A STUDY TO DETERMINE THE OPTIMUM END SPAN LENGTH FOR A STANDARD FOUR SPAN INTER-STATE HIGHWAY GRADE SEPARATION

by 680

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SYNOPSIS

The objective of this study was to find the end span length resulting in the minimum girder weight for a four span symmetric four girder bridge under the following constraints:

1. The interior spans are 95 feet each.
2. There is to be no uplift at the abutments.
3. H20-44 loading is to be used.
4. The girders are to have a prismatic haunch over the interior supports. (The ratios of the moment of inertia at the supports to the moment of inertia in the positive moment regions of the girders investigated are 1.0, 1.5 and 2.0.)
5. Use the AASHO Specification 1965 Edition.
6. A non-composite reinforced concrete deck is to be used on the welded girders.
7. For design, use the uplift resulting from the loading which includes concentrated loads for moment but not for shear.
8. Use A-36 steel.

The results of this study indicate that the range of end span lengths in which the minimum cost girders will fall, with no uplift at the abutments, is relatively narrow. This range appears to be from approximately 47' to 52'. However, since this report was confined to working only with the superstructure, the most economical structural length was not necessarily found.

INTRODUCTION

In the design of highway grade separation structures, there is an increasing amount of emphasis being placed on safety and the removal of obstructions, which uncontrolled vehicles might otherwise encounter, from the side of the roadways. Many of these structures are designed using structural steel so that they may be constructed with a minimum of interference to traffic.

In the past, steel bridges normally have had an end span to interior span ratio of approximately 1 to 1.25, in order to give as near a balanced design arrangement as possible. Now, however, the interior span becomes quite long with the use of the present safety criteria. This is especially true if there is a slight skew. The interior span length can often approach 100 feet and in some cases there have been spans of over 135 feet. In using the balanced span arrangement, the end span is sometimes considerably longer than necessary to take care of the fill slope coming down from the abutment. There has been considerable discussion as to the economical advantage of shortening the end span to the point where uplift might occur at the abutment.

If the end spans are shortened drastically with respect to the interior span and uplift occurs, the AASHO Specification calls for a 100% overload increase, to oppose the uplift. This can sometimes be accomplished by using a heavy attached abutment. Unfortunately, the advantage of the attached abutment is not present in the design of a steel structure, so when uplift is encountered on these structure some positive means of hold down must be used. These devices become expensive to design and fabricate. They present a construction problem and there is a continual maintenance problem following construction. Therefore, it is desirable to design steel structures with span lengths which do not lead to uplift and still meet an economical length criterion.

This study used a trial and error method to determine the optimum end span lengths for various ratios of the moment of inertia over the piers to the moment of inertia at mid-span. The depth of the girder as well as the interior span length was held constant. The dead load weight of the girder was taken as the average weight of the girder and the design of stiffeners and diaphrams was omitted for purposes of simplifying the calculations.

The criteria which governed this study are as follows:

1. The interior spans are 95 feet each.
2. There is to be no uplift at the abutments.
3. H20-44 loading is to be used.
4. The girders are to have a prismatic haunch over the interior supports. (The ratios of the moment of inertia at the supports to the moment of inertia in the positive moment regions of the girders investigated are 1.0, 1.5 and 2.0.)
5. Use AASHO Specification 1965 Edition.
6. A typical cross section of the bridge is shown in Fig. A-3.
7. A non-composite reinforced concrete deck is to be used on the welded girders.

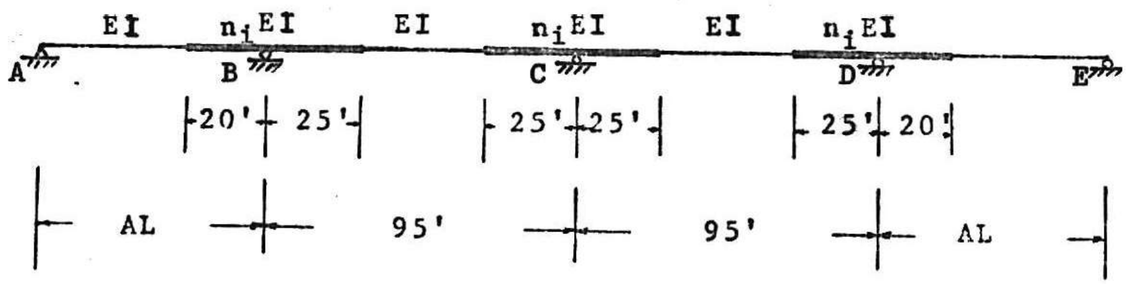
8. For design, use the uplift resulting from the loading which includes the concentrated loads for moment but not for shear.

9. Use A-36 steel.

The trials were made with the end span length (AL) ranging from 45' to 80' and for ratios of the moment of inertia of the girder haunch over the piers to the moment of inertia of the girder at mid-span of 1, 1.5 and 2. A total of 19 cases was investigated. The analyses and designs for the 19 cases are summarized in Table 1 and Fig. 7.

There are several criteria which might be used in determining the "optimum" span length. Total cost of structure including foundations, piers and superstructure, superstructure cost or girder weight are all criteria which might be used. Since the cost of foundations and piers will vary from location to location it would be difficult to include these costs in a study such as this one. Superstructure cost is a more reasonable value to calculate. However, the bid price of reinforced concrete in place varies considerable depending on structure location. It appeared that obtaining and analyzing the pricing information might well become a sizable task in itself. For these reasons the criterion used in this study was total girder weight and the "optimum" structure was taken to be the one with minimum total girder weight.

