLINE('(F)IGURE 1.  (C)ONTINUOUS BEAM WITH TRANSVERSE LOADIN
1373           *G.$')
1374            CALL CTLINE('$')
1375            CALL LTLINE('(E)ACH SPAN OF THE BEAM IS ALSO STATICALLY INDETERMIN
1376           *ATE.  (H)OWEVER, IF THE$')
1377            CALL LTLINE('MOMENTS AT THE SUPPORTS ARE KNOWN, EACH SPAN CAN BE R
1378           *EPRESENTED AS A SINGLE$')
1379            CALL LTLINE('SPAN, STATICALLY DETERMINATE BEAM AND THUS THE TOTAL
1380           *BEAM WILL BE STATI-$')
1381            CALL LTLINE('CALLY DETERMINATE.$')
1382            CALL CTLINE('$')
1383            CALL LTLINE('(T)HE BEAM SHOWN IN (F)IGURE 1 WILL EXPERIENCE DEFLEC
1384           *TIONS AND ROTATIONS AT$')
1385            CALL LTLINE('EACH POINT ALONG THE LENGTH.  (T)HE BEAM ROTATIONS AT
1386           *  THE SUPPORTS ARE OF$')
1387            CALL LTLINE('PARTICULAR IMPORTANCE FOR THE DEVELOPMENT OF THE 3-MO
1388           *MENT EQUATION.  (E)QUA-$')
1389            CALL LTLINE('TIONS CAN BE WRITTEN FOR THE BEAM ROTATION AT EACH SU
1390           *PPORT BY USING MOMENT$')
1391            CALL LTLINE('AREA THEOREMS AND THE PRINCIPLE OF SUPERPOSITION.$')
1392            CALL CTLINE('$')
1393            CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
1394            CALL ENDTAB(0)
1395            CALL INSERT(10)
1396            CALL AREA2D(16.,3.)
1397            CALL HEIGHT(.25)
1398            CALL SETCLR('CYAN')
1399            CALL VECTOR(1.,1.6,15.,1.6,0)
1400            CALL VECTOR(1.8,1.4,2.2,1.4,0)
1401            CALL VECTOR(7.8,1.4,8.2,1.4,0)
1402            CALL VECTOR(13.8,1.4,14.2,1.4,0)
1403            CALL BLCIR(2.,1.5,.1,.01)
1404            CALL BLCIR(8.,1.5,.1,.01)
1405            CALL BLCIR(14.,1.5,.1,.01)
1406            CALL MESSAG('(I>L.4)N',8,4.6,1.1)
1407            CALL MESSAG('(I>L.4)N>H.8)+1',15,10.5,1.1)
1408            CALL SETCLR('GREEN')
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1409            CALL VECTOR(1.,2.,2.,2.,0)
1410            CALL VECTOR(2.,2.4,8.,2.4,0)
1411            CALL VECTOR(8.,2.,14.,2.,0)
1412            CALL VECTOR(14.,2.4,15.,2.4,0)
1413            CALL VECTOR(1.5,2.,1.5,1.7,1301)
1414            DO 900 I=2,8
1415     900    CALL VECTOR(I,2.4,I,1.7,1301)
1416            DO 901 I=9,13
1417     901    CALL VECTOR(I,2.,I,1.7,1301)
1418            CALL VECTOR(14.,2.4,14.,1.7,1301)
1419            CALL VECTOR(.9,1.4,1.1,2.2,0)
1420            CALL VECTOR(14.9,1.4,15.1,2.6,0)
1421            CALL VECTOR(4.,3.,4.,2.5,1401)
1422            CALL VECTOR(7.,3.,7.,2.5,1401)
1423            CALL VECTOR(11.,3.,11.,2.1,1401)
1424            CALL MESSAG('W>L.4)N',7.5,,2.6)
1425            CALL MESSAG('W>L.4)N>H.8)+1',14.9,,2.2)
1426            CALL MESSAG('(P>L.4H.8)1',11.4,,3.2)
1427            CALL MESSAG('(P>L.4H.8)2',11.7,,3.2)
1428            CALL MESSAG('(P>L.4H.8)3',11.11.,3.2)
1429            CALL SETCLR('YELLOW')
1430            CALL VECTOR(2.,.1,2.,.7,0)
1431            CALL VECTOR(8.,.1,8.,.7,0)
1432            CALL VECTOR(14.,.1,14.,.7,0)
1433            CALL VECTOR(2.,.3,8.,.3,1402)
1434            CALL VECTOR(8.,.3,14.,.3,1402)
1435            CALL MESSAG('L>L.4)N',7.4.6,.5)
1436            CALL MESSAG('L>L.4)N>H.8)+1',14,10.5,.5)
1437            CALL SETCLR('WHITE')
1438            CALL MESSAG('N>H.8)-1',8,1.8,.9)
1439            CALL MESSAG('N',1,8,,.9)
1440            CALL MESSAG('N>H.8)+1',8,13.8,.9)
1441            CALL RESET('HEIGHT')
1442            CALL ENDGR(0)
1443            CALL ENDPL(0)
1444            CALL TABLET('CENTER','LONG')
1445            CALL LTLINE('(F)IGURE 2 PRESENTS THE FREE-BODY DIAGRAMS OF SPANS N
1446           * AND N>H.8)+1>HX).  (I)N ORDER$')
1447            CALL LTSET(11)
1448            CALL RTSET(12)
1449            CALL CTLINE('(F)IGURE 2.  (F)REE-BODY DIAGRAMS OF SPANS N AND N>H.
1450           *8)+1>HX)$')
1451            CALL NEWSET
1452            CALL CTLINE('$')
1453            CALL LTLINE('TO MAKE USE OF THE MOMENT AREA THEOREMS, THE (M/EI) O
1454           *R (E)LASTIC (W)EIGHT DIA-$')
1455            CALL LTLINE('GRAMS ARE NEEDED FOR EACH SPAN.  (H)OWEVER, THE TOTAL
1456           * (M/EI) DIAGRAM IS TOO$')
1457            CALL LTLINE('COMPLEX FOR EASY APPLICATION OF THE MOMENT AREA THEOR
1458           *EMS.  (T)HE PRINCIPLE$')
1459            CALL LTLINE('OF SUPERPOSITION STATES THE TOTAL (M/EI) DIAGRAM MAY
1460           *BE DECOMPOSED INTO THE$')
1461            CALL LTLINE('SUM OF THE INDIVIDUAL (M/EI) DIAGRAMS.  (F)OR SPAN N,
1462           * THE (M/EI) DIAGRAMS FOR$')
1463            CALL LTLINE('THE END MOMENTS AND THE TRANSVERSE LOADING ARE SHOWN
1464           *IN (F)IGURE 3.$')
1465            CALL LTSET(13)
1466            CALL CTSET(14)
1467            CALL RTSET(15)
1468            CALL CTLINE('(F)IGURE 3.  (M/EI) DIAGRAMS FOR SPAN N.$')
1469            CALL CTLINE('$')
1470            CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
1471            CALL ENDTAB(0)
1472            CALL INSERT(11)
1473            CALL AREA2D(8.,3.)
1474            CALL HEIGHT(.25)
1475            CALL SETCLR('CYAN')
1476            CALL VECTOR(1.,1.6,7.,1.6,0)
1477            CALL MESSAG('(I>L.4)N',8,3.5,1.1)
1478            CALL SETCLR('RED')
1479            CALL VECTOR(1.,.9,1.,1.5,1401)
1480            CALL VECTOR(7.,1.5,7.,.9,1401)
1481            X=1.
1482            Y=1.6
1483            CALL ARC1(X,Y)
1484            X=7.
1485            Y=1.6
1486            CALL ARC2(X,Y)
1487            CALL SETCLR('GREEN')
1488            CALL VECTOR(1.,2.4,7.,2.4,0)
1489            DO 902 I=1,7
1490     902    CALL VECTOR(I,2.4,I,1.7,1301)
1491            CALL VECTOR(3.,3.,3.,2.5,1401)
1492            CALL VECTOR(6.,3.,6.,2.5,1401)
1493            CALL MESSAG('W>L.4)N',7.4.,2.6)
1494            CALL MESSAG('(P>L.4H.8)1',11.3.,3.2)
1495            CALL MESSAG('(P>L.4H.8)2',11.6.,3.2)
1496            CALL SETCLR('YELLOW')
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1497          CALL VECTOR(1.,1.,1.,7,0)
1498          CALL VECTOR(7.,1.,7.,7,0)
1499          CALL VECTOR(1.,3.,7.,3,1402)
1500          CALL MESSAG('L>L.4)N',7,3.7,.5)
1501          CALL SETCLR('WHITE')
1502          CALL MESSAG('>L.4)R>LX)(V>L.4)N>H.8)-1',25,1.2,.9)
1503          CALL MESSAG('>L.4)L>LX)(V>L.4)N',18,7.2,.9)
1504          CALL MESSAG('(M>L.4)N>H.8)-1',15,0.,1.0)
1505          CALL MESSAG('(M>L.4)N',8,7.6,1.4)
1506          CALL RESET('HEIGHT')
1507          CALL ENDGR(0)
1508          CALL INSERT(12)
1509          CALL AREA2D(8.,3.)
1510          CALL HEIGHT(.25)
1511          CALL SETCLR('CYAN')
1512          CALL VECTOR(1.,1.6,7.,1.6,0)
1513          CALL MESSAG('(I>L.4)N>H.8)+1',15,3.5,1.1)
1514          CALL SETCLR('RED')
1515          CALL VECTOR(1.,.9,1.,1.5,1401)
1516          CALL VECTOR(7.,1.5,7.,.9,1401)
1517          X=1.
1518          Y=1.6
1519          CALL ARC1(X,Y)
1520          X=7.
1521          Y=1.6
1522          CALL ARC2(X,Y)
1523          CALL SETCLR('GREEN')
1524          CALL VECTOR(1.,2.0,7.,2.0,0)
1525          DO 903 I=1,7
1526    903   CALL VECTOR(I,2.0,I,1.7,1301)
1527          CALL VECTOR(4.,3.,4.,2.1,1401)
1528          CALL MESSAG('W>L.4)N>H.8)+1',14,3.,2.2)
1529          CALL MESSAG('(P>L.4H.8)3',11,4.,3.2)
1530          CALL SETCLR('YELLOW')
1531          CALL VECTOR(1.,1.,1.,7,0)
1532          CALL VECTOR(7.,1.,7.,7,0)
1533          CALL VECTOR(1.,3.,7.,3,1402)
1534          CALL MESSAG('L>L.4)N>H.8)+1',14,3.5,.5)
1535          CALL SETCLR('WHITE')
1536          CALL MESSAG('>L.4)R>LX)(V>L.4)N',18,1.2,.9)
1537          CALL MESSAG('>L.4)L>LX)(V>L.4)N>H.8)+1',25,7.2,.9)
1538          CALL MESSAG('(M>L.4)N',8,.3,1.0)
1539          CALL MESSAG('(M>L.4)N>H.8)+1',15,7.6,1.4)
1540          CALL RESET('HEIGHT')
1541          CALL ENDGR(0)
1542          CALL INSERT(13)
1543          CALL AREA2D(8.,3.)
1544          CALL HEIGHT(.3)
1545          CALL SETCLR('CYAN')
1546          CALL VECTOR(1.,1.5,7.,1.5,0)
1547          CALL SETCLR('MAGENTA')
1548          CALL VECTOR(1.,1.5,1.,2.5,0)
1549          CALL VECTOR(1.,2.5,7.,1.5,0)
1550          CALL SETCLR('WHITE')
1551          CALL MESSAG('0',1.,.5,1.3)
1552          CALL MESSAG('0',1.7,2,1.3)
1553          CALL MESSAG('>PE.4)(M>E.2)N>H.8)-1>HXEXU',27,0.0,2.5)
1554          CALL MESSAG('(EI>L.2)N',9,0.0,2.0)
1555          CALL MESSAG('A. LEFT SUPPORT MOMENT',22,1.,.5)
1556          CALL RESET('HEIGHT')
1557          CALL ENDGR(0)
1558          CALL INSERT(14)
1559          CALL AREA2D(8.,3.)
1560          CALL HEIGHT(.3)
1561          CALL SETCLR('CYAN')
1562          CALL VECTOR(1.,1.5,7.,1.5,0)
1563          CALL SETCLR('MAGENTA')
1564          CALL STRTPT(1.,1.50)
1565          CALL CONNPT(2.,2.06)
1566          CALL CONNPT(3.,2.44)
1567          CALL CONNPT(4.,2.50)
1568          CALL CONNPT(5.,2.39)
1569          CALL CONNPT(6.,2.11)
1570          CALL CONNPT(7.,1.50)
1571          CALL VECTOR(3.7,2.3,3.7,1.7,1401)
1572          CALL MESSAG('(A>L.4)N',8,3.9,1.9)
1573          CALL SETCLR('YELLOW')
1574          CALL VECTOR(1.,3.,1.,1.8,0)
1575          CALL VECTOR(3.7,3.,3.7,2.6,0)
1576          CALL VECTOR(7.,3.,7.,1.8,0)
1577          CALL VECTOR(1.,2.8,3.7,2.8,1402)
1578          CALL VECTOR(3.7,2.8,7.,2.8,1402)
1579          CALL MESSAG('C>L.4)N',7,2.2,3.)
1580          CALL MESSAG('D>L.4)N',7,5.2,3.)
1581          CALL SETCLR('WHITE')
1582          CALL MESSAG('0',1.,.5,1.3)
1583          CALL MESSAG('0',1.7,2,1.3)
1584          CALL MESSAG('B. BEAM LOADING MOMENT',22,1.,.5)
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      CALL RESET('HEIGHT')
      CALL ENDGR(0)
      CALL INSERT(15)
      CALL AREA2D(8.,3.)
      CALL HEIGHT(.3)
      CALL SETCLR('CYAN')
      CALL VECTOR(1.,1.5,7.,1.5,0)
      CALL SETCLR('MAGENTA')
      CALL VECTOR(1.,1.5,7.,2.5,0)
      CALL VECTOR(7.,2.5,7.,1.5,0)
      CALL SETCLR('WHITE')
      CALL MESSAG('0',1.,.5,1.3)
      CALL MESSAG('0',1.,7.2,1.3)
      CALL MESSAG('>PE.4)(M>E.2)N>EXUGL1.8)(EI>L2.)N',33,7.2,7.5)
      CALL MESSAG('C. RIGHT SUPPORT MOMENT',23,1.,.5)
      CALL RESET('HEIGHT')
      CALL ENDGR(0)
      CALL ENDPL(0)
      CALL TABLET('CENTER','LONG')
      CALL LTLINE('(T)HE TERM, (A>L.2)N>LX), IN (F)IGURE 3 IS THE AREA O
     *F THE BEAM LOADING (M/EI) DIAGRAM,$')
      CALL LTLINE('AND C>L.2)N>LX) & D>L.2)N>LX) DEFINE THE LOCATION OF
     *THE CENTROID OF AREA (A>L.2)N>LX).$')
      CALL CTLINE('$')
      CALL LTLINE('(A)PPLICATION OF THE MOMENT AREA THEOREMS YIELDS EQUA
     *TIONS FOR THE BEAM RO-$')
      CALL LTLINE('TATIONS AT SUPPORTS N>H.8)-1>HX) AND N.$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('>T2.5L.7*Q)>L.9)N>H.8)-1>HXL.7) = >LXPE.4)(M>E.2)N>H.
     *6)-1>HXE.4)L>E.2)N>EXUB5L1.8)3(EI>L2.)N>LXA1)$')
      CALL LTLINE('>01.5T3.9L.7) + >PL1.8)(EI>L2.)N>L1.8)L>L2.)N>LXUB5E.
     *4)(A>E.2)N>E.4)D>E.2)N>EXA1)$')
      CALL LTLINE('>03.0T4.8L.7) + >PE.4)(M>E.2)N>E.4)L>E.2)N>EXUGL1.8)6
     *(EI>L2.)N>LX)$')
      CALL LTLINE('>04.0T8.5:8)1:9)$')
      CALL LTLINE('>T2.6L.7*Q)>L.9)N>L.7) = >LXPE.4)(M>E.2)N>H.8)-1>HXE.
     *4)L>E.2)N>EXUB5L1.8)6(EI>L2.)N>LXA1)$')
      CALL LTLINE('>01.5T3.9L.7) + >PL1.8)(EI>L2.)N>L1.8)L>L2.)N>LXUB5E.
     *4)(A>E.2)N>E.4)C>E.2)N>EXA1)$')
      CALL LTLINE('>03.0T4.8L.7) + >PE.4)(M>E.2)N>E.4)L>E.2)N>EXUGL1.8)3
     *(EI>L2.)N>LX)$')
      CALL LTLINE('>04.0T8.5:8)2:9)$')
      CALL LTLINE('>T1.5*Q)>L.2)N>H.8)-1>HXLX) = BEAM ROTATION ON RIGHT
     *SIDE OF SUPPORT$')
      CALL LTLINE('>T2.3)N>H.8)-1>HX) MEASURED CLOCKWISE.$')
      CALL CTLINE('$')
      CALL LTLINE('>T1.7*Q)>L.2)N>LX) = BEAM ROTATION ON LEFT SIDE OF SU
     *PPORT$')
      CALL LTLINE('>T2.3)N MEASURED COUNTERCLOCKWISE.$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('(R)EPEATING THE PREVIOUS PROCEDURE FOR SPAN N>H.8)+1>
     *HX) RESULTS IN TWO ADDITIONAL$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
      CALL ENDTAB(0)
      CALL ENDPL(0)
      CALL TABLET('CENTER','LONG')
      CALL LTLINE('EQUATIONS FOR THE BEAM ROTATIONS AT THE ENDS OF SPAN
     *N>H.8)+1>HX)...$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('>T2.1L.7*Q)>PL.9)N>LXGE.3),>EXL.7) = >LXPE.4)(M>E.2)N
     *>E.4)L>E.2)N>H.8)+1>HXEXUGL1.8)3(EI>L2.)N>H.8)+1>HXLX)$')
      CALL LTLINE('>01.5T3.4L.7) + >PL1.8)(EI>L2.)N>H.8)+1>HXL1.8)L>L2.)
     *N>H.8)+1>HXLXUB9E.4)(A>E.2)N>H.8)+1>HXE.4)D>E.2)N>H.8)+1>HXEXA1)$'
     *)
      CALL LTLINE('>03.0T4.8L.7) + >LXPE.4)(M>E.2)N>H.8)+1>HXE.4)L>E.2)N
     *>H.8)+1>HXEXUB7L1.8)6(EI>L2.)N>H.8)+1>HXLX)$')
      CALL LTLINE('>04.0T8.5:8)3:9)$')
      CALL LTLINE('>T2.L.7*Q)>L.9)N>H.8)+1>HXL.7) = >LXPE.4)(M>E.2)N>E.4
     *)L>E.2)N>H.8)+1>HXEXUGL1.8)6(EI>L2.)N>H.8)+1>HXLX)$')
      CALL LTLINE('>01.5T3.4L.7) + >PL1.8)(EI>L2.)N>H.8)+1>HXL1.8)L>L2.)
     *N>H.8)+1>HXLXUB9E.4)(A>E.2)N>H.8)+1>HXE.4)C>E.2)N>H.8)+1>HXEXA1)$'
     *)
      CALL LTLINE('>03.0T4.8L.7) + >LXPE.4)(M>E.2)N>H.8)+1>HXE.4)L>E.2)N
     *>H.8)+1>HXEXUB7L1.8)3(EI>L2.)N>H.8)+1>HXLX)$')
      CALL LTLINE('>04.0T8.5:8)4:9)$')
      CALL LTLINE('>T1.7*Q)>L.2)N>LXB1E1.),>EX) = BEAM ROTATION ON RIGHT
     * SIDE OF SUPPORT$')
      CALL LTLINE('>T2.3)N MEASURED COUNTERCLOCKWISE.$')
      CALL CTLINE('$')
      CALL LTLINE('>T1.5*Q)>L.2)N>H.8)+1>HXLX) = BEAM ROTATION ON LEFT S
     *IDE OF SUPPORT$')
      CALL LTLINE('>T2.3)N>H.8)+1>HX) MEASURED COUNTERCLOCKWISE.$')
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1673          CALL CTLINE('$')
1674          CALL CTLINE('$')
1675          CALL LTLINE('(S)LOPE COMPATABILITY AT SUPPORT N PROVIDES THE THIRD
1676         * EQUATION...$')
1677          CALL CTLINE('$')
1678          CALL CTLINE('$')
1679          CALL LTLINE('>T3.0)*Q)>L.2)N>LX) = -*Q)>PL.2)N>LXGE1.),>EX)$')
1680          CALL LTLINE('>01.0T3.5:8)5:9)$')
1681          CALL CTLINE('$')
1682          CALL LTLINE('(S)UBSTITUTING EQUATIONS 2 AND 3 INTO EQUATION 5 YIEL
1683         *DS THE GENERAL$')
1684          CALL CTLINE('$')
1685          CALL CTLINE('$')
1686          CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
1687          CALL ENDTAB(0)
1688          CALL ENDPL(0)
1689          CALL TABLET('CENTER','LONG')
1690          CALL LTLINE('3-MOMENT EQUATION FOR A BEAM WITH SUPPORTS AT A CONST
1691         *ANT ELEVATION.$')
1692          CALL CTLINE('$')
1693          CALL LTLINE('>0-3.0T.5PE.4)(M>E.2)N>H.8)-1>HXE.4)L>E.2)N>EXUB4L1.8
1694         *)(I>L2.)N>LXA1)$')
1695          CALL LTLINE('>0-1.5T1.2L.7) + 2(M>L.9)N>L1.H2:8>LXHX)$')
1696          CALL LTLINE('>T2.1PE.4)L>E.2)N>EXUGL1.8)(I>L2.)N>L.7) + >LXPE.4)L>
1697         *E.2)N>H.8)+1>HXEXUGL1.8)(I>L2.)N>H.8)+1>HXL1.H2:9>LXHX)$')
1698          CALL LTLINE('>01.5T3.3L.7) + >LXPE.4)(M>E.2)N>H.8)+1>HXE.4)L>E.2)N
1699         *>H.8)+1>HXEXUB6L1.8)(I>L2.)N>H.8)+1>HXLX)$')
1700          CALL LTLINE('>03.0T4.6L.7)= -6>L1.H2:8>LXHXPE.4)(A>E.2)N>E.4)C>E.2
1701         *)N>EXUGL1.8)(I>L2.)N>L1.8)L>L2.)N>LXA1L.7)+>LX)$')
1702          CALL LTLINE('>04.5T6.3PE.4)(A>E.2)N>H.8)+1>HXE.4)D>E.2)N>H.8)+1>EX
1703         *HXUGL1.8)(I>L2.)N>H.8)+1>HXL1.8)L>L2.)N>H.8)+1>HXA1L1.H2:9)>HXLX)$
1704         *')
1705          CALL LTLINE('>05.5T8.5:8)6:9)$')
1706          CALL LTLINE('(I)NSPECTION OF THE TERMS ON THE RIGHT-HAND SIDE OF E
1707         *QUATION 6 REVEALS...$')
1708          CALL CTLINE('$')
1709          CALL CTLINE('$')
1710          CALL LTLINE('>T1.5PE.4)(A>E.2)N>E.4)C>E.2)N>EXUGL1.8)(I>L2.)N>L1.8
1711         *)L>L2.)N>L.7) =>LX)$')
1712          CALL LTLINE('>01.5T2.5L.7)RIGHT REACTION OF THE (M/EI) DIAGRAM>LX)
1713         *$')
1714          CALL LTLINE('>01.5T2.5L.7)FOR SPAN N, SEE (F)IGURE 3B.>LX)$')
1715          CALL CTLINE('$')
1716          CALL CTLINE('$')
1717          CALL LTLINE('>T1.5PE.4)(A>E.2)N>H.8)+1>HXE.4)D>E.2)N>H.8)+1>HXEXUG
1718         *L1.8)(I>L2.)N>H.8)+1>HXL1.8)L>L2.)N>H.8)+1>HXL.7) =>LX)$')
1719          CALL LTLINE('>01.5T2.8L.7)LEFT REACTION OF THE (M/EI) DIAGRAM>LX)$
1720         *')
1721          CALL LTLINE('>01.5T2.8L.7)FOR SPAN N>H.8)+1>HX), SEE (F)IGURE 3B.>
1722         *LX)$')
1723          CALL CTLINE('$')
1724          CALL CTLINE('$')
1725          CALL LTLINE('(T)HUS, THE RIGHT-HAND SIDE OF EQUATION 6 IS SIMPLY E
1726         *QUAL TO 6 TIMES THE$')
1727          CALL LTLINE('REACTION OF THE ELASTIC WEIGHT DIAGRAMS OF THE ADJACE
1728         *NT SPANS.$')
1729          CALL CTLINE('$')
1730          CALL CTLINE('$')
1731          CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
1732          CALL ENDTAB(0)
1733          CALL ENDPL(0)
1734          CALL TABLET('CENTER','LONG')
1735          CALL LTLINE('(S)UBSTITUTING THE LETTER (R) FOR THESE REACTIONS, EQ
1736         *UATION 6 BECOMES...$')
1737          CALL CTLINE('$')
1738          CALL LTLINE('>0-3.0T1.5PE.4)(M>E.2)N>H.8)-1>HXE.4)L>E.2)N>EXUB4L1.
1739         *8)(I>L2.)N>LXA1)$')
1740          CALL LTLINE('>0-1.5T2.2L.7) + 2(M>L.9)N>L1.H2:8>LXHX)$')
1741          CALL LTLINE('>T3.1PE.4)L>E.2)N>EXUGL1.8)(I>L2.)N>L.7) + >LXPE.4)L>
1742         *E.2)N>H.8)+1>HXEXUGL1.8)(I>L2.)N>H.8)+1>HXL1.H2:9>LXHX)$')
1743          CALL LTLINE('>01.5T4.3L.7) + >LXPE.4)(M>E.2)N>H.8)+1>HXE.4)L>E.2)N
1744         *>H.8)+1>HXEXUB6L1.8)(I>L2.)N>H.8)+1>HXA2L.7) = -6(R)>LX)$')
1745          CALL LTLINE('>02.5T8.5:8)7:9)$')
1746          CALL CTLINE('$')
1747          CALL LTLINE('(E)QUATION 7 IS ONLY APPLICABLE TO A CONTINUOUS BEAM
1748         *WHOSE SUPPORTS ARE$')
1749          CALL LTLINE('AT A COMMON ELEVATION.  (F)OR MOST REAL LIFE CASES HO
1750         *WEVER, SUPPORT ELEVA-$')
1751          CALL CTSET(16)
1752          CALL CTLINE('(F)IGURE 4.  (V)ERTICAL BEAM DISPLACEMENTS.$')
1753          CALL CTLINE('$')
1754          CALL CTLINE('$')
1755          CALL LTLINE('TIONS MAY VARY BECAUSE OF SETTLEMENT OR INITIAL PLACE
1756         *MENT.  (F)IGURE 4 IL-$')
1757          CALL LTLINE('LUSTRATES A CONTINUOUS BEAM WHOSE THREE ADJACENT SUPP
1758         *ORTS HAVE UNDERGONE$')
1759          CALL LTLINE('VERTICAL DEFLECTIONS.  (E)XPRESSIONS FOR BEAM SLOPE I
1760         *N SPANS N AND N>H.8)+1>HX) CAN$')
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1761          CALL LTLINE('BE WRITTEN AS FOLLOWS...$')
1762          CALL CTLINE('$')
1763          CALL LTLINE('>T2.2L.7*Q)>L.9)N>L.7) = >LXPE.4*D)>E.2)N>E.4)-*D)>E.
1764         *2)N>H.8)-1>HXEXUB5L1.8)L>L2.)N>LX)$')
1765          CALL LTLINE('>01.5T4.2L.7*Q)>L.9)N>H.8)+1>HXL.7) = >LXPE.4*D)>E.2)
1766         *N>H.8)+1>HXE.4)-*D)>E.2)N>EXUB5L1.8)L>L2.)N>H.8)+1>HXLX)$')
1767          CALL CTLINE('$')
1768          CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
1769          CALL ENDTAB(0)
1770          CALL INSERT(16)
1771          CALL AREA2D(16.,3.)
1772          CALL HEIGHT(.25)
1773          CALL SETCLR('CYAN')
1774          CALL VECTOR(1.,2.8,15.,2.8,0)
1775          CALL VECTOR(1.8,2.6,2.2,2.6,0)
1776          CALL VECTOR(7.8,2.6,8.2,2.6,0)
1777          CALL VECTOR(13.8,2.6,14.2,2.6,0)
1778          CALL BLCIR(2.,2.7,.1,.01)
1779          CALL BLCIR(8.,2.7,.1,.01)
1780          CALL BLCIR(14.,2.7,.1,.01)
1781          CALL VECTOR(1.,1.6,15.,.2,0)
1782          CALL VECTOR(1.8,1.3,2.2,1.3,0)
1783          CALL VECTOR(7.8,.7,8.2,.7,0)
1784          CALL VECTOR(13.8,.1,14.2,.1,0)
1785          CALL BLCIR(2.,1.4,.1,.01)
1786          CALL BLCIR(8.,.8,.1,.01)
1787          CALL BLCIR(14.,.2,.1,.01)
1788          CALL VECTOR(.9,2.6,1.1,3.,0)
1789          CALL VECTOR(14.9,2.6,15.1,3.,0)
1790          CALL VECTOR(.9,1.4,1.1,1.8,0)
1791          CALL VECTOR(14.9,0.,15.1,.4,0)
1792          CALL MESSAG('L>L.4)N',7,4.5,3.)
1793          CALL MESSAG('L>L.4)N>H.8)+1',14,10.5,3.)
1794          CALL MESSAG('(I>L.4)N',8,4.5,2.3)
1795          CALL MESSAG('(I>L.4)N>H.8)+1',15,10.5,2.3)
1796          CALL SETCLR('YELLOW')
1797          CALL VECTOR(2.4,1.5,5.,1.5,0)
1798          CALL VECTOR(8.4,.9,11.,.9,0)
1799          CALL VECTOR(14.4,.3,15.,.3,0)
1800          CALL VECTOR(2.8,2.8,2.8,1.5,1402)
1801          CALL VECTOR(8.8,2.8,8.8,.9,1402)
1802          CALL VECTOR(14.8,2.8,14.8,.3,1402)
1803          CALL VECTOR(4.45,2.,4.49,1.75,0)
1804          CALL VECTOR(4.49,1.75,4.5,1.5,1301)
1805          CALL VECTOR(4.39,.76,4.45,1.,0)
1806          CALL VECTOR(4.45,1.,4.49,1.25,1301)
1807          CALL VECTOR(4.49,1.25,4.5,1.5,0)
1808          CALL VECTOR(10.45,1.4,10.49,1.15,0)
1809          CALL VECTOR(10.49,1.19,10.5,.9,1301)
1810          CALL VECTOR(10.39,.16,10.45,.4,0)
1811          CALL VECTOR(10.45,.4,10.49,.65,1301)
1812          CALL VECTOR(10.49,.65,10.5,.9,0)
1813          CALL MESSAG('*D)>L.4)N>H.8)-1',16,3.,2.1)
1814          CALL MESSAG('*D)>L.4)N',9,9,1.7)
1815          CALL MESSAG('*D)>L.4)N>H.8)+1',16,15.,1.3)
1816          CALL MESSAG('*Q)>L.4)N',9,4.7,1.7)
1817          CALL MESSAG('*Q)>L.4)N>H.8)+1',16,10.7,1.1)
1818          CALL SETCLR('WHITE')
1819          CALL MESSAG('N>H.8)-1',8,1.8,2.1)
1820          CALL MESSAG('N',1,8.,2.1)
1821          CALL MESSAG('N>H.8)+1',8,13.8,2.1)
1822          CALL RESET('HEIGHT')
1823          CALL ENDGR(0)
1824          CALL ENDPL(0)
1825          CALL TABLET('CENTER','LONG')
1826          CALL LTLINE('(T)HESE EXPRESSIONS CAN BE INCLUDED IN EQUATIONS 2 AN
1827         *D 3 TO YIELD...$')
1828          CALL CTLINE('$')
1829          CALL LTLINE('>0-1.5T1.5L.7*Q)>L.9)N>L.7) = >LXPE.4)(M>E.2)N>H.8)-1
1830         *>HXE.4)L>E.2)N>EXUB5L1.8)6(EI>L2.)N>LXA1)$')
1831          CALL LTLINE('>T2.8L.7) + >PL1.8)(EI>L2.)N>L1.8)L>L2.)N>LXUB5)>E.4)
1832         *(A>E.2)N>E.4)C>E.2)N>EXA1)$')
1833          CALL LTLINE('>01.5T3.8L.7) + >PE.4)(M>E.2)N>E.4)L>E.2)N>EXUGL1.8)3
1834         *(EI>L2.)N>LX)$')
1835          CALL LTLINE('>03.0T4.8L.7)- >LXPE.4*D)>E.2)N>E.4)-*D)>E.2)N>H.8)-1
1836         *>HXEXUB5L1.8)L>L2.)N>LX)$')
1837          CALL LTLINE('>04.0T8.5:8)8:9)$')
1838          CALL LTLINE('>T1.5L.7*Q)>PL.9)N>GLXE.2),>EXL.7) = >LXPE.4)(M>E.2)N
1839         *>E.4)L>E.2)N>H.8)+1>HXEXUGL1.8)3(EI>L2.)N>H.8)+1>HXLX)$')
1840          CALL LTLINE('>01.5T2.8L.7) + >PL1.8)(EI>L2.)N>H.8)+1>HXL1.8)L>L2.)
1841         *N>H.8)+1>HXLXUB9E.4)(A>E.2)N>H.8)+1>HXE.4)D>E.2)N>H.8)+1>HXEXA1)$'
1842         *)
1843          CALL LTLINE('>03.0T4.1L.7) + >LXPE.4)(M>E.2)N>H.8)+1>HXE.4)L>E.2)N
1844         *>H.8)+1>HXEXUB7L1.8)6(EI>L2.)N>H.8)+1>HXLX)$')
1845          CALL LTLINE('>04.5T5.4L.7)+ >PE.4*D)>E.2)N>H.8)+1>HXE.4)-*D)>E.2)N
1846         *>EXUB5L1.8)L>L2.)N>H.8)+1>HXLX)$')
1847          CALL LTLINE('>05.5T8.5:8)9:9)$')
1848          CALL LTLINE('(S)UBSTITUTING EQUATIONS 8 AND 9 INTO EQUATION 5, THE
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1849          * GENERAL 3-MOMENT$')
1850           CALL LTLINE('EQUATION BECOMES...$')
1851           CALL REQ1
1852           CALL LTLINE('>05.5T8.5:8)10:9)$')
1853           CALL LTLINE('.E)QUATION 10 THUS EXPRESSES A RELATIONSHIP BETWEEN T
1854          *HE NEGATIVE SUPPORTS$')
1855           CALL LTLINE('MOMENTS OF THREE ADJACENT SUPPORTS.  (I)T IS THIS EQU
1856          *ATION WHICH WILL BE$')
1857           CALL LTLINE('USED TO COMPUTE ORDINATES FOR SUPPORT MOMENT INFLUENC
1858          *E LINES.  (I)NFLUENCE$')
1859           CALL LTLINE('LINE ORDINATES FOR SPAN MOMENTS, SHEARS, REACTIONS, A
1860          *ND DEFLECTIONS CAN$')
1861           CALL LTLINE('THEN BE COMPUTED ONCE THE SUPPORT MOMENT INFLUENCE LI
1862          *NES ARE ESTABLISHED.$')
1863           CALL CTLINE('$')
1864           CALL CTLINE('$')
1865           CALL LTLINE('(P)RESS (RETURN) TO RETURN TO (E)QUATION (M)ENU...$')
1866           CALL ENDTAB(0)
1867           CALL ENDPL(0)
1868           GO TO 999
1869      465  CALL TABLET('CENTER','LONG')
1870           CALL LTLINE('(SUPPORT MOMENT EQUATIONS)$')
1871           CALL LTLINE('(-----------------------)$')
1872           CALL CTLINE('$')
1873           CALL LTLINE('(R)ECALL FROM PREVIOUS WORK, THE GENERAL FORM OF THE
1874          *3-MOMENT EQUATION...$')
1875           CALL REQ1
1876           CALL LTLINE('>05.5T8.5:8)11:9)$')
1877           CALL LTLINE('(T)HIS EQUATION EXPRESSES A RELATIONSHIP BETWEEN THE
1878          *MOMENTS AT THREE CON-$')
1879           CALL LTLINE('SECUTIVE SUPPORTS AND THE PHYSICAL PROPERTIES OF THE
1880          *BEAM.  (A)PPLICATION$')
1881           CALL LTLINE('OF THE 3-MOMENT EQUATION TO A CONTINUOUS BEAM WITH N
1882          *SPANS, YIELDS A SYS-$')
1883           CALL LTLINE('TEM OF N>H.8)-1>HX) EQUATIONS WHICH ARE THEN SOLVED S
1884          *IMULTANEOUSLY FOR THE MOMENTS$')
1885           CALL LTLINE('AT THE SUPPORTS.  (F)OR EXAMPLE, CONSIDER THE FOLLOWI
1886          *NG 3-SPAN BEAM...$')
1887           CALL CTSET(17)
1888          *CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
1889           CALL ENDTAB(0)
1890           CALL INSERT(17)
1891           CALL AREA2D(16.,3.)
1892           CALL HEIGHT(.25)
1893           CALL SETCLR('CYAN')
1894           CALL VECTOR(2.,2.,14.,2.,0)
1895           CALL VECTOR(1.8,1.8,2.2,1.8,0)
1896           CALL VECTOR(5.8,1.8,6.2,1.8,0)
1897           CALL VECTOR(9.8,1.8,10.2,1.8,0)
1898           CALL VECTOR(13.8,1.8,14.2,1.8,0)
1899           CALL VECTOR(1.9,1.8,2.,2.,0)
1900           CALL VECTOR(2.,2.,2.1,1.8,0)
1901           CALL BLCIR(6.,1.9,.1,.01)
1902           CALL BLCIR(10.,1.9,.1,.01)
1903           CALL BLCIR(14.,1.9,.1,.01)
1904           CALL MESSAG('(I>L.4H.8)1',11,3.7,1.6)
1905           CALL MESSAG('(I>L.4H.8)2',11,7.7,1.6)
1906           CALL MESSAG('(I>L.4H.8)3',11,11.7,1.6)
1907           CALL MESSAG('1',1,1.9,2.2)
1908           CALL MESSAG('2',1,5.9,2.2)
1909           CALL MESSAG('3',1,9.9,2.2)
1910           CALL MESSAG('4',1,13.9,2.2)
1911           CALL SETCLR('YELLOW')
1912           CALL VECTOR(2.,.5,2.,1.5,0)
1913           CALL VECTOR(6.,.5,6.,1.5,0)
1914           CALL VECTOR(10.,.5,10.,1.5,0)
1915           CALL VECTOR(14.,.5,14.,1.5,0)
1916           CALL VECTOR(2.,.7,6.,.7,1402)
1917           CALL VECTOR(6.,.7,10.,.7,1402)
1918           CALL VECTOR(10.,.7,14.,.7,1402)
1919           CALL MESSAG('L>L.4H.8)1',10,3.7,.9)
1920           CALL MESSAG('L>L.4H.8)2',10,7.7,.9)
1921           CALL MESSAG('L>L.4H.8)3',10,11.7,.9)
1922           CALL SETCLR('WHITE')
1923           CALL RESET('HEIGHT')
1924           CALL ENDGR(0)
1925           CALL ENDPL(0)
1926           CALL TABLET('CENTER','LONG')
1927           CALL LTLINE('(A)PPLYING THE 3-MOMENT EQUATION TO SUPPORTS 1, 2, AN
1928          *D 3, WE HAVE...$')
1929           CALL CTLINE('$')
1930           CALL CTLINE('$')
1931           CALL CTLINE('$')
1932           CALL LTLINE('>T2.3L.7)2(M>L.9H.8)2>L1.H2:8>LXHXPE.4)L>E.2H.8)1>HXE
1933          *XUGL1.8)(I>L2.H.8)1>HXL.7) + >LXPE.4)L>E.2H.8)2>EXHXUGL1.8)(I>L2.H
1934          *.8)2>L1.H2:9)>HXLX)$')
1935           CALL LTLINE('>01.5T3.9L.7)+ (M>L.9H.8)3>L1.H2:8>LXHXPE.4)L>E.2H.8)
1936          *2>HXLXUGL1.8)(I>L2.H.8)2>L1.H2:9)>HXL.7) = -6(A>LX)$')
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1937          CALL LTLINE('>02.5T8.5:8)12:9)$')
1938          CALL CTLINE('$')
1939          CALL CTLINE('$')
1940          CALL LTLINE('AND APPLYING THE 3-MOMENT EQUATION TO SUPPORTS 2, 3,
1941         *AND 4, WE HAVE...$')
1942          CALL CTLINE('$')
1943          CALL CTLINE('$')
1944          CALL CTLINE('$')
1945          CALL LTLINE('>T2.3L.7)(M>L.9H.8)2>L1.H2:8>LXHXPE.4)L>E.2H.8)2>HXEX
1946         *UGL1.8)(I>L2.H.8)2>L1.H2:9)>HXL.7) +>LX)$')
1947          CALL LTLINE('>01.5T3.5L.7)2(M>L.9H.8)3>L1.H2:8>LXHXPE.4)L>E.2H.8)2
1948         *>HXEXUGL1.8)(I>L2.H.8)2>HXL.7) + >LXPE.4)L>E.2H.8)3>EXHXUGL1.8)(I>
1949         *L2.H.8)3>L1.H2:9)>LXHX)$')
1950          CALL LTLINE('>03.0T5.1L.7)= -6(B>LX)$')
1951          CALL LTLINE('>04.0T8.5:8)13:9)$')
1952          CALL CTLINE('$')
1953          CALL LTLINE('WHERE (M>L.2H.8)1>HXLX)=(M>L.2H.8)4>LXHX)=0, *D)>L.2H
1954         *.8)2>LXHX)-*D)>L.2H.8)1>LXHX)=*D)>L.2H.8)3>LXHX)-*D)>L.2H.8)2>LXHX
1955         *)=$')
1956          CALL LTLINE('>01.5T3.2*D)>L.2H.8)4>LXHX)-*D)>L.2H.8)3>LXHX)=0, AND
1957         * THE (A) AND (B) TERMS WILL BE DIS-$')
1958          CALL LTLINE('>01.5)CUSSED LATER.$')
1959          CALL CTLINE('$')
1960          CALL LTLINE('(T)HUS 2 EQUATIONS WITH 2 UNKNOWNS HAVE BEEN GENERATE
1961         *D AND CAN BE SOLVED$')
1962          CALL LTLINE('SIMULTANEOUSLY FOR THE MOMENTS AT THE TWO INTERIOR SU
1963         *PPORTS.  (T)HE SAME$')
1964          CALL LTLINE('PROCEDURE CAN BE REPEATED FOR BEAMS WITH ANY NUMBER O
1965         *F SPANS, BUT ONLY 2,$')
1966          CALL LTLINE('3, AND 4 SPAN BEAMS ARE USED IN THIS PROGRAM AND THE
1967         *RESULTING EQUATIONS$')
1968          CALL LTLINE('ARE LISTED ON THE NEXT PAGE.$')
1969          CALL CTLINE('$')
1970          CALL CTLINE('$')
1971          CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
1972          CALL ENDTAB(0)
1973          CALL ENDPL(0)
1974          CALL TABLET('CENTER','LONG')
1975          CALL LTLINE('>PE.4)(2-SPAN BEAM)>EXUA5E.4)(M>E.2H.8)1>HXE.4) = (M>
1976         *E.2H.8)3>HXE.4) = 0>EX)$')
1977          CALL CTLINE('$')
1978          CALL CTLINE('$')
1979          CALL REQ2
1980          CALL LTLINE('>04.0T8.5:8)14:9)$')
1981          CALL CTLINE('$')
1982          CALL LTLINE('>PE.4)(3-SPAN BEAM)>EXUA5E.4)(M>E.2H.8)1>HXE.4) = (M>
1983         *E.2H.8)4>HXE.4) = 0>EX)$')
1984          CALL CTLINE('$')
1985          CALL REQ3
1986          CALL LTLINE('>04.0T8.5:8)15:9)$')
1987          CALL REQ4
1988          CALL LTLINE('>04.0T8.5:8)16:9)$')
1989          CALL CTLINE('$')
1990          CALL CTLINE('$')
1991          CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
1992          CALL ENDTAB(0)
1993          CALL ENDPL(0)
1994          CALL TABLET('CENTER','LONG')
1995          CALL LTLINE('>PE.4)(4-SPAN BEAM)>EXUA5E.4)(M>E.2H.8)1>HXE.4) = (M>
1996         *E.2H.8)5>HXE.4) = 0>EX)$')
1997          CALL CTLINE('$')
1998          CALL REQ3
1999          CALL LTLINE('>04.0T8.5:8)17:9)$')
2000          CALL REQ5
2001          CALL LTLINE('>04.0T8.5:8)18:9)$')
2002          CALL CTLINE('$')
2003          CALL REQ6
2004          CALL LTLINE('>04.0T8.5:8)19:9)$')
2005          CALL CTLINE('$')
2006          CALL CTLINE('$')
2007          CALL LTLINE('(T)HE STUDENT SHOULD NOTE THAT THE SUPPORT VERTICAL L
2008         *OCATION EXPRESSION ON$')
2009          CALL LTLINE('THE RIGHT-HAND SIDE OF THESE EQUATIONS IS A FUNCTION
2010         *OF THE BEAM GEOMETRY$')
2011          CALL LTLINE('AND INDEPENDENT OF UNIT LOAD POSITION.  (T)HUS, THE E
2012         *XPRESSION MUST NOT BE$')
2013          CALL LTLINE('INCLUDED WHEN COMPUTING INFLUENCE LINE ORDINATES.$')
2014          CALL CTLINE('$')
2015          CALL CTLINE('$')
2016          CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
2017          CALL ENDTAB(0)
2018          CALL ENDPL(0)
2019          CALL TABLET('CENTER','LONG')
2020          CALL LTLINE('(A, B, AND C TERMS)$')
2021          CALL LTLINE('(-----------------)$')
2022          CALL CTLINE('$')
2023          CALL LTLINE('(T)HE "(R)" TERM ON THE RIGHT-HAND SIDE OF THE 3-MOME
2024         *NT EQUATION WAS SHOWN$')
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2025          CALL LTLINE('EARLIER TO BE THE REACTION OF THE ELASTIC WEIGHT DIAG
2026         *RAMS FOR ADJACENT$')
2027          CALL LTLINE('SPANS.  (T)HIS CONCEPT WILL NOW BE EXAMINED MORE CLOS
2028         *ELY IN TERMS OF A$')
2029          CALL LTLINE('UNIT LOAD TRAVELING ACROSS THE BEAM.$')
2030          CALL CTLINE('$')
2031          CALL LTLINE('(F)ROM THE DEVELOPMENT OF THE 3-MOMENT EQUATION, THE
2032         *"(R)" TERM WAS DEFINED$')
2033          CALL LTLINE('TO BE...$')
2034          CALL CTLINE('$')
2035          CALL CTLINE('$')
2036          CALL LTLINE('>T3.0L.7)(R>L.7) = >LXPE.4)(A>E.2)N>E.4)C>E.2)N>EXUGL
2037         *1.8)(I>L2.)N>L1.8)L>L2.)N>LXA1L.7)+>LX)$')
2038          CALL LTLINE('>01.5T4.4PE.4)(A>E.2)N>H.8)+1>HXE.4)D>E.2)N>H.8)+1>EX
2039         *HXUGL1.8)(I>L2.)N>H.8)+1>HXL1.8)L>L2.)N>H.8)+1>HXLX)$')
2040          CALL LTLINE('>02.5T8.5:8)20:9)$')
2041          CALL CTLINE('$')
2042          CALL LTLINE('          OR (R) = RIGHT REACTION OF ELASTIC WEIGHT DI
2043         *AGRAM FOR$')
2044          CALL LTLINE('                   SPAN N PLUS THE LEFT REACTION OF THE
2045         *ELASTIC$')
2046          CALL LTLINE('                   WEIGHT DIAGRAM FOR SPAN N>H.8)+1>HX).
2047         *$')
2048          CALL CTLINE('$')
2049          CALL CTLINE('$')
2050          CALL LTLINE('(L)ET US NOW APPLY THIS TO ANY CONTINUOUS SPAN BEAM U
2051         *P TO 4 SPANS AND DE-$')
2052          CALL LTLINE('FINE THE TERMS (A, B, )AND (C).$')
2053          CALL CTLINE('$')
2054          CALL CTLINE('$')
2055          CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
2056          CALL ENDTAB(0)
2057          CALL ENDPL(0)
2058          CALL TABLET('CENTER','LONG')
2059          CALL LTLINE('(B)REAKING A 4-SPAN CONTINUOUS BEAM INTO 4 SINGLE-SPA
2060         *N BEAMS, WE HAVE...$')
2061          CALL CTSET(18)
2062          CALL LTLINE('WHERE THE (L) AND (R) TERMS ARE THE LEFT AND RIGHT RE
2063         *ACTIONS, RESPECTIVE-$')
2064          CALL LTLINE('LY, OF THE ELASTIC WEIGHT DIAGRAM FOR A SINGLE-SPAN B
2065         *EAM SUBJECTED TO A$')
2066          CALL LTLINE('UNIT LOAD.$')
2067          CALL CTLINE('$')
2068          CALL LTLINE('(N)OTE THAT (A, B, )AND (C) ARE FUNCTIONS OF THE UNIT
2069         * LOAD POSITION AND INDE-$')
2070          CALL LTLINE('PENDENT OF THE NUMBER OF SPANS.  (T)HUS WE HAVE THE F
2071         *OLLOWING RELATION-$')
2072          CALL LTLINE('SHIPS BETWEEN THE UNIT LOAD POSITION AND (A, B, )AND
2073         *(C)...$')
2074          CALL CTLINE('$')
2075          CALL CTLINE('$')
2076          CALL LTLINE('>T1.5)(  UNIT LOAD POSITION      A      B      C)$')
2077          CALL LTLINE('>T1.5)-----------------------------------------$')
2078          CALL LTLINE('>T1.5A7)(SPAN 1)>A9)(R>L.2H.8)1>HXLXA4)0>A4)0$')
2079          CALL LTLINE('>T1.5A7)(SPAN 2)>A9)(L>L.2H.8)2>HXLXA4)(R>L.2H.8)2>HX
2080         *LXA3)0$')
2081          CALL LTLINE('>T1.5A7)(SPAN 3)>A9)0>A5)(L>L.2H.8)3>LXHXA3)(R>L.2H.6
2082         *)3>LXHX)$')
2083          CALL LTLINE('>T1.5A7)(SPAN 4)>A9)0>A5)0>A4)(L>L.2H.8)4>LXHX)$')
2084          CALL LTLINE('>T1.5)-----------------------------------------$')
2085          CALL CTLINE('$')
2086          CALL CTLINE('$')
2087          CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
2088          CALL ENDTAB(0)
2089          CALL INSERT(18)
2090          CALL AREA2D(16.,3.)
2091          CALL HEIGHT(.25)
2092          CALL SETCLR('CYAN')
2093          CALL VECTOR(1.,2.,4.,2.,0)
2094          CALL VECTOR(4.5,2.,7.5,2.,0)
2095          CALL VECTOR(8.,2.,11.,2.,0)
2096          CALL VECTOR(11.5,2.,14.5,2.,0)
2097          CALL MESSAG('L>L.4H.8)1',10,2.3,2.2)
2098          CALL MESSAG('L>L.4H.3)2',10,5.8,2.2)
2099          CALL MESSAG('L>L.4H.8)3',10,9.3,2.2)
2100          CALL MESSAG('L>L.4H.8)4',10,12.8,2.2)
2101          CALL SETCLR('RED')
2102          CALL VECTOR(1.,1.,1.,1.9,1401)
2103          CALL VECTOR(4.,1.,4.,1.9,1401)
2104          CALL VECTOR(4.5,1.,4.5,1.9,1401)
2105          CALL VECTOR(7.5,1.,7.5,1.9,1401)
2106          CALL VECTOR(8.,1.,8.,1.9,1401)
2107          CALL VECTOR(11.,1.,11.,1.9,1401)
2108          CALL VECTOR(11.5,1.,11.5,1.9,1401)
2109          CALL VECTOR(14.5,1.,14.5,1.9,1401)
2110          CALL SETCLR('WHITE')
2111          CALL MESSAG('(L>L.4H.8)1',11,1.2,1.)
2112          CALL MESSAG('(R>L.4H.8)1',11,3.4,1.)
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2113          CALL MESSAG('(L>L.4H.8)2',11,4.7,1.)
2114          CALL MESSAG('(R>L.4H.8)2',11,6.9,1.)
2115          CALL MESSAG('(L>L.4H.8)3',11,8.2,1.)
2116          CALL MESSAG('(R>L.4H.8)3',11,10.4,1.)
2117          CALL MESSAG('(L>L.4H.8)4',11,11.7,1.)
2118          CALL MESSAG('(R>L.4H.8)4',11,13.9,1.)
2119          CALL MESSAG('(A=R)>L.4H.8)1>LXHX)+(L>L.4H.8)2',32,3.5,.2)
2120          CALL MESSAG('(B=R)>L.4H.8)2>LXHX)+(L>L.4H.8)3',32,7.0,.2)
2121          CALL MESSAG('(C=R)>L.4H.8)3>LXHX)+(L>L.4H.8)4',32,10.5,.2)
2122          CALL RESET('HEIGHT')
2123          CALL ENDGR(0)
2124          CALL ENDPL(0)
2125          CALL TABLET('CENTER','LONG')
2126          CALL LTLINE('(F)OR A UNIT LOAD POSITIONED IN SOME SPAN N, EXPRESSI
2127         *ONS FOR (L>L.2)N>LX) AND (R>L.2)N>LX) CAN$')
2128          CALL LTLINE('BE DEVELOPED FROM THE FOLLOWING...$')
2129          CALL CTSET(19)
2130          CALL LTLINE('>T2.0L.7)(L>L.9)N>L.7) = >LXPE.8)B>E.6)N>E.8):8)L>F.6
2131         *)N>B1E1.6H.8)2>HXE.8) - B>E.6)N>B1E1.6H.8)2>HXE.6:9)>EXUB9L1.8)6(I
2132         *>L2.)N>L1.8)L>L2.)N>LX)$')
2133          CALL LTLINE('>01.5T5.0L.7)(R>L.9)N>L.7) = >LXPE.8)A>E.6)N>E.8):8)L
2134         *>E.6)N>B1E1.6H.8)2>HXE.8) - A>E.6)N>B1E1.6H.8)2>HXE.6:9)>EXUB9L1.8
2135         *)6(I>L2.)N>L1.8)L>L2.)N>LX)$')
2136          CALL CTLINE('$')
2137          CALL CTLINE('$')
2138          CALL LTLINE('(T)HESE EXPRESSIONS FOR (L>L.2)N>LX) AND (R>L.2)N>LX)
2139         *  CAN NOW BE USED TO EVALUATE THE (A, B,$')
2140          CALL LTLINE('AND (C) TERMS IN THE PREVIOUS TABLE.  (I)T WILL BE NE
2141         *CESSARY FOR THE STUDENT$')
2142          CALL LTLINE('TO COPY THE TABLE AND EXPRESSIONS FOR (L>L.2)N>LX) AN
2143         *D (R>L.2)N>LX) FOR FUTURE USE IN THIS$')
2144          CALL LTLINE('PROGRAM.  (N)OTE THAT (E) HAS BEEN ELIMINATED FROM EX
2145         *PRESSIONS FOR (L>L.2)N>LX) AND (R>L.2)N>LX)$')
2146          CALL LTLINE('SO AS TO FACILITATE DIRECT SUBSTITUTION INTO THE 3-MO
2147         *MENT EQUATION.$')
2148          CALL CTLINE('$')
2149          CALL CTLINE('$')
2150          CALL LTLINE('(P)RESS (RETURN) TO RETURN TO (E)QUATION (M)ENU...$')
2151          CALL ENDTAB(0)
2152          CALL INSERT(19)
2153         *CALL AREA2D(16.,3.)
2154          CALL HEIGHT(.25)
2155          CALL SETCLR('CYAN')
2156          CALL VECTOR(1.,1.5,8.,1.5,0)
2157          CALL VECTOR(.9,1.3,1.1,1.7,0)
2158          CALL VECTOR(7.9,1.3,8.1,1.7,0)
2159          CALL VECTOR(1.8,1.3,2.2,1.3,0)
2160          CALL VECTOR(6.8,1.3,7.2,1.3,0)
2161          CALL BLCIR(2.,1.4,.1,.01)
2162          CALL BLCIR(7.,1.4,.1,.01)
2163          CALL MESSAG('(I>L.4)N',8,4.3,1.1)
2164          CALL SETCLR('GREEN')
2165          CALL VECTOR(4.,2.5,4.,1.6,1401)
2166          CALL MESSAG('1>E.8H.8)K',10,4.,2.7)
2167          CALL SETCLR('YELLOW')
2168          CALL VECTOR(2.,.2,2.,1.,0)
2169          CALL VECTOR(7.,.2,7.,1.,0)
2170          CALL VECTOR(2.,.4,7.,.4,1402)
2171          CALL VECTOR(2.,1.7,2.,2.5,0)
2172          CALL VECTOR(7.,1.7,7.,2.5,0)
2173          CALL VECTOR(2.,2.4,.2.2,1402)
2174          CALL VECTOR(4.,2.2,7.,2.2,1402)
2175          CALL MESSAG('L>L.4)N',7,4.3,.6)
2176          CALL MESSAG('A>L.4)N',7,2.7,2.4)
2177          CALL MESSAG('B>L.4)N',7,5.3,2.4)
2178          CALL SETCLR('CYAN')
2179          CALL VECTOR(9.5,1.5,14.5,1.5,0)
2180          CALL SETCLR('MAGENTA')
2181          CALL VECTOR(9.5,1.5,11.5,2.8,0)
2182          CALL VECTOR(11.5,2.8,14.5,1.5,0)
2183          CALL SETCLR('RED')
2184          CALL VECTOR(9.5,.7,9.5,1.4,1401)
2185          CALL VECTOR(14.5,.7,14.5,1.4,1401)
2186          CALL SETCLR('YELLOW')
2187          CALL VECTOR(11.7,2.8,15.5,2.8,0)
2188          CALL VECTOR(14.7,1.5,15.5,1.5,0)
2189          CALL VECTOR(15.2,2.8,15.2,1.5,1402)
2190          CALL MESSAG('>PL1.8)(EI>L2.2)N>L1.8)L>L2.2)N>LXU)',36,15.5,2.15)
2191          CALL MESSAG('A>L.4)N>LX)B>L.4)N',18,15.6,2.35)
2192          CALL SETCLR('WHITE')
2193          CALL MESSAG('(L>L.4)N',8,9.7,.7)
2194          CALL MESSAG('(R>L.4)N',8,14.7,.7)
2195          CALL MESSAG('(E)LASTIC (W)EIGHT (D)IAGRAM',28,9.6,0.)
2196          CALL RESET('HEIGHT')
2197          CALL ENDGR(0)
2198          CALL ENDPL(0)
2199          GO TO 999
2200    466   CALL TABLET('CENTER','LONG')
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2201          CALL LTLINE('(SPAN MOMENT EQUATIONS)$')
2202          CALL LTLINE('(----------------------)$')
2203          CALL CTLINE('$')
2204          CALL LTLINE('(I)T HAS BEEN SAID PREVIOUSLY THAT IF THE MOMENTS AT
2205         *THE ENDS OF ANY SPAN$')
2206          CALL LTLINE('IN A CONTINUOUS BEAM WERE KNOWN, THEN VALUES FOR SHEA
2207         *PS, MOMENTS, AND DE-$')
2208          CALL LTLINE('FLECTIONS COULD BE COMPUTED AT ANY POINT IN THE SPAN.
2209         *  (F)ROM THIS, IT IS$')
2210          CALL LTLINE('POSSIBLE TO DEVELOP INFLUENCE LINES FOR SPAN MOMENTS
2211         *AT ANY POINT ALONG$')
2212          CALL LTLINE('THE BEAM.$')
2213          CALL CTLINE('$')
2214          CALL LTLINE('(T)HEREFORE, NOW LOOK AT A SPAN N LOADED WITH A UNIT
2215         *LOAD AND END MOMENTS...$')
2216          CALL CTSET(20)
2217          CALL CTLINE('$')
2218          CALL LTLINE('WHERE X IS DEFINED AS THE DISTANCE FROM THE LEFT SUPP
2219         *ORT OF SPAN N TO THE$')
2220          CALL LTLINE('POINT AT WHICH THE SPAN MOMENT INFLUENCE LINE WILL BE
2221         * DEVELOPED.  (T)HE MO-$')
2222          CALL LTLINE('MENTS AND SHEARS AT THE ENDS OF SPAN N ARE THOSE WHIC
2223         *H RESULT FROM A UNIT$')
2224          CALL LTLINE('LOAD BEING POSITIONED ANYWHERE ON THE CONTINUOUS BEAM
2225         *.$')
2226          CALL CTLINE('$')
2227          CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
2228          CALL ENDTAB(0)
2229          CALL INSERT(20)
2230          CALL BEAM2
2231          CALL ENDGR(0)
2232          CALL ENDPL(0)
2233          CALL TABLET('CENTER','LONG')
2234          CALL LTLINE('(B)Y USING SUPERPOSITION TO DIVIDE THE BEAM LOADING I
2235         *NTO 3 SEPARATE CASES$')
2236          CALL LTLINE('(M>L.2)L>LX), (M>L.2)R>LX), AND UNIT LOAD, THE GENERA
2237         *L EQUATION FOR THE MOMENT AT A DISTANCE$')
2238          CALL LTLINE('X FROM THE LEFT SUPPORT IS...$')
2239          CALL CTLINE('$')
2240          CALL CTLINE('$')
2241          CALL CTLINE('$')
2242          CALL LTLINE('>T2.5L.7)(M>L.9)X>L.7) = (M>L.9)0>L.7) + (M>L.9)L>L1.
2243         *H2:8>LXHXPE.4)L>E.2)N>E.4)-X>EXUB3L1.8)L>L2.)N>A1L1.H2:9>LXHX)$')
2244          CALL LTLINE('>01.5T5.0L.7)+ (M>L.9)R>L1.H2:8>HXPL1.8)L>L2.)N>LXUB2
2245         *E.4)X>EXA1))L1.H2:9>LXHX)$')
2246          CALL LTLINE('>02.5T8.5:8)21:9)$')
2247          CALL CTLINE('$')
2248          CALL LTLINE('>T1.5)WHERE (M>L.2)0>LX) = 0 IF UNIT LOAD IS NOT IN S
2249         *PAN N$')
2250          CALL CTLINE('$')
2251          CALL CTLINE('$')
2252          CALL LTLINE('>T1.5L.7)OR     (M>L.9)0>L.7) = A>L.9)N>L.7) - X + >LX
2253         *PE.4)B>E.2)N>E.4)X>EXUB3L1.8)L>L2.)N>L.7A5)FOR A>L.9)N>L.7) LESS T
2254         *HAN OR EQUAL TO X>LX)$')
2255          CALL CTLINE('$')
2256          CALL CTLINE('$')
2257          CALL LTLINE('>T1.5L.7)OR     (M>L.9)0>L.7) = >LXPE.4)B>E.2)N>E.4)X>
2258         *EXUB3L1.8)L>L2.)N>L.7A5)FOR A>L.9)N>L.7) GREATER THAN X>LX)$')
2259          CALL CTLINE('$')
2260          CALL CTLINE('$')
2261          CALL CTLINE('$')
2262          CALL LTLINE('(T)HE STUDENT IS URGED TO COPY THE EQUATIONS FOR (M>L
2263         *.2)0>LX) FOR FUTURE USE IN$')
2264          CALL LTLINE('THE PROGRAM.$')
2265          CALL CTLINE('$')
2266          CALL CTLINE('$')
2267          CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
2268          CALL ENDTAB(0)
2269          CALL ENDPL(0)
2270          CALL TABLET('CENTER','LONG')
2271          CALL LTLINE('(T)HE GENERAL EQUATION CAN NOW BE USED TO DEVELOP EQU
2272         *ATIONS WHICH WILL$')
2273          CALL LTLINE('COMPUTE INFLUENCE LINE ORDINATES FOR A GIVEN POINT IN
2274         * A GIVEN SPAN.$')
2275          CALL CTLINE('$')
2276          CALL CTLINE('$')
2277          CALL CTLINE('$')
2278          CALL REQ7
2279          CALL LTLINE('>02.1T8.5:8)22:9)$')
2280          CALL CTLINE('$')
2281          CALL CTLINE('$')
2282          CALL CTLINE('$')
2283          CALL REQ8
2284          CALL LTLINE('>03.6T8.5:8)23:9)$')
2285          CALL CTLINE('$')
2286          CALL CTLINE('$')
2287          CALL REQ9
2288          CALL LTLINE('>03.6T8.5:8)24:9)$')
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2289          CALL CTLINE('$')
2290          CALL CTLINE('$')
2291          CALL REQ10
2292          CALL LTLINE('>02.1T8.5:8)25:9)$')
2293          CALL CTLINE('$')
2294          CALL CTLINE('$')
2295          CALL LTLINE(' (N)OTE THAT THESE EQUATIONS ARE DEPENDENT ONLY ON THE
2296         * POSITION OF THE$')
2297          CALL LTLINE('UNIT LOAD AND MAY BE USED FOR 2, 3, OR 4 SPAN BEAMS.$
2298         *')
2299          CALL CTLINE('$')
2300          CALL CTLINE('$')
2301          CALL LTLINE('(P)RESS (RETURN) TO RETURN TO (E)QUATION (M)ENU...$')
2302          CALL ENDTAB(0)
2303          CALL ENDPL(0)
2304          GO TO 999
2305      467 CALL TABLET('CENTER','LONG')
2306          CALL LTLINE('(SHEAR EQUATIONS)$')
2307          CALL LTLINE('(---------------)$')
2308          CALL CTLINE('$')
2309          CALL LTLINE('(T)HE PROCEDURE USED TO DEVELOP THE SHEAR EQUATIONS I
2310         *S IDENTICAL TO THAT$')
2311          CALL LTLINE('FOR SPAN MOMENTS.  (L)OOKING AGAIN AT SPAN N LOADED W
2312         *ITH A UNIT LOAD AND$')
2313          CALL LTLINE('END MOMENTS...$')
2314          CALL CTSET(21)
2315          CALL CTLINE('$')
2316          CALL LTLINE('WHERE ALL TERMS ARE AS PREVIOUSLY DEFINED.$')
2317          CALL CTLINE('$')
2318          CALL LTLINE('(A)GAIN, THE PRINCIPLE OF SUPERPOSITION CAN BE APPLIE
2319         *D TO SEPARATE THE$')
2320          CALL LTLINE('BEAM LOADING INTO 3 SEPARATE LOAD CASES.  (D)OING THI
2321         *S RESULTS IN A GEN-$')
2322          CALL LTLINE('ERAL EQUATION FOR THE SHEAR AT A DISTANCE X FROM THE
2323         *LEFT SUPPORT...$')
2324          CALL CTLINE('$')
2325          CALL CTLINE('$')
2326          CALL LTLINE('>T3.0L.7)(V>L.9)X>L.7) = (V>L.9)0>L.7) + >LXPE.4)(M>E
2327         *.2)R>E.4)-(M>E.2)L>EXUB3L1.8)L>L2.)N>LX)$')
2328          CALL LTLINE('>01.0T8.5:8)26:9)$')
2329          CALL CTLINE('$')
2330          CALL CTLINE('$')
2331          CALL LTLINE(' (P)RESS (RETURN) TO CONTINUE...$')
2332          CALL ENDTAB(0)
2333          CALL INSERT(21)
2334          CALL BEAM2
2335          CALL ENDGR(0)
2336          CALL ENDPL(0)
2337          CALL TABLET('CENTER','LONG')
2338          CALL LTLINE('>T1.0)WHERE (V>L.2)0>LX) = 0 IF UNIT LOAD IS NOT IN S
2339         *PAN N$')
2340          CALL CTLINE('$')
2341          CALL LTLINE('>T1.0L.7)OR    (V>L.9)0>L.7) = - >LXPE.4)A>E.2)N>EXUB
2342         *L1.8)L>L2.)N>L.7A5)FOR A>L.9)N>L.7) LESS THAN OR EQUAL TO X>LX)$')
2343          CALL CTLINE('$')
2344          CALL CTLINE('$')
2345          CALL LTLINE('>T1.0L.7)OR    (V>L.9)0>L.7) = 1 - >LXPE.4)A>E.2)N>EX
2346         *UGL1.8)L>L2.)N>L.7A5)FOR A>L.9)N>L.7) GREATER THAN X>LX)$')
2347          CALL CTLINE('$')
2348          CALL CTLINE('$')
2349          CALL CTLINE('$')
2350          CALL LTLINE('(A)GAIN THE STUDENT IS URGED TO COPY THE EXPRESSIONS
2351         *FOR (V>L.2)0>LX) FOR FUTURE$')
2352          CALL LTLINE('USE IN THE PROGRAM.$')
2353          CALL CTLINE('$')
2354          CALL LTLINE(' (T)HE GENERAL EQUATION CAN NOW BE USED TO DEVELOP EQU
2355         *ATIONS WHICH WILL$')
2356          CALL LTLINE('COMPUTE INFLUENCE LINE ORDINATES FOR A GIVEN POINT IN
2357         * A GIVEN SPAN.$')
2358          CALL CTLINE('$')
2359          CALL CTLINE('$')
2360          CALL REQ11
2361          CALL LTLINE('>02.1T8.5:8)27:9)$')
2362          CALL CTLINE('$')
2363          CALL REQ12
2364          CALL LTLINE('>02.1T8.5:8)28:9)$')
2365          CALL CTLINE('$')
2366          CALL REQ13
2367          CALL LTLINE('>02.1T8.5:8)29:9)$')
2368          CALL CTLINE('$')
2369          CALL REQ14
2370          CALL LTLINE('>02.1T8.5:8)30:9)$')
2371          CALL CTLINE('$')
2372          CALL LTLINE(' (N)OTE THAT THESE EQUATIONS ARE DEPENDENT ONLY ON THE
2373         * POSITION OF THE$')
2374          CALL LTLINE('UNIT LOAD AND MAY BE USED FOR 2, 3, OR 4 SPAN BEAMS.$
2375         *')
2376          CALL CTLINE('$')
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2377          CALL LTLINE('(P)RESS (RETURN) TO RETURN TO (E)QUATION (M)ENU...$')
2378          CALL ENDTAB(0)
2379          CALL ENDPL(0)
2380          GO TO 999
2381     468  CALL TABLET('CENTER','LONG')
2382          CALL LTLINE('(REACTION EQUATIONS)$')
2383          CALL LTLINE('(-----------------)$')
2384          CALL CTLINE('$')
2385          CALL LTLINE('(A) SIMPLE FREE-BODY DIAGRAM OF A SUPPORT WILL VERIFY
2386         * THAT THE MAGNITUDE$')
2387          CALL LTLINE('OF THE REACTION FORCE IS EQUAL TO THE SUM OF THE SHEA
2388         *RS ON EACH SIDE OF$')
2389          CALL LTLINE('THE SUPPORT.  (T)HUS, IF THE SHEARS ARE KNOWN ON EACH
2390         * SIDE OF A SUPPORT N,$')
2391          CALL LTLINE('IT IS VERY EASY TO COMPUTE THE REACTION AT SUPPORT N.
2392         *  (T)HE SHEAR EQUA-$')
2393          CALL CTSET(22)
2394          CALL LTLINE('TIONS DEVELOPED EARLIER DEFINE SHEARS IN VARIOUS SPAN
2395         *S DEPENDING ON THE$')
2396          CALL LTLINE('UNIT LOAD POSTION AND THUS CAN BE USED DIRECTLY TO DE
2397         *VELOP THE FOLLOWING$')
2398          CALL LTLINE('REACTION EQUATIONS...$')
2399          CALL CTLINE('$')
2400          CALL CTLINE('$')
2401          CALL CTLINE('$')
2402          CALL REQ15
2403          CALL LTLINE('>03.6T8.5:8)31:9)$')
2404          CALL CTLINE('$')
2405          CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
2406          CALL ENDTAB(0)
2407          CALL INSERT(22)
2408          CALL AREA2D(8.,3.)
2409          CALL HEIGHT(.25)
2410          CALL SETCLR('CYAN')
2411          CALL VECTOR(2.,2.,4.,2.,0)
2412          CALL VECTOR(2.8,1.8,3.2,1.8,0)
2413          CALL BLCIR(3.,1.9,.1,.01)
2414          CALL SETCLR('RED')
2415          CALL VECTOR(1.8,2.5,1.8,1.5,0)
2416          CALL VECTOR(1.8,1.5,1.7,1.7,0)
2417          CALL VECTOR(4.2,2.5,4.2,1.5,0)
2418          CALL VECTOR(4.2,1.5,4.3,1.7,0)
2419          CALL VECTOR(3.,.2,3.,1.2,1401)
2420          CALL SETCLR('WHITE')
2421          CALL MESSAG('N',1,2.9,1.5)
2422          CALL MESSAG('>L.4)L>LX)(V>L.4)N',18,1.0,2.0)
2423          CALL MESSAG('>L.4)R>LX)(V>L.4)N',18,4.4,2.0)
2424          CALL MESSAG('(R>L.4)N = ',11,3.2,.5)
2425          CALL MESSAG('>L.4)L>LX)(V>L.4)N + >L.4)R>LX)(V>L.4)N',39,4.3,.5)
2426          CALL RESET('HEIGHT')
2427          CALL ENDGR(0)
2428          CALL ENDPL(0)
2429          CALL TABLET('CENTER','LONG')
2430          CALL CTLINE('$')
2431          CALL REQ16
2432          CALL LTLINE('>05.1T8.5:8)32:9)$')
2433          CALL CTLINE('$')
2434          CALL REQ17
2435          CALL LTLINE('>05.1T8.5:8)33:9)$')
2436          CALL CTLINE('$')
2437          CALL REQ18
2438          CALL LTLINE('>05.1T8.5:8)34:9)$')
2439          CALL CTLINE('$')
2440          CALL REQ19
2441          CALL LTLINE('>03.6T8.5:8)35:9)$')
2442          CALL CTLINE('$')
2443          CALL LTLINE('(N)OTE THAT THESE EQUATIONS ARE DEPENDENT ONLY ON THE
2444         * POSITION OF THE$')
2445          CALL LTLINE('UNIT LOAD AND MAY BE USED FOR 2, 3, OR 4 SPAN BEAMS.$
2446         *')
2447          CALL CTLINE('$')
2448          CALL LTLINE('(T)HE (A) AND (B) TERMS IN THE ABOVE EQUATIONS ACCOUN
2449         *T FOR THE (V>L.2)O>LX) TERMS$')
2450          CALL LTLINE('IN THE SHEAR EQUATIONS, AND ARE DEFINED ON THE NEXT P
2451         *AGE.$')
2452          CALL CTLINE('$')
2453          CALL CTLINE('$')
2454          CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
2455          CALL ENDTAB(0)
2456          CALL ENDPL(0)
2457          CALL TABLET('CENTER','LONG')
2458          CALL LTLINE('>L.2H.8)1>LXHX)(A>L.2)O>LX), >L.2H.8)2>LXHX)(A>L.2)O>
2459         *LX), >L.2H.8)3>LXHX)(A>L.2)O>LX), & >L.2H.8)4>LXHX)(A>L.2)O>LX)$')
2460          CALL LTLINE('>01.5T2.5)REPRESENT THE SHEARS AT THE LEFT END OF A$'
2461         *)
2462          CALL LTLINE('>01.5)SIMPLY-SUPPORTED, SINGLE-SPAN BEAM SUBJECTED TO
2463         * A UNIT LOAD.$')
2464          CALL CTLINE('$')
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      CALL LTLINE('>L.2H.8)1>LXHX)(B>L.2)O>LX), >L.2H.8)2>LXHX)(B>L.2)O>
     *LX), >L.2H.8)3>LXHX)(B>L.2)O>LX), & >L.2H.8)4>LXHX)(B>L.2)O>LX)$')
      CALL LTLINE('>O1.5T2.5)REPRESENT THE SHEARS AT THE RIGHT END OF A$
     *')
      CALL LTLINE('>O1.5)SIMPLY-SUPPORTED, SINGLE-SPAN BEAM SUBJECTED TO
     * A UNIT LOAD.$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('(NOTES)--:8)1:9) THE SUBSCRIPTS 1, 2, 3, & 4 DENOTE T
     *HE SPAN$')
      CALL LTLINE('            NUMBER IN WHICH THE UNIT LOAD IS APPLIED$'
     *)
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('        :8)2:9) EITHER OR BOTH OF THE (A) AND (B) TERM
     *S MAY BE$')
      CALL LTLINE('            ZERO IF THE UNIT LOAD IS IN A SPAN NOT EQU
     *AL$')
      CALL LTLINE('            TO THE LEFT SUBSCRIPT NUMBER$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('        :8)3:9) (A) AND (B) TERMS WILL ALWAYS BE POSIT
     *IVE$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('(P)RESS (RETURN) TO RETURN TO (E)QUATION (M)ENU...$')
      CALL ENDTAB(0)
      CALL ENDPL(0)
      GO TO 999
  469 CALL TABLET('CENTER','LONG')
      CALL LTLINE('(DEFLECTION EQUATIONS)$')
      CALL LTLINE('(--------------------)$')
      CALL CTLINE('$')
      CALL LTLINE('(I)N GENERAL, THE DEFLECTION EQUATIONS ARE DERIVED IN
     * A MANNER IDENTICAL$')
      CALL LTLINE('TO THAT FOR SPAN MOMENTS AND SHEARS.  (L)OOKING AGAIN
     * AT SPAN N LOADED$')
      CALL LTLINE('WITH THE UNIT LOAD AND END MOMENTS...$')
      CALL CTSET(23)
      CALL LTLINE('(T)HE PRINCIPLE OF SUPERPOSITION IS USED TO SEPARATE
     *THE BEAM LOADING IN-$')
      CALL LTLINE('TO 3 SEPARATE LOAD CASES.  (T)HE MOMENT AREA THEOREMS
     * ARE THEN USED TO DE-$')
      CALL LTLINE('VELOP EXPRESSIONS FOR DEFLECTIONS ALONG THE BEAM AS F
     *UNCTIONS OF (M>L.2)L>LX), (M>L.2)R>LX),$')
      CALL LTLINE('AND THE UNIT LOAD.  (C)ARRYING OUT THE NECESSARY MATH
     *EMATICS YIELDS THE$')
      CALL LTLINE('FOLLOWING GENERAL EXPRESSION FOR THE DEFLECTION AT A
     *DISTANCE X FROM THE$')
      CALL LTLINE('LEFT SUPPORT...$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('>T1.5L.7*D)>L.9)X>L.7) = *D)>L.9)O>L.7) + >LXPE.4)X:8
     *)L>E.2)N>E.4)-X:9)>EXUGL1.8)6(EI>L2.)N>L1.8)L>L2.)N>LX)$')
      CALL LTLINE('>O1.5T3.6L.7:2)(M>L.9)L>L.7:8)2L>L.9)N>L.7)-X:9) + (M
     *>L.9)R>L.7:8)L>L.9)N>L.7)+X:93)$')
      CALL LTLINE('>O2.5T8.5:8)36:9)$')
      CALL CTLINE('$')
      CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
      CALL ENDTAB(0)
      CALL INSERT(23)
      CALL BEAM2
      CALL ENDGR(0)
      CALL ENDPL(0)
      CALL TABLET('CENTER','LONG')
      CALL LTLINE('WHERE *D>L.2)O>LX) = 0 IF UNIT LOAD IS NOT IN SPAN N$
     *')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('>T.4L.7*D)>L.9)O>L.7) = >LXPE.4)A>E.2)N>E.4:8)L>E.2)N
     *>E.4)-X:9)>EXUB7L1.8)6(EI>L2.)N>L1.8)L>L2.)N>LX)$')
      CALL LTLINE('>O1.5T2.1L.7:2)B>L.9)N>LXB1E.2H.8)2>HXEXL.7) + 2A>L.9
     *)N>L.7)B>L.9)N>L.7) - :8)L>L.9)N>L.7)-X:9)>LXE.2H.8)2>EXHXL.7:3)>L
     *X)$')
      CALL LTLINE('>O3.0T4.8L.7)FOR A>L.9)N>L.7) LESS THAN OR EQUAL TO X
     *>LX)$')
      CALL CTLINE('$')
      CALL LTLINE('>T.4L.7*D)>L.9)O>L.7) = >PL1.8)6(EI>L2.)N>L1.8)L>L2.)
     *N>LXUB5E.4)B>E.2)N>E.4)X>EX)$')
      CALL LTLINE('>O1.5T1.9L.7:2)A>L.9)N>LXB1E.2H.8)2>HXEXL.7) + 2A>L.9
     *)N>L.7)B>L.9)N>L.7) - X>LXE.2H.8)2>HXEXL.7:3) FOR A>L.9)N>L.7) GRE
     *ATER THAN X>LX)$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('(T)HE STUDENT IS URGED TO COPY THE EXPRESSIONS FOR *D
     *)>L.2)O>LX) FOR FUTURE USE IN$')
      CALL LTLINE('THE PROGRAM.$')
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2553          CALL CTLINE('$')
2554          CALL LTLINE(' (T)HE GENERAL EXPRESSION FOR *D)>L.2)X>LX) CAN NOW BE
2555         * USED TO DEVELOP DEFLECTION$')
2556          CALL LTLINE('EQUATIONS FOR EACH SPAN.$')
2557          CALL CTLINE('$')
2558          CALL CTLINE('$')
2559          CALL REQ20
2560          CALL LTLINE('>03.6T8.5:8)37:9)$')
2561          CALL CTLINE('$')
2562          CALL REQ21
2563          CALL LTLINE('>03.6T8.5:8)38:9)$')
2564          CALL CTLINE('$')
2565          CALL REQ22
2566          CALL LTLINE('>03.6T8.5:8)39:9)$')
2567          CALL CTLINE('$')
2568          CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
2569          CALL ENDTAB(0)
2570          CALL ENDPL(0)
2571          CALL TABLET('CENTER','LONG')
2572          CALL REQ23
2573          CALL LTLINE('>03.6T8.5:8)40:9)$')
2574          CALL CTLINE('$')
2575          CALL LTLINE(' (N)OTE THAT THESE EQUATIONS ARE DEPENDENT ONLY ON THE
2576         * POSITION OF THE$')
2577          CALL LTLINE('UNIT LOAD AND MAY BE USED FOR 2, 3, OR 4 SPAN BEAMS.$
2578         *')
2579          CALL CTLINE('$')
2580          CALL CTLINE('$')
2581          CALL LTLINE('(P)RESS (RETURN) TO RETURN TO (E)QUATION (M)ENU...$')
2582          CALL ENDTAB(0)
2583          CALL ENDPL(0)
2584    999   TYPE 785
2585          GO TO 450
2586    C
2587    C BEAM DATA INPUT FOR DEVELOPMENT SEGMENT
2588    C
2589    471   TYPE 785
2590          TYPE 472
2591    472   FORMAT(' BEAM PHYSICAL DATA INPUT')
2592          TYPE 473
2593    473   FORMAT(' ------------------------'/)
2594          TYPE 474
2595    474   FORMAT(T6,'The student is now asked to specify physical data for a
2596         * 2, 3, or 4 span')
2597          TYPE 475
2598    475   FORMAT(T6,'beam.  The beam will be used in section (D) for computa
2599         *tion of influ-')
2600          TYPE 476
2601    476   FORMAT(T6,'ence lines using the previously developed equations.'//
2602         *)
2603    477   TYPE 478
2604    478   FORMAT(T6,'Press "C" to continue with beam physical data input')
2605          TYPE 479
2606    479   FORMAT(T9,'or "R" to return to Development Menu: ',$)
2607          ACCEPT 48, ZZ
2608          IF(ZZ.NE.'C' .AND. ZZ.NE.'R') GO TO 477
2609          TYPE 785
2610          IF(ZZ.EQ.'C') GO TO 481
2611          GO TO 470
2612    481   CALL BEAMINP(E,EE,NO,BEAM,SC,CF1)
2613          INFLAG1=2
2614          CALL DISDX(NO,BEAM,DX,SC)
2615          CALL LINORD(E,NO,N9,RN9,A,B,D,D1,BEAM,SUPPM,SPANM,SHEAR,REACT,
2616         *DELTA,ABC,CF2,DELSM)
2617          TYPE 785
2618          GO TO 470
2619    482   TYPE 785
2620          TYPE 483
2621    483   FORMAT(' COMPUTATION OF INFLUENCE LINE ORDINATES')
2622          TYPE 484
2623    484   FORMAT(' ---------------------------------------'/)
2624          TYPE 485
2625    485   FORMAT(T6,'The student will now be given the opportunity to use th
2626         *e influence line')
2627          TYPE 486
2628    486   FORMAT(T6,'equations and develop any influence line for the beam s
2629         *pecified earlier')
2630          TYPE 487
2631    487   FORMAT(T6,'in part (C).  Student input will be checked for correct
2632         *ness against com-')
2633          TYPE 488
2634    488   FORMAT(T6,'puter generated values, and will be allowed to proceed
2635         *through the pro-')
2636          TYPE 489
2637    489   FORMAT(T6,'gram when input is correct.  Incorrect input will resul
2638         *t in the student')
2639          TYPE 490
2640    490   FORMAT(T6,'being prompted for correct values until input is correc
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2641          *t.  The student')
2642           TYPE 491
2643     491   FORMAT(T6,'should have a calculator available to make any necessar
2644          *y computations.'/)
2645     462   TYPE 825
2646           ACCEPT 48, ZZ
2647           IF(ZZ.NE.'C') GO TO 462
2648     493   CALL GRAPH1
2649           CALL GRAPH4(NO,N9,BEAM,SC,DX)
2650           TYPE 785
2651           TYPE 494
2652     494   FORMAT(T6,'COMPUTATION MENU')
2653           TYPE 495
2654     495   FORMAT(T6,'----------------')
2655           TYPE 496
2656     496   FORMAT(T11,'(A) Support Moment I.L.      (D) Reaction I.L.')
2657           TYPE 497
2658     497   FORMAT(T11,'(B) Span Moment I.L.         (E) Deflection I.L.')
2659           TYPE 498
2660     498   FORMAT(T11,'(C) Shear I.L.               (F) Return to Development
2661          *Menu'/)
2662     436   TYPE 46
2663           ACCEPT 48, CMI
2664           IF(CMI.LT.'A' .OR. CMI.GT.'F') GO TO 436
2665           IF(CMI.EQ.'A') GO TO 423
2666           IF(CMI.EQ.'B') GO TO 424
2667           IF(CMI.EQ.'C') GO TO 425
2668           IF(CMI.EQ.'D') GO TO 426
2669           IF(CMI.EQ.'E') GO TO 427
2670           TYPE 326
2671           TYPE 785
2672           GO TO 470
2673     423   TYPE 785
2674           TYPE 786
2675     786   FORMAT(' SUPPORT MOMENT I.L. ORDINATES')
2676           TYPE 787
2677     787   FORMAT(' ----------------------------'/)
2678     788   TYPE 789
2679     789   FORMAT(T5,' Specify support number from above: ',$)
2680           ACCEPT 790, ISN
2681           IF(ISN.LT.2 .OR. ISN.GT.(NO)) GO TO 788
2682     791   TYPE 785
2683           TYPE 792
2684     792   FORMAT(T6,'Would you like to review the equation(s) used for')
2685           TYPE 793
2686     793   FORMAT(T5,' computing the ordinates (Y/N)? ',$)
2687           ACCEPT 48, ZZ
2688           IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 791
2689           IF(ZZ.EQ.'N') GO TO 795
2690           CALL EQUA1(NO)
2691           CALL GRAPH1
2692           CALL GRAPH4(NO,N9,BEAM,SC,DX)
2693     795   YMAX=0.
2694           DO 606 I=1,N9*NO+1
2695             YVALUE=ABS(SUPPM(I,ISN-1))
2696             IF(YVALUE.GT.YMAX) THEN
2697               YMAX=YVALUE
2698             END IF
2699     606   CONTINUE
2700           TYPE 155
2701           TYPE 610
2702     610   FORMAT(' !JUM 25,14')
2703           TYPE 614, ISN
2704     614   FORMAT(' Support Moment I.L. at Support No. ',I1)
2705           CALL YMAX2(YMAX)
2706           TYPE 151
2707           TYPE 785
2708           TYPE 796
2709     796   FORMAT(T6,'Several terms in the equations are independent of the')
2710           TYPE 797
2711     797   FORMAT(T6,'unit load position, and need be input only once.'/)
2712     799   TYPE 825
2713     825   FORMAT(/T5,' Press "C" to continue...',$)
2714           ACCEPT 48, ZZ
2715           IF(ZZ.NE.'C') GO TO 799
2716           TYPE 785
2717           TYPE 826
2718     826   FORMAT(T6,'SPAN LENGTHS')
2719           TYPE 827
2720     827   FORMAT(T6,'------------'/)
2721           DO 831 I=1,NO
2722     828     TYPE 829, I
2723     829     FORMAT(T11,' Span No. ',I1,' (ft): ',$)
2724             ACCEPT 889, SPL
2725             IF(SPL.NE.BEA1(I,1)) GO TO 828
2726     831   CONTINUE
2727           TYPE 785
2728           TYPE 832
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2729    832   FORMAT(T6,'MOMENTS OF INERTIA')
2730          TYPE 833
2731    833   FORMAT(T6,'------------------'/)
2732          DO 837 I=1,NO
2733    834     TYPE 835, I
2734    835     FORMAT(T11,' Span No. ',I1,' (ft.^4): ',$)
2735            ACCEPT 794, SPI
2736            IF(SPI.NE.BEAM(I,2)) GO TO 834
2737    837   CONTINUE
2738    882   TYPE 785
2739          TYPE 844
2740    844   FORMAT(T6,'A, B, & C TERMS')
2741          TYPE 845
2742    845   FORMAT(T6,'---------------'/)
2743          TYPE 846
2744    846   FORMAT(T6,'The A, B, & C terms on the right side of the equations'
2745         *)
2746          TYPE 847
2747    847   FORMAT(T6,'are dependent on the unit load position.  Please specif
2748         *y')
2749          TYPE 843
2750    848   FORMAT(T5,' a 10th-point position for the unit load: ',$)
2751          ACCEPT 849, LPT
2752          IF(LPT.LT.1 .OR. LPT.GT.(N9*NO+1)) GO TO 882
2753    871   TYPE 785
2754          TYPE 722
2755          CALL ULOAD(LPT,N9,X3,DX)
2756          TYPE 617
2757    617   FORMAT(' !STR /1 kip/')
2758          TYPE 850
2759    850   FORMAT(T6,'Using a hand calculator and recalling equations given')
2760          TYPE 851
2761    851   FORMAT(T6,'earlier for A, B, & C, the student must now compute')
2762          TYPE 852
2763    852   FORMAT(T6,'and enter values for A, B, & C.')
2764          TYPE 823
2765          VMIN=CF3*ABC(LPT,1)
2766          VMAX=CF4*ABC(LPT,1)
2767    853   TYPE 854
2768    854   FORMAT(T11,' A = ',$)
2769          ACCEPT 855, AA
2770          IF(AA.LT.VMIN .OR. AA.GT.VMAX) GO TO 853
2771          VMIN=CF3*ABC(LPT,2)
2772          VMAX=CF4*ABC(LPT,2)
2773    856   TYPE 857
2774    857   FORMAT(T11,' B = ',$)
2775          ACCEPT 855, BB
2776          IF(BB.LT.VMIN .OR. BB.GT.VMAX) GO TO 856
2777          VMIN=CF3*ABC(LPT,3)
2778          VMAX=CF4*ABC(LPT,3)
2779    858   TYPE 859
2780    859   FORMAT(T11,' C = ',$)
2781          ACCEPT 855, CC
2782          IF(CC.LT.VMIN .OR. CC.GT.VMAX) GO TO 858
2783    860   TYPE 785
2784          YORD=SUPPM(LPT,ISN-1)
2785          TYPE 861
2786    861   FORMAT(T6,'All terms in the equation(s) have now been defined, and
2787         * solution for the')
2788          TYPE 862
2789    862   FORMAT(T6,'support moments yields:'/)
2790          TYPE 863, YORD,LPT
2791    863   FORMAT(T15,'I.L. Ordinate = ',F7.2,' ft-kips at 10th-Point No. ',I
2792         *2/)
2793    864   TYPE 825
2794          ACCEPT 48, ZZ
2795          IF(ZZ.NE.'C') GO TO 864
2796          TYPE 785
2797          CALL PLPT(X3,YORD,YMAX,Y3)
2798          TYPE 865
2799    865   FORMAT(T6,'Note that the influence line ordinate value has been')
2800          TYPE 866
2801    866   FORMAT(T6,'plotted on the beam above.'//)
2802    867   TYPE 868
2803    868   FORMAT(T5,' Do you want to compute another ordinate (Y/N)? ',$)
2804          ACCEPT 48, ZZ
2805          IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 867
2806          IF(ZZ.EQ.'N') GO TO 872
2807          TYPE 700
2808          CALL ULOAD(LPT,N9,X3,DX)
2809          TYPE 618
2810    618   FORMAT(' !STR /      /')
2811          TYPE 785
2812    869   TYPE 870
2813    870   FORMAT(T5,' Specify new 10th-point position of unit load: ',$)
2814          ACCEPT 849, LPT
2815          IF(LPT.LT.1 .OR. LPT.GT.(N9*NO+1)) GO TO 869
2816          GO TO 871
```

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2817    872    TYPE 785
2818           TYPE 873
2819    873    FORMAT(T5,' Plot the total influence line (Y/N)? ',$)
2820           ACCEPT 48, ZZ
2821           IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 872
2822           IF(ZZ.EQ.'N') GO TO 874
2823           TYPE 748
2824           TYPE 723
2825           CALL PLOT1(NO,N9,YMAX,DX,SUPPM(1,ISN-1))
2826    874    TYPE 785
2827           TYPE 875
2828    875    FORMAT(T5,' Hard copy of influence line ordinates (Y/N)? ',$)
2829           ACCEPT 48, ZZ
2830           IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 874
2831           IF(ZZ.EQ.'N') GO TO 876
2832           CALL HCBPD(EE,NO,BEAM,SC)
2833           ILT=1
2834           NS=0
2835           TYPE='Support Moment',
2836           LOCA='    Support No.',
2837           CALL HCILO(NO,N9,NS,ILT,ISN,TYPE,LOCA,SUPPM(1,ISN-1))
2838    876    GO TO 493
2839    424    TYPE 785
2840           TYPE 877
2841    877    FORMAT(' SPAN MOMENT I.L. ORDINATES')
2842           TYPE 878
2843    878    FORMAT(' -------------------------'/)
2844    879    TYPE 880
2845    880    FORMAT(T6,'Please specify 10th-point for which the influence')
2846           TYPE 881
2847    881    FORMAT(T5,' line will be developed: ',$)
2848           ACCEPT 849, ILP
2849           IF(ILP.LT.2 .OR. ILP.GT.(N9*NO)) GO TO 879
2850           NS=INT((ILP-1)/RN9)+1
2851    883    TYPE 785
2852           TYPE 792
2853           TYPE 793
2854           ACCEPT 48, ZZ
2855           IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 883
2856           IF(ZZ.EQ.'N') GO TO 884
2857           CALL EQUA2(NS)
2858           CALL GRAPH1
2859           CALL GRAPH4(NO,N9,BEAM,SC,DX)
2860    884    YMAX=0.
2861           DO 619 I=1,N9*NO+1
2862             YVALUE=ABS(SPANM(I,ILP))
2863             IF(YVALUE.GT.YMAX) THEN
2864               YMAX=YVALUE
2865             END IF
2866    619    CONTINUE
2867           TYPE 155
2868           TYPE 610
2869           TYPE 726, ILP
2870    726    FORMAT(' Span Moment I.L. at 10th-Point No. ',I2)
2871           CALL YMAX2(YMAX)
2872           TYPE 151
2873           TYPE 785
2874           TYPE 385
2875    885    FORMAT(T6,'The terms "x" and "l" are independent of the unit load
2876          *position and')
2877           TYPE 886
2878    886    FORMAT(T6,'need be input only once.'/)
2879    887    TYPE 888, NS
2880    888    FORMAT(T10,' Distance from left end of span ',I1,', x (ft): ',$)
2881           ACCEPT 463, DIS1
2882           DIS2=(ILP-((NS-1)*N9+1))*BEAM(NS,1)/RN9
2883           IF(DIS1.NE.DIS2) GO TO 887
2884           TYPE 823
2885    890    TYPE 891, NS
2886    891    FORMAT(T10,' Length of Span No. ',I1,', l (ft): ',$)
2887           ACCEPT 889, SPL
2888           IF(SPL.NE.BEAM(NS,1)) GO TO 890
2889    893    TYPE 785
2890           TYPE 894
2891    894    FORMAT(T5,' Specify 10th-point position of unit load: ',$)
2892           ACCEPT 849, LPT
2893           IF(LPT.LT.1 .OR. LPT.GT.(N9*NO+1)) GO TO 893
2894    895    TYPE 785
2895           TYPE 722
2896           CALL ULOAD(LPT,N9,X3,DX)
2897           TYPE 617
2898           TYPE 896, LPT
2899    896    FORMAT(T6,'With a unit load at 10th-point ',I2,' the moment(s) at
2900          *the interior')
2901           TYPE 897
2902    897    FORMAT(T6,'support(s) are:'/)
2903           DO 899 I=2,NO
2904             TYPE 898, I,SUPPM(LPT,I-1)
```