GENERAL PROCEDURES



Girder Haunch Locations

Fig. 1

1. Given the value of n_i. n_i = 1.0, 1.5, 2.0
   (where n_i = the ratio of the moment of inertia of the girder over the piers to the moment of inertia of the girder at mid-span)
2. Given the value of $(AL)_i$. $(AL)_i$ = 45', 50'........80'
   (where AL = length of the end span of the bridge)
3. Calculate the elements of the displacement-deformation matrix. Use the displacement method to calculate the ordinates of the influence lines for all positive and negative moments such as M_B, M_C, M_P. (where M_P is the maximum positive moment in the span).
4. Using the values of the influence line for M_B, find the minimum girder weight which will prevent uplift at abutment A.

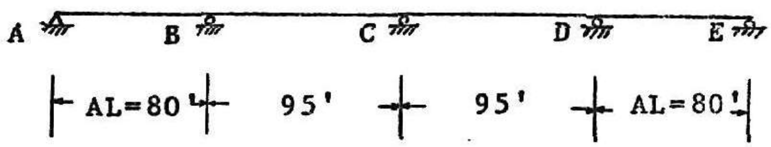
5. Assume a girder weight larger than the minimum required to prevent uplift. Find the dead load moment for M_B, M_C and M_P. Combine the dead load moment and the maximum live load moment (lane loading for maximum stress shown in Fig. A-5, Appendix A) to determine the maximum moment for designing the girder section.
6. Calculate the maximum shearing force at abutment A and at interior supports B and C, by combining the shearing forces caused by the dead and live loads.
7. Design the girder section with the actual shearing stress and actual bending stress to meet the requirements of the AASHO Specification.
8. Calculate the weight of the girder chosen. If it is different from the assumed value, repeat steps 5 through 7 until a suitable section is obtained.
9. Calculate the total weight of the four girders in kips.
10. Pick a new value of AL, and repeat steps 3 through 9 until the pertinent range of AL has been covered.
11. Pick a new value of n_i, and repeat steps 2 through 10 until the three chosen values of n_i have been used.
12. Use the length of the end span as the abscissa and the total weight of the four girders as the vertical coordinate, and plot the results into curves with respect to $n_i=1$, $n_i=1.5$ and $n_i=2$. Then, estimate the optimum end span length from the curves.

NUMERICAL EXAMPLE

From the values of the dead load, live lane loading and the distribution factors*it can be seen that the interior girders will control the design.

1. Analysis and design for $n_i=1$

1.1 AL = 80 ft.

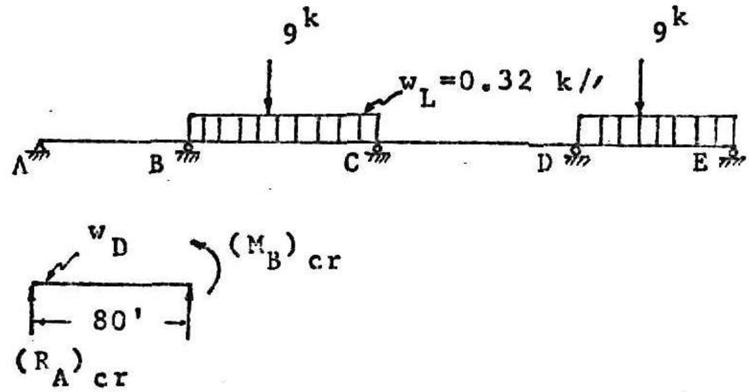


Bridge Dimensions

Fig. 2

The results of the analysis of this structure are included in Tables B-2, B-3, B-4 and B-5 in Appendix B.

1.1.1 *Find the lower limit of girder weight which will prevent uplift at the abutment.*



Live Loading for Minimum Reaction at A

Fig. 3

*See Appendix A

(A) Find the critical moment at interior support B

$$I = \frac{50}{80+125} = 0.244$$

(1) Due to dead load

$$(M_B)_D = -777.4291\ w_D$$

(2) Due to live load

(a) Two concentrated loads

$$(M_B)_{conc} = -(8.1831 + 0.5520)(9)(1.244) = -98 \text{ kip-ft}$$

(b) Uniform live load in spans BC and CD

$$(M_B)_{unif} = (-512.0627)(0.32)(1.244) = -204 \text{ kip-ft}$$

$$(M_B)_L = -(98+204) = -302 \text{ kip-ft}$$

$$(M_B)_{cr} = -777.4\ w_D + (-302)(1.4545) = -777.4\ w_D - 440$$

(B) For $(R_A)_{min} \geq 0$

$$(R_A)_{min} = [(M_B)_{cr} + \frac{w_D}{2}(80)^2]/80 \geq 0$$

$$-777.4\ w_D - 440 + 3200\ w_D \geq 0$$

$$w_D \geq 0.182 \text{ kips/ft}$$

but	concrete deck	= 0.78 kips/ft
	estimated stiffeners and diaphrams	= 0.015 kips/ft
		0.795 kips/ft

$$(w_g)_{min} \geq w_D - 0.795$$
$$\geq 0.182 - 0.795 < 0$$

Minimum girder weight = 0 kips/ft

1.1.2 Calculate maximum moments

Dead load : concrete deck + stiffeners 795 lb/ft

estimated weight of girder 160 lb/ft

0.955 k/ft

Case 1. Maximum negative moment

From the analysis in Tables B-2, B-3, B-4 and B-5, Appendix B, it can be seen that $M_B > M_C$.

(A) Maximum moment at B

$$I = \frac{50}{\frac{1}{2}(80+85)+125} = 0.235$$

(1) Due to live load

(a) Due to concentrated loads

$$(M_B)_{conc} = -(8.1831+7.5833)(9)(1.235) = -175 \text{ kip -ft}$$

(b) Due to uniform load

$$(M_B)_{unif} = (-906.4899)(0.32)(1.235) = -358 \text{ kip -ft}$$

$$(M_B)_L = -(175+358) = -533 \text{ kips-ft}$$

(2) Due to dead load

$$(M_B)_D = (-777.4291)(9.955) = -743 \text{ kip -ft}$$

$$(M_B)_{max} = (-743)+(533)(1.4545) = -1520 \text{ kip -ft}$$

Case II. Maximum positive moment

Tables B-3, B-4 and B-5, Appendix B, indicate that the positive moment in the end span is larger than that in the interior span.