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2905    898     FORMAT(T18,'Moment at Support No. ',I1,' = ',F7.2,' ft-kips')
2906    899   CONTINUE
2907    919   TYPE 825
2908          ACCEPT 48, ZZ
2909          IF(ZZ.NE.'C') GO TO 919
2910          TYPE 785
2911          TYPE 921
2912    921   FORMAT(T6,'Using a hand calculator and recalling equations given')
2913          TYPE 922
2914    922   FORMAT(T6,'earlier for Mo, the student must now compute and')
2915          TYPE 923
2916    923   FORMAT(T6,'enter the value for Mo.'/)
2917          NSUL=INT((LPT-1)/RN9)+1
2918          IF(NSUL.NE.NS) GO TO 908
2919          DIS3=(LPT-((NS-1)*N9+1))*BEAM(NS,1)/RN9
2920          IF(LPT.LE.ILP) THEN
2921            SMO=DIS3*(1.-DIS2/BEAM(NS,1))
2922          ELSE
2923            SMO=DIS2*(1.-DIS3/BEAM(NS,1))
2924          END IF
2925          GO TO 909
2926    908   SMO=0.
2927    909   VMIN=CF3*SMO
2928          VMAX=CF4*SMO
2929    924   TYPE 906
2930    906   FORMAT(T11,' Mo = ',$)
2931          ACCEPT 576, SM1
2932          IF(SM1.LT.VMIN .OR. SM1.GT.VMAX) GO TO 924
2933    910   TYPE 785
2934          YORD=SPANM(LPT,ILP)
2935          TYPE 861
2936          TYPE 911
2937    911   FORMAT(T6,'I.L. ordinate is:'/)
2938          TYPE 912, YORD,LPT
2939    912   FORMAT(T22,'Mx = ',F7.2,' ft-kips at 10th-Point No. ',I2/)
2940    913   TYPE 825
2941          ACCEPT 48, ZZ
2942          IF(ZZ.NE.'C') GO TO 913
2943          TYPE 785
2944          CALL PLPT(X3,YORD,YMAX,Y3)
2945          TYPE 865
2946          TYPE 866
2947    914   TYPE 868
2948          ACCEPT 48, ZZ
2949          IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 914
2950          IF(ZZ.EQ.'N') GO TO 916
2951          TYPE 700
2952          CALL ULOAD(LPT,N9,X3,DX)
2953          TYPE 618
2954    915   TYPE 785
2955          TYPE 870
2956          ACCEPT 849, LPT
2957          IF(LPT.LT.1 .OR. LPT.GT.(N9*NO+1)) GO TO 915
2958          GO TO 895
2959    916   TYPE 785
2960          TYPE 873
2961          ACCEPT 48, ZZ
2962          IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 916
2963          IF(ZZ.EQ.'N') GO TO 917
2964          TYPE 748
2965          TYPE 723
2966          CALL PLOT1(NO,N9,YMAX,DX,SPANM(1,ILP))
2967    917   TYPE 785
2968          TYPE 875
2969          ACCEPT 48, ZZ
2970          IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 917
2971          IF(ZZ.EQ.'N') GO TO 918
2972          CALL HCRPD(EE,NO,BEAM,SC)
2973          ILT=2
2974          TYPE='Span Moment    '
2975          LOCA='10th-Point No. '
2976          CALL HCILO(NO,N9,NS,ILT,ILP,TYPE,LOCA,SPANM(1,ILP))
2977    918   GO TO 493
2978    425   TYPE 785
2979          TYPE 925
2980    925   FORMAT(' SHEAR I.L. ORDINATES')
2981          TYPE 926
2982    926   FORMAT(' --------------------'/)
2983    927   TYPE 880
2984          TYPE 881
2985          ACCEPT 849, ILP
2986          IF(ILP.LT.1 .OR. ILP.GT.(N9*NO+1)) GO TO 927
2987          IF(ILP.EQ.1) THEN
2988            VSP='R'
2989          ELSE IF(ILP.EQ.(N9*NO+1)) THEN
2990            VSP='L'
2991          ELSE IF(ILP.EQ.11 .OR. ILP.EQ.21 .OR. ILP.EQ.31) THEN
2992            TYPE 823
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2993    928     TYPE 929
2994    929     FORMAT(T5,' Left or right of support (L/R): ',$)
2995            ACCEPT 48, VSP
2996            IF(VSP.NE.'L' .AND. VSP.NE.'R') GO TO 928
2997          ELSE
2998            VSP='N'
2999          END IF
3000          IF(VSP.EQ.'L') THEN
3001            NS=INT((ILP-1)/RN9)
3002          ELSE
3003            NS=INT((ILP-1)/RN9)+1
3004          END IF
3005    930   TYPE 785
3006          TYPE 792
3007          TYPE 793
3008          ACCEPT 48, ZZ
3009          IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 930
3010          IF(ZZ.EQ.'N') GO TO 931
3011          CALL EQUA3(NS)
3012          CALL GRAPH1
3013          CALL GRAPH4(NO,N9,BEAM,SC,DX)
3014    931   ILC=ILP+NS-1
3015          YMAX=0.
3016          DO 907 I=1,N9*NO+2
3017            YVALUE=ABS(SHEAR(I,ILC))
3018            IF(YVALUE.GT.YMAX) THEN
3019              YMAX=YVALUE
3020            END IF
3021    907   CONTINUE
3022          TYPE 155
3023          IF(VSP.EQ.'L' .OR. VSP.EQ.'R') THEN
3024            TYPE 419
3025    419     FORMAT(' !JUM 25,14')
3026            IF(VSP.EQ.'L') THEN
3027              TYPE 420, ILP
3028    420       FORMAT(' Shear I.L. left of 10th-Point No. ',I2)
3029            ELSE
3030              TYPE 434, ILP
3031    434       FORMAT(' Shear I.L. right of 10th-Point No. ',I2)
3032            END IF
3033          ELSE
3034            TYPE 435
3035    435     FORMAT(' !JUM 25,16')
3036            TYPE 437, ILP
3037    437     FORMAT(' Shear I.L. at 10th-Point No. ',I2)
3038          END IF
3039          CALL YMAX2(YMAX)
3040          TYPE 151
3041          TYPE 785
3042          TYPE 932
3043    932   FORMAT(T6,'The "L" term is independent of the unit load position a
3044         *nd need be')
3045          TYPE 933
3046    933   FORMAT(T6,'input only once.'/)
3047    934   TYPE 891, NS
3048          ACCEPT 889, SPL
3049          IF(SPL.NE.BEAM(NS,1)) GO TO 934
3050    935   TYPE 785
3051          TYPE 894
3052          ACCEPT 849, LPT
3053          IF(LPT.LT.1 .OR. LPT.GT.(N9*NO+1)) GO TO 935
3054    936   IF(LPT.EQ.1) THEN
3055            VSUL='R'
3056          ELSE IF(LPT.EQ.(N9*NO+1)) THEN
3057            VSUL='L'
3058          ELSE IF(LPT.EQ.11 .OR. LPT.EQ.21 .OR. LPT.EQ.31) THEN
3059            TYPE 823
3060    237     TYPE 929
3061            ACCEPT 48, VSUL
3062            IF(VSUL.NE.'L' .AND. VSUL.NE.'R') GO TO 237
3063          ELSE
3064            VSUL='N'
3065          END IF
3066          IF(VSUL.EQ.'L') THEN
3067            NSUL=INT((LPT-1)/RN9)
3068          ELSE
3069            NSUL=INT((LPT-1)/RN9)+1
3070          END IF
3071          IF(LPT.LE.ILP .AND. VSP.EQ.'N') THEN
3072            ILR=LPT
3073          ELSE IF(LPT.EQ.ILP .AND. VSP.EQ.'L') THEN
3074            ILR=LPT
3075          ELSE
3076            ILR=LPT+1
3077          END IF
3078          TYPE 785
3079          TYPE 722
3080          CALL ULOAD(LPT,N9,X3,DX)
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3081            TYPE 617
3082            TYPE 896, LPT
3083            TYPE 897
3084            DO 937 I=2,NO
3085              TYPE 898, I,SUPPM(LPT,I-1)
3086    937     CONTINUE
3087    938     TYPE 825
3088            ACCEPT 48, ZZ
3089            IF(ZZ.NE.'C') GO TO 938
3090            TYPE 785
3091            TYPE 921
3092            TYPE 939
3093    939     FORMAT(T6,'earlier for Vo, the student must now compute and')
3094            TYPE 940
3095    940     FORMAT(T6,'enter the value for Vo.'/)
3096            IF(NSUL.NE.NS) GO TO 238
3097            LUL=LPT-(NSUL-1)*N9-1
3098            IF(VSP.EQ.'R' .AND. LPT.EQ.ILP) THEN
3099              SVO=1.
3100            ELSE IF(VSP.EQ.'L' .AND. LPT.EQ.ILP) THEN
3101              SVO=-1.
3102            ELSE IF(LPT.LE.ILP) THEN
3103              SVO=-LUL/RN9
3104            ELSE IF(LPT.GT.ILP) THEN
3105              SVO=1.-LUL/RN9
3106            END IF
3107            GO TO 239
3108    238     SVO=0.0
3109    239     IF(SVO.LE.C.) THEN
3110              VMIN=CF4*SVO
3111              VMAX=CF3*SVO
3112            ELSE
3113              VMIN=CF3*SVO
3114              VMAX=CF4*SVO
3115            END IF
3116    941     TYPE 942
3117    942     FORMAT(T11,' Vo = ',$)
3118            ACCEPT 943, SV1
3119    945     IF(SV1.LT.VMIN .OR. SV1.GT.VMAX) GO TO 941
3120    946     TYPE 785
3121            YORD=SHEAR(ILR,ILC)
3122            TYPE 861
3123            TYPE 911
3124            TYPE 947, YORD,LPT
3125    947     FORMAT(T22,'Vx = ',F7.2,' kips at 10th-Point No. ',I2/)
3126    948     TYPE 825
3127            ACCEPT 48, ZZ
3128            IF(ZZ.NE.'C') GO TO 948
3129            TYPE 785
3130            CALL PLPT(X3,YORD,YMAX,Y3)
3131            TYPE 865
3132            TYPE 866
3133    949     TYPE 869
3134            ACCEPT 48, ZZ
3135            IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 949
3136            IF(ZZ.EQ.'N') GO TO 951
3137            TYPE 700
3138            CALL ULOAD(LPT,N9,X3,DX)
3139            TYPE 618
3140    950     TYPE 785
3141            TYPE 870
3142            ACCEPT 349, LPT
3143            IF(LPT.LT.1 .OR. LPT.GT.(N9*NO+1)) GO TO 950
3144            GO TO 936
3145    951     TYPE 785
3146            TYPE 873
3147            ACCEPT 48, ZZ
3148            IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 951
3149            IF(ZZ.EQ.'N') GO TO 952
3150            TYPE 748
3151            TYPE 723
3152            CALL PLOT2(ILP,NO,N9,NS,YMAX,DX,SHEAR(1,ILC))
3153    952     TYPE 785
3154            TYPE 875
3155            ACCEPT 48, ZZ
3156            IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 952
3157            IF(ZZ.EQ.'N') GO TO 953
3158            CALL HCBPD(EE,NO,BEAM,SC)
3159            ILT=3
3160            TYPE='Shear          '
3161            LOCA='10th-Point No. '
3162            CALL HCILO(NO,N9,NS,ILT,ILP,TYPE,LOCA,SHEAR(1,ILC))
3163    953     GO TO 493
3164    426     TYPE 785
3165            TYPE 954
3166    954     FORMAT(' REACTION I.L. ORDINATES')
3167            TYPE 955
3168    955     FORMAT(' ----------------------'/)
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3169    956   TYPE 789
3170          ACCEPT 790, ISN
3171          IF(ISN.LT.1 .OR. ISN.GT.(NO+1)) GO TO 956
3172    957   TYPE 785
3173          TYPE 792
3174          TYPE 793
3175          ACCEPT 48, ZZ
3176          IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 957
3177          IF(ZZ.EQ.'N') GO TO 958
3178          CALL EQUA4(ISN)
3179          CALL GRAPH1
3180          CALL GRAPH4(NO,N9,BEAM,SC,DX)
3181    958   YMAX=0.
3182          DO 461 I=1,N9*NO+1
3183            YVALUE=ABS(REACT(I,ISN))
3184            IF(YVALUE.GT.YMAX) THEN
3185              YMAX=YVALUE
3186            END IF
3187    461   CONTINUE
3188          TYPE 155
3189          TYPE 480
3190    480   FORMAT(' !JUM 25,17')
3191          TYPE 499, ISN
3192    499   FORMAT(' Reaction I.L. at Support No. ',I1)
3193          CALL YMAX2(YMAX)
3194          TYPE 151
3195          TYPE 785
3196          TYPE 959
3197    959   FORMAT(T6,'The "L" term(s) are independent of the unit load positi
3198         *on and need be')
3199          TYPE 960
3200    960   FORMAT(T6,'input only once.'/)
3201          IF(ISN.EQ.1) THEN
3202            L1=1
3203            L2=1
3204          ELSE IF(ISN.EQ.5) THEN
3205            L1=4
3206            L2=4
3207          ELSE
3208            L1=ISN-1
3209            L2=ISN
3210          END IF
3211          DO 963 I=L1,L2
3212    961     TYPE 962, I
3213    962     FORMAT(T10,' Length of Span No. ',I1,' (ft): ',$)
3214            ACCEPT 889, SPL
3215            IF(SPL.NE.BEAM(I,1)) GO TO 961
3216    963   CONTINUE
3217    964   TYPE 785
3218          TYPE 894
3219          ACCEPT 849, LPT
3220          IF(LPT.LT.1 .OR. LPT.GT.(N9*NO+1)) GO TO 964
3221    984   TYPE 785
3222          TYPE 722
3223          CALL ULOAD(LPT,N9,X3,DX)
3224          TYPE 617
3225          TYPE 896, LPT
3226          TYPE 897
3227          DO 965 I=2,NO
3228            TYPE 898, I,SUPPM(LPT,I-1)
3229    965   CONTINUE
3230    966   TYPE 825
3231          ACCEPT 48, ZZ
3232          IF(ZZ.NE.'C') GO TO 966
3233          TYPE 785
3234          TYPE 967
3235    967   FORMAT(T6,'Recalling earlier definitions for the "A" and "B" terms
3236         * in the reaction')
3237          TYPE 968
3238    968   FORMAT(T6,'equation, the student must now enter values for these "
3239         *shear" terms.')
3240          TYPE 969
3241    969   FORMAT(T6,'Recall that either or both of the terms may be zero, de
3242         *pending on which')
3243          TYPE 970
3244    970   FORMAT(T6,'span the unit load occupies'/)
3245          IL=(ISN-2)*N9+1
3246          IMN=IL+N9
3247          IU=IMN+N9
3248          IF(LPT.LT.IL .OR. LPT.GT.IU) THEN
3249            AB=0.
3250            BB=0.
3251          ELSE IF(LPT.LE.IMN) THEN
3252            AB=0.
3253            BB=(LPT-IL)/RN9
3254          ELSE IF(LPT.GE.IMN) THEN
3255            AB=(IU-LPT)/RN9
3256            BB=0.
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3257            END IF
3258            IF(ISN.EQ.1) THEN
3259              VMIN=CF3*AB
3260              VMAX=CF4*AB
3261     972      TYPE 854
3262              ACCEPT 943, AA
3263              IF(AA.LT.VMIN .OR. AA.GT.VMAX) GO TO 972
3264            ELSE IF(ISN.EQ.2 .OR. ISN.EQ.3 .OR. ISN.EQ.4) THEN
3265              IF(AB.EQ.1.) THEN
3266                AC=1.
3267              ELSE
3268                AC=AB+BB
3269              END IF
3270              VMIN=CF3*AC
3271              VMAX=CF4*AC
3272     973      TYPE 974
3273     974      FORMAT(T11,' B + A = ',$)
3274              ACCEPT 943, AA
3275              IF(AA.LT.VMIN .OR. AA.GT.VMAX) GO TO 973
3276            ELSE
3277              VMIN=CF3*BB
3278              VMAX=CF4*BB
3279     975      TYPE 857
3280              ACCEPT 943, AA
3281              IF(AA.LT.VMIN .OR. AA.GT.VMAX) GO TO 975
3282            END IF
3283     976    TYPE 785
3284            YORD=REACT(LPT,ISN)
3285            TYPE 861
3286            TYPE 911
3287            TYPE 977, YORD,LPT
3288     977    FORMAT(T26,F6.2,' kips at 10th-Point No. ',I2/)
3289     978    TYPE 825
3290            ACCEPT 48, ZZ
3291            IF(ZZ.NE.'C') GO TO 978
3292            TYPE 785
3293            CALL PLPT(X3,YORD,YMAX,Y3)
3294            TYPE 865
3295            TYPE 866
3296     979    TYPE 868
3297            ACCEPT 48, ZZ
3298            IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 979
3299            IF(ZZ.EQ.'N') GO TO 981
3300            TYPE 700
3301            CALL ULOAD(LPT,N9,X3,DX)
3302            TYPE 618
3303     980    TYPE 785
3304            TYPE 870
3305            ACCEPT 849, LPT
3306            IF(LPT.LT.1 .OR. LPT.GT.(N9*NO+1)) GO TO 980
3307            GO TO 984
3308     981    TYPE 785
3309            TYPE 873
3310            ACCEPT 48, ZZ
3311            IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 981
3312            IF(ZZ.EQ.'N') GO TO 982
3313            TYPE 748
3314            TYPE 723
3315            CALL PLOT1(NO,N9,YMAX,DX,REACT(1,ISN))
3316     982    TYPE 785
3317            TYPE 875
3318            ACCEPT 48, ZZ
3319            IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 982
3320            IF(ZZ.EQ.'N') GO TO 983
3321            CALL HCBPD(EE,NO,BEAM,SC)
3322            ILT=4
3323            NS=0
3324            TYPE='Reaction      '
3325            LOCA='   Support No. '
3326            CALL HCILO(NO,N9,NS,ILT,ISN,TYPE,LOCA,REACT(1,ISN-1))
3327     983    GO TO 493
3328     427    TYPE 785
3329            TYPE 652
3330     652    FORMAT(' DEFLECTION I.L. ORDINATES')
3331            TYPE 653
3332     653    FORMAT(' -------------------------'/)
3333     654    TYPE 880
3334            TYPE 881
3335            ACCEPT 849, ILP
3336            IF(ILP.LT.1 .OR. ILP.GT.(N9*NO+1)) GO TO 654
3337            IF(ILP.EQ.1 .OR. ILP.EQ.11 .OR. ILP.EQ.21 .OR. ILP.EQ.31 .OR. ILP.
3338           *EQ.41) THEN
3339              TYPE 240
3340     240      FORMAT(/T6,'--> DATA ERROR--10th-Point must be in a span <--')
3341     241      TYPE 825
3342              ACCEPT 48, ZZ
3343              IF(ZZ.NE.'C') GO TO 241
3344              TYPE 735
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```
3345            GO TO 654
3346          END IF
3347          NS=INT((ILP-1)/RN9)+1
3348    655   TYPE 785
3349          TYPE 792
3350          TYPE 793
3351          ACCEPT 48, ZZ
3352          IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 655
3353          IF(ZZ.EQ.'N') GO TO 656
3354          CALL EQUA5(NS)
3355          CALL GRAPH1
3356          CALL GRAPH4(NO,N9,BEAM,SC,DX)
3357    656   YMAX=0.
3358          DO 539 I=1,N9*NO+1
3359            YVALUE=ABS(DELTA(I,ILP))
3360            IF(YVALUE.GT.YMAX) THEN
3361              YMAX=YVALUE
3362            END IF
3363    539   CONTINUE
3364          TYPE 155
3365          TYPE 610
3366          TYPE 551, ILP
3367    551   FORMAT(' Deflection I.L. at 10th-Point No. ',I2)
3368          TYPE 634
3369          TYPE 793, YMAX
3370          TYPE 595
3371          TYPE 516
3372          TYPE 695
3373          TYPE 798, -YMAX
3374          TYPE 151
3375          TYPE 785
3376          TYPE 657
3377    657   FORMAT(T6,'The terms "x", "l", "E", and "I" are independent of the
3378         * unit load posi-')
3379          TYPE 658
3380    658   FORMAT(T6,'tion and need be input only once.'/)
3381    659   TYPE 889, NS
3382          ACCEPT 463, DIS1
3383         . DIS2=(ILP-((NS-1)*N9+1))*BEAM(NS,1)/RN9
3384          IF(DIS1.NE.DIS2) GO TO 659
3385    660   TYPE 891, NS
3386          ACCEPT 889, SPL
3387          IF(SPL.NE.BEAM(NS,1)) GO TO 660
3388    661   TYPE 662, NS
3389    662   FORMAT(T10,' Moment of Inertia in Span No. ',I1,', I (ft.^4): ',$)
3390          ACCEPT 794, SPI
3391          IF(SPI.NE.BEAM(NS,2)) GO TO 661
3392    664   TYPE 665
3393    665   FORMAT(T10,' Modulus of Elasticity, E (ksi): ',$)
3394          ACCEPT 663, EES
3395          IF(EES.NE.EE) GO TO 664
3396    667   TYPE 785
3397          TYPE 894
3398          ACCEPT 849, LPT
3399          IF(LPT.LT.1 .OR. LPT.GT.(N9*NO+1)) GO TO 667
3400    668   TYPE 785
3401          TYPE 722
3402          CALL ULOAD(LPT,N9,X3,DX)
3403          TYPE 617
3404          TYPE 896, LPT
3405          TYPE 897
3406          DO 669 I=2,NO
3407            TYPE 898, I,SUPPM(LPT,I-1)
3408    669   CONTINUE
3409    670   TYPE 825
3410          ACCEPT 48, ZZ
3411          IF(ZZ.NE.'C') GO TO 670
3412          TYPE 785
3413          NSUL=INT((LPT-1)/RN9)+1
3414          IF(NSUL.NE.NS) GO TO 677
3415          LUL=(NS-1)*N9+1
3416          AN=(LPT-LUL)*BEAM(NSUL,1)/RN9
3417          BN=BEAM(NSUL,1)-AN
3418          XN=DIS2
3419          SPL=BEAM(NS,1)
3420          SPI=BEAM(NS,2)/CF2
3421          IF(AN.LE.XN) THEN
3422            DO=AN*(1.-XN/SPL)*(BN**2.+2.*AN*BN-(SPL-XN)**2.)/(6.*E*SPI)
3423          ELSE
3424            DO=BN*(XN/SPL)*(AN**2.+2.*AN*BN-XN**2.)/(6.*E*SPI)
3425          END IF
3426          GO TO 678
3427    677   DO=0.
3428    678   TYPE 671
3429    671   FORMAT(T6,'Recall that the deflection term on the right side of th
3430         *e deflection equa-')
3431          TYPE 672
3432    672   FORMAT(T6,'tion is a function of unit load position and the point
```

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     *for which the I.L.')
      TYPE 673, LPT
673   FORMAT(T6,'is being developed.  Thus, for a unit load at 10th-Poin
     *t No.',I2,' the')
      TYPE 674, ILP,DO
674   FORMAT(T6,'simple-span deflection at 10th-Point No. ',I2,' is: ',F
     *13.7,' feet.'/)
676   TYPE 825
      ACCEPT 48, ZZ
      IF(ZZ.NE.'C') GO TO 676
      TYPE 785
      YORD=DELTA(LPT,ILP)
      TYPE 861
      TYPE 911
      TYPE 679, YORD,LPT
679   FORMAT(T20,'Deflection = ',F13.7,' feet at 10th-Point No. ',I2/)
680   TYPE 825
      ACCEPT 48, ZZ
      IF(ZZ.NE.'C') GO TO 680
      TYPE 785
      CALL PLPT(X3,YORD,YMAX,Y3)
      TYPE 865
      TYPE 866
681   TYPE 868
      ACCEPT 48, ZZ
      IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 681
      IF(ZZ.EQ.'N') GO TO 683
      TYPE 700
      CALL ULOAD(LPT,N9,X3,DX)
      TYPE 618
682   TYPE 785
      TYPE 870
      ACCEPT 849, LPT
      IF(LPT.LT.1 .OR. LPT.GT.(N9*NO+1)) GO TO 682
      GO TO 668
683   TYPE 785
      TYPE 873
      ACCEPT 48, ZZ
      IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 683
      IF(ZZ.EQ.'N') GO TO 684
      TYPE 748
      TYPE 723
      CALL PLOT1(NO,N9,YMAX,DX,DELTA(1,ILP))
684   TYPE 785
      TYPE 875
      ACCEPT 48, ZZ
      IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 684
      IF(ZZ.EQ.'N') GO TO 685
      CALL HCBPD(EE,NO,BEAM,SC)
      ILT=5
      TYPE='Deflection    '
      LOCA='10th-Point No. '
      CALL HCILO(NO,N9,NS,ILT,ILP,TYPE,LOCA,DELTA(1,ILP))
685   GO TO 493
C
C APPLICATION SEGMENT FROM MAIN MENU
C
500   TYPE 326
      TYPE 785
      TYPE 502
502   FORMAT(' APPLICATION OF INFLUENCE LINES')
      TYPE 503
503   FORMAT(' ------------------------------'/)
      TYPE 504
504   FORMAT(T6,'The true benefit derived from using influence lines is
     *the designer de-')
      TYPE 505
505   FORMAT(T6,'velops an ability for defining "worst load" situations.
     *  This portion of')
      TYPE 506
506   FORMAT(T6,'the program will let the student see how the reposition
     *ing of loads or')
      TYPE 507
507   FORMAT(T6,'supports affects moments, shears, reactions, and deflec
     *tions at various')
      TYPE 508
508   FORMAT(T6,'points along the beam.  Thus it is hoped the student wi
     *ll develop a feel')
      TYPE 509
509   FORMAT(T6,'for the behavior of continuous beams subjected to vario
     *us loading cases.'/)
      INFLAG1=1
      INFLAG2=1
518   TYPE 519
519   FORMAT(T6,'APPLICATION MENU')
      TYPE 520
520   FORMAT(T6,'================'/)
      TYPE 510
```

```
3521    510   FORMAT(T11,'(A) Beam physical data input')
3522          TYPE 511
3523    511   FORMAT(T11,'(B) Display of influence lines')
3524          TYPE 512
3525    512   FORMAT(T11,'(C) Beam load data input')
3526          TYPE 513
3527    513   FORMAT(T11,'(D) Application of DL & LL to influence lines')
3528          TYPE 514
3529    514   FORMAT(T11,'(E) Return to Main Menu'//)
3530    515   TYPE 46
3531          ACCEPT 48, AM
3532          IF(AM.LT.'A' .OR. AM.GT.'E') GO TO 515
3533          IF(AM.EQ.'A') GO TO 530
3534          IF(AM.EQ.'B' .OR. AM.EQ.'C') THEN
3535            IF(INFLAG1.EQ.1) THEN
3536              TYPE 529
3537              TYPE 720
3538    612       TYPE 825
3539              ACCEPT 48, ZZ
3540              IF(ZZ.NE.'C') GO TO 612
3541              TYPE 785
3542              GO TO 518
3543            END IF
3544          END IF
3545          IF(AM.EQ.'B') GO TO 540
3546          IF(AM.EQ.'C') GO TO 560
3547          IF(AM.EQ.'D') THEN
3548            IF(INFLAG2.EQ.2) GO TO 620
3549            TYPE 529
3550            IF(INFLAG1.EQ.1) THEN
3551              TYPE 720
3552            END IF
3553            IF(INFLAG2.EQ.1) THEN
3554              TYPE 379
3555    379       FORMAT('--> INPUT LOGIC ERROR--PLEASE SPECIFY BEAM LOAD DATA
3556         *<--'//)
3557            END IF
3558    380     TYPE 825
3559            ACCEPT 48, ZZ
3560            IF(ZZ.NE.'C') GO TO 380
3561            TYPE 785
3562            GO TO 518
3563          END IF
3564          TYPE 326
3565          TYPE 785
3566          GO TO 33
3567    C
3568    C BEAM DATA INPUT FOR APPLICATION SEGMENT
3569    C
3570    530   TYPE 785
3571          TYPE 531
3572    531   FORMAT(' BEAM PHYSICAL DATA INPUT')
3573          TYPE 532
3574    532   FORMAT(' ------------------------'/)
3575          TYPE 533
3576    533   FORMAT(T6,'The student is now asked to specify physical data for a
3577         * 2, 3, or 4 span')
3578          TYPE 534
3579    534   FORMAT(T6,'beam of his or her choice.  This beam will serve as a m
3580         *odel to be used')
3581          TYPE 535
3582    535   FORMAT(T6,'for viewing various influence lines and applying variou
3583         *s loads.'/)
3584    536   TYPE 537
3585    537   FORMAT(T6,'Press "C" to continue with beam physical data input')
3586          TYPE 538
3587    538   FORMAT(T9,'or "R" to return to Application Menu: ',$)
3588          ACCEPT 48, ZZ
3589          IF(ZZ.NE.'C' .AND. ZZ.NE.'R') GO TO 536
3590          TYPE 785
3591          IF(ZZ.EQ.'R') GO TO 518
3592    501   CALL BEAMINP(E,EE,NO,BEAM,SC,CF1)
3593    C
3594    C COMPUTE ELEVATIONS AT 10TH-POINTS ASSUMING STRAIGHT
3595    C LINES BETWEEN SUPPORTS
3596    C
3597          DO 135 I=1,NO
3598            ELS=SC(I,2)
3599            SPL=BEAM(I,1)
3600            SPD=BEAM(I,3)
3601            DO 135 J=0,N9
3602              K=N9*(I-1)+J+1
3603              DELX(K)=ELS+J*SPD/RN9
3604    135   CONTINUE
3605          INFLAG1=2
3606          CALL DISDX(NO,BEAM,DX,SC)
3607          CALL LINORD(E,NO,N9,RN9,A,B,D,D1,BEAM,SUPPM,SPANM,SHEAR,REACT,
3608         *DELTA,ABC,CF2,DELSM)
```