(1) Due to live load

(a) Due to concentrated load

$$M_{conc} = (16.3666)(9)(1.244) = 184 \text{ kip-ft}$$

(b) Due to uniform load

$$M_{unif} = (650.4863)(0.32)(1.244) = 260 \text{ kip-ft}$$

$$(M)_L = 184 + 260 = 444 \text{ kip-ft}$$

(2) Due to dead load

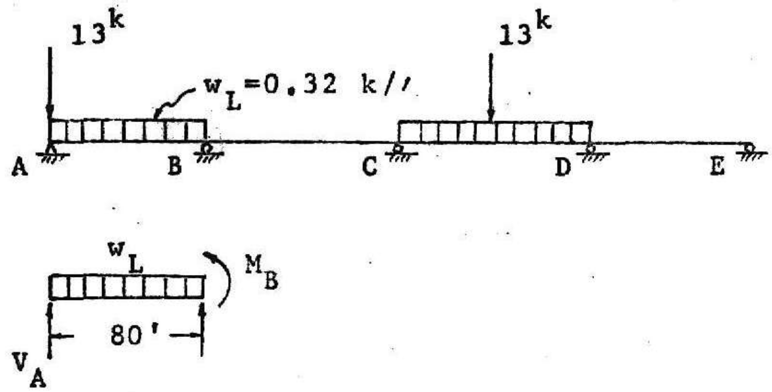
$$(M)_D = (458.4638)(0.955) = 438 \text{ kip-ft}$$

$$(M)_{max} = 438 + 444(1.4545) = 1084 \text{ kip-ft}$$

$$M_{des} = (M_B)_{max} = 1520 \text{ kip-ft}$$

1.1.3 Calculate maximum shear force

Case I. Maximum shear force at end support



Loading for Maximum End Reaction

Fig. 4

(1) Due to dead load

$$M_B = -777.4291 \times 0.955 = -743 \text{ kips-ft}$$

$(V_A)_D = [M_B + \frac{w_D}{2}(80)^2]/80 = [-743 + 3050]/80 = 28.8$ kips

(2) Due to live load $I = 0.244$

(a) Concentrated loads

$V_{AI} = 13 \times 1.244 = 16.2$ kips

$M_B = +2.1870 \times 13 = 28$ kip -ft

$V_{A2} = \frac{28}{80} \times 1.244 = 0.4$ kips

$(V_A)_{conc} = 16.6$ kips

(b) Uniform load

$M_B = -265.3713)(0.32) = -85$ kip -ft

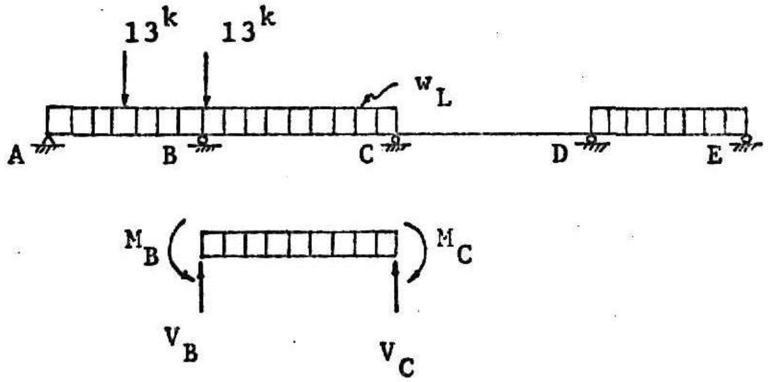
$(V_A)_{unif} = [M_B + \frac{w_D}{2}(80)^2] \times 1.244/80 = 14.6$ kips

$(V_A)_L = 16.6 + 14.6 = 31.2$ kips

$(V_A)_{max} = (V_A)_D + 1.4545(V_A)_L = 28.8 + 45.4 = 74.2$ kips

Case 2. Maximum shear force at interior support

(A) Find $(V_B)_{max}$ $I = 0.2273$



Loading for Maximum Shear Force at B

Fig. 5

(1) Due to dead load

$M_C = 739.4116 \times 0.955 = 705$ kip -ft

$M_B = 743$ kip -ft

$(V_B)_D = [\frac{w_D}{2}(95)^2 + M_B - M_C]/95$

$= [4320 + 38]/95 = 45.8$ kips

(2) Due to live load

(a) Concentrated loads

$V_{B1} = 13 \times 1.2273 = 16$ kips

$M_B = +7.5833 \times 13 = 00$ kip -ft

$M_C = -2.0338 \times 13 = -26$ kip -ft

$V_{B2} = [M_B - M_C] \times 1.2273/95 = 1.6$ kips

$(V_B)_{conc} = 17.6$ kips

(b) Uniform load

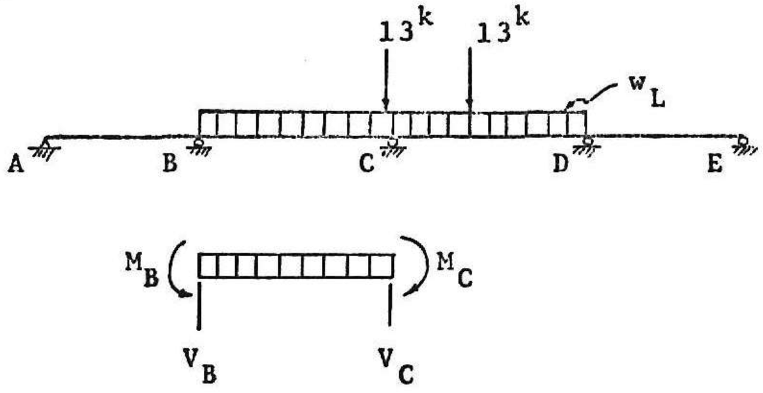
$M_B = 906.4899 \times 0.32 = 290$ kip -ft