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3609          CALL AREAS(NO,N9,RN9,E,CF2,SUPPM,SPANM,SHEAR,REACT,DELTA,BEAM,
3610         *AREAM,AREAV,AREAD,AREAR,VORD,DELSM,DELM,DELV,DELD)
3611          TYPE 785
3612          GO TO 518
3613    C
3614    C DISPLAY OF INFLUENCE LINES IN APPLICATION SEGMENT
3615    C
3616    540   TYPE 785
3617          TYPE 541
3618    541   FORMAT(' DISPLAY OF INFLUENCE LINES')
3619          TYPE 542
3620    542   FORMAT(' ------------------------'/)
3621          TYPE 543
3622    543   FORMAT(T6,'Influence lines have been generated for the beam specif
3623         *ied in part (A) and')
3624          TYPE 544
3625    544   FORMAT(T6,'are now available for viewing by the student.'/)
3626    521   TYPE 825
3627          ACCEPT 48, DIL
3628          IF(DIL.NE.'C') GO TO 521
3629    528   CALL GRAPH1
3630          CALL GRAPH4(NO,N9,BEAM,SC,DX)
3631    545   TYPE 546
3632    546   FORMAT(T6,'INFLUENCE LINE MENU')
3633          TYPE 547
3634    547   FORMAT(T6,'--------------------'/)
3635          TYPE 548
3636    548   FORMAT(T11,'(A) Support Moment I.L.      (D) Reaction I.L.')
3637          TYPE 549
3638    549   FORMAT(T11,'(B) Span Moment I.L.         (E) Deflection I.L.')
3639          TYPE 550
3640    550   FORMAT(T11,'(C) Shear I.L.               (F) Return to Application
3641         *Menu'/)
3642    554   TYPE 46
3643          ACCEPT 48, DI
3644          IF(DI.LT.'A' .OR. DI.GT.'F') GO TO 554
3645          IF(DI.EQ.'A') GO TO 523
3646          IF(DI.EQ.'B') GO TO 524
3647          IF(DI.EQ.'C') GO TO 525
3648          IF(DI.EQ.'D') GO TO 526
3649          IF(DI.EQ.'E') GO TO 527
3650          TYPE 326
3651          TYPE 785
3652          GO TO 518
3653    C
3654    C DISPLAY SUPPORT MOMENT INFLUENCE LINES
3655    C
3656    523   NC=NO-1
3657          NR=41
3658          CALL YMAX1(NC,NR,YMAX,SUPPM)
3659          TYPE 388
3660    388   FORMAT(' !VEC 132,14')
3661          TYPE 389
3662    389   FORMAT(' !STR /SUPPORT MOMENT INFLUENCE LINE(S)/')
3663          TYPE 155
3664          CALL YMAX2(YMAX)
3665          TYPE 151
3666    390   TYPE 785
3667          TYPE 789
3668          ACCEPT 790, ISN
3669          IF(ISN.LT.2 .OR. ISN.GT.NO) GO TO 390
3670          TYPE 748
3671          TYPE 723
3672          CALL PLOT1(NO,N9,YMAX,DX,SUPPM(1,ISN-1))
3673    985   TYPE 785
3674          TYPE 875
3675          ACCEPT 48, ZZ
3676          IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 985
3677          IF(ZZ.EQ.'N') GO TO 686
3678          CALL HCRPD(EE,NO,BEAM,SC)
3679          ILT=1
3680          NS=0
3681          TYPE='Support Moment'
3682          LOCA='   Support No. '
3683          CALL HCILO(NO,N9,NS,ILT,ISN,TYPE,LOCA,SUPPM(1,ISN-1))
3684    686   TYPE 785
3685          TYPE 687
3686    687   FORMAT(T6,'Press "D" to display another I.L. or "R" to return')
3687          TYPE 688
3688    688   FORMAT(T5,' to Influence Line Menu...',$)
3689          ACCEPT 48, ZZ
3690          IF(ZZ.NE.'D' .AND. ZZ.NE.'R') GO TO 686
3691          IF(ZZ.EQ.'D') GO TO 390
3692          GO TO 528
3693    C
3694    C DISPLAY SPAN MOMENT INFLUENCE LINES
3695    C
3696    524   NC=N9*NO+1
```