$M_C = 263.9208 \times 0.32 = 85$ kip -ft

$(V_B)_{unif} = [M_B - M_C + \frac{w_L}{2}(85)^2] \times 1.2273/95 = 21.4$ kips

$(V_B)_L = 17.6 + 21.4 = 39$ kips

$(V_B)_{max} = (V_B)_D + 1.4545\ (V_B)_L = 102.6$ kips



Loading for Maximum Shear Force at C

Fig. 6

(1) Due to dead load

$(V_C)_D = (0.955) \times 95 - (V_B)_D = 90.7 - 45.8 = 44.9$ kips

(2) Due to live load

(a) Concentrated loads

$V_{C1} = 13 \times 1.2273 = 16$ kips

$M_B = -2.1840 \times 13 = -29$ kip -ft

$M_C = 8.0545 \times 13 = 104$ kip -ft

$V_{C2} = [M_C - M_B] \times 1.2243/95 = 1.7$ kips

$(V_C)_{conc} = 17.7$ kips

(b) Uniform load

$M_B = 354.2858 \times 0.32 = 113$ kip -ft

$M_C = 950.9838 \times 0.32 = 304$ kip -ft

$(V_C)_{unif} = [M_C - M_B + \frac{w_L}{2}(95)^2] \times 1.2273/95 = 20.8$ kips

$(V_C)_L = 17.7 + 20.8 = 38.5$ kips

$$(V_C)_{max} = 44.9 + 38.5 \times 1.4545 = 100.9 \text{ kips}$$

Since $(V_B)_{max} > (V_C)_{max} > (V_A)_{max}$

$$V_{des} = (V_B)_{max} = 102.6 \text{ kips}$$

1.1.4 Design of girder section

(A) Assume $w_g = 160$ lb/ft

Therefore $M_{des} = 1520$ kip -ft

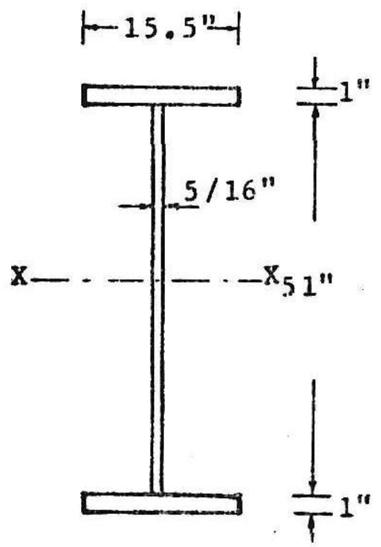
$V_{des} = 102.6$ kips

(a) Web design[1]

Assume t = 5/16"

$\frac{D}{t} \leq 165 \qquad D \leq 165 \times \frac{5}{16} = 51.5$

use D = 51"



(b) Flange design[2]

Assume $A_f = 15.5$ sq. in.

$t_f = 1"$, $b_f = 15.5"$

$b_f/t_f = 15.5 < 23$

(c) Check bending stress

Web: $51" \times \frac{5}{16}"$ $\quad I_x = 3474$[3]

$A_f = 15.5$ sq. in. $\quad I_x = 1352 \times 15.5 = 20956$

Total $I_x = 24,430$

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[1]AASHO Specification 1965 Edition, p. 113.

[2]AASHO Specification 1965 Edition, p. 112.

[3]Manual of Steel Construction, Sixth Edition, p. 2-61, 2-67.

It is assumed that the compression flange is partially supported. With the length of unsupported flange between lateral supports 25 feet, the allowable compression stress is defined by the AASHO Specification as follows:

$F_b = 20{,}000 - 7.5\,(L/b_f)^2 \quad \text{with } L/b_f \leq 36$ [4]

L = length, in inches, of unsupported flange between lateral supports

But continuous girders may be proportioned for negative moment at interior supports for an allowable unit stress 20 per cent[5] higher than permitted by this formula.

$$F_b = [20{,}000 - 7.5(\frac{300}{15.5})^2] \times 1.2 = 20.6 \text{ ksi}$$

The allowable unit stress calculated from the above formula can not exceed the allowable unit stress for the compression flange supported throughout its length (20 ksi in A-36 steel). Therefore use

$F_b = 20$ ksi.

$$f_b = \frac{M_{des}\,C}{I_x} \qquad C = 26.5''$$

$$f_b = \frac{1520 \times 12 \times 26.5}{24430} = 19.8 \text{ ksi} < 20 \text{ ksi}$$

(d) Check shearing stress.

$$f_v = \frac{V_{des}}{A_w} = \frac{102.6}{\frac{5}{16} \times 51} = 6.4 \text{ ksi} < F_V = 12 \text{ ksi}$$

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[4] AASHO Specification 1965 Edition, p. 81.

[5] AASHO Specification 1965 Edition, p. 83.

(e) Check girder weight

$$A = \frac{5}{16} + 51 + 2 \times 15.5 = 47 \text{ sq. in.}$$

$$w_g = 3.4 \times 47 = 160 \text{ lb/ft}$$

1.1.5 Total weight of girders

$$W_T = 0.16 \times 350 \times 4 = 224 \text{ kips}$$

The analysis and design for the other values of n_i and AL are summarized in Table 1 and Fig. 7.

OVERSIZED DOCUMENT

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Table 1. Summary of designs

n_i	AL ft	$(W_g)_{min}$ lb/ft	Max. negative moment kip-ft	Max. positive moment kip-ft	V_{des} kips	Girder section fo negative moment	
						web	flang
1	80	0	1520*	1084**	102.6	51x5/16†	15.5x1
	70	0	1550	1012	102.8	"	16x1
	65	0	1560	1010	103.4	"	"
	60	0	1573	1010	104	"	"
	55	0	1577	1008	104	"	"
	50	0	1578	1004	104.4	"	"
	45	210	1615	1017	106.4	•	•
1.5	80	0	1685*	1035**	103.7	51x5/16	17.5x1
	70	0	1673	911	102	"	"
	65	0	1694	906	102.5	"	"
	60	0	1710	906	103	"	18x1
	50	135	1720	896	104.6	"	"
	45	745	•	•	•	•	•
2.0	80	0	1825*	1002**	105.6	51x5/16	17x1
	70	0	1767	839	103.9	"	15x1
	65	0	1796	835	102.6	"	"
	60	0	1807	833	102.4	"	"
	55	0	1812	826	103.8	"	"
	50	295	•	•	•	•	•

Remarks:

† All web and flange dimensions are in inches
* Max. negative moment controlled by M_B, otherwise by
** Max. positive moment in end span, otherwise in inter
• $(w_g)_{min}$ increases sharply, therefore the design is o

n for ment	Girder section for positive moment		f_b ksi	f_v ksi	w_g lb/ft	W_T kips
lange	web	flange				
.5x1†	51x5/16†	15.5x1†	19.8	6.4	160	224
6x1	"	16x1	19.65	6.4	163	215
"	"	"	19.75	6.45	163	208.5
"	"	"	19.9	6.5	163	202
"	"	"	20	6.5	163	195.5
"	"	"	20	6.5	163	189
•	•	•	•	•	210	235
.5x1	51x5/16	12.5x7/8	19.75	6.5	147	206
"	"	"	19.6	6.4	148	195.5
"	"	"	19.8	6.4	149	191
3x1	"	13x7/8	19.6	6.43	152	188
"	"	"	19.7	6.53	154	179
•	•	•	•	•	745	834
7x1$\frac{1}{4}$	51x5/16	11x7/8	19.9	6.6	152	212.8
5x1$\frac{1}{4}$	"	9.5x7/8	19.53	6.5	141	186
"	"	"	19.8	6.4	142	182
"	"	"	19.97	6.4	144	179
"	"	"	19.99	6.5	144	173
•	•	•	•	•	295	343

by M_C
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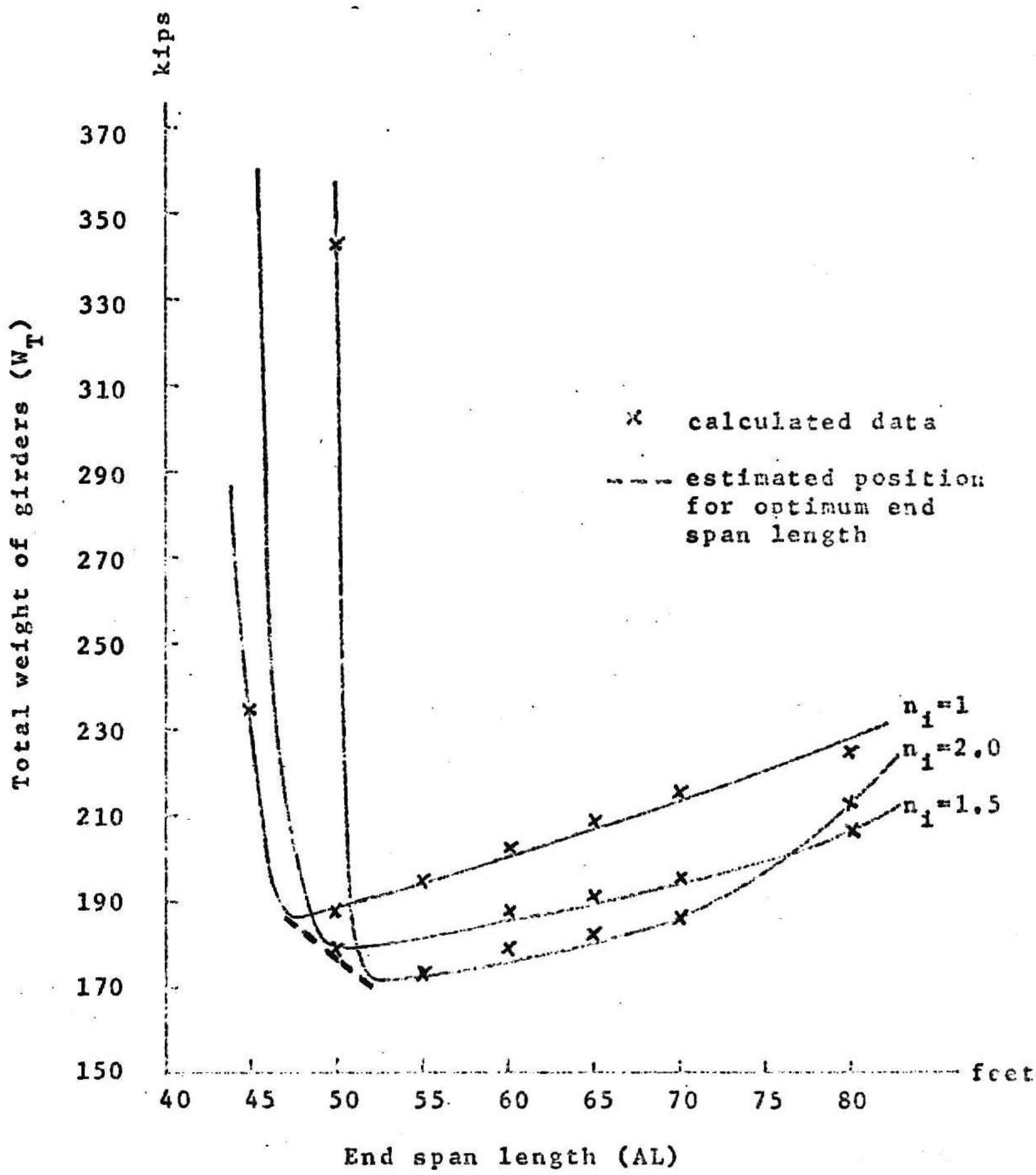