```
3697          NR=41
3698          CALL YMAX1(NC,NR,YMAX,SPANM)
3699          TYPE 388
3700          TYPE 391
3701    391   FORMAT(' !STR / SPAN MOMENT INFLUENCE LINE(S)/')
3702          TYPE 155
3703          CALL YMAX2(YMAX)
3704          TYPE 151
3705    392   TYPE 785
3706          TYPE 689
3707    689   FORMAT(T5,' Specify 10th-point from above: ',$)
3708          ACCEPT 849, ILP
3709          IF(ILP.LT.2 .OR. ILP.GT.(N9*NO)) GO TO 392
3710          TYPE 748
3711          TYPE 723
3712          CALL PLOT1(NO,N9,YMAX,DX,SPANM(1,ILP))
3713    986   TYPE 785
3714          TYPE 875
3715          ACCEPT 48, ZZ
3716          IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 986
3717          IF(ZZ.EQ.'N') GO TO 690
3718          CALL HCBPD(EE,NO,BEAM,SC)
3719          ILT=2
3720          TYPE='Span Moment    '
3721          LOCA='10th-Point No. '
3722          CALL HCILO(NO,N9,NS,ILT,ILP,TYPE,LOCA,SPANM(1,ILP))
3723    690   TYPE 785
3724          TYPE 687
3725          TYPE 688
3726          ACCEPT 48, ZZ
3727          IF(ZZ.NE.'D' .AND. ZZ.NE.'R') GO TO 690
3728          IF(ZZ.EQ.'D') GO TO 392
3729          GO TO 528
3730    C
3731    C DISPLAY SHEAR INFLUENCE LINES
3732    C
3733    525   NC=NO*(N9+1)
3734          NR=42
3735          CALL YMAX1(NC,NR,YMAX,SHEAR)
3736          TYPE 388
3737          TYPE 393
3738    393   FORMAT(' !STR /      SHEAR INFLUENCE LINE(S)/')
3739          TYPE 155
3740          CALL YMAX2(YMAX)
3741          TYPE 151
3742    394   TYPE 785
3743          TYPE 689
3744          ACCEPT 849, ILP
3745          IF(ILP.LT.1 .OR. ILP.GT.(N9*NO+1)) GO TO 394
3746          IF(ILP.EQ.1) THEN
3747            VSP='R'
3748          ELSE IF(ILP.EQ.(N9*NO+1)) THEN
3749            VSP='L'
3750          ELSE IF(ILP.EQ.11 .OR. ILP.EQ.21 .OR. ILP.EQ.31) THEN
3751            TYPE 823
3752    691     TYPE 929
3753            ACCEPT 48, VSP
3754            IF(VSP.NE.'L' .AND. VSP.NE.'R') GO TO 691
3755          ELSE
3756            VSP='N'
3757          END IF
3758          IF(VSP.EQ.'L') THEN
3759            NS=INT((ILP-1)/RN9)
3760          ELSE
3761            NS=INT((ILP-1)/RN9)+1
3762          END IF
3763          ILC=ILP+NS-1
3764          TYPE 748
3765          TYPE 723
3766          CALL PLOT2(ILP,NO,N9,NS,YMAX,DX,SHEAR(1,ILC))
3767    987   TYPE 785
3768          TYPE 875
3769          ACCEPT 48, ZZ
3770          IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 987
3771          IF(ZZ.EQ.'N') GO TO 692
3772          CALL HCBPD(EE,NO,BEAM,SC)
3773          ILT=3
3774          TYPE='Shear          '
3775          LOCA='10th-Point No. '
3776          CALL HCILO(NO,N9,NS,ILT,ILP,TYPE,LOCA,SHEAR(1,ILC))
3777    692   TYPE 785
3778          TYPE 687
3779          TYPE 688
3780          ACCEPT 48, ZZ
3781          IF(ZZ.NE.'D' .AND. ZZ.NE.'R') GO TO 692
3782          IF(ZZ.EQ.'D') GO TO 394
3783          GO TO 528
3784    C
```

```
C DISPLAY REACTION INFLUENCE LINES
C
526     NC=NO+1
        NR=41
        CALL YMAX1(NC,NR,YMAX,REACT)
        TYPE 388
        TYPE 395
395     FORMAT(' !STR /   REACTION INFLUENCE LINE(S)/')
        TYPE 155
        CALL YMAX2(YMAX)
        TYPE 151
396     TYPE 785
        TYPE 789
        ACCEPT 790, ISN
        IF(ISN.LT.1 .OR. ISN.GT.(NO+1)) GO TO 396
        TYPE 748
        TYPE 723
        CALL PLOT1(NO,N9,YMAX,DX,REACT(1,ISN))
988     TYPE 785
        TYPE 875
        ACCEPT 48, ZZ
        IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 988
        IF(ZZ.EQ.'N') GO TO 693
        CALL HCBPD(EE,NO,BEAM,SC)
        ILT=4
        NS=0
        TYPE='Reaction      '
        LOCA='   Support No. '
        CALL HCILO(NO,N9,NS,ILT,ISN,TYPE,LOCA,REACT(1,ISN))
693     TYPE 785
        TYPE 687
        TYPE 688
        ACCEPT 48, ZZ
        IF(ZZ.NE.'D' .AND. ZZ.NE.'R') GO TO 693
        IF(ZZ.EQ.'D') GO TO 396
        GO TO 528
C
C DISPLAY DEFLECTION INFLUENCE LINES
C
527   .NC=N9*NO+1
        NR=41
        CALL YMAX1(NC,NR,YMAX,DELTA)
        TYPE 388
        TYPE 397
397     FORMAT(' !STR /  DEFLECTION INFLUENCE LINE(S)/')
        TYPE 155
        TYPE 634
        TYPE 798, YMAX
        TYPE 595
        TYPE 516
        TYPE 695
        TYPE 798, -YMAX
        TYPE 151
398     TYPE 785
        TYPE 689
        ACCEPT 849, ILP
        IF(ILP.LT.1 .OR. ILP.GT.(N9*NO+1)) GO TO 398
        IF(ILP.EQ.1 .OR. ILP.EQ.11 .OR. ILP.EQ.21 .OR. ILP.EQ.31 .OR. ILP.
       *EQ.41) GO TO 398
        TYPE 748
        TYPE 723
        CALL PLOT1(NO,N9,YMAX,DX,DELTA(1,ILP))
989     TYPE 785
        TYPE 875
        ACCEPT 48, ZZ
        IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 989
        IF(ZZ.EQ.'N') GO TO 694
        CALL HCBPD(EE,NO,BEAM,SC)
        ILT=5
        TYPE='Deflection    '
        LOCA='10th-Point No. '
        CALL HCILO(NO,N9,NS,ILT,ILP,TYPE,LOCA,DELTA(1,ILP))
694     TYPE 785
        TYPE 687
        TYPE 688
        ACCEPT 48, ZZ
        IF(ZZ.NE.'D' .AND. ZZ.NE.'R') GO TO 694
        IF(ZZ.EQ.'D') GO TO 398
        GO TO 528
C
C LOAD DATA INPUT FOR APPLICATION SEGMENT
C
560     TYPE 785
        TYPE 561
561     FORMAT(' BEAM LOAD DATA INPUT')
        TYPE 562
562     FORMAT(' --------------------'/)
        TYPE 563
```