End Span Length vs. Total Weight of Girders

Fig. 7

DISCUSSION

The tabulated data in Appendix B indicates that the negative moment at C, $(M_C)_L$, due to live load increases as end span length, AL, increases. However, the negative moment at C, due to dead load, $(M_C)_D$, decreases as the end span length increases and the two effects therefore tend to offset each other. The data also indicates that the negative moment at B, due to both live load and dead load, M_B, increases as end span length increases. The maximum negative moment is the combination of moments due to dead load and due to live load (including impact). Study of Table 1 shows that the maximum negative moment, when it occurs at point C, decreases somewhat as end span length increases. The reason being that the rate of decrement of moment due to dead load is larger than the rate of increment of moment due to live load. When the end span length reaches 80 feet, the maximum negative moment will be controlled by M_B. As stated above the moment at B, M_B, increases as the end span length increases. This indicates that the maximum negative moment will be increased as the end span length increases beyond 80 feet.

When n_i=2 and AL=80', the design will be controlled by the maximum positive moment. Since the maximum positive moment increases rather rapidly as the end span length increases, the slope of the curve, with n_i=2, in Fig. 7 will be increased as the end span length increases beyond 80'.

When n_i=1.5 and AL=80', it can be seen that we are approaching the point where the design will be controlled by the maximum positive moment as discussed above. Therefore it can be anticipated that the slope of the curve with $n_i=1.5$ in Fig. 7 will be increased as the end span length increases beyond 80'.

The exact locations of the points at which $(w_g)_{min}=w_g$ were not found. In the case of $n_i=1.5$, for AL=50', $(w_g)_{min}=135$ lb/ft and the average design weight is 154 lb/ft indicating that we are approaching the cross over point where weight rather than stress is the controlling factor. For $n_i=1$ and $n_i=2$, the design points chosen straddle the cross over points and the shape of these curves in this region has been estimated based on the shape of the curve for $n_i=1.5$ and the values of $(w_g)_{min}$ for the chosen design points.

When $n_i=1$, AL=45', a girder with web section 51" x $\frac{5}{16}$" and flange section 16.5" x 1" was tried. It met the requirements of the AASHO Specification but the weight of this girder section is 167 lb/ft which is considerably less than the minimum weight for preventing uplift. Therefore the design was omitted from Table 1. The designs for $n_i=1.5$, AL=45' and $n_i=2$, AL=50' were omitted for the same reason.

The optimum end span length is therefore estimated within the range of 47' to 52' as shown by the dashed line in Fig. 7.

CONCLUSIONS

Since this report was confined to working only with the superstructure, the most economical total structural length was not necessarily found. To determine this length the cost of the structural steel, the reinforced concrete and the substructure would have to be considered. It can be seen from Fig. 7 that the minimum girder weight occurs for n_i=2 and AL=52'. However, the quantity of reinforced concrete will increase as the span length increases, therefore if the whole superstructure is considered the optimum length might be different from that indicated for the girders alone.

Study of Fig. 7 does indicate that the range of lengths in which the minimum cost girders will fall, with no uplift at the abutments, is relatively narrow. This range appears to be from approximately 47' to 52'.

ACKNOWLEDGMENT

The author wishes to express his sincere gratitude and deep appreciation to his major professor, Dr. Robert R. Snell, for his aid, advice, suggestions, and encouragement during the preparation of this report.

NOTATION

AL	=	length of the end span of the bridge
A	=	total cross sectional area of the plate girder
A_f	=	cross sectional area of one flange
A_w	=	cross sectional area of the web
b_f	=	width of the flange
C	=	the distance from outer fiber of the flange to neutral axis of the girder
D	=	depth of the web
D.F.	=	lateral load distribution factor
EI	=	flexural rigidity
F_b	=	allowable bending stress
f_b	=	actual bending stress
F_v	=	allowable shearing stress
f_v	=	actual shearing stress
I	=	impact fraction
I_x	=	moment of inertia of the girder about the x-axis
M_{des}	=	moment used for the design of the girder section
M_B, M_C	=	the moments at supports B, C
$(M_B)_D, (M_C)_D$	=	the moments at supports B, C, due to dead load
$(M_B)_L, (M_C)_L$	=	the moments at supports B, C, due to live load
$(M_B)_{max}, (M_C)_{max}$	=	maximum moments at supports B, C

$(M_B)_{cr}$ = critical moment at B for minimum reaction at A

n_i = the ratio of the moment of inertia of the girder haunch over the piers to the moment of inertia of the girder at mid-span

M_{conc} = moments due to concentrated loads

M_{unif} = moments due to uniform live load

$(R_A)_{min}$ = minimum reaction at abutment A

t = thickness of the web

t_f = thickness of the flange

V_A, V_B, V_C = shearing force at supports A, B, C

V_{des} = shearing force used for the design of the girder

w_D = average dead load in kips/ft.

w_g = weight of girder in kips/ft.

$(w_g)_{min}$ = the minimum girder weight which will prevent uplift at the abutment

w_L = uniform live load in kips/ft.

W_T = total weight of the four girders in the bridge

REFERENCES

1. "AASHO Specification," 1965 Edition.

2. "Structural Steel Design," by Linn S. Beedle and . . . The Ronald Press Company, New York, 1964.

3. "Computer Methods in Solid Mechanics," by Joseph J. Gennaro, The Macmillan Company, New York, 1965 (Chapter 5).

4. "Matrix Methods of Structural Analysis," by C. K. Wang, International Textbook Company, Scranton, Pennsylvania, 1966 (Chapter 4,6)

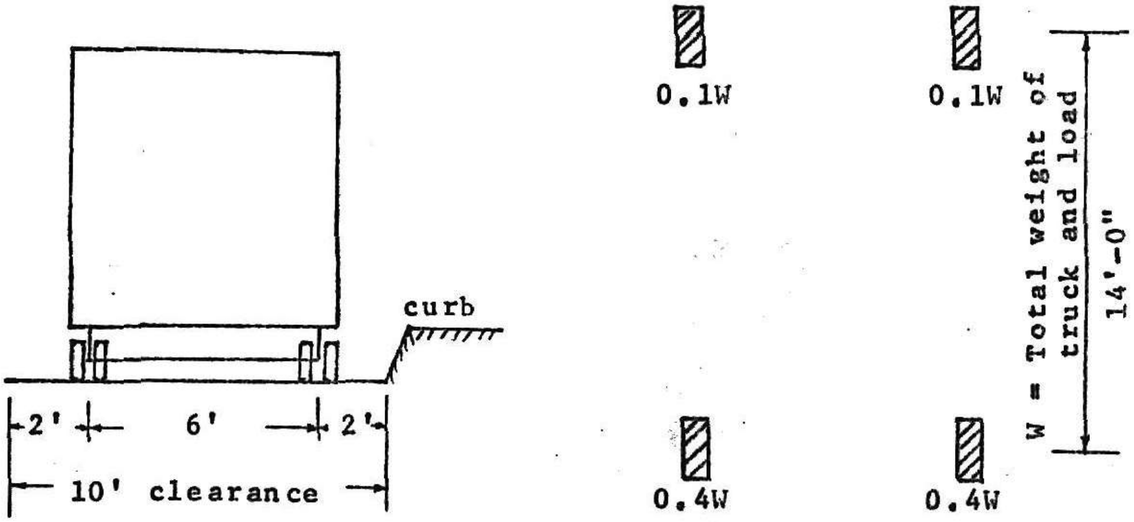
5. "Manual of Steel Construction," by American Institute of Steel Construction, Inc., Sixth Edition, Pages 2-66 — 2-72.

APPENDIX A

LOADING INFORMATION

(1) H20-44 Loading [1]