```
3873    563   FORMAT(T6,'The student can now apply dead loads and live loads to
3874         *the beam speci-')
3875          TYPE 564
3876    564   FORMAT(T6,'fied in part (A).  For purposes of visualizing the effe
3877         *cts of loads on a')
3878          TYPE 565
3879    565   FORMAT(T6,'continuous beam, the application of one dead load, one
3880         *live load, and a')
3881          TYPE 566
3882    566   FORMAT(T6,'combination of DL+LL is sufficient.'/)
3883    558   TYPE 825
3884          ACCEPT 48, ZZ
3885          IF(ZZ.NE.'C') GO TO 558
3886          TYPE 785
3887          TYPE 567
3888    567   FORMAT(T6,'DEAD LOAD INPUT')
3889          TYPE 568
3890    568   FORMAT(T6,'---------------'/)
3891          TYPE 569
3892    569   FORMAT(T11,'Dead loads will be assumed as being uniformly distribu
3893         *ted and')
3894          TYPE 570
3895    570   FORMAT(T11,'constant for all spans.')
3896    571   TYPE 529
3897    574   TYPE 575
3898    575   FORMAT(T10,' Specify uniform DL (k/ft): ',$)
3899          ACCEPT 943, UDL
3900          IF(UDL.LT.(-9.99) .OR. UDL.GT.(9.99)) GO TO 574
3901          DO 577 I=1,NO
3902            UNIDL(I)=UDL
3903    577   CONTINUE
3904          TYPE 785
3905          TYPE 584
3906    584   FORMAT(T6,'LIVE LOAD INPUT')
3907          TYPE 585
3908    585   FORMAT(T6,'---------------'/)
3909          TYPE 586
3910    586   FORMAT(T11,'Although a continuous beam may experience several type
3911         *s of live')
3912          TYPE 587
3913    587   FORMAT(T11,'loads, it is possible to illustrate live load effects
3914         *on contin-')
3915          TYPE 588
3916    588   FORMAT(T11,'uous beams by using either uniformly distributed loads
3917         * or AASHTO')
3918          TYPE 589
3919    589   FORMAT(T11,'truck loads.'/)
3920          TYPE 590
3921    590   FORMAT(T11,'Live load will be: (A) zero')
3922          TYPE 591
3923    591   FORMAT(T30,'(B) uniformly distributed')
3924          TYPE 592
3925    592   FORMAT(T30,'(C) AASHTO truck load'//)
3926    593   TYPE 594
3927    594   FORMAT(T10,' PLEASE SELECT ONE OF THE ABOVE: ',$)
3928          ACCEPT 48, TLL
3929          IF(TLL.LT.'A' .OR. TLL.GT.'C') GO TO 593
3930          IF(TLL.EQ.'A') GO TO 611
3931          IF(TLL.EQ.'B') GO TO 596
3932          IF(TLL.EQ.'C') GO TO 599
3933    596   TYPE 529
3934          TYPE 597
3935    597   FORMAT(T10,' Specify uniform LL (k/ft): ',$)
3936          ACCEPT 943, ULL
3937          IF(ULL.LT.(-9.99) .OR. ULL.GT.(9.99)) GO TO 596
3938          GO TO 611
3939    599   TYPE 529
3940          TYPE 600
3941    600   FORMAT(T11,'Available AASHTO truck loads are: (A) H10-44')
3942          TYPE 601
3943    601   FORMAT(T45,'(B) H15-44')
3944          TYPE 602
3945    602   FORMAT(T45,'(C) H20-44')
3946          TYPE 603
3947    603   FORMAT(T45,'(D) HS15-44')
3948          TYPE 604
3949    604   FORMAT(T45,'(E) HS20-44'//)
3950    605   TYPE 594
3951          ACCEPT 48, ALL
3952          IF(ALL.LT.'A' .OR. ALL.GT.'E') GO TO 605
3953          DOT='L-->R'
3954          CALL TRUCK(ALL,NP,AASHTO,AASHTL)
3955    611   TYPE 785
3956          INFLAG2=2
3957          GO TO 518
3958    C
3959    C APPLICATION OF DL & LL TO INFLUENCE LINES IN APPLICATION SEGMENT
3960    C
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3961    620   TYPE 785
3962          TYPE 621
3963    621   FORMAT(' APPLICATION OF DL & LL TO INFLUENCE LINES')
3964          TYPE 622
3965    622   FORMAT(' ----------------------------------------'/)
3966          TYPE 623
3967    623   FORMAT(T6,'The dead and live loads specified earlier in part (C) c
3968         *an now be applied')
3969          TYPE 624
3970    624   FORMAT(T6,'to the beam to (1) create shear & moment envelopes, (2)
3971         * compute support')
3972          TYPE 625
3973    625   FORMAT(T6,'reactions, or (3) compute beam deflections.  The studen
3974         *t is allowed to re-')
3975          TYPE 626
3976    626   FORMAT(T6,'position the live load and observe what effect this has
3977         * on the moments,')
3978          TYPE 627
3979    627   FORMAT(T6,'shears, or deflections.'/)
3980          IF(TLL.EQ.'B') GO TO 630
3981          IF(TLL.EQ.'C') GO TO 635
3982          TYPE 628
3983    628   FORMAT(T6,'You have chosen not to use a live load, therefore only
3984         *the beam DL will be')
3985          TYPE 629
3986    629   FORMAT(T6,'used to compute shear & moment envelopes, reactions, an
3987         *d deflections.'/)
3988    199   TYPE 825
3989          ACCEPT 48, ZZ
3990          IF(ZZ.NE.'C') GO TO 199
3991          CALL UDLORD(NO,N9,ENVEM,UNIDL,AREAM,ENVEV,AREAV,ENVED,AREAD,ENVER,
3992         *AREAR,TLL,LDLV,BEAM,NORDV,CONLL,DELM,DELV,DELD,DELX,EDT,NP)
3993          GO TO 301
3994    630   TYPE 631, ULL
3995    631   FORMAT(T6,'You have specified a uniformly distributed LL of ',F5.2
3996         *,' (k/ft) to be ap-')
3997          TYPE 632
3998    632   FORMAT(T6,'plied to various spans of the beam.  Please specify whi
3999         *ch spans the LL')
4000          TYPE 633
4001    633   FORMAT(T6,'will occupy:')
4002          TYPE 529
4003          CALL LIVE(NO,ULL,UNILL)
4004          CALL UDLORD(NO,N9,ENVEM,UNIDL,AREAM,ENVEV,AREAV,ENVED,AREAD,ENVER,
4005         *AREAR,TLL,LDLV,BEAM,NORDV,CONLL,DELM,DELV,DELD,DELX,EDT,NP)
4006          CALL ULLORD(NO,N9,ENVEM,UNILL,AREAM,ENVEV,AREAV,ENVED,AREAD,ENVER,
4007         *AREAR,DELX,EDT)
4008          GO TO 607
4009    635   IF(ALL.EQ.'D' .OR. ALL.EQ.'E') GO TO 637
4010          TYPE 636, AASHTL
4011    636   FORMAT(T6,'You have chosen to use an ',A6,' AASHTO truck load for
4012         *the beam live')
4013          GO TO 639
4014    637   TYPE 638, AASHTL
4015    638   FORMAT(T6,'You have chosen to use an ',A7,' AASHTO truck load for
4016         *the beam live')
4017    639   TYPE 640
4018    640   FORMAT(T6,'load.  Assuming the truck travels from left to right ac
4019         *ross the beam,')
4020          TYPE 641
4021    641   FORMAT(T6,'specify the distance, in feet, from the far left suppor
4022         *t to the front')
4023          TYPE 642
4024    642   FORMAT(T5,' wheels of the truck: ',$)
4025          ACCEPT 855, CONLL(1,1)
4026          IF(CONLL(1,1).LT.0. .OR. CONLL(1,1).GT.BEAM(5,1)) GO TO 635
4027          CONLL(2,1)=CONLL(1,1)-14.
4028          IF(ALL.EQ.'A' .OR. ALL.EQ.'B' .OR. ALL.EQ.'C') THEN
4029            CONLL(3,1)=0.
4030          ELSE
4031            TYPE 823
4032    644     TYPE 645
4033    645     FORMAT(T5,' Distance, in feet, from 2nd to 3rd axle (14 min, 30
4034         *max): ',$)
4035            ACCEPT 463, AXLE
4036            IF(AXLE.LT.14. .OR. AXLE.GT.30.) GO TO 644
4037            CONLL(3,1)=CONLL(2,1)-AXLE
4038          END IF
4039          CALL CONP(N9,NP,BEAM,CONLL,NORD,NORDV,NSFW)
4040          CALL UDLORD(NO,N9,ENVEM,UNIDL,AREAM,ENVEV,AREAV,ENVED,AREAD,ENVER,
4041         *AREAR,TLL,LDLV,BEAM,NORDV,CONLL,DELM,DELV,DELD,DELX,EDT,NP)
4042          CALL TLLORD(NO,N9,NP,SL,BEAM,SUPPM,SPANM,SHEAR,REACT,DELTA,NORD,
4043         *NORDV,TRLLV,CONLL,AASHTO,ENVEM,ENVEV,ENVED,ENVER,DELX,EDT)
4044    607   CALL CDLLL(NO,N9,NP,TLL,ENVEM,ENVEV,ENVED,ENVER,UDLV,TRLLV,TRWV,
4045         *DELX,EDT)
4046    301   TYPE 785
4047          TYPE 317
4048    317   FORMAT(' APPLICATION OPTIONS')
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4049          TYPE 318
4050    318   FORMAT(' --------------------')
4051          TYPE 322
4052    322   FORMAT(T6,'(A) Display moment envelopes, shear envelopes, or defle
4053         *ctions')
4054          TYPE 323
4055    323   FORMAT(T6,'(B) Revise DL or LL')
4056          TYPE 325
4057    325   FORMAT(T6,'(C) Return to Application Menu'//)
4058    248   TYPE 46
4059          ACCEPT 48, AO
4060          IF(AO.LT.'A' .OR. AO.GT.'C') GO TO 248
4061          IF(AO.EQ.'A') GO TO 327
4062          IF(AO.EQ.'B') GO TO 328
4063          TYPE 326
4064          GO TO 518
4065    C
4066    C DISPLAY MOMENT ENVELOPES, SHEAR ENVELOPES, OR DEFLECTION CURVES
4067    C
4068    327   CALL GRAPH1
4069          CALL GRAPH2(NO,BEAM,SC,UDL,ULL,TLL,AASHTO,CONLL,AASHTL,UNILL,ALL,
4070         *DX)
4071    387   TYPE 785
4072          TYPE 331
4073    331   FORMAT(T6,'DISPLAY OPTIONS')
4074          TYPE 332
4075    332   FORMAT(T6,'---------------')
4076          TYPE 333
4077    333   FORMAT(T11,'(A) Display moment envelopes      (C) Display deflectio
4078         *n curves')
4079          TYPE 334
4080    334   FORMAT(T11,'(B) Display shear envelopes       (D) Return to Applica
4081         *tion Options'/)
4082    249   TYPE 46
4083          ACCEPT 48, DO
4084          IF(DO.LT.'A' .OR. DO.GT.'D') GO TO 249
4085          IF(TLL.EQ.'A') THEN
4086            NC=1
4087          ELSE
4088            NC=3
4089          END IF
4090          IF(DO.EQ.'A') GO TO 555
4091          IF(DO.EQ.'B') GO TO 556
4092          IF(DO.EQ.'C') GO TO 557
4093          IF(DO.EQ.'D') GO TO 377
4094    C
4095    C DISPLAY MOMENT ENVELOPES
4096    C
4097    555   NR=41
4098          CALL YMAX1(NC,NR,YMAX,ENVEM)
4099          MORD=INT(YMAX)
4100          TYPE 399
4101    399   FORMAT(' !VEC 196,14',' !STR /MOMENT ENVELOPES/')
4102          TYPE 155
4103          TYPE 634
4104          TYPE 429, MORD
4105    429   FORMAT(I9,' ft-kips')
4106          TYPE 595
4107          TYPE 516
4108    516   FORMAT(' 0')
4109          TYPE 695
4110          TYPE 429, -MORD
4111          TYPE 151
4112          TYPE 748
4113          TYPE 559
4114    559   FORMAT(' !VEC 519,105',' !STR /CURVE LEGEND/')
4115          TYPE 573
4116    573   FORMAT(' !VEC 505,97,621,97')
4117          TYPE 740
4118          CALL PLOT1(NO,N9,YMAX,DX,ENVEM(1,1))
4119          TYPE 578
4120    578   FORMAT(' !VEC 515,80,563,80',' !STR /  DL/')
4121          IF(TLL.EQ.'A') GO TO 581
4122          TYPE 744
4123          CALL PLOT1(NO,N9,YMAX,DX,ENVEM(1,2))
4124          TYPE 579
4125    579   FORMAT(' !VEC 515,65,563,65',' !STR /  LL/')
4126          TYPE 722
4127          CALL PLOT1(NO,N9,YMAX,DX,ENVEM(1,3))
4128          TYPE 580
4129    580   FORMAT(' !VEC 515,50,563,50',' !STR /  DL+LL/')
4130    581   TYPE 785
4131          TYPE 748
4132          TYPE 183
4133    183   FORMAT(T6,'The student should note that any contribution to beam m
4134         *oments resulting')
4135          TYPE 184
4136    184   FORMAT(T6,'from uneven supports has been included in the DL curve.
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4137          *'/)
4138     190   TYPE 825
4139          ACCEPT 48, ZZ
4140          IF(ZZ.NE.'C') GO TO 190
4141          GO TO 327
4142     C
4143     C DISPLAY SHEAR ENVELOPES
4144     C
4145     556   NR=44
4146          BLENGTH=BEAM(5,1)
4147          CALL YMAX1(NC,NR,YMAX,ENVEV)
4148          TYPE 727
4149     727   FORMAT(' !VEC 196,14',' !STR / SHEAR ENVELOPES/')
4150          TYPE 155
4151          TYPE 634
4152          TYPE 728, YMAX
4153     728   FORMAT(F10.2,' kips')
4154          TYPE 595
4155          TYPE 516
4156          TYPE 695
4157          TYPE 728, -YMAX
4158          TYPE 151
4159          TYPE 748
4160          TYPE 559
4161          TYPE 573
4162          TYPE 740
4163          NVE=1
4164          CALL PLOT3(NO,N9,NP,NVE,TLL,BLENGTH,YMAX,DX,NORDV,CONLL,
4165         *ENVEV(1,1),UDLV)
4166          TYPE 578
4167          IF(TLL.EQ.'A') GO TO 813
4168          TYPE 744
4169          NVE=2
4170          CALL PLOT3(NO,N9,NP,NVE,TLL,BLENGTH,YMAX,DX,NORDV,CONLL,
4171         *ENVEV(1,2),TRLLV)
4172          TYPE 579
4173          TYPE 722
4174          NVE=3
4175          CALL PLOT3(NO,N9,NP,NVE,TLL,BLENGTH,YMAX,DX,NORDV,CONLL,
4176         *ENVEV(1,3),TRWV)
4177          TYPE 580
4178     813   TYPE 785
4179          TYPE 748
4180          TYPE 185
4181     185   FORMAT(T6,'The student should note that any contribution to beam s
4182         *hear resulting')
4183          TYPE 184
4184     191   TYPE 825
4185          ACCEPT 48, ZZ
4186          IF(ZZ.NE.'C') GO TO 191
4187          GO TO 327
4188     C
4189     C DISPLAY DEFLECTION CURVES
4190     C
4191     557   NR=41
4192          CALL YMAX1(NC,NR,YMAX,ENVED)
4193          TYPE 815
4194     815   FORMAT(' !VEC 196,14',' !STR /DEFLECTION CURVES/')
4195          TYPE 155
4196          TYPE 634
4197          TYPE 817, -YMAX
4198     817   FORMAT(F13.7,' ft')
4199          TYPE 595
4200          TYPE 516
4201          TYPE 695
4202          TYPE 817, YMAX
4203          TYPE 151
4204          TYPE 748
4205          TYPE 559
4206          TYPE 573
4207          TYPE 740
4208          CALL PLOT1(NO,N9,YMAX,DX,ENVED(1,1))
4209          TYPE 578
4210          IF(TLL.EQ.'A') GO TO 819
4211          TYPE 744
4212          CALL PLOT1(NO,N9,YMAX,DX,ENVED(1,2))
4213          TYPE 579
4214          TYPE 722
4215          CALL PLOT1(NO,N9,YMAX,DX,ENVED(1,3))
4216          TYPE 580
4217     819   TYPE 785
4218          TYPE 748
4219          TYPE 186
4220     186   FORMAT(T6,'For purposes of graphical presentation, the reference a
4221         *xis for deflec-')
4222          TYPE 187
4223     187   FORMAT(T6,'tions is assumed to be a straight line.  Thus, the defl
4224         *ection curves')
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4225          TYPE 189
4226    188   FORMAT(T6,'may experience slope discontinuity at a support if the
4227         *beam has uneven')
4228          TYPE 189
4229    189   FORMAT(T6,'supports.'/)
4230    192   TYPE 825
4231          ACCEPT 48, ZZ
4232          IF(ZZ.NE.'C') GO TO 192
4233          GO TO 327
4234    C
4235    C HARD COPY OPTION
4236    C
4237    377   TYPE 785
4238          TYPE 324
4239    324   FORMAT(T6,'Would you like a hard copy of all envelope ordinates an
4240         *d reactions')
4241          TYPE 329
4242    329   FORMAT(T5,' for this beam (Y/N)? ',$)
4243          ACCEPT 48, ZZ
4244          IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 377
4245          IF(ZZ.EQ.'N') GO TO 301
4246          CALL HCBPD(EE,NO,BEAM,SC)
4247          CALL HCBLD(NO,AXLE,DOT,AASHTL,UNIDL,UNILL,CONLL,TLL,NSFW)
4248          TITL='    >>>>>  DL'
4249          CALL HCMVD(NO,N9,TITL,ENVEM(1,1),ENVEV(1,1),EDT(1,1))
4250          IF(TLL.EQ.'A') GO TO 378
4251          TITL='     >>>>  LL'
4252          CALL HCMVD(NO,N9,TITL,ENVEM(1,2),ENVEV(1,2),EDT(1,2))
4253          TITL='>>>>>  DL+LL'
4254          CALL HCMVD(NO,N9,TITL,ENVEM(1,3),ENVEV(1,3),EDT(1,3))
4255    378   CALL HCSUR(NO,TLL,ENVER)
4256          GO TO 301
4257    C
4258    C DL & LL REVISION
4259    C
4260    328   TYPE 785
4261          TYPE 341
4262    341   FORMAT(T5,' DL O.K. (Y/N)? ',$)
4263          ACCEPT 48, ZZDL
4264          IF(ZZDL.NE.'Y' .AND. ZZDL.NE.'N') GO TO 328
4265         *IF(ZZDL.EQ.'Y') GO TO 432
4266          TYPE 823
4267    157   TYPE 342
4268    342   FORMAT(T10,' Specify new uniform DL (k/ft): ',$)
4269          ACCEPT 943, UDL
4270          IF(UDL.LT.(-9.99) .OR. UDL.GT.(9.99)) GO TO 157
4271          DO 343 I=1,NO
4272            UNIDL(I)=UDL
4273    343   CONTINUE
4274    432   IF(TLL.EQ.'A') GO TO 346
4275    344   TYPE 785
4276          TYPE 345
4277    345   FORMAT(T5,' LL O.K. (Y/N)? ',$)
4278          ACCEPT 48, ZZLL
4279          IF(ZZLL.NE.'Y' .AND. ZZLL.NE.'N') GO TO 344
4280          IF(ZZLL.EQ.'Y') GO TO 361
4281          IF(TLL.EQ.'B') GO TO 358
4282          IF(TLL.EQ.'C') GO TO 367
4283    346   TYPE 785
4284          TYPE 347
4285    347   FORMAT(T5,' Current LL=0, do you want to add a LL to the beam (Y/N
4286         *)? ',$)
4287          ACCEPT 48, ZZLL0
4288          IF(ZZLL0.NE.'Y' .AND. ZZLL0.NE.'N') GO TO 346
4289          IF(ZZLL0.EQ.'N') GO TO 361
4290          TYPE 785
4291    348   TYPE 349
4292    349   FORMAT(T5,' Type "U" for uniform LL or "T" for AASHTO truck LL: ',
4293         *$)
4294
4295          ACCEPT 48, ZZ
4296          IF(ZZ.NE.'U' .AND. ZZ.NE.'T') GO TO 348
4297          IF(ZZ.EQ.'L') THEN
4298            TLL='B'
4299            TYPE 823
4300    159     TYPE 597
4301            ACCEPT 943, ULL
4302            IF(ULL.LT.(-9.99) .OR. ULL.GT.(9.99)) GO TO 159
4303            TYPE 823
4304            CALL LIVE(NO,ULL,UNILL)
4305          ELSE
4306            DOT='L-->R'
4307            TLL='C'
4308            CALL TRUCK2(ALL,AXLE,NP,AASHTO,AASHTL,CONLL,BEAM)
4309    356   END IF
4310          GO TO 361
4311    358   TYPE 785
4312          TYPE 359
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4313    359   FORMAT(T5,' Revise uniform LL to AASHTO truck LL (Y/N)? ',$)
4314          ACCEPT 48, ZZ
4315          IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 358
4316          IF(ZZ.EQ.'N') GO TO 362
4317          DOT='L-->R'
4318          TLL='C'
4319          CALL TRUCK2(ALL,AXLE,NP,AASHTO,AASHTL,CONLL,BEAM)
4320          GO TO 361
4321    362   TYPE 785
4322          TYPE 363
4323    363   FORMAT(T5,' Revise uniform LL magnitude (Y/N)? ',$)
4324          ACCEPT 48, ZZ
4325          IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 362
4326          IF(ZZ.EQ.'N') GO TO 365
4327          TYPE 823
4328    161   TYPE 364
4329    364   FORMAT(T10,' Specify new uniform LL (k/ft): ',$)
4330          ACCEPT 943, ULL
4331          IF(ULL.LT.(-9.99) .OR. ULL.GT.(9.99)) GO TO 161
4332    365   TYPE 785
4333          TYPE 366
4334    366   FORMAT(T5,' Revise spans occupied by uniform LL (Y/N)? ',$)
4335          ACCEPT 48, ZZ
4336          IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 365
4337          IF(ZZ.EQ.'N') GO TO 361
4338          TYPE 823
4339          CALL LIVE(NO,ULL,UNILL)
4340          GO TO 361
4341    367   TYPE 785
4342          TYPE 368
4343    368   FORMAT(T5,' Revise AASHTO truck LL to uniform LL (Y/N)? ',$)
4344          ACCEPT 48, ZZ
4345          IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 367
4346          IF(ZZ.EQ.'N') GO TO 369
4347          TLL='U'
4348    246   TYPE 785
4349          TYPE 597
4350          ACCEPT 943, ULL
4351          IF(ULL.LT.(-9.99) .OR. ULL.GT.(9.99)) GO TO 246
4352          TYPE 823
4353         *CALL LIVE(NO,ULL,UNILL)
4354          GO TO 361
4355    369   TYPE 785
4356          TYPE 371
4357    371   FORMAT(T5,' Revise AASHTO truck type (Y/N)? ',$)
4358          ACCEPT 48, ZZ
4359          IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 369
4360          IF(ZZ.EQ.'N') GO TO 372
4361          CALL TRUCK2(ALL,AXLE,NP,AASHTO,AASHTL,CONLL,BEAM)
4362          GO TO 361
4363    372   TYPE 785
4364          TYPE 373
4365    373   FORMAT(T5,' Revise distance to front wheels (Y/N)? ',$)
4366          ACCEPT 48, ZZ
4367          IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 372
4368          IF(ZZ.EQ.'N') GO TO 374
4369    428   TYPE 529
4370          TYPE 336
4371    336   FORMAT(T6,'Assuming the truck travels from left to right, specify
4372         *the')
4373          TYPE 337
4374    337   FORMAT(T5,' distance from far left support to front wheels: ',$)
4375          ACCEPT 855, CONLL(1,1)
4376          IF(CONLL(1,1).LT.0. .OR. CONLL(1,1).GT.BEAM(5,1)) GO TO 428
4377          CONLL(2,1)=CONLL(1,1)-14.
4378          IF(ALL.EQ.'D' .OR. ALL.EQ.'E') THEN
4379            CONLL(3,1)=CONLL(2,1)-AXLE
4380          ELSE
4381            CONLL(3,1)=0.
4382          END IF
4383          CALL TRUCK(ALL,NP,AASHTO,AASHTL)
4384          GO TO 361
4385    374   IF(ALL.EQ.'A' .OR. ALL.EQ.'B' .OR. ALL.EQ.'C') GO TO 361
4386    375   TYPE 785
4387          TYPE 376
4388    376   FORMAT(T5,' Revise rear axle spacing (Y/N)? ',$)
4389          ACCEPT 48, ZZ
4390          IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 375
4391          IF(ZZ.EQ.'N') GO TO 361
4392    892   TYPE 529
4393          TYPE 645
4394          ACCEPT 463, AXLE
4395          IF(AXLE.LT.14. .OR. AXLE.GT.30.) GO TO 892
4396          CONLL(3,1)=CONLL(2,1)-AXLE
4397    361   IF(ZZDL.EQ.'Y' .AND. ZZLL.EQ.'Y') GO TO 301
4398          IF(ZZDL.EQ.'Y' .AND. ZZLLO.EQ.'N') GO TO 301
4399          IF(TLL.EQ.'A') THEN
4400            CALL UDLCRD(NO,N9,ENVEM,UNIDL,AREAM,ENVEV,AREAV,ENVED,AREAD,
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4401          *   ENVER,AREAR,TLL,UDLV,BEAM,NORDV,CONLL,DELM,DELV,DELD,DELX,
4402          *   EDT,NP)
4403              GO TO 301
4404           ELSE IF(TLL.EQ.'B') THEN
4405              CALL UDLCRD(NO,N9,ENVEM,UNIDL,AREAM,ENVEV,AREAV,ENVED,AREAD,
4406          *   ENVER,AREAR,TLL,UDLV,BEAM,NORDV,CONLL,DELM,DELV,DELD,DELX,
4407          *   EDT,NP)
4408              CALL ULLCRD(NO,N9,ENVEM,UNILL,AREAM,ENVEV,AREAV,ENVED,AREAD,
4409          *   ENVER,AREAR,DELX,EDT)
4410           ELSE IF(TLL.EQ.'C') THEN
4411              CALL CONP(N9,NP,BEAM,CONLL,NORD,NORDV,NSFW)
4412              CALL UDLCRD(NO,N9,ENVEM,UNIDL,AREAM,ENVEV,AREAV,ENVED,AREAD,
4413          *   ENVER,AREAR,TLL,UDLV,BEAM,NORDV,CONLL,DELM,DELV,DELD,DELX,
4414          *   EDT,NP)
4415              CALL TLLCRD(NO,N9,NP,SL,BEAM,SUPPM,SPANM,SHEAR,REACT,DELTA,
4416          *   NORD,NORDV,TRLLV,CONLL,AASHTO,ENVEM,ENVEV,ENVED,ENVER,DELX,EDT)
4417           END IF
4418           CALL CDLLL(NO,N9,NP,TLL,ENVEM,ENVEV,ENVED,ENVER,UDLV,TRLLV,TRWV,
4419          *DELX,EDT)
4420           GO TO 301
4421    9999   CALL DONEPL
4422           TYPE 785
4423           TYPE 583
4424    990    FORMAT(T10,A54)
4425           TYPE 990,'*************************************************************'
4426           TYPE 990,'*                                                           *'
4427           TYPE 990,'*                                                           *'
4428           TYPE 990,'*   one final comment...                                    *'
4429           TYPE 990,'*                                                           *'
4430           TYPE 990,'*                                                           *'
4431           TYPE 990,'*   The computer is but a tool, and cannot make a           *'
4432           TYPE 990,'*   good engineer out of a poor engineer...                 *'
4433           TYPE 990,'*                                                           *'
4434           TYPE 990,'*   But it can make a good engineer even better!            *'
4435           TYPE 990,'*                                                           *'
4436           TYPE 990,'*                                                           *'
4437           TYPE 990,'*                    HAVE A NICE DAY!!                      *'
4438           TYPE 990,'*                                                           *'
4439           TYPE 990,'*                                                           *'
4440           TYPE 990,'*************************************************************'
4441           TYPE 583
4442           END
4443    C-------------------------------------------------------------------------C
4444    C------------------------   SUBROUTINE LISTING   -------------------------C
4445    C-------------------------------------------------------------------------C
4446           SUBROUTINE ARC1(X,Y)
4447    C
4448    C  SUBROUTINE TO DRAW CLOCKWISE +M ARROW
4449    C
4450           CALL STRTPT(X-.129,Y-.483)
4451           CALL CONNPT(X-.354,Y-.354)
4452           CALL CONNPT(X-.483,Y-.129)
4453           CALL CONNPT(X-.483,Y+.129)
4454           CALL CONNPT(X-.354,Y+.354)
4455           CALL VECTOR(X-.354,Y+.354,X-.129,Y+.483,1401)
4456           RETURN
4457           END
4458    C-------------------------------------------------------------------------C
4459           SUBROUTINE ARC2(X,Y)
4460    C
4461    C  SUBROUTINE TO DRAW COUNTERCLOCKWISE +M ARROW
4462    C
4463           CALL STRTPT(X+.129,Y-.483)
4464           CALL CONNPT(X+.354,Y-.354)
4465           CALL CONNPT(X+.483,Y-.129)
4466           CALL CONNPT(X+.483,Y+.129)
4467           CALL CONNPT(X+.354,Y+.354)
4468           CALL VECTOR(X+.354,Y+.354,X+.129,Y+.483,1401)
4469           RETURN
4470           END
4471    C-------------------------------------------------------------------------C
4472           SUBROUTINE ARC3(X,Y)
4473    C
4474    C  SUBROUTINE TO DRAW COUNTERCLOCKWISE -M ARROW
4475    C
4476           CALL STRTPT(X-.129,Y+.483)
4477           CALL CONNPT(X-.354,Y+.354)
4478           CALL CONNPT(X-.483,Y+.129)
4479           CALL CONNPT(X-.483,Y-.129)
4480           CALL CONNPT(X-.354,Y-.354)
4481           CALL VECTOR(X-.354,Y-.354,X-.129,Y-.483,1401)
4482           RETURN
4483           END
4484    C-------------------------------------------------------------------------C
4485           SUBROUTINE ARC4(X,Y)
4486    C
4487    C  SUBROUTINE TO DRAW CLOCKWISE -M ARROW
4488    C
```

```
      CALL STRTPT(X+.129,Y+.483)
      CALL CONNPT(X+.354,Y+.354)
      CALL CONNPT(X+.483,Y+.129)
      CALL CONNPT(X+.483,Y-.129)
      CALL CONNPT(X+.354,Y-.354)
      CALL VECTOR(X+.354,Y-.354,X+.129,Y-.483,1401)
      RETURN
      END
C-----------------------------------------------------------------------C
      SUBROUTINE AREAS(NO,N9,RN9,E,CF2,SUPPM,SPANM,SHEAR,REACT,DELTA,
     *BEAM,AREAM,AREAV,AREAD,AREAR,VORD,DELSM,DELM,DELV,DELD)
      IMPLICIT REAL*8 (A-H,O-Z)
      DIMENSION SUPPM(41,3),SPANM(41,41),SHEAR(42,44),REACT(41,5),
     *DELTA(41,41),BEAM(5,3),AREAM(41,4),AREAV(44,4),AREAD(41,4),
     *AREAR(5,4),VORD(40),DELSM(3),DELM(41),DELV(44),DELD(41)
C
C COMPUTE AND STORE AREAS OF MOMENT AND DEFLECTION INFLUENCE LINES
C
      DO 103 I=1,N9*NO+1
        DO 103 J=1,NO
          J1=N9*(J-1)+1
          J2=N9*J
          SUM1=0.
          SUM2=0.
          DO 101 K=J1,J2
            SUM1=SUM1+SPANM(K,I)+SPANM(K+1,I)
            SUM2=SUM2+DELTA(K,I)+DELTA(K+1,I)
101       CONTINUE
          AREAM(I,J)=SUM1*BEAM(J,1)/(2.*N9)
          AREAD(I,J)=SUM2*BEAM(J,1)/(2.*N9)
103   CONTINUE
C
C COMPUTE AND STORE AREAS OF SHEAR INFLUENCE LINES
C
      DO 111 I=1,NO*(N9+1)
        K=1
        DO 107 J=1,N9*NO+1
          VORD(K)=0.0
          V1=SHEAR(J,I)
          V2=SHEAR(J+1,I)
          V3=V2-V1
          IF(V3.GT.(.999) .AND. V3.LT.(1.001)) GO TO 107
          VORD(K)=V1+V2
          K=K+1
107     CONTINUE
        DO 111 L=1,NO
          SUM3=0.
          L1=N9*(L-1)+1
          L2=N9*L
          DO 109 M=L1,L2
            SUM3=SUM3+VORD(M)
109       CONTINUE
          AREAV(I,L)=SUM3*BEAM(L,1)/(2.*N9)
111   CONTINUE
C
C COMPUTE AND STORE AREAS OF REACTION INFLUENCE LINES
C
      DO 115 I=1,NO+1
        DO 115 J=1,NO
          J1=N9*(J-1)+1
          J2=N9*J
          SUM4=0.
          DO 113 K=J1,J2
            SUM4=SUM4+REACT(K,I)+REACT(K+1,I)
113       CONTINUE
          AREAR(I,J)=SUM4*BEAM(J,1)/(2.*N9)
115   CONTINUE
C
C COMPUTE AND STORE MOMENT, SHEAR, & DEFLECTION ORDINATES
C RESULTING FROM UNEVEN SUPPORT ELEVATIONS.
C
      DO 117 I=1,NO
        SPL=BEAM(I,1)
        SPI=BEAM(I,2)/CF2
        IF(I.EQ.1) THEN
          SML=0.0
          SMR=DELSM(I)
        ELSE IF(I.EQ.NO) THEN
          SML=DELSM(I-1)
          SMR=0.0
        ELSE
          SML=DELSM(I-1)
          SMR=DELSM(I)
        END IF
        SPANV=(SMR-SML)/RN9
        DO 117 J=0,N9
          K=N9*(I-1)+J+1
          L=(N9+1)*(I-1)+J+1
```

```
4577              DELM(K)=SML-(J/RN9)*(SML-SMR)
4578              DELV(L)=SPANV
4579              SPX=J*SPL/RN9
4580              DELD(K)=SPX*(1.-J/RN9)*(SML*(2.*SPL-SPX)+SMR*(SPL+SPX))/
4581             *                (6.*E*SPI)
4582        117   CONTINUE
4583              RETURN
4584              END
4585        C-------------------------------------------------------------------------C
4586              SUBROUTINE BEAM1
4587        C
4588        C SUBROUTINE TO GRAPH A 3-SPAN BEAM WITH SPAN RATIOS OF 1:1.3:1
4589        C
4590              CALL SETCLR('CYAN')
4591              CALL VECTOR(1.,2.,14.2,2.,0)
4592              CALL VECTOR(.8,1.8,1.2,1.8,0)
4593              CALL VECTOR(.9,1.8,1.,2.,0)
4594              CALL VECTOR(1.,2.,1.1,1.8,0)
4595              CALL VECTOR(4.8,1.8,5.2,1.8,0)
4596              CALL VECTOR(10.0,1.8,10.4,1.8,0)
4597              CALL VECTOR(14.0,1.8,14.4,1.8,0)
4598              CALL BLCIR(5.,1.9,.1,.01)
4599              CALL BLCIR(10.2,1.9,.1,.01)
4600              CALL BLCIR(14.2,1.9,.1,.01)
4601              RETURN
4602              END
4603        C-------------------------------------------------------------------------C
4604              SUBROUTINE BEAM2
4605        C
4606        C SUBROUTINE TO GRAPH FREE-BODY DIAGRAM OF SPAN N
4607        C
4608              CALL AREA2D(8.,3.)
4609              CALL HEIGHT(.25)
4610              CALL SETCLR('CYAN')
4611              CALL VECTOR(1.,2.,7.,2.,0)
4612              CALL MESSAG('(I>L.4)N',8,3.7,1.6)
4613              CALL SETCLR('RED')
4614              CALL VECTOR(1.,1.2,1.,1.9,1401)
4615              CALL VECTOR(7.,1.9,7.,1.2,1401)
4616             X=1.
4617              Y=2.
4618              CALL ARC1(X,Y)
4619              X=7.
4620              Y=2.
4621              CALL ARC2(X,Y)
4622              CALL SETCLR('GREEN')
4623              CALL VECTOR(3.,2.9,3.,2.1,1401)
4624              CALL MESSAG('1>E.8H.8)K',10,3.,3.2)
4625              CALL SETCLR('YELLOW')
4626              CALL VECTOR(1.,.1,1.,1.,0)
4627              CALL VECTOR(7.,.1,7.,1.,0)
4628              CALL VECTOR(1.,.3,7.,.3,1402)
4629              CALL VECTOR(2.5,.6,2.5,1.6,0)
4630              CALL VECTOR(1.,.8,2.5,.8,1402)
4631              CALL VECTOR(2.48,1.9,2.48,2.1,0)
4632              CALL VECTOR(2.52,1.9,2.52,2.1,0)
4633              CALL VECTOR(1.,2.2,1.,2.9,0)
4634              CALL VECTOR(7.,2.2,7.,2.9,0)
4635              CALL VECTOR(1.,2.6,3.,2.6,1402)
4636              CALL VECTOR(3.,2.6,7.,2.6,1402)
4637              CALL MESSAG('L>L.4)N',7,3.7,.5)
4638              CALL MESSAG('X',1,1.7,1.)
4639              CALL MESSAG('A>L.4)N',7,1.7,2.8)
4640              CALL MESSAG('B>L.4)N',7,4.7,2.8)
4641              CALL SETCLR('WHITE')
4642              CALL MESSAG('(V>L.4)L',8,.5,1.)
4643              CALL MESSAG('(V>L.4)R',8,7.2,1.)
4644              CALL MESSAG('(M>L.4)L',8,0.1,1.8)
4645              CALL MESSAG('(M>L.4)R',8,7.6,1.8)
4646              CALL RESET('HEIGHT')
4647              RETURN
4648              END
4649        C-------------------------------------------------------------------------C
4650              SUBROUTINE BEAMINP(E,EE,NO,BEAM,SC,CF1)
4651              IMPLICIT REAL*8 (A-H,O-Z)
4652              DIMENSION BEAM(5,3),SC(5,2)
4653              CHARACTER ZZ
4654        C
4655        C BEAM PHYSICAL DATA INPUT SUBROUTINE
4656        C
4657        48    FORMAT(A1)
4658        386   FORMAT(F7.1,F5.2)
4659        794   FORMAT(F7.2)
4660        663   FORMAT(F8.1)
4661        790   FORMAT(I1)
4662        227   FORMAT(I5)
4663        823   FORMAT(/)
4664        529   FORMAT(//)
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4665    583   FORMAT(///)
4666    785   FORMAT(' !ERA M')
4667    209   TYPE 210
4668    210   FORMAT(' BEAM PHYSICAL DATA INPUT')
4669          TYPE 211
4670    211   FORMAT(' ------------------------'/)
4671    212   TYPE 213
4672    213   FORMAT(T5,' Specify number of spans (2, 3, or 4): ',$)
4673          ACCEPT 790, NO
4674          IF(NO.LT.2 .OR. NO.GT.4) GO TO 212
4675          TYPE 529
4676          TYPE 215
4677    215   FORMAT(T6,'SUPPORT COORDINATE INPUT')
4678          TYPE 208
4679    208   FORMAT(T6,'-------------------------'/)
4680          TYPE 214
4681    214   FORMAT(T11,'Support No. 1 coordinates are [0.0,0.0]'/)
4682          SC(1,1)=0.C
4683          SC(1,2)=0.C
4684          DO 218 I=2,NO+1
4685            TYPE 216,I
4686    216     FORMAT(I10,' Specify X,Y for Support No. ',I1,' (ft): ',$)
4687            ACCEPT 386, SC(I,1),SC(I,2)
4688    218   CONTINUE
4689          TYPE 529
4690          TYPE 220
4691    220   FORMAT(T6,'MOMENT OF INERTIA INPUT')
4692          TYPE 207
4693    207   FORMAT(T6,'-----------------------'/)
4694          DO 225 I=1,NO
4695            TYPE 222,I
4696    222     FORMAT(I10,' Moment of Inertia for Span No. ',I1,' (ft.^4): ',$)
4697            ACCEPT 794, BEAM(I,2)
4698    225   CONTINUE
4699          TYPE 529
4700          TYPE 226
4701    226   FORMAT(T5,' Modulus of Elasticity, E (ksi): ',$)
4702          ACCEPT 663, EE
4703          TYPE 529
4704    228   TYPE 229
4705    229   FORMAT(T5,' BEAM PHYSICAL DATA O.K. (Y/N)? ',$)
4706          ACCEPT 48, ZZ
4707          IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 228
4708          IF(ZZ.EQ.'Y') GO TO 221
4709          TYPE 785
4710          TYPE 276
4711    276   FORMAT(' BEAM PHYSICAL DATA REVISION')
4712          TYPE 277
4713    277   FORMAT(' -------------------------'/)
4714    278   TYPE 279, NO
4715    279   FORMAT(T6,'A. Revise existing ',I1,' span beam')
4716          TYPE 280
4717    280   FORMAT(T6,'B. Configure a new beam'//)
4718    281   TYPE 46
4719    46    FORMAT(T5,' PLEASE SELECT ONE OF THE ABOVE: ',$)
4720          ACCEPT 48, ZZ
4721          IF(ZZ.NE.'A' .AND. ZZ.NE.'B') GO TO 281
4722          IF(ZZ.EQ.'A') GO TO 284
4723          TYPE 785
4724          GO TO 209
4725    284   TYPE 785
4726          TYPE 381
4727    381   FORMAT(' CURRENT SUPPORT COORDINATES (feet)')
4728          TYPE 382
4729    382   FORMAT(' ----------------------------------'//)
4730          TYPE 285
4731    285   FORMAT(T22,'SUPPORT       X-ORD       Y-ORD ')
4732          TYPE 287
4733    287   FORMAT(T20,'-----------------------------------')
4734          DO 289 I=1,NO+1
4735            TYPE 288, I,SC(I,1),SC(I,2)
4736    288     FORMAT(24X,I1,3X,2F12.2)
4737    289   CONTINUE
4738          TYPE 287
4739          TYPE 529
4740    290   TYPE 291
4741    291   FORMAT(T5,' Support coordinates O.K. (Y/N)? ',$)
4742          ACCEPT 48, ZZ
4743          IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 290
4744          IF(ZZ.EQ.'Y') GO TO 296
4745          TYPE 529
4746    294   TYPE 295
4747    295   FORMAT(T5,' Specify Support No. needing coordinate revision: ',$)
4748          ACCEPT 790, I
4749          IF(I.LT.2 .OR. I.GT.(NO+1)) GO TO 294
4750          TYPE 823
4751          TYPE 216, I
4752          ACCEPT 386, SC(I,1),SC(I,2)
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4753            GO TO 284
4754      296   TYPE 785
4755            TYPE 383
4756      383   FORMAT(' CURRENT MOMENTS OF INERTIA (ft.^4)')
4757            TYPE 384
4758      384   FORMAT(' ----------------------------------'//)
4759            TYPE 297
4760      297   FORMAT(T22,'SPAN           MOMENT OF INERTIA')
4761            TYPE 287
4762            DO 299 I=1,NO
4763              TYPE 298, I,BEAM(I,2)
4764      298     FORMAT(23X,I1,16X,F7.2)
4765      299   CONTINUE
4766            TYPE 287
4767            TYPE 529
4768      166   TYPE 167
4769      167   FORMAT(T5,' Moments of inertia O.K. (Y/N)? ',$)
4770            ACCEPT 48, ZZ
4771            IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 166
4772            IF(ZZ.EQ.'Y') GO TO 174
4773            TYPE 529
4774      169   TYPE 170
4775      170   FORMAT(T5,' Specify Span No. needing Moment of Inertia revision:
4776           *',$)
4777            ACCEPT 790, I
4778            IF(I.LT.1 .OR. I.GT.NO) GO TO 169
4779            TYPE 823
4780      171   TYPE 222, I
4781            ACCEPT 386, BEAM(I,2)
4782            GO TO 296
4783      174   TYPE 785
4784            TYPE 529
4785            TYPE 176, EE
4786      176   FORMAT(T2,'Modulus of Elasticity = ',F7.0,' ksi')
4787            TYPE 529
4788      172   TYPE 173
4789      173   FORMAT(T5,' Modulus of Elasticity O.K. (Y/N)? ',$)
4790            ACCEPT 48, ZZ
4791            IF(ZZ.NE.'Y' .AND. ZZ.NE.'N') GO TO 172
4792           IF(ZZ.EQ.'Y') GO TO 221
4793            TYPE 823
4794      177   TYPE 175
4795      175   FORMAT(T10,' Specify new E (ksi): ',$)
4796            ACCEPT 663, EE
4797            GO TO 174
4798      221   TYPE 785
4799            LFLAG=1
4800      C
4801      C ROUTINE TO CHECK ALL INPUT DATA AGAINST LIMITATIONS
4802      C
4803            DO 206 I=2,NO+1
4804      232     BEAM(I-1,1)=SC(I,1)-SC(I-1,1)
4805              BEAM(I-1,3)=SC(I,2)-SC(I-1,2)
4806              VDBS=BEAM(I-1,3)
4807              IF(BEAM(I-1,1).GE.100. .AND. BEAM(I-1,1).LE.300.) GO TO 223
4808              LFLAG=2
4809              TYPE 217, I-1
4810      217     FORMAT(T6,'--> DATA ERROR--SPAN ',I1,' LENGTH EXCEEDS ',
4811           *  'LIMITS <--')
4812      223     IF(VDBS.GE.(-1.0) .AND. VDBS.LE.(1.0)) GO TO 205
4813              LFLAG=2
4814              TYPE 224, I-1
4815      224     FORMAT(T6,'--> DATA ERROR--SPAN ',I1,' SLOPE EXCEEDS ',
4816           *  'LIMITS <--')
4817      205     IF(BEAM(I-1,2).GE.(1.) .AND. BEAM(I-1,2).LE.(999.99)) GO TO 206
4818              LFLAG=2
4819              TYPE 230, I-1
4820      230     FORMAT(T6,'--> DATA ERROR--SPAN ',I1,' MOMENT OF INERTIA ',
4821           *  'EXCEEDS LIMITS <--')
4822      206   CONTINUE
4823            IF(EE.GE.10000. .AND. EE.LE.99999.) GO TO 234
4824            LFLAG=2
4825            TYPE 231
4826      231   FORMAT(T6,'--> DATA ERROR--MODULUS OF ELASTICITY EXCEEDS ',
4827           *'LIMITS <--')
4828      234   IF(LFLAG.EQ.2) GO TO 203
4829            E=EE*CF1
4830            BEAM(5,1)=0.
4831            DO 201 I=1,NO
4832              BEAM(5,1)=BEAM(5,1)+BEAM(I,1)
4833      201   CONTINUE
4834            GO TO 202
4835      203   TYPE 529
4836            TYPE 204
4837      204   FORMAT(T5,' Press "C" to make necessary corrections...',$)
4838            ACCEPT 48, ZZ
4839            IF(ZZ.NE.'C') GO TO 203
4840            GO TO 284
```

```
4841    202   RETURN
4842          END
4843    C-------------------------------------------------------------------------C
4844          SUBROUTINE CDLLL(NO,N9,NP,TLL,ENVEM,ENVEV,ENVED,ENVER,UDLV,TRLLV,
4845         *TRWV,DELX,EDT)
4846          IMPLICIT REAL*8 (A-H,O-Z)
4847          DIMENSION ENVEM(41,3),ENVEV(44,3),ENVED(41,3),ENVER(5,3),
4848         *UDLV(3,2),TRLLV(3,2),TRWV(3,2),DELX(41),EDT(41,3)
4849          CHARACTER TLL
4850    C
4851    C SUBROUTINE TO COMBINE DL & LL ENVELOPE ORDINATES
4852    C
4853          DO 705 I=1,N9*NO+1
4854            ENVEM(I,3)=ENVEM(I,1)+ENVEM(I,2)
4855            ENVED(I,3)=ENVED(I,1)+ENVED(I,2)
4856            EDT(I,3)=-ENVED(I,3)+DELX(I)
4857    705   CONTINUE
4858          DO 706 I=1,(N9+1)*NO
4859            ENVEV(I,3)=ENVEV(I,1)+ENVEV(I,2)
4860    706   CONTINUE
4861          DO 707 I=1,NO+1
4862            ENVER(I,3)=ENVER(I,1)+ENVER(I,2)
4863    707   CONTINUE
4864          IF(TLL.EQ.'C') THEN
4865            DO 708 I=1,NP
4866              TRWV(I,1)=UDLV(I,1)+TRLLV(I,1)
4867              TRWV(I,2)=UDLV(I,1)+TRLLV(I,2)
4868    708       CONTINUE
4869          END IF
4870          RETURN
4871          END
4872    C-------------------------------------------------------------------------C
4873          SUBROUTINE CONP(N9,NP,BEAM,CONLL,NORD,NORDV,NSFW)
4874          IMPLICIT REAL*8 (A-H,O-Z)
4875          DIMENSION BEAM(5,3),CONLL(3,2),NORD(3,2),NORDV(3,2)
4876    C
4877    C SUBROUTINE TO COMPUTE 10TH POINT NUMBERS ON EACH SIDE
4878    C OF THE CONCENTRATED AASHTO POINT LOADS
4879    C
4880         * DL1=BEAM(1,1)
4881          DL2=DL1+BEAM(2,1)
4882          DL3=DL2+BEAM(3,1)
4883          DO 615 I=1,NP
4884            D9=CONLL(I,1)
4885            IF(D9.LE.DL1) THEN
4886              D2=0.
4887              NSTW=1
4888            ELSE IF(D9.LE.DL2) THEN
4889              D2=DL1
4890              NSTW=2
4891            ELSE IF(D9.LE.DL3) THEN
4892              D2=DL2
4893              NSTW=3
4894            ELSE
4895              D2=DL3
4896              NSTW=4
4897            END IF
4898            IF(I.EQ.1) NSFW=NSTW
4899            D3=D9-D2
4900            C1=BEAM(NSTW,1)
4901            N1=INT(10.*D3/C1)
4902            D4=N1*C1/10.
4903            CONLL(I,2)=D3-D4
4904            M1=N9*NSTW+N1-9
4905            NORD(I,1)=M1
4906            NORD(I,2)=M1+1
4907            NORDV(I,1)=M1+NSTW-1
4908            NORDV(I,2)=M1+NSTW
4909    615   CONTINUE
4910          RETURN
4911          END
4912    C-------------------------------------------------------------------------C
4913          SUBROUTINE DISDX(NO,BEAM,DX,SC)
4914          IMPLICIT REAL*8 (A-H,O-Z)
4915          DIMENSION BEAM(5,3),DX(5),SC(5,2)
4916    C
4917    C SUBROUTINE TO COMPUTE GRAPHICAL LOCATIONS OF BEAM SUPPORTS
4918    C
4919          DX(1)=60.
4920          DO 293 I=2,NO+1
4921            DX(I)=DX(1)+(SC(I,1)-SC(1,1))*400./BEAM(5,1)
4922    293   CONTINUE
4923          RETURN
4924          END
4925    C-------------------------------------------------------------------------C
4926          SUBROUTINE EQUA1(NO)
4927    C
4928    C SUBROUTINE TO DISPLAY SUPPORT MOMENT EQUATIONS
```

```
C
      CALL TABLET('CENTER','LONG')
      CALL LTLINE('(SUPPORT MOMENT EQUATIONS)$')
      CALL LTLINE('----------------------$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      IF(NO.EQ.2) THEN
        CALL REQ2
      ELSE IF(NO.EQ.3) THEN
        CALL REQ3
        CALL CTLINE('$')
        CALL REQ4
      ELSE
        CALL REQ3
        CALL CTLINE('$')
        CALL REQ5
        CALL CTLINE('$')
        CALL REQ6
      END IF
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('(R)EMEMBER THAT THE SUPPORT VERTICAL LOCATION EXPRESS
     *ION ON THE RIGHT-HAND$')
      CALL LTLINE('SIDE OF THE EQUATIONS IS INDEPENDENT OF UNIT LOAD POS
     *ITION, AND THUS, NOT$')
      CALL LTLINE('TO BE INCLUDED FOR COMPUTING INFLUENCE LINE ORDINATES
     *.$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
      CALL ENDTAB(0)
      CALL ENDPL(0)
      RETURN
      END
C-----------------------------------------------------------------------C
      SUBROUTINE EQUA2(NS)
C
C SUBROUTINE TO DISPLAY SPAN MOMENT EQUATIONS
C
      CALL TABLET('CENTER','LONG')
      CALL LTLINE('(SPAN MOMENT EQUATION)$')
      CALL LTLINE('--------------------$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      IF(NS.EQ.1) THEN
        CALL REQ7
      ELSE IF(NS.EQ.2) THEN
        CALL REQ8
      ELSE IF(NS.EQ.3) THEN
        CALL REQ9
      ELSE
        CALL REQ10
      END IF
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
      CALL ENDTAB(0)
      CALL ENDPL(0)
      RETURN
      END
C-----------------------------------------------------------------------C
      SUBROUTINE EQUA3(NS)
C
C SUBROUTINE TO DISPLAY SHEAR EQUATIONS
C
      CALL TABLET('CENTER','LONG')
      CALL LTLINE('(SHEAR EQUATION)$')
      CALL LTLINE('--------------$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      IF(NS.EQ.1) THEN
        CALL REQ11
      ELSE IF(NS.EQ.2) THEN
        CALL REQ12
      ELSE IF(NS.EQ.3) THEN
        CALL REQ13
      ELSE
        CALL REQ14
      END IF
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL CTLINE('$')
      CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
      CALL ENDTAB(0)
      CALL ENDPL(0)
      RETURN
      END
```

```
5017    C-------------------------------------------------------------------------C
5018          SUBROUTINE EQUA4(ISN)
5019    C
5020    C SUBROUTINE TO DISPLAY REACTION EQUATION
5021    C
5022          CALL TABLET('CENTER','LONG')
5023          CALL LTLINE('(REACTION EQUATION)$')
5024          CALL LTLINE('-----------------$')
5025          CALL CTLINE('$')
5026          CALL CTLINE('$')
5027          IF(ISN.EQ.1) THEN
5028            CALL REQ15
5029          ELSE IF(ISN.EQ.2) THEN
5030            CALL REQ16
5031          ELSE IF(ISN.EQ.3) THEN
5032            CALL REQ17
5033          ELSE IF(ISN.EQ.4) THEN
5034            CALL REQ18
5035          ELSE
5036            CALL REQ19
5037          END IF
5038          CALL CTLINE('$')
5039          CALL CTLINE('$')
5040          CALL CTLINE('$')
5041          CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
5042          CALL ENDTAB(0)
5043          CALL ENDPL(0)
5044          RETURN
5045          END
5046    C-------------------------------------------------------------------------C
5047          SUBROUTINE EQUA5(NS)
5048    C
5049    C SUBROUTINE TO DISPLAY DEFLECTION EQUATION
5050    C
5051          CALL TABLET('CENTER','LONG')
5052          CALL LTLINE('(DEFLECTION EQUATION)$')
5053          CALL LTLINE('-------------------$')
5054          CALL CTLINE('$')
5055          CALL CTLINE('$')
5056          IF(NS.EQ.1) THEN
5057            CALL REQ20
5058          ELSE IF(NS.EQ.2) THEN
5059            CALL REQ21
5060          ELSE IF(NS.EQ.3) THEN
5061            CALL REQ22
5062          ELSE
5063            CALL REQ23
5064          END IF
5065          CALL CTLINE('$')
5066          CALL CTLINE('$')
5067          CALL CTLINE('$')
5068          CALL LTLINE('(P)RESS (RETURN) TO CONTINUE...$')
5069          CALL ENDTAB(0)
5070          CALL ENDPL(0)
5071          RETURN
5072          END
5073    C-------------------------------------------------------------------------C
5074          SUBROUTINE GRAPH1
5075    C
5076    C SUBROUTINE TO SET UP THE MONITOR AND WORKSPACE FOR GRAPHING
5077    C
5078          TYPE 701
5079    701   FORMAT(' !MON 8 H K')
5080          TYPE 702
5081    702   FORMAT(' !GRA 1,26,1,80')
5082          TYPE 703
5083    703   FORMAT(' !COL C6')
5084          TYPE 704
5085    704   FORMAT(' !VEC 0,0,639,0,639,349,0,349,0,0')
5086          TYPE 708
5087    708   FORMAT(' !COL C4')
5088          LX=30
5089          LY=30
5090          TYPE 709, LX,LY,LX,LY+180
5091    709   FORMAT(' !VEC',4(' ',I3))
5092          DO 711 I=LY,LY+180,18
5093            TYPE 709, LX,I,LX+5,I
5094    711   CONTINUE
5095          DO 713 I=LY,LY+180,90
5096            TYPE 709, LX,I,LX+10,I
5097    713   CONTINUE
5098          LX=490
5099          LY=30
5100          TYPE 709, LX,LY,LX,LY+180
5101          DO 716 I=LY,LY+180,18
5102            TYPE 709, LX,I,LX-5,I
5103    716   CONTINUE
5104          DO 718 I=LY,LY+180,90
```

```
5105            TYPE 709, LX,I,LX-10,I
5106    718     CONTINUE
5107            RETURN
5108            END
5109    C-------------------------------------------------------------------------C
5110            SUBROUTINE GRAPH2(NO,BEAM,SC,UDL,ULL,TLL,AASHTO,CONLL,AASHTL,
5111           *UNILL,ALL,DX)
5112            IMPLICIT REAL*8 (A-H,O-Z)
5113            DIMENSION BEAM(5,3),SC(5,2),AASHTO(3),CONLL(3,2),UNILL(4),DX(5)
5114            CHARACTER TLL,AASHTL*7,ALL
5115    C
5116    C SUBROUTINE TO GRAPH BEAM WITH DL & LL
5117    C
5118    754     FORMAT(A12)
5119    943     FORMAT(F5.2)
5120    794     FORMAT(F8.2)
5121    227     FORMAT(I5)
5122    760     FORMAT(I6)
5123    748     FORMAT(' !COL C0')
5124    740     FORMAT(' !COL C2')
5125    744     FORMAT(' !COL C3')
5126    708     FORMAT(' !COL C4')
5127    151     FORMAT(' !MON')
5128    155     FORMAT(' !WOR')
5129    613     FORMAT(' !JUM',2(' ',I2))
5130            CALL GRAPH3(BEAM,SC,DX,NO)
5131            TYPE 155
5132            TYPE 740
5133            TYPE 741
5134    741     FORMAT(' !VEC 60,315,460,315')
5135            IY1=315
5136            IY2=303
5137            DO 743 I=60,460,40
5138              TYPE 742, I,IY1,I,IY2
5139    742       FORMAT(' !VEC',4(' ',I3))
5140    743     CONTINUE
5141            TYPE 744
5142            IF(TLL.EQ.'B') THEN
5143              Y1=330.0
5144              Y2=318.0
5145              DO 747 I=1,NO
5146                IF(UNILL(I).EQ.0.) GO TO 747
5147                TYPE 745, DX(I),Y1,DX(I+1),Y1
5148    745         FORMAT(' !VEC',4(' ',F8.3))
5149                DX1=(DX(I+1)-DX(I))/5.
5150                DO 747 X=DX(I),DX(I+1),DX1
5151                  TYPE 745, X,Y1,X,Y2
5152    747       CONTINUE
5153            ELSE IF(TLL.EQ.'C') THEN
5154              DW1=60.+CONLL(1,1)*400./BEAM(5,1)
5155              DW2=DW1-12.
5156              DW3=DW1-24.
5157              X1=DW1-28.
5158              X2=DW1-32.
5159              X3=DW1-6.
5160              X4=DW1+2.
5161              X5=DW1+4.
5162              Y1=320.
5163              Y2=Y1+2.
5164              Y3=Y1+14.
5165              Y4=Y1+12.
5166              Y5=Y1+6.
5167              TYPE 745, DW1,Y1,DW1,Y1
5168              TYPE 768
5169    768       FORMAT(' !CIR 2')
5170              TYPE 745, DW2,Y2,DW2,Y2
5171              TYPE 770
5172    770       FORMAT(' !CIR 4')
5173              TYPE 745, DW3,Y2,DW3,Y2
5174              TYPE 770
5175              TYPE 745, X1,Y2,X2,Y2
5176              TYPE 745, X2,Y2,X2,Y3
5177              TYPE 745, X2,Y3,X3,Y3
5178              TYPE 745, X3,Y3,X3,Y5
5179              TYPE 745, X3,Y5,X5,Y5
5180              TYPE 745, X5,Y5,X5,Y1
5181              TYPE 745, X5,Y1,X4,Y1
5182              TYPE 745, X3,Y4,X4,Y4
5183              TYPE 745, X4,Y4,X4,Y5
5184              TYPE 745, X1+8.,Y2,X1+12.,Y2
5185            ELSE IF(TLL.EQ.'A') THEN
5186              CONTINUE
5187            END IF
5188            TYPE 748
5189            LROW=3
5190            LCOL=62
5191            TYPE 613, LROW,LCOL
5192            IF(TLL.EQ.'B') THEN
```

```
5193            TYPE 750, ULL,' k/ft'
5194    750     FORMAT(' LL = ',F5.2,A5)
5195          ELSE IF(TLL.EQ.'C') THEN
5196            TYPE 780, AASHTL
5197    780     FORMAT(' LL = ',A7)
5198          ELSE IF(TLL.EQ.'A') THEN
5199            TYPE 781
5200    781     FORMAT(' LL = 0')
5201          END IF
5202          LROW=4
5203          TYPE 613, LROW,LCOL
5204          TYPE 752, UDL,' k/ft'
5205    752   FORMAT(' DL = ',F5.2,A5)
5206          TYPE 753
5207    753   FORMAT(' !VEC 496,280',' !STR /I   (ft.^4)/')
5208          TYPE 755
5209    755   FORMAT(' !VEC 496,266',' !STR /X-ORD  (ft)/')
5210          TYPE 756
5211    756   FORMAT(' !VEC 496,252',' !STR /Y-ORD  (ft)/')
5212          TYPE 757
5213    757   FORMAT(' !VEC 216,226',' !STR /BEAM LOADING/')
5214          TYPE 758
5215    758   FORMAT(' !VEC 200,220,328,220')
5216          LROW=6
5217          DO 761 I=1,NO
5218            LCOL=INT((DX(I)-24.+(DX(I+1)-DX(I))/2.)/8.)
5219            TYPE 613, LROW,LCOL
5220            TYPE 794, BEAM(I,2)
5221    761   CONTINUE
5222          DO 766 I=1,NO+1
5223            LCOL=INT((DX(I)-12.)/8.)
5224            LROW=7
5225            LCX=INT(SC(I,1))
5226            TYPE 613, LROW,LCOL
5227            TYPE 227, LCX
5228            LROW=8
5229            TYPE 613, LROW,LCOL
5230            TYPE 243, SC(I,2)
5231    766   CONTINUE
5232          TYPE 151
5233          RETURN
5234          END
5235    C-------------------------------------------------------------------------C
5236          SUBROUTINE GRAPH3(BEAM,SC,DX,NO)
5237          IMPLICIT REAL*8 (A-H,O-Z)
5238          DIMENSION BEAM(5,3),SC(5,2),DX(5)
5239    C
5240    C SUBROUTINE TO GRAPH THE BEAMS INTO THE WORKSPACE
5241    C
5242    729   FORMAT(' !COL C5')
5243          TYPE 729
5244          TYPE 730
5245    730   FORMAT(' !VEC 60,120,460,120')
5246          TYPE 731
5247    731   FORMAT(' !VEC 60,300,460,300')
5248          TYPE 732
5249    732   FORMAT(' !VEC 60,115,60,125')
5250          TYPE 733
5251    733   FORMAT(' !VEC 50,294,70,294')
5252          TYPE 734
5253    734   FORMAT(' !POL 55,294,65,294,60,300')
5254          DO 739 I=2,NO+1
5255            X1=DX(I)
5256            X2=X1-5.
5257            X3=X1+5.
5258            Y1=294.0
5259            Y2=297.0
5260            Y3=115.0
5261            Y4=125.0
5262            TYPE 735, X2,Y1,X3,Y1
5263    735     FORMAT(' !VEC',4(' ',F8.3))
5264            TYPE 735, X1,Y2,X1,Y2
5265            TYPE 737
5266    737     FORMAT(' !CIR 3')
5267            TYPE 735, X1,Y3,X1,Y4
5268    739   CONTINUE
5269          RETURN
5270          END
5271    C-------------------------------------------------------------------------C
5272          SUBROUTINE GRAPH4(NO,N9,BEAM,SC,DX)
5273          IMPLICIT REAL*8 (A-H,O-Z)
5274          DIMENSION BEAM(5,3),SC(5,2),DX(5)
5275    C
5276    C SUBROUTINE TO GRAPH THE BEAMS WITH 10TH-POINTS
5277    C
5278    822   FORMAT(A21)
5279    943   FORMAT(F5.2)
5280    849   FORMAT(I2)
```

```
5281    790   FORMAT(I3)
5282    643   FORMAT(I5)
5283    748   FORMAT(' !COL C0')
5284    729   FORMAT(' !COL C5')
5285    151   FORMAT(' !MON')
5286    155   FORMAT(' !WOR')
5287    613   FORMAT(' !JUM',2(' ',I3))
5288          CALL GRAPH3(BEAM,SC,DX,NO)
5289          TYPE 155
5290          Y1=300.0
5291          Y2=303.0
5292          Y3=306.0
5293          LROW=4
5294          LCOL=8
5295          TYPE 729
5296          TYPE 613, LROW,LCOL
5297          TYPE 598
5298    598   FORMAT(' 1')
5299          DO 803 I=1,NO
5300            X1=DX(I)
5301            X2=DX(I+1)
5302            DX2=(X2-X1)/N9
5303            NP1=I*N9+1
5304            NP2=NP1-5
5305              DO 801 X=X1,X2,DX2
5306                TYPE 800, X,Y2,X,Y1
5307    800         FORMAT(' !VEC',4(' ',F8.3))
5308    801         CONTINUE
5309              DO 803 X=X1,X2,DX2*5.
5310                LCOL=INT(X/8.)
5311                TYPE 800, X,Y3,X,Y1
5312                IF(X.EQ.X1) GO TO 803
5313                TYPE 613, LROW,LCOL
5314                IF(X.EQ.(X1+DX2*5.)) THEN
5315                  TYPE 790, NP2
5316                ELSE
5317                  TYPE 790, NP1
5318                END IF
5319    803   CONTINUE
5320          TYPE 804
5321    804   FORMAT(' !VEC 496,308',' !STR /10th-POINTS/')
5322          TYPE 806
5323    806   FORMAT(' !VEC 496,280',' !STR /SUPPORT NO./')
5324          TYPE 808
5325    808   FORMAT(' !VEC 496,266',' !STR /X-ORD/')
5326          TYPE 810
5327    810   FORMAT(' !VEC 496,252',' !STR /Y-ORD/')
5328          LROW1=6
5329          LROW2=7
5330          LROW3=8
5331          DO 820 I=1,NO+1
5332            LCOL=INT((DX(I)+4.)/8.)
5333            TYPE 613, LROW1,LCOL
5334            TYPE 849, I
5335            LCOL=INT((DX(I)-12.)/8.)
5336            TYPE 613, LROW2,LCOL
5337            LCX=INT(SC(I,1))
5338            TYPE 643, LCX
5339            TYPE 613, LROW3,LCOL
5340            TYPE 943, SC(I,2)
5341    820   CONTINUE
5342          TYPE 821
5343    821   FORMAT(' !VEC 176,226',' !STR /BEAM WITH 10th-POINTS/')
5344          TYPE 748
5345          TYPE 824
5346    824   FORMAT(' !VEC 164,220,356,220')
5347          TYPE 151
5348          RETURN
5349          END
5350    C-------------------------------------------------------------------------C
5351          SUBROUTINE HCBLD(NO,AXLE,DOT,AASHTL,UNIDL,UNILL,CONLL,TLL,NSFW)
5352          IMPLICIT REAL*8 (A-H,O-Z)
5353          DIMENSION UNIDL(4),UNILL(4),CONLL(3,2)
5354          CHARACTER DOT*5,AASHTL*7,TLL
5355    C
5356    C SUBROUTINE TO HARD COPY BEAM LOAD DATA
5357    C
5358    823   FORMAT(/)
5359          WRITE(9,1000)
5360    1000  FORMAT('1',///T29,'>>>>>  BEAM LOAD DATA  <<<<<'////)
5361          WRITE(9,1001)
5362    1001  FORMAT(T13,'SPAN',8X,'DL',26X,'LL')
5363          WRITE(9,1002)
5364    1002  FORMAT(T32,'\----------------------------------------\')
5365          WRITE(9,1003)
5366    1003  FORMAT(T34,'UNIFORM',12X,'AASHTO TRUCK')
5367          WRITE(9,1004)
5368    1004  FORMAT(T23,'(k/ft)',6X,'(k/ft)',6X,'(TYPE : DOT : DLS : RAS)**')
```

```
5369          WRITE(9,1005)
5370    1005  FORMAT(T10,'\--------\----------\---------\--------------------
5371         *----------\'/)
5372          DO 1009 I=1,NO
5373            IF(TLL.EQ.'A') THEN
5374              WRITE(9,1006) I,UNIDL(I)
5375    1006      FORMAT(T15,I1,7X,F5.2,9X,'--',18X,'---'/)
5376            ELSE IF(TLL.EQ.'B') THEN
5377              WRITE(9,1007) I,UNIDL(I),UNILL(I)
5378    1007      FORMAT(T15,I1,2(7X,F5.2),17X,'---'/)
5379            ELSE
5380              IF(I.EQ.NSFW) THEN
5381                WRITE(9,1008) I,UNIDL(I),AASHTL,DOT,CONLL(1,1),AXLE
5382    1008        FORMAT(T15,I1,7X,F5.2,9X,'--',6X,A7,':',A5,':',F8.2,':',F5.1
5383         *        /)
5384              ELSE
5385                WRITE(9,1006) I,UNIDL(I)
5386              END IF
5387            END IF
5388    1009    CONTINUE
5389          WRITE(9,1005)
5390          WRITE(9,823)
5391          WRITE(9,1010)
5392    1010  FORMAT(T13,'** TYPE: H10-44, H15-44, H20-44, HS15-44, OR HS20-44'/
5393         *)
5394          WRITE(9,1011)
5395    1011  FORMAT(T14,'  DOT : direction of truck travel'/)
5396          WRITE(9,1012)
5397    1012  FORMAT(T14,'  DLS : distance to front wheels from Support No. 1, f
5398         *eet'/)
5399          WRITE(9,1013)
5400    1013  FORMAT(T14,'  RAS : rear axle spacing, feet (HS15-44 & HS20-44 onl
5401         *y)')
5402          RETURN
5403          END
5404    C-------------------------------------------------------------------------C
5405          SUBROUTINE HCBPD(EE,NO,BEAM,SC)
5406          IMPLICIT REAL*8 (A-H,O-Z)
5407          DIMENSION BEAM(5,3),SC(5,2)
5408    C
5409    C SUBROUTINE TO HARD COPY BEAM PHYSICAL DATA
5410    C
5411          WRITE(9,1014)
5412    1014  FORMAT('1',///T27,'>>>>>  BEAM PHYSICAL DATA  <<<<<'////)
5413          WRITE(9,1015) NO
5414    1015  FORMAT(T33,'Number of spans.... ',I1/)
5415          WRITE(9,1016) EE
5416    1016  FORMAT(T24,'Modulus of Elasticity.... ',F9.2,' ksi'////)
5417          WRITE(9,1017)
5418    1017  FORMAT(T12,'SPAN',16X,'COORDINATES',16X,'LENGTH   MOMENT OF')
5419          WRITE(9,1018)
5420    1018  FORMAT(T17,'\-----------------------------------\',11X,'INERTI
5421         *A')
5422          WRITE(9,1019)
5423    1019  FORMAT(T21,'LEFT  SUPPORT',7X,'RIGHT SUPPORT')
5424          WRITE(9,1020)
5425    1020  FORMAT(T23,'X',7X,'Y*',10X,'X',7X,'Y*',7X,'(ft)',5X,'(ft.^4)')
5426          WRITE(9,1021)
5427    1021  FORMAT(T10,'\------\------------------\------------------\------
5428         *--\----------\'/)
5429          DO 1023 I=1,NO
5430            WRITE(9,1022) I,SC(I,1),SC(I,2),SC(I+1,1),SC(I+1,2),BEAM(I,1),
5431         *  BEAM(I,2)
5432    1022    FORMAT(T14,I1,3X,2(F8.2,3X,F5.2,4X),F7.2,3X,F7.2/)
5433    1023  CONTINUE
5434          WRITE(9,1021)
5435          WRITE(9,1024)
5436    1024  FORMAT(//T24,'*  Y-coordinate is (+) measured downward.')
5437          RETURN
5438          END
5439    C-------------------------------------------------------------------------C
5440          SUBROUTINE HCILO(NO,N9,NS,ILT,NUM,TYPE,LOCA,HC)
5441          IMPLICIT REAL*8 (A-H,O-Z)
5442          DIMENSION HC(42)
5443          CHARACTER TYPE*14,LOCA*15
5444    C
5445    C SUBROUTINE TO HARD COPY INFLUENCE LINE ORDINATES
5446    C
5447          WRITE(9,1024)
5448    1024  FORMAT('1',///T24,'>>>>>  INFLUENCE LINE ORDINATES  <<<<<'//)
5449          WRITE(9,1025) TYPE
5450    1025  FORMAT(T33,'Type: ',A14/)
5451          WRITE(9,1026) LOCA,NUM
5452    1026  FORMAT(T33,'Location: ',A15,I2//)
5453          WRITE(9,1027)
5454    1027  FORMAT(T23,'SPAN       10th-POINT       I.L. ORDINATE')
5455          WRITE(9,1028)
5456    1028  FORMAT(T20,'\--------\------------\--------------------\')
```

```
      DO 1032 I=1,NO
        WRITE(9,1029) I
1029    FORMAT(T25,I1)
        DO 1032 J=1,N9+1
          K=N9*(I-1)+J
          IF(ILT.EQ.5) THEN
            WRITE(9,1030) K,HC(K)
1030        FORMAT(T36,I2,11X,F12.7)
          ELSE IF(ILT.NE.3) THEN
            WRITE(9,1031) K,HC(K)
1031        FORMAT(T36,I2,12X,F8.3)
          ELSE
            IF(I.LE.NS .AND. K.LE.NUM) THEN
              WRITE(9,1031) K,HC(K)
              IF(I.EQ.NS .AND. K.EQ.NUM) THEN
                WRITE(9,1031) K,HC(K+1)
              END IF
            ELSE
              WRITE(9,1031) K,HC(K+1)
            END IF
          END IF
1032    CONTINUE
        WRITE(9,1028)
        RETURN
        END
C-------------------------------------------------------------------------C
        SUBROUTINE HCMVD(NO,N9,TITL,HCM,HCV,HCD)
        IMPLICIT REAL*8 (A-H,O-Z)
        DIMENSION HCM(41),HCV(44),HCD(41)
        CHARACTER TITL*12
C
C SUBROUTINE TO HARD COPY M, V, & D ENVELOPE ORDINATES
C
        WRITE(9,1033) TITL
1033    FORMAT('1',///T22,A12,' ENVELOPE ORDINATES  <<<<<'//)
        WRITE(9,1034)
1034    FORMAT(T14,'SPAN   10th-POINT      MOMENT',8X,'SHEAR      DEFLECTIO
       *N++')
        WRITE(9,1035)
1035    FORMAT(T35,'(ft-kip)',7X,'(kip)',9X,'(ft)')
        WRITE(9,1036)
1036    FORMAT(T12,'\------\------------\------------\------------\------
       *-------\')
        DO 1039 I=1,NO
          WRITE(9,1037) I
1037      FORMAT(T16,I1)
          DO 1039 J=1,N9+1
            KMD=N9*(I-1)+J
            KV=(N9+1)*(I-1)+J
            WRITE(9,1038) KMD,HCM(KMD),HCV(KV),HCD(KMD)
1038        FORMAT(T25,I2,6X,F10.2,5X,F8.2,4X,F11.6)
1039    CONTINUE
        WRITE(9,1036)
        WRITE(9,1040)
1040    FORMAT(/T23,'++  Deflection is (+) measured downward.')
        RETURN
        END
C-------------------------------------------------------------------------C
        SUBROUTINE HCSUR(NO,TLL,HCR)
        IMPLICIT REAL*8 (A-H,O-Z)
        DIMENSION HCR(5,3)
        CHARACTER TLL
C
C SUBROUTINE TO HARD COPY SUPPORT REACTIONS
C
        WRITE(9,1040)
1040    FORMAT('1',///T24,'>>>>>  SUPPORT REACTIONS (kips)  <<<<<'////)
        WRITE(9,1041)
1041    FORMAT(T17,'SUPPORT',8X,'DL',13X,'LL',12X,'DL+LL')
        WRITE(9,1042)
1042    FORMAT(T15,'\---------\--------------\--------------\-------------
       *--\'/)
        DO 1045 I=1,NO+1
          IF(TLL.EQ.'A') THEN
            WRITE(9,1043) I,HCR(I,1)
1043        FORMAT(T20,I1,6X,F9.2,10X,'--',13X,'---'/)
          ELSE
            WRITE(9,1044) I,HCR(I,1),HCR(I,2),HCR(I,3)
1044        FORMAT(T20,I1,6X,F9.2,6X,F9.2,7X,F9.2/)
          END IF
1045    CONTINUE
        WRITE(9,1042)
        RETURN
        END
C-------------------------------------------------------------------------C
        SUBROUTINE LENGTH(J,SL,BEAM,NORD)
        IMPLICIT REAL*8 (A-H,O-Z)
        DIMENSION BEAM(5,3),NORD(3,2)
```

```
5545    C
5546    C SUBROUTINE TO DETERMINE SPAN LENGTH USED IN SUBROUTINE TLLORD
5547    C
5548          N=NORD(J,2)
5549          IF(N.LE.11) THEN
5550            SL=BEAM(1,1)
5551          ELSE IF(N.LE.21) THEN
5552            SL=BEAM(2,1)
5553          ELSE IF(N.LE.31) THEN
5554            SL=BEAM(3,1)
5555          ELSE
5556            SL=BEAM(4,1)
5557          END IF
5558          RETURN
5559          END
5560    C-------------------------------------------------------------------------C
5561          SUBROUTINE LINORD(E,NO,N9,RN9,A,B,D,D1,BEAM,SUPPM,SPANM,SHEAR,
5562         *REACT,DELTA,ABC,CF2,DELSM)
5563          IMPLICIT REAL*8 (A-H,O-Z)
5564          DIMENSION A(5),B(5),D(5),D1(5),BEAM(5,3),SUPPM(41,3),SPANM(41,41),
5565         *SHEAR(42,44),REACT(41,5),DELTA(41,41),ABC(41,3),DELSM(3)
5566    C
5567    C COMPUTATION OF INFLUENCE LINE ORDINATES
5568    C
5569    C
5570    C ***** SUPPORT MOMENT ORDINATES *****
5571    C
5572    C COMPUTE MOMENT COEFFICIENTS FOR LEFT SIDE OF 3-MOMENT EQUATION
5573    C
5574          N1=NO-1
5575          DO 100 I=1,N1
5576            IF(I.EQ.1) THEN
5577              B(I)=0.
5578            ELSE
5579              B(I)=BEAM(I,1)*CF2/BEAM(I,2)
5580            END IF
5581            D1(I)=2.*(BEAM(I,1)/BEAM(I,2)+BEAM(I+1,1)/BEAM(I+1,2))*CF2
5582            IF(I.NE.N1) THEN
5583              A(I)=BEAM(I+1,1)*CF2/BEAM(I+1,2)
5584          .   ELSE
5585              A(I)=0.0
5586            END IF
5587    100   CONTINUE
5588    C
5589    C COMPUTE CONSTANTS FOR RIGHT SIDE OF 3-MOMENT EQUATION
5590    C
5591    102   DO 104 I=1,NO
5592            G2=CF2*BEAM(I,1)**2./BEAM(I,2)
5593            DO 104 J=0,N9
5594              K=N9*(I-1)+J+1
5595              G1=J/RN9
5596              G6=(G1-G1**3.)*G2
5597              G7=(G1**3.-3.*G1**2.+2.*G1)*G2
5598              G8=G6/6.
5599              G9=G7/6.
5600              IF(I.EQ.1) THEN
5601                VA=-G6
5602                VB=0.
5603                VC=0.
5604                ABC(K,1)=G8
5605                ABC(K,2)=0.
5606                ABC(K,3)=0.
5607              ELSE IF(I.EQ.2 .AND. NO.EQ.2) THEN
5608                VA=-G7
5609                VB=0.
5610                VC=0.
5611                ABC(K,1)=G9
5612                ABC(K,2)=0.
5613                ABC(K,3)=0.
5614              ELSE IF(I.EQ.2 .AND. NO.GT.2) THEN
5615                VA=-G7
5616                VB=-G6
5617                VC=0.
5618                ABC(K,1)=G9
5619                ABC(K,2)=G8
5620                ABC(K,3)=0.
5621              ELSE IF(I.EQ.3 .AND. NO.EQ.3) THEN
5622                VA=0.
5623                VB=-G7
5624                VC=0.
5625                ABC(K,1)=0.
5626                ABC(K,2)=G9
5627                ABC(K,3)=0.
5628              ELSE IF(I.EQ.3 .AND. NO.GT.3) THEN
5629                VA=0.
5630                VB=-G7
5631                VC=-G6
5632                ABC(K,1)=0.
```

```
5633                ABC(K,2)=G9
5634                ABC(K,3)=G8
5635              ELSE
5636                VA=0.
5637                VB=0.
5638                VC=-G7
5639                ABC(K,1)=0.
5640                ABC(K,2)=0.
5641                ABC(K,3)=G9
5642              END IF
5643              SUPPM(K,1)=VA
5644              SUPPM(K,2)=VB
5645              SUPPM(K,3)=VC
5646     104    CONTINUE
5647     C
5648     C TRIDIAGONAL SOLUTION OF EQUATIONS BY ELIMINATION
5649     C
5650           DO 110 K=1,N9*NO+1
5651             DO 106 I=1,N1
5652               D(I)=D1(I)
5653     106       CONTINUE
5654               DO 108 I=2,N1
5655                 R=B(I)/D(I-1)
5656                 D(I)=D(I)-R*A(I-1)
5657                 SUPPM(K,I)=SUPPM(K,I)-R*SUPPM(K,I-1)
5658     108       CONTINUE
5659               SUPPM(K,N1)=SUPPM(K,N1)/D(N1)
5660               DO 110 I=2,N1
5661                 J=N1-I+1
5662                 SUPPM(K,J)=(SUPPM(K,J)-A(J)*SUPPM(K,J+1))/D(J)
5663     110    CONTINUE
5664     C
5665     C COMPUTE SUPPORT MOMENTS RESULTING FROM UNEVEN SUPPORTS
5666     C
5667           DO 111 I=1,NO-1
5668             DELSM(I)=6.*E*(BEAM(I,3)/BEAM(I,1)-BEAM(I+1,3)/BEAM(I+1,1))
5669     111    CONTINUE
5670           DO 112 I=1,N1
5671             D(I)=D1(I)
5672     112   CONTINUE
5673           DO 113 I=2,N1
5674             R=B(I)/D(I-1)
5675             D(I)=D(I)-R*A(I-1)
5676             DELSM(I)=DELSM(I)-R*DELSM(I-1)
5677     113    CONTINUE
5678           DELSM(N1)=DELSM(N1)/D(N1)
5679           DO 114 I=2,N1
5680             J=N1-I+1
5681             DELSM(J)=(DELSM(J)-A(J)*DELSM(J+1))/D(J)
5682     114    CONTINUE
5683     C
5684     C ***** REACTION ORDINATES *****
5685     C
5686           DO 122 I=1,NO
5687             DO 122 J=0,N9
5688               BO=J/RN9
5689               AO=1.-BO
5690               M=N9*(I-1)+J+1
5691               SM2=SUPPM(M,1)
5692               SM3=SUPPM(M,2)
5693               SM4=SUPPM(M,3)
5694               IF(NO.EQ.2) SM3=0.
5695               IF(NO.EQ.2 .OR. NO.EQ.3) SM4=0.
5696               IF(I.EQ.1) THEN
5697                 VA=AC
5698               ELSE
5699                 VA=0.
5700               END IF
5701               REACT(M,1)=VA+SM2/BEAM(1,1)
5702               IF(I.EQ.1) THEN
5703                 VA=BC
5704               ELSE IF(I.EQ.2) THEN
5705                 VA=AC
5706               ELSE
5707                 VA=0.
5708               END IF
5709     116       REACT(M,2)=VA-SM2*(1./BEAM(1,1)+1./BEAM(2,1))+SM3/BEAM(2,1)
5710               IF(I.EQ.2) THEN
5711                 VA=BC
5712               ELSE IF(I.EQ.3) THEN
5713                 VA=AC
5714               ELSE
5715                 VA=0.
5716               END IF
5717     118       REACT(M,3)=VA+SM2/BEAM(2,1)-SM3/BEAM(2,1)
5718               IF(NO.EQ.2) GO TO 122
5719               REACT(M,3)=REACT(M,3)-(SM3-SM4)/BEAM(3,1)
5720               IF(I.EQ.3) THEN
```

```
5721                VA=BC
5722              ELSE IF(I.EQ.4) THEN
5723                VA=AC
5724              ELSE
5725                VA=0.
5726              END IF
5727    120       REACT(M,4)=VA+SM3/BEAM(3,1)-SM4/BEAM(3,1)
5728              IF(NO.EQ.3) GO TO 122
5729              REACT(M,4)=REACT(M,4)-SM4/BEAM(4,1)
5730              IF(I.EQ.4) THEN
5731                VA=BC
5732              ELSE
5733                VA=0.
5734              END IF
5735              REACT(M,5)=VA+SM4/BEAM(4,1)
5736    122     CONTINUE
5737    C
5738    C COMPUTATION OF SPAN MOMENT AND DEFLECTION INFLUENCE LINE ORDINATES
5739    C
5740          DO 146 I=1,NO
5741            SL1=BEAM(I,1)
5742            SI1=BEAM(I,2)/CF2
5743            DO 146 J=0,N9
5744              XN=J*SL1/RN9
5745              M=N9*(I-1)+J+1
5746              DO 146 K=1,NO
5747                DO 146 L=0,N9
5748                  N=N9*(K-1)+L+1
5749    C
5750    C ***** SPAN MOMENT ORDINATES *****
5751    C
5752                    SM2=SUPPM(N,1)
5753                    SM3=SUPPM(N,2)
5754                    SM4=SUPPM(N,3)
5755                    IF(K.NE.I) GO TO 124
5756                    IF(L.LE.J) THEN
5757                      SM0=SL1*(L/RN9)*(1.-J/RN9)
5758                    ELSE
5759                      SM0=SL1*(J/RN9)*(1.-L/RN9)
5760         *          END IF
5761                    GO TO 125
5762    124             SM0=0.
5763    125             GO TO (126,128,130,132),I
5764    126             SPANM(N,M)=SM0+J*SM2/RN9
5765                    GO TO 134
5766    128             IF(K.EQ.2 .AND. NO.EQ.2) SM3=0.
5767                    SPANM(N,M)=SM0+(1.-J/RN9)*SM2+J*SM3/RN9
5768                    GO TO 134
5769    130             IF(K.EQ.3 .AND. NO.EQ.3) SM4=0.
5770                    SPANM(N,M)=SM0+(1.-J/RN9)*SM3+J*SM4/RN9
5771                    GO TO 134
5772    132             SPANM(N,M)=SM0+(1.-J/RN9)*SM4
5773    C
5774    C ***** DEFLECTION ORDINATES *****
5775    C
5776                    SM2=SUPPM(N,1)
5777                    SM3=SUPPM(N,2)
5778                    SM4=SUPPM(N,3)
5779    134             IF(K.NE.I) GO TO 136
5780                    AN=L*SL1/RN9
5781                    BN=SL1-AN
5782                    IF(L.LE.J) THEN
5783                      DO=AN*(1.-J/RN9)*(BN**2.+2.*AN*BN-(SL1-XN)**2.)
5784         *              /(6.*E*SI1)
5785                    ELSE
5786                      DO=BN*(J/RN9)*(AN**2.+2.*AN*BN-XN**2.)/(6.*E*SI1)
5787                    END IF
5788                    GO TO 137
5789    136             DO=0.
5790    137             GO TO (138,140,142,144),I
5791    138             DELTA(N,M)=DO+(J/RN9)*SM2*(SL1-XN)*(SL1+XN)/(6.*E*SI1)
5792                    GO TO 146
5793    140             IF(K.EQ.2 .AND. NO.EQ.2) SM3=0.
5794                    DELTA(N,M)=DO+(J/RN9)*(SL1-XN)*(SM2*(2.*SL1-XN)+SM3*
5795         *                        (SL1+XN))/(6.*E*SI1)
5796                    GO TO 146
5797    142             IF(K.EQ.3 .AND. NO.EQ.3) SM4=0.
5798                    DELTA(N,M)=DO+(J/RN9)*(SL1-XN)*(SM3*(2.*SL1-XN)+SM4*
5799         *                        (SL1+XN))/(6.*E*SI1)
5800                    GO TO 146
5801    144             DELTA(N,M)=DO+(J/RN9)*SM4*(2.*SL1-XN)*(SL1-XN)/(6.*
5802         *                        E*SI1)
5803    146     CONTINUE
5804    C
5805    C ***** SHEAR ORDINATES *****
5806    C
5807          DO 164 I=1,NO
5808            SL1=BEAM(I,1)
```

```
5809            DO 164 J=1,N9+1
5810              M=(N9+1)*(I-1)+J
5811              N2=0
5812              DO 164 K=1,NO
5813                DO 164 L=0,N9
5814                  N=N9*(K-1)+L+1
5815                  NN=N+N2
5816                  SM2=SUPPM(N,1)
5817                  SM3=SUPPM(N,2)
5818                  SM4=SUPPM(N,3)
5819  150             IF(K.NE.I) GO TO 152
5820                  IF(L.LT.J) THEN
5821                    VO=-L/RN9
5822                  ELSE
5823                    VO=1.-L/RN9
5824                  END IF
5825                  GO TO 153
5826  152             VO=0.
5827  153             GO TO (154,156,158,160),I
5828  154             SHEAR(NN,M)=VO+SM2/SL1
5829                  GO TO 162
5830  156             IF(K.EQ.2 .AND. NO.EQ.2) SM3=0.
5831                  SHEAR(NN,M)=VO+(SM3-SM2)/SL1
5832                  GO TO 162
5833  158             IF(K.EQ.3 .AND. NO.EQ.3) SM4=0.
5834                  SHEAR(NN,M)=VO+(SM4-SM3)/SL1
5835                  GO TO 162
5836  160             SHEAR(NN,M)=VO-SM4/SL1
5837  162             IF(K.EQ.I .AND. L.EQ.(J-1)) THEN
5838                    SHEAR(NN+1,M)=SHEAR(NN,M)+1.
5839                    N2=1
5840                  END IF
5841  164       CONTINUE
5842            RETURN
5843            END
5844  C-------------------------------------------------------------------------C
5845            SUBROUTINE LIVE(NO,ULL,UNILL)
5846            IMPLICIT REAL*8 (A-H,O-Z)
5847            DIMENSION UNILL(4)
5848            CHARACTER ZZ
5849  C
5850  C SUBROUTINE TO PLACE LL ON SPECIFIED SPANS
5851  C
5852  48        FORMAT(A1)
5853            DO 651 I=1,NO
5854  648         TYPE 649, I
5855  649         FORMAT(T10,' LL will occupy Span No. ',I1,' (Y/N)? ',$)
5856              ACCEPT 48, ZZ
5857              IF(ZZ.NE.'Y'.AND. ZZ.NE.'N') GO TO 648
5858              IF(ZZ.EQ.'Y') THEN
5859                UNILL(I)=ULL
5860              ELSE
5861                UNILL(I)=0.0
5862              END IF
5863  651       CONTINUE
5864            RETURN
5865            END
5866  C-------------------------------------------------------------------------C
5867            SUBROUTINE PLOT1(NO,N9,YMAX,DX,GRAPH)
5868            IMPLICIT REAL*8 (A-H,O-Z)
5869            DIMENSION DX(5),GRAPH(41)
5870  C
5871  C SUBROUTINE TO GRAPH: (1) -M I.L., (2) +M I.L., (3) REACTION I.L.,
5872  C (4) DEFLECTION I.L., (5) MOMENT ENVELOPES, & (6) DEFLECTION CURVES.
5873  C
5874            X1=60.
5875            X2=60.
5876            Y1=120.
5877            Y2=120.+GRAPH(1)*90./YMAX
5878            TYPE 338, X1,Y1,X2,Y2
5879            DO 339 I=1,NO
5880              X=(DX(I+1)-DX(I))/N9
5881              DO 339 J=1,N9
5882                K=N9*(I-1)+J
5883                K1=K+1
5884                X1=DX(I)+(J-1)*X
5885                X2=X1+X
5886                Y1=120.+GRAPH(K)*90./YMAX
5887                Y2=120.+GRAPH(K1)*90./YMAX
5888                TYPE 338, X1,Y1,X2,Y2
5889  338           FORMAT(' !VEC',4(' ',F10.3))
5890  339       CONTINUE
5891            X1=X2
5892            X2=460.
5893            Y1=Y2
5894            Y2=120.
5895            TYPE 338, X1,Y1,X2,Y2
5896            RETURN
```

```
      END
C-----------------------------------------------------------------------C
      SUBROUTINE PLOT2(ILP,NO,N9,NS,YMAX,DX,GRAPH)
      IMPLICIT REAL*8 (A-H,O-Z)
      DIMENSION DX(5),GRAPH(42)
C
C SUBROUTINE TO PLOT SHEAR I.L.'S
C
      X1=60.
      X2=60.
      Y1=120.
      Y2=120.+GRAPH(1)*90./YMAX
      TYPE 438, X1,Y1,X2,Y2
      DO 439 I=1,NO
        IF(I.EQ.NS) THEN
          MN9=N9+1
        ELSE
          MN9=N9
        END IF
        X=(DX(I+1)-DX(I))/N9
        DO 439 J=1,MN9
          IF(I.GT.NS) THEN
            K=N9*(I-1)+J+1
          ELSE
            K=N9*(I-1)+J
          END IF
          K1=K+1
          Y1=120.+GRAPH(K)*90./YMAX
          Y2=120.+GRAPH(K1)*90./YMAX
          IF(K.EQ.ILP) THEN
            X2=X1
          ELSE
            X2=X1+X
          END IF
          TYPE 438, X1,Y1,X2,Y2
438       FORMAT(' !VEC',4(' ',F10.3))
          X1=X2
439   CONTINUE
      X2=460.
      Y1=Y2
      Y2=120.
      TYPE 438, X1,Y1,X2,Y2
      RETURN
      END
C-----------------------------------------------------------------------C
      SUBROUTINE PLOT3(NO,N9,NP,NVE,TLL,BLENGTH,YMAX,DX,NORDV,CONLL,
     *GRAPH,WORD)
      IMPLICIT REAL*8 (A-H,O-Z)
      DIMENSION DX(5),NORDV(3,2),CONLL(3,2),GRAPH(44),WORD(3,2)
      CHARACTER TLL
C
C SUBROUTINE TO GRAPH SHEAR ENVELOPES
C
      NW1=0
      IF(NVE.EQ.1 .OR. TLL.EQ.'B') GO TO 200
      DO 100 I=1,NP
        IF(CONLL(I,1).GT.0.0) NW1=I
100   CONTINUE
200   X1=60.
      X2=60.
      Y1=120.
      Y2=120.+GRAPH(1)*90./YMAX
      TYPE 763, X1,Y1,X2,Y2
      DO 784 I=1,NO
        X=(DX(I+1)-DX(I))/N9
        DO 765 J=1,N9
          K=(N9+1)*(I-1)+J
          K1=K+1
          Y1=120.+GRAPH(K)*90./YMAX
          Y2=120.+GRAPH(K1)*90./YMAX
          X2=X1+X
          IF(NVE.EQ.1 .OR. TLL.EQ.'B') GO TO 500
          IF(K.EQ.NORDV(NW1,1)) THEN
            X3=X1
            Y3=Y1
300         X4=60.+CONLL(NW1,1)*400./BLENGTH
            Y4=120.+WORD(NW1,1)*90./YMAX
            Y5=120.+WORD(NW1,2)*90./YMAX
            TYPE 763, X3,Y3,X4,Y4
            TYPE 763, X4,Y4,X4,Y5
            NW1=NW1-1
            IF(NW1.LT.1) GO TO 400
            IF(K.EQ.NORDV(NW1,1)) THEN
              X3=X4
              Y3=Y5
              GO TO 300
            END IF
400         TYPE 763, X4,Y5,X2,Y2
```

```
5985              GO TO 764
5986              END IF
5987    500       TYPE 763, X1,Y1,X2,Y2
5988    763       FORMAT(' !VEC',4(' ',F10.3))
5989    764       X1=X2
5990    765     CONTINUE
5991            IF(I.EQ.NO) GO TO 784
5992            K2=K1+1
5993            Y1=Y2
5994            Y2=120.+GRAPH(K2)*90./YMAX
5995            X2=X1
5996            TYPE 763, X1,Y1,X2,Y2
5997    784   CONTINUE
5998          X1=X2
5999          Y1=Y2
6000          Y2=120.
6001          TYPE 763, X1,Y1,X2,Y2
6002          RETURN
6003          END
6004    C-------------------------------------------------------------------------C
6005          SUBROUTINE PLPT(X3,YORD,YMAX,Y3)
6006          IMPLICIT REAL*8 (A-H,O-Z)
6007    C
6008    C SUBROUTINE TO PLOT I.L. ORDINATE
6009    C
6010    748   FORMAT(' !COL CO')
6011          Y3=120.+YORD*90./YMAX
6012          TYPE 748
6013          TYPE 782, X3,Y3
6014    782   FORMAT(' !VEC',2(' ',F10.3))
6015          TYPE 783
6016    783   FORMAT(' !CIR 2')
6017          RETURN
6018          END
6019    C-------------------------------------------------------------------------C
6020    C                                                                         C
6021    C    THE FOLLOWING SUBROUTINES REQ1 THROUGH REQ23 ARE THE FUNDAMENTAL     C
6022    C     EQUATIONS WHICH APPEAR IN BOTH THE DEVELOPMENT AND APPLICATION      C
6023    C                        SEGMENTS OF THE PROGRAM                          C
6024    C                                                                         C
6025    C-------------------------------------------------------------------------C
6026          SUBROUTINE REQ1
6027          CALL LTLINE('>0-4.5T.5PE.4)(M>E.2)N>H.8)-1>HXE.4)L>E.2)N>EXUB4L1.8
6028         *)(I>L2.)N>LXA1)$')
6029          CALL LTLINE('>0-3.0T1.2L.7) + 2(M>L.9)N>L1.H2:8>LXHX)$')
6030          CALL LTLINE('>0-1.5T2.1PE.4)L>E.2)N>EXUGL1.8)(I>L2.)N>L.7) + >LXPE
6031         *.4)L>E.2)N>H.8)+1>HXEXUGL1.8)(I>L2.)N>H.8)+1>HXL1.H2:9>LXHX)$')
6032          CALL LTLINE('>T3.3L.7) + >LXPE.4)(M>E.2)N>H.8)+1>HXE.4)L>E.2)N>H.8
6033         *)+1>HXEXUB6L1.8)(I>L2.)N>H.8)+1>HXLX)$')
6034          CALL LTLINE('>01.5T4.6L.7)= -6(R) + 6(E>L1.H2.:8>LXHX)$')
6035          CALL LTLINE('>03.0T6.1PE.4*D)>E.2)N>E.4)-*D)>E.2)N>H.8)-1>HXEXUB5L
6036         *1.8)L>L2.)N>A3L.7)->LX)$')
6037          CALL LTLINE('>04.5T7.2PE.4*D)>E.2)N>H.8)+1>HXE.4)-*D)>E.2)N>EXUB5L
6038         *1.8)L>L2.)N>H.8)+1>HXA1L1.H2:9>HXLX)$')
6039          RETURN
6040          END
6041          SUBROUTINE REQ2
6042          CALL LTLINE('>0-1.5T1.5L.7)2(M>L.9H.8)2>L1.H2:8>LXHXPE.4)L>E.2H.8)
6043         *1>HXEXUGL1.8)(I>L2.H.8)1>HXL.7) + >LXPE.4)L>E.2H.8)2>EXHXUGL1.8)(I
6044         *>L2.H.8)2>L1.H2.:9)>HXLX)$')
6045          CALL LTLINE('>T3.1L.7)= -6(A) + 6(E>L1.H2:8)>LXHX)$')
6046          CALL LTLINE('>01.5T4.5PE.4*D)>E.2H.8)2>HXE.4)-*D)>E.2H.8)1>HXEXUB3
6047         *L1.8)L>L2.H.8)1>HXA1L.7) ->LX)$')
6048          CALL LTLINE('>03.0T5.4PE.4*D)>E.2H.8)3>HXE.4)-*D)>E.2H.8)2>HXEXUB3
6049         *L1.8)L>L2.H.8)2>A1H2L1.:9>HXLX)$')
6050          RETURN
6051          END
6052          SUBROUTINE REQ3
6053          CALL LTLINE('>0-3.0T1.L.7)2(M>L.9H.8)2>L1.H2:8>LXHXPE.4)L>E.2H.8)1
6054         *>HXEXUGL1.8)(I>L2.H.8)1>HXL.7) + >LXPE.4)L>E.2H.8)2>EXHXUGL1.8)(I>
6055         *L2.H.8)2>L1.H2:9)>HXLX)$')
6056          CALL LTLINE('>0-1.5T2.7L.7)+ (M>L.9H.8)3>L1.H2:8>LXHXPE.4)L>E.2H.8
6057         *)2>HXLXUGL1.8)(I>L2.H.8)2>L1.H2:9)>HXLX)$')
6058          CALL LTLINE('>T4.0L.7)= -6(A) + 6(E>L1.H2:8)>LXHX)$')
6059          CALL LTLINE('>01.5T5.4PE.4*D)>E.2H.8)2>HXE.4)-*D)>E.2H.8)1>HXEXUB3
6060         *L1.8)L>L2.H.8)1>HXA1L.7) ->LX)$')
6061          CALL LTLINE('>03.0T6.3PE.4*D)>E.2H.8)3>HXE.4)-*D)>E.2H.8)2>HXEXUB3
6062         *L1.8)L>L2.H.8)2>A1H2L1.:9>HXLX)$')
6063          RETURN
6064          END
6065          SUBROUTINE REQ4
6066          CALL LTLINE('>0-3.0T1.L.7)(M>L.9H.8)2>L1.H2:8>LXHXPE.4)L>E.2H.8)2>
6067         *HXEXUGL1.8)(I>L2.H.8)2>L1.H2:9)>HXL.7) +>LX)$')
6068          CALL LTLINE('>0-1.5T2.2L.7)2(M>L.9H.8)3>L1.H2:8>LXHXPE.4)L>E.2H.6)
6069         *2>HXEXUGL1.8)(I>L2.H.8)2>HXL.7) + >LXPE.4)L>E.2H.8)3>EXHXUGL1.8)(I
6070         *>L2.H.8)3>L1.H2:9)>LXHX)$')
6071          CALL LTLINE('>T3.9L.7)= -6(B) + 6(E>L1.H2:8)>LXHX)$')
6072          CALL LTLINE('>01.5T5.3PE.4*D)>E.2H.3)3>HXE.4)-*D)>E.2H.8)2>HXEXUB3
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6073          *L1.8)L>L2.H.8)2>HXA1L.7) ->LX)$')
6074           CALL LTLINE('>03.0T6.2PE.4*D)>E.2H.8)4>HXE.4)-*D)>E.2H.8)3>HXEXUB3
6075          *L1.8)L>L2.H.8)3>A1H2L1.:9>HXLX)$')
6076           RETURN
6077           END
6078           SUBROUTINE REQ5
6079           CALL LTLINE('>0-4.5T.5L.7)(M>L.9H.8)2>L1.H2:8>LXHXPE.4)L>E.2H.8)2>
6080          *HXEXUGL1.8)(I>L2.H.8)2>L1.H2:9)>HXL.7) +>LX)$')
6081           CALL LTLINE('>0-3.0T1.6L.7)2(M>L.9H.8)3>L1.H2:8>LXHXPE.4)L>E.2H.6)
6082          *2>HXEXUGL1.8)(I>L2.H.8)2>HXL.7) + >LXPE.4)L>E.2H.8)3>EXHXUGL1.8)(I
6083          *>L2.H.8)3>L1.H2:9)>HXLX)$')
6084           CALL LTLINE('>0-1.5T3.3L.7)+ (M>L.9H.8)4>L1.H2:3>LXHXPE.4)L>E.2H.8
6085          *)4>HXEXUGL1.8)(I>L2.H.8)2>L1.H2:9)>HXLX)$')
6086           CALL LTLINE('>T4.6L.7)= -6(B) + 6(E>L1.H2:8)>LXHX)$')
6087           CALL LTLINE('>01.5T6.1PE.4*D)>E.2H.8)3>HXE.4)-*D)>E.2H.8)2>HXEXUB3
6088          *L1.8)L>L2.H.8)2>HXA1L.7) ->LX)$')
6089           CALL LTLINE('>03.0T7.0PE.4*D)>E.2H.8)4>HXE.4)-*D)>E.2H.8)3>HXEXUB3
6090          *L1.8)L>L2.H.8)3>A1H2L1.:9>HXLX)$')
6091           RETURN
6092           END
6093           SUBROUTINE REQ6
6094           CALL LTLINE('>0-3.0T1.L.7)(M>L.9H.8)3>L1.H2:8>LXHXPE.4)L>E.2H.8)3>
6095          *HXEXUGL1.8)(I>L2.H.8)3>L1.H2:9)>HXL.7) +>LX)$')
6096           CALL LTLINE('>0-1.5T2.2L.7)2(M>L.9H.3)4>L1.H2:8>LXHXPE.4)L>E.2H.6)
6097          *3>HXEXUGL1.8)(I>L2.H.8)3>HXL.7) + >LXPE.4)L>E.2H.8)4>EXHXUGL1.8)(I
6098          *>L2.H.8)4>L1.H2:9)>LXHX)$')
6099           CALL LTLINE('>T3.9L.7)= -6(C) + 6(E>L1.H2.:8)>LXHX)$')
6100           CALL LTLINE('>01.5T5.3PE.4*D)>E.2H.8)4>HXE.4)-*D)>E.2H.8)3>HXEXUB3
6101          *L1.8)L>L2.H.8)3>HXA1L.7) ->LX)$')
6102           CALL LTLINE('>03.0T6.2PE.4*D)>E.2H.8)5>HXE.4)-*D)>E.2H.8)4>HXEXUB3
6103          *L1.8)L>L2.H.8)4>A1H2L1.:9>HXLX)$')
6104           RETURN
6105           END
6106           SUBROUTINE REQ7
6107           CALL LTLINE('>T1.0PE.4)(SPAN 1)>EXUA801.1L.7)(M>L.9)X>L.7) = (M>L.
6108          *9)O>L.7) + (M>L.9H.8)2>L1.H2:8>LXHXPE.4)X>EXUGL1.8)L>L2.H.8)1>L1.H
6109          *2:9>LXHX)$')
6110           RETURN
6111           END
6112           SUBROUTINE REQ8
6113           CALL LTLINE('>T1.0PE.4)(SPAN 2)>EXUA801.1L.7)(M>L.9)X>L.7) = (M>L.
6114          *9)O>L.7) + (M>L.9H.8)2>L1.H2:8>LXHXPE.4)L>E.2H.8)2>HXE.4)-X>EXUB3L
6115          *1.8)L>L2.H.8)2>A1L1.H2:9>LXHX)$')
6116           CALL LTLINE('>02.6T5.3L.7)+ (M>L.9H.8)3>L1.H2:8>LXHXPE.4)X>EXUGL1.
6117          *8)L>L2.H.8)2>L1.H2:9>LXHX)$')
6118           RETURN
6119           END
6120           SUBROUTINE REQ9
6121           CALL LTLINE('>T1.0PE.4)(SPAN 3)>EXUA801.1L.7)(M>L.9)X>L.7) = (M>L.
6122          *9)O>L.7) + (M>L.9H.8)3>L1.H2:8>LXHXPE.4)L>E.2H.8)3>HXE.4)-X>EXUB3L
6123          *1.8)L>L2.H.8)3>A1L1.H2:9>LXHX)$')
6124           CALL LTLINE('>02.6T5.3L.7)+ (M>L.9H.8)4>L1.H2:8>LXHXPE.4)X>EXUGL1.
6125          *8)L>L2.H.8)3>L1.H2:9>LXHX)$')
6126           RETURN
6127           END
6128           SUBROUTINE REQ10
6129           CALL LTLINE('>T1.0PE.4)(SPAN 4)>EXUA801.1L.7)(M>L.9)X>L.7) = (M>L.
6130          *9)O>L.7) + (M>L.9H.8)4>L1.H2:8>LXHXPE.4)L>E.2H.8)4>HXE.4)-X>EXUB3L
6131          *1.8)L>L2.H.8)4>A1L1.H2:9>LXHX)$')
6132           RETURN
6133           END
6134           SUBROUTINE REQ11
6135           CALL LTLINE('>T1.8PE.4)(SPAN 1)>EXUA801.1L.7)(V>L.9)X>L.7) = (V>L.
6136          *9)O>L.7) + >LXPE.4)(M>E.2H.8)2>EXHXUGL1.8)L>L2.H.8)1>LXHX)$')
6137           RETURN
6138           END
6139           SUBROUTINE REQ12
6140           CALL LTLINE('>T1.8PE.4)(SPAN 2)>EXUA801.1L.7)(V>L.9)X>L.7) = (V>L.
6141          *9)O>L.7) + >LXPE.4)(M>E.2H.8)3>HXE.4)-(M>E.2H.8)2>EXHXUB3L1.8)L>L2
6142          *.H.8)2>LXHX)$')
6143           RETURN
6144           END
6145           SUBROUTINE REQ13
6146           CALL LTLINE('>T1.8PE.4)(SPAN 3)>EXUA801.1L.7)(V>L.9)X>L.7) = (V>L.
6147          *9)O>L.7) + >LXPE.4)(M>E.2H.8)4>HXE.4)-(M>E.2H.8)3>EXHXUB3L1.8)L>L2
6148          *.H.8)3>LXHX)$')
6149           RETURN
6150           END
6151           SUBROUTINE REQ14
6152           CALL LTLINE('>T1.8PE.4)(SPAN 4)>EXUA801.1L.7)(V>L.9)X>L.7) = (V>L.
6153          *9)O>L.7) - >LXPE.4)(M>E.2H.8)4>EXHXUGL1.8)L>L2.H.8)4>LXHX)$')
6154           RETURN
6155           END
6156           SUBROUTINE REQ15
6157           CALL LTLINE('>T1.PE.4)(SUPPOPT #1)>EXUA501.1L.7)(R>L.9H.8)1>HXL.7)
6158          * = >L.94.8)1>HXL.7)(A>L.9H.8)O>HXL.7) +>LX)$')
6159           CALL LTLINE('>02.6T4.1PE.4)(M>E.2H.8)2>HXEXUGL1.8)L>L2.H.8)1>HXLX)
6160          *$')
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      RETURN
      END
      SUBROUTINE REQ16
      CALL LTLINE('>T1.PE.4)(SUPPORT #2)>EXUA501.1L.7)(R>L.9H.8)2>HXL.7)
     * = >L.9H.8)1>HXL.7)(B>L.9H.8)0>HXL.7) +>LX)$')
      CALL LTLINE('>02.6T4.1L.9H.8)2>HXL.7)(A>L.9H.8)0>HXL.7) - (M>L.9H.
     *6)2>L1.42:8>HXLX)$')
      CALL LTLINE('>04.1T5.2PE.4)1>EXUGL1.8)L>L2.H.8)1>HXL.7) + >LXPE.4)
     *1>EXUGL1.8)L>L2.H.8)2>L1.H2:9)>HXL.7) + >LXPE.4)(M>E.2H.8)3>EXHXUG
     *L1.8)L>L2.H.8)2>HXLX)$')
      RETURN
      END
      SUBROUTINE REQ17
      CALL LTLINE('>T1.PE.4)(SUPPORT #3)>EXUA501.1L.7)(R>L.9H.8)3>HXL.7)
     * = >L.9H.8)2>HXL.7)(B>L.9H.8)0>HXL.7) +>LX)$')
      CALL LTLINE('>02.6T4.1L.9H.8)3>HXL.7)(A>L.9H.8)0>HXL.7) + >LXPE.4)
     *(M>E.2H.8)2>HXEXUGL1.8)L>L2.H.8)2>HXL.7) - (M>L.9H.8)3>L1.H2:8>HXL
     *X)$')
      CALL LTLINE('>04.1T5.8PE.4)1>EXUGL1.8)L>L2.H.8)2>HXL.7) + >LXPE.4)
     *1>EXUGL1.8)L>L2.H.8)3>L1.H2:9)>HXL.7) + >LXPE.4)(M>E.2H.9)4>EXHXUG
     *L1.8)L>L2.H.8)3>HXLX)$')
      RETURN
      END
      SUBROUTINE REQ18
      CALL LTLINE('>T1.PE.4)(SUPPORT #4)>EXUA501.1L.7)(R>L.9H.8)4>HXL.7)
     * = >L.9H.8)3>HXL.7)(B>L.9H.8)0>HXL.7) +>LX)$')
      CALL LTLINE('>02.6T4.1L.9H.8)4>HXL.7)(A>L.9H.8)0>HXL.7) + >LXPE.4)
     *(M>E.2H.8)3>HXEXUGL1.8)L>L2.H.8)3>HXL.7) - (M>L.9H.8)4>L1.H2:8>HXL
     *X)$')
      CALL LTLINE('>04.1T5.8PE.4)1>EXUGL1.8)L>L2.H.8)3>HXL.7) + >LXPE.4)
     *1>EXUGL1.8)L>L2.H.8)4>L1.H2:9)>HXLX)$')
      RETURN
      END
      SUBROUTINE REQ19
      CALL LTLINE('>T1.PE.4)(SUPPORT #5)>EXUA501.1L.7)(R>L.9H.8)5>HXL.7)
     * = >L.9H.8)4>HXL.7)(B>L.9H.8)0>HXL.7) +>LX)$')
      CALL LTLINE('>02.6T4.1PE.4)(M>E.2H.8)4>HXEXUGL1.8)L>L2.H.8)4>HXLX)
     *$')
      RETURN
      END
      SUBROUTINE REQ20
      CALL LTLINE('>T.5PE.4)(SPAN 1)>EXUA801.1L.7*D)>L.9)X>L.7) = *D>L.9
     *)0>L.7) + >LXPE.4)X:8)L>E.2H.8)1>HXE.4)-X:9)>EXUGL1.8)6(EI>L2.H.8)
     *1>HXL1.8)L>L2.H.8)1>HXLX)$')
      CALL LTLINE('>02.6T4.4L.7:2)(M>L.9H.8)2>HXL.7:8)L>L.9H.8)1>HXL.7)+
     *X:93)>LX)$')
      RETURN
      END
      SUBROUTINE REQ21
      CALL LTLINE('>T.5PE.4)(SPAN 2)>EXUA801.1L.7*D)>L.9)X>L.7) = *D>L.9
     *)0>L.7) + >LXPE.4)X:8)L>E.2H.8)2>HXE.4)-X:9)>EXUGL1.8)6(EI>L2.H.8)
     *2>HXL1.8)L>L2.H.8)2>HXLX)$')
      CALL LTLINE('>02.6T4.4L.7:2)(M>L.9H.8)2>HXL.7:8)2L>L.9H.8)2>HXL.7)
     *-X:9) + (M>L.9H.8)3>HXL.7:8)L>L.9H.8)2>HXL.7)+X:93)>LX)$')
      RETURN
      END
      SUBROUTINE REQ22
      CALL LTLINE('>T.5PE.4)(SPAN 3)>EXUA801.1L.7*D)>L.9)X>L.7) = *D>L.9
     *)0>L.7) + >LXPE.4)X:8)L>E.2H.8)3>HXE.4)-X:9)>EXUGL1.8)6(EI>L2.H.8)
     *3>HXL1.8)L>L2.H.8)3>HXLX)$')
      CALL LTLINE('>02.6T4.4L.7:2)(M>L.9H.8)3>HXL.7:8)2L>L.9H.8)3>HXL.7)
     *-X:9) + (M>L.9H.8)4>HXL.7:8)L>L.9H.8)3>HXL.7)+X:93)>LX)$')
      RETURN
      END
      SUBROUTINE REQ23
      CALL LTLINE('>T.5PE.4)(SPAN 4)>EXUA801.1L.7*D)>L.9)X>L.7) = *D>L.9
     *)0>L.7) + >LXPE.4)X:8)L>E.2H.8)4>HXE.4)-X:9)>EXUGL1.8)6(EI>L2.H.8)
     *4>HXL1.8)L>L2.H.8)4>HXLX)$')
      CALL LTLINE('>02.6T4.4L.7:2)(M>L.9H.8)4>HXL.7:8)2L>L.9H.8)4>HXL.7)
     *-X:93)>LX)$')
      RETURN
      END
C-----------------------------------------------------------------------C
      SUBROUTINE TLLORD(NO,N9,NP,SL,BEAM,SUPPM,SPANM,SHEAR,REACT,DELTA,
     *NORD,NORDV,TRLLV,CONLL,AASHTO,ENVEM,ENVEV,ENVED,ENVER,DELX,EDT)
      IMPLICIT REAL*8 (A-H,O-Z)
      DIMENSION BEAM(5,3),SUPPM(41,3),SPANM(41,41),SHEAR(42,44),
     *REACT(41,5),DELTA(41,41),NORD(3,2),NORDV(3,2),TRLLV(3,2),
     *CONLL(3,2),AASHTO(3),ENVEM(41,3),ENVEV(44,3),ENVED(41,3),
     *ENVER(5,3),DELX(41),EDT(41,3)
C
C SUBROUTINE TO COMPUTE MOMENT ENVELOPE ORDINATES, SHEAR ENVELOPE
C ORDINATES, DEFLECTION ORDINATES, & REACTIONS FOR AASHTO TRUCK LL
C
C <<<<< MOMENT ENVELOPE ORDINATES >>>>>
C
      DO 143 I=1,N9*NO+1
        ENVEM(I,2)=0.0
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6249            DO 143 J=1,NP
6250              PORDL=SPANM(NORD(J,1),I)
6251              PORDR=SPANM(NORD(J,2),I)
6252              CALL LENGTH(J,SL,BEAM,NORD)
6253              PORD=PORDL+N9*CONLL(J,2)*(PORDR-PORDL)/SL
6254              ENVEM(I,2)=ENVEM(I,2)+PORD*AASHTO(J)
6255     143    CONTINUE
6256     C
6257     C <<<<< SHEAR ENVELOPE ORDINATES AT 10TH-POINTS >>>>>
6258     C
6259            DO 145 I=1,NO*(N9+1)
6260              ENVEV(I,2)=0.0
6261              IF(I.LE.11) THEN
6262                I1=I
6263              ELSE IF(I.LE.22) THEN
6264                I1=I-1
6265              ELSE IF(I.LE.33) THEN
6266                I1=I-2
6267              ELSE
6268                I1=I-3
6269              END IF
6270            DO 145 J=1,NP
6271              IF(I1.LE.NORD(J,1)) THEN
6272                PORDL=SHEAR(NORD(J,1)+1,I)
6273                PORDR=SHEAR(NORD(J,2)+1,I)
6274              ELSE
6275                PORDL=SHEAR(NORD(J,1),I)
6276                PORDR=SHEAR(NORD(J,2),I)
6277              END IF
6278              CALL LENGTH(J,SL,BEAM,NORD)
6279              PORD=PORDL+N9*CONLL(J,2)*(PORDR-PORDL)/SL
6280              ENVEV(I,2)=ENVEV(I,2)+PORD*AASHTO(J)
6281     145    CONTINUE
6282     C
6283     C <<<<< SHEAR ENVELOPE ORDINATES AT WHEEL POINTS >>>>>
6284     C
6285            DO 146 K=1,NP
6286              DO 146 L=1,NO*(N9+1)-1
6287                IF(L.EQ.NORDV(K,1)) THEN
6288                  VLEFT=ENVEV(L,2)
6289                  TRLLV(K,1)=VLEFT
6290                  TRLLV(K,2)=VLEFT-AASHTO(K)
6291                END IF
6292     146    CONTINUE
6293     C
6294     C <<<<< DEFLECTION ORDINATES >>>>>
6295     C
6296            DO 148 I=1,N9*NO+1
6297              C3=0.0
6298              DO 147 J=1,NP
6299                PORDL=DELTA(NORD(J,1),I)
6300                PORDR=DELTA(NORD(J,2),I)
6301                CALL LENGTH(J,SL,BEAM,NORD)
6302                PORD=PORDL+N9*CONLL(J,2)*(PORDR-PORDL)/SL
6303                C3=C3-PORD*AASHTO(J)
6304     147        CONTINUE
6305                ENVED(I,2)=C3
6306                EDT(I,2)=-C3+DELX(I)
6307     148    CONTINUE
6308     C
6309     C <<<<< REACTIONS >>>>>
6310     C
6311            DO 149 I=1,NO+1
6312              ENVER(I,2)=0.0
6313              DO 149 J=1,NP
6314                PORDL=REACT(NORD(J,1),I)
6315                PORDR=REACT(NORD(J,2),I)
6316                CALL LENGTH(J,SL,BEAM,NORD)
6317                PORD=PORDL+N9*CONLL(J,2)*(PORDR-PORDL)/SL
6318                ENVER(I,2)=ENVER(I,2)+PORD*AASHTO(J)
6319     149    CONTINUE
6320            RETURN
6321            END
6322     C-------------------------------------------------------------------------C
6323            SUBROUTINE TRUCK(ALL,NP,AASHTO,AASHTL)
6324            IMPLICIT REAL*8 (A-H,O-Z)
6325            DIMENSION AASHTO(3)
6326            CHARACTER ALL,AASHTL*7
6327     C
6328     C SUBROUTINE TO DEFINE TRUCK POINT LOADS
6329     C
6330            IF(ALL.EQ.'A') THEN
6331              AASHTO(1)=4.
6332              AASHTO(2)=16.
6333              AASHTO(3)=0.
6334              AASHTL='H10-44'
6335              NP=2
6336            ELSE IF(ALL.EQ.'B') THEN
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6337            AASHTO(1)=6.
6338            AASHTO(2)=24.
6339            AASHTO(3)=0.
6340            AASHTL='H15-44'
6341            NP=2
6342          ELSE IF(ALL.EQ.'C') THEN
6343            AASHTO(1)=8.
6344            AASHTO(2)=32.
6345            AASHTO(3)=0.
6346            AASHTL='H20-44'
6347            NP=2
6348          ELSE IF(ALL.EQ.'D') THEN
6349            AASHTO(1)=6.
6350            AASHTO(2)=24.
6351            AASHTO(3)=24.
6352            AASHTL='HS15-44'
6353            NP=3
6354          ELSE
6355            AASHTO(1)=8.
6356            AASHTO(2)=32.
6357            AASHTO(3)=32.
6358            AASHTL='HS20-44'
6359            NP=3
6360          END IF
6361          RETURN
6362          END
6363    C-------------------------------------------------------------------------C
6364          SUBROUTINE TRUCK2(ALL,AXLE,NP,AASHTO,AASHTL,CONLL,BEAM)
6365          IMPLICIT REAL*8 (A-H,O-Z)
6366          DIMENSION AASHTO(3),CONLL(3,2),BEAM(5,3)
6367          CHARACTER ALL,AASHTL*7
6368    C
6369    C SUBROUTINE TO INPUT AASHTO TRUCK TYPE & LOCATION
6370    C
6371    48    FORMAT(A1)
6372    463   FORMAT(F5.1)
6373    855   FORMAT(F7.1)
6374          TYPE 785
6375    785   FORMAT(' !ERA M')
6376         *TYPE 351
6377    351   FORMAT(T6,'Available AASHTO truck types are:'/)
6378          TYPE 352
6379    352   FORMAT(T11,'(A) H10-44       (D) HS15-44')
6380          TYPE 353
6381    353   FORMAT(T11,'(B) H15-44       (E) HS20-44')
6382          TYPE 354
6383    354   FORMAT(T11,'(C) H20-44'/)
6384    355   TYPE 46
6385    46    FORMAT(T5,' PLEASE SELECT ONE OF THE ABOVE: ',$)
6386          ACCEPT 48, ALL
6387          IF(ALL.LT.'A' .OR. ALL.GT.'E') GO TO 355
6388    428   TYPE 785
6389          TYPE 336
6390    336   FORMAT(T6,'Assuming the truck travels from left to right, specify
6391         *the')
6392          TYPE 337
6393    337   FORMAT(T5,' distance from far left support to front wheels: ',$)
6394          ACCEPT 855, CONLL(1,1)
6395          IF(CONLL(1,1).LT.0. .OR. CONLL(1,1).GT.BEAM(5,1)) GO TO 428
6396          CONLL(2,1)=CONLL(1,1)-14.
6397          IF(ALL.EQ.'A' .OR. ALL.EQ.'B' .OR. ALL.EQ.'C') THEN
6398            CONLL(3,1)=0.
6399          ELSE
6400    650     TYPE 645
6401    645     FORMAT(/T5,' Distance, in feet, from 2nd to 3rd axle (14 min, 30
6402         * max): ',$)
6403            ACCEPT 463, AXLE
6404            IF(AXLE.LT.14. .OR. AXLE.GT.30.) GO TO 650
6405            CONLL(3,1)=CONLL(2,1)-AXLE
6406          END IF
6407          CALL TRUCK(ALL,NP,AASHTO,AASHTL)
6408          RETURN
6409          END
6410    C-------------------------------------------------------------------------C
6411          SUBROUTINE UDLORD(NO,N9,ENVEM,UNIDL,AREAM,ENVEV,AREAV,ENVED,AREAD,
6412         *ENVER,AREAR,TLL,UDLV,BEAM,NORDV,CONLL,DELM,DELV,DELD,DELX,EDT,NP)
6413          IMPLICIT REAL*8 (A-H,O-Z)
6414          DIMENSION ENVEM(41,3),UNIDL(4),AREAM(41,4),ENVEV(44,3),
6415         *AREAV(44,4),ENVED(41,3),AREAD(41,4),ENVER(5,3),AREAR(5,4),
6416         *UDLV(3,2),BEAM(5,3),NORDV(3,2),CONLL(3,2),DELM(41),DELV(44),
6417         *DELD(41),DELX(41),EDT(41,3)
6418          CHARACTER TLL
6419    C
6420    C SUBROUTINE TO COMPUTE MOMENT ENVELOPE ORDINATES, SHEAR ENVELOPE
6421    C ORDINATES, DEFLECTION ORDINATES, & REACTIONS FOR UNIFORM DL
6422    C
6423    C
6424    C <<<<< MOMENT ENVELOPE ORDINATES >>>>>
```

```
6425    C
6426          DO 118 I=1,N9*NO+1
6427            C1=0.0
6428            DO 117 J=1,NO
6429              C1=C1+UNIDL(J)*AREAM(I,J)
6430    117     CONTINUE
6431            ENVEM(I,1)=C1+DELM(I)
6432    118   CONTINUE
6433    C
6434    C <<<<< SHEAR ENVELOPE ORDINATES AT 10TH-POINTS >>>>>
6435    C
6436          DO 120 I=1,NO*(N9+1)
6437            C2=0.0
6438            DO 119 J=1,NO
6439              C2=C2+UNIDL(J)*AREAV(I,J)
6440    119     CONTINUE
6441            ENVEV(I,1)=C2+DELV(I)
6442    120   CONTINUE
6443    C
6444    C <<<<< SHEAR ENVELOPE ORDINATES AT WHEEL POINTS >>>>>
6445    C
6446          IF(TLL.EQ.'C') THEN
6447            DO 121 K=1,NP
6448              DO 121 L=1,NO*(N9+1)-1
6449                IF(L.EQ.NORDV(K,1)) THEN
6450                  VLEFT=ENVEV(L,1)
6451                  VRIGHT=ENVEV(L+1,1)
6452                  NS=INT((L-1)/(N9+1))+1
6453                  DDX=BEAM(NS,1)/N9
6454                  VDROP=CONLL(K,2)*(VLEFT-VRIGHT)/DDX
6455                  UDLV(K,1)=VLEFT-VDROP
6456                END IF
6457    121       CONTINUE
6458          END IF
6459    C
6460    C <<<<< DEFLECTION ORDINATES >>>>>
6461    C
6462          DO 124 I=1,N9*NO+1
6463            C3=0.0
6464            DO 123 J=1,NO
6465              C3=C3-UNIDL(J)*AREAD(I,J)
6466    123       CONTINUE
6467            ENVED(I,1)=C3-DELD(I)
6468            EDT(I,1)=-ENVED(I,1)+DELX(I)
6469    124   CONTINUE
6470    C
6471    C <<<<< REACTIONS >>>>>
6472    C
6473          DO 126 I=1,NO+1
6474            C4=0.0
6475            DO 125 J=1,NO
6476              C4=C4+UNIDL(J)*AREAR(I,J)
6477    125       CONTINUE
6478            KL=(N9+1)*(I-1)
6479            KR=KL+1
6480            IF(I.EQ.1) THEN
6481              VCON=DELV(KR)
6482            ELSE IF(I.EQ.(NO+1)) THEN
6483              VCON=-DELV(KL)
6484            ELSE
6485              VCON=DELV(KR)-DELV(KL)
6486            END IF
6487            ENVER(I,1)=C4+VCON
6488    126   CONTINUE
6489          RETURN
6490          END
6491    C-------------------------------------------------------------------------C
6492          SUBROUTINE ULLORD(NO,N9,ENVEM,UNILL,AREAM,ENVEV,AREAV,ENVED,AREAD,
6493         *ENVER,AREAR,DELX,EDT)
6494          IMPLICIT REAL*8 (A-H,O-Z)
6495          DIMENSION ENVEM(41,3),UNILL(4),AREAM(41,4),ENVEV(44,3),
6496         *AREAV(44,4),ENVED(41,3),AREAD(41,4),ENVER(5,3),AREAR(5,4),
6497         *DELX(41),EDT(41,3)
6498    C
6499    C SUBROUTINE TO COMPUTE MOMENT ENVELOPE ORDINATES, SHEAR ENVELOPE
6500    C ORDINATES, DEFLECTION ORDINATES, & REACTIONS FOR UNIFORM LL
6501    C
6502    C
6503    C <<<<< MOMENT ENVELOPE ORDINATES >>>>>
6504    C
6505          DO 127 I=1,N9*NO+1
6506            ENVEM(I,2)=0.0
6507            DO 127 J=1,NO
6508              ENVEM(I,2)=ENVEM(I,2)+UNILL(J)*AREAM(I,J)
6509    127   CONTINUE
6510    C
6511    C <<<<< SHEAR ENVELOPE ORDINATES >>>>>
6512    C
```

```
      DO 129 I=1,NO*(N9+1)
        ENVEV(I,2)=0.0
        DO 129 J=1,NO
          ENVEV(I,2)=ENVEV(I,2)+UNILL(J)*AREAV(I,J)
129   CONTINUE
C
C <<<<< DEFLECTION ORDINATES >>>>>
C
      DO 131 I=1,N9*NO+1
        C3=0.0
        DO 130 J=1,NO
          C3=C3-UNILL(J)*AREAD(I,J)
130     CONTINUE
        ENVED(I,2)=C3
        EDT(I,2)=-ENVED(I,2)+DELX(I)
131   CONTINUE
C
C <<<<< REACTIONS >>>>>
C
      DO 133 I=1,NO+1
        ENVER(I,2)=0.0
        DO 133 J=1,NO
          ENVER(I,2)=ENVER(I,2)+UNILL(J)*AREAR(I,J)
133   CONTINUE
      RETURN
      END
C-----------------------------------------------------------------------C
      SUBROUTINE ULOAD(LPT,N9,X3,DX)
      IMPLICIT REAL*8 (A-H,O-Z)
      DIMENSION DX(5)
C
C SUBROUTINE TO POSITION UNIT LOAD ON BEAM
C
748   FORMAT(' !COL 60')
723   FORMAT(' !LIN 1')
      TYPE 723
      NSUL=INT((LPT-1)/N9)+1
      LUL=(NSUL-1)*N9+1
      X3=DX(NSUL)+(LPT-LUL)*(DX(NSUL+1)-DX(NSUL))/N9
      X4=X3-2.
      X5=X3+2.
      X6=X3+12.
      Y1=325.0
      Y2=Y1+10.
      Y3=Y1+5.
      Y4=Y1+23.
      TYPE 696, X3,Y4,X3,Y1
696   FORMAT(' !VEC',4(' ',F8.3))
      TYPE 777, X3,Y1,X4,Y3,X5,Y3
777   FORMAT(' !POL',6(' ',F8.3))
      TYPE 748
      TYPE 696, X6,Y2,X6,Y2
      RETURN
      END
C-----------------------------------------------------------------------C
      SUBROUTINE YMAX1(NC,NR,YMAX,YVALU)
      IMPLICIT REAL*8 (A-H,O-Z)
      DIMENSION YVALU(NR,NC)
C
C SUBROUTINE TO COMPUTE MAXIMUM I.L. ORDINATE VALUES IN
C SUPPM, SPANM, SHEAR, REACT, OR DELTA MATRICES
C
      YMAX=0.
      DO 401 I=1,NC
        DO 401 J=1,NR
          YVALUE=ABS(YVALU(J,I))
          IF(YVALUE.GT.YMAX) THEN
            YMAX=YVALUE
          END IF
401   CONTINUE
      RETURN
      END
C-----------------------------------------------------------------------C
      SUBROUTINE YMAX2(YMAX)
      IMPLICIT REAL*8 (A-H,O-Z)
C
C SUBROUTINE TO PLOT MAXIMUM ORDINATE VALUES ON ORDINATE AXIS
C
794   FORMAT(F9.2)
516   FORMAT(' 0')
      TYPE 634
634   FORMAT(' !JUM 12,63')
      TYPE 794, YMAX
      TYPE 595
595   FORMAT(' !JUM 18,63')
      TYPE 516
      TYPE 695
695   FORMAT(' !JUM 24,63')
```

```
      TYPE 794, -YMAX
      RETURN
      END
C-----------------------------------------------------------------------C
C------------------------- END OF SUBROUTINES --------------------------C
C-----------------------------------------------------------------------C
C                                                                       C
C  MATRIX DEFINITIONS                                                   C
C  ==================                                                   C
C                                                                       C
C  A(5)            TRI-DIAGONAL COEFFICIENTS ABOVE DIAGONAL             C
C                                                                       C
C  AASHTO(3)       AASHTO TRUCK WHEEL LOADS                             C
C                                                                       C
C  ABC(41,3)       ELASTIC WEIGHT REACTIONS ON RIGHT SIDE OF            C
C                  3-MOMENT EQUATION                                    C
C                                                                       C
C  AREAD(41,4)     DEFLECTION I.L. AREAS                                C
C                                                                       C
C  AREAM(41,4)     MOMENT I.L. AREAS                                    C
C                                                                       C
C  AREAR(5,4)      REACTION I.L. AREAS                                  C
C                                                                       C
C  AREAV(44,4)     SHEAR I.L. AREAS                                     C
C                                                                       C
C  B(5)            TRI-DIAGONAL COEFFICIENTS BELOW DIAGONAL             C
C                                                                       C
C  BEAM(5,3)       BEAM PHYSICAL DATA                                   C
C                                                                       C
C  CONLL(3,2)      AASHTO TRUCK WHEEL LOCATIONS                         C
C                                                                       C
C  D(5)            TRI-DIAGONAL COEFFICIENTS ON DIAGONAL                C
C                                                                       C
C  DELD(41)        DEFLECTION ORDINATES DUE TO UNEVEN SUPPORTS          C
C                                                                       C
C  DELM(41)        MOMENT ORDINATES DUE TO UNEVEN SUPPORTS              C
C                                                                       C
C  DELSM(3)        SUPPORT MOMENTS DUE TO UNEVEN SUPPORTS               C
C                                                                       C
C  DELTA(41,41)    DEFLECTION I.L. ORDINATES                            C
C                                                                       C
C  DELV(44)        SHEAR ORDINATES DUE TO UNEVEN SUPPORTS               C
C                                                                       C
C  DELX(41)        STRAIGHT LINE DEFLECTIONS BETWEEN SUPPORTS           C
C                                                                       C
C  DX(5)           SUPPORT LOCATIONS IN PIXEL COORDINATES               C
C                                                                       C
C  D1(5)           TRI-DIAGONAL COEFFICIENTS ON DIAGONAL                C
C                                                                       C
C  EDT(41,3)       DEFLECTION ENVELOPE ORDINATES FOR UNEVEN SUPPORTS    C
C                                                                       C
C  ENVED(41,3)     DEFLECTION ENVELOPE ORDINATES                        C
C                                                                       C
C  ENVEM(41,3)     MOMENT ENVELOPE ORDINATES                            C
C                                                                       C
C  ENVER(5,3)      REACTION ENVELOPE ORDINATES                          C
C                                                                       C
C  ENVEV(44,3)     SHEAR ENVELOPE ORDINATES                             C
C                                                                       C
C  NORD(3,2)       10TH-POINTS EACH SIDE OF AASHTO TRUCK WHEELS         C
C                                                                       C
C  NORDV(3,2)      10TH-POINTS EACH SIDE OF AASHTO TRUCK WHEELS         C
C                                                                       C
C  REACT(41,5)     REACTION I.L. ORDINATES                              C
C                                                                       C
C  SC(5,2)         SUPPORT COORDINATES                                  C
C                                                                       C
C  SHEAR(42,44)    SHEAR I.L. ORDINATES                                 C
C                                                                       C
C  SPANM(41,41)    SPAN MOMENT I.L. ORDINATES                           C
C                                                                       C
C  SUPPM(41,3)     SUPPORT MOMENT I.L. ORDINATES                        C
C                                                                       C
C  TRLLV(3,2)      SHEAR ENVELOPE ORDINATES AT TRUCK WHEELS, LL          C
C                                                                       C
C  TRWV(3,2)       SHEAR ENVELOPE ORDINATES AT TRUCK WHEELS, DL+LL       C
C                                                                       C
C  UDLV(3,2)       SHEAR ENVELOPE ORDINATES AT TRUCK WHEELS, DL          C
C                                                                       C
C  UNIDL(4)        SPAN UNIFORM DEAD LOADS                              C
C                                                                       C
C  UNILL(4)        SPAN UNIFORM LIVE LOADS                              C
C                                                                       C
C  VORD(40)        SHEAR I.L. AREAS BETWEEN 10TH-POINTS                 C
C                                                                       C
C  WORD(3,2)       SHEAR ENVELOPE ORDINATES AT AASHTO TRUCK WHEELS       C
C                                                                       C
C  XL1(30)         X-COORD DATA FOR 3-SPAN BEAM (1:1.5:2)               C
```

```
6689    C
6690    C  XL2(30)        X-COORD DATA FOR 3-SPAN BEAM (1:1.3:1)                C
6691    C
6692    C  YL1(30)        Y-COORD DATA FOR -M @ SUPPORT NO. 2                   C
6693    C
6694    C  YL2(30)        Y-COORD DATA FOR -M @ SUPPORT NO. 3                   C
6695    C
6696    C  YL3(30)        Y-COORD DATA FOR -M @ SUPPORT NO. 2                   C
6697    C
6698    C  YL4(30)        Y-COORD DATA FOR +M @ 10TH-POINT NO. 15               C
6699    C
6700    C  YL5(31)        Y-COORD DATA FOR V @ 10TH-POINT NO. 6                 C
6701    C
6702    C  YL6(31)        Y-COORD DATA FOR V LEFT OF 10TH-POINT NO. 21          C
6703    C
6704    C  YL7(31)        Y-COORD DATA FOR V RIGHT OF 10TH-POINT NO. 21         C
6705    C
6706    C  YL8(30)        Y-COORD DATA FOR R @ SUPPORT NO. 1                    C
6707    C
6708    C  YL9(30)        Y-COORD DATA FOR R @ SUPPORT NO. 3                    C
6709    C
6710    C  YL10(30)       Y-COORD DATA FOR DELTA @ 10TH-POINT NO. 16            C
6711    C
6712    C  YL11(30)       Y-COORD DATA FOR DELTA @ 10TH-POINT NO. 26            C
6713    C
6714    C-------------------------------------------------------------------------C
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