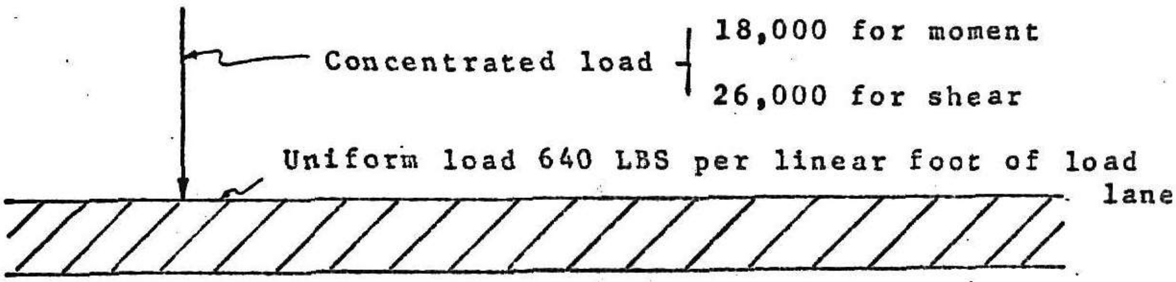
(a) Truck Loading : W=40,000 LBS



Truck Loading Diagram

Fig. A-1

(b) Lane Loading



Lane Loading Diagram

Fig. A-2

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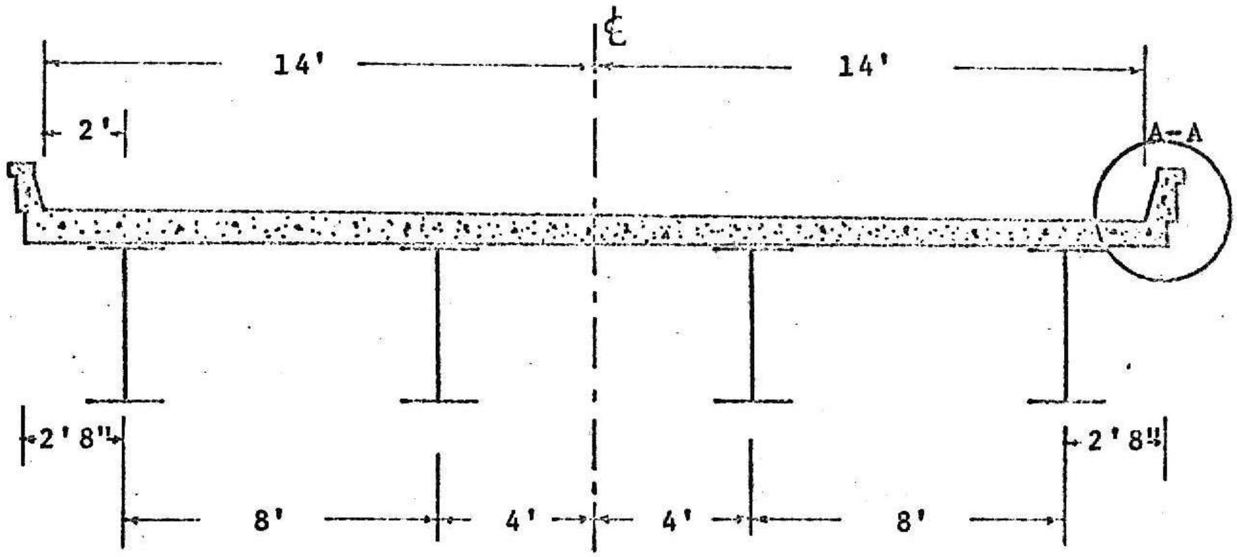
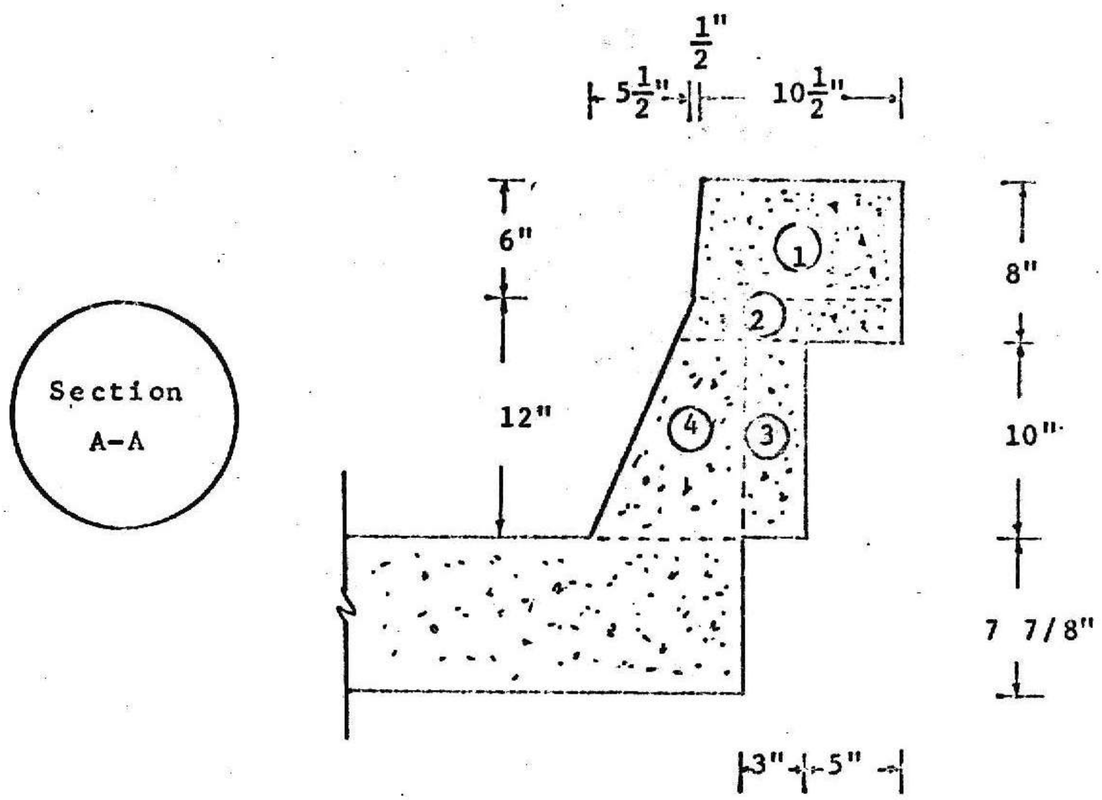
1. AASHO Specification 1965 Edition, p. 14-15.

(2) Girder Layout





Typical Cross Section

Fig. A-3

(3) Concrete Deck (Dead Load)

	Exterior Girder	Interior Girder
Slab :	$(4+2.67)(7\frac{7}{8}/12)\times150=657$ lb/ft	$8\times(7\frac{7}{8}/12)\times150=780$ lb/ft

Parapet :

Area 1 :	64.5	sq. in.
Area 2 :	22.0	sq. in.
Area 3 :	60.0	sq. in.
Area 4 :	30.0	sq. in.
	176.5	sq. in.

(176.5/144) x 150 = 184 lb/ft

	Exterior Girder	Interior Girder
Total	841 lb/ft	780 lb/ft

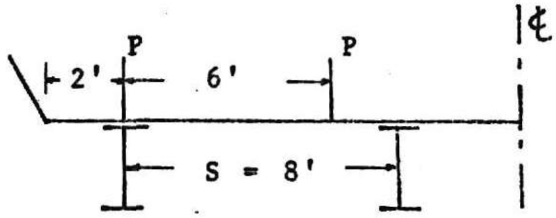
(4) Distribution of Loads

Exterior Girder [3] | Interior Girder [2]

Case 1. Assuming the flooring to act as a simple span between girders.

$$D.F. = 1 + \frac{2}{S} = 1.25$$

Interior Girder: $D.F. = \frac{S}{5.5} = 1.4545$



Typical Lane Loading

Fig. A-4

2. AASHO Specification 1965 Edition, p. 28.

3. AASHO Specification 1965 Edition, p. 29.

Case 2. $$D.F. = \frac{S}{4.0 + 0.25S}$$

$$= 1.3333$$

$$D.F. = 1.3333$$

(5) Impact Formula

" The amount of this allowance or increment is expressed as a fraction of the live load stress, and shall be determined by the formula:

$$I = \frac{50}{L + 125} \quad \text{in which}$$

I = impact fraction (maximum 30 per cent)

L = length in feet of the portion of the span which is loaded to produce the maximum stress in the member.

For continuous spans use the length of span under consideration for positive moment, and use the average of two adjacent loaded spans for negative moment."[4]

(6) Loading for Maximum Stress

" The lane loadings shall consist of the loads shown in Figure 1.2.5B and in addition thereto another concentrated load of equal weight shall be placed in one other span in the series in such position as to produce maximum negative moment. For maximum positive moment, only one concentrated load shall be used per lane, combined with as many spans loaded uniformly as required to produce maximum moment.

The lane loading shall be continuous or discontinuous, as may be necessary to produce maximum stresses and the concentrated

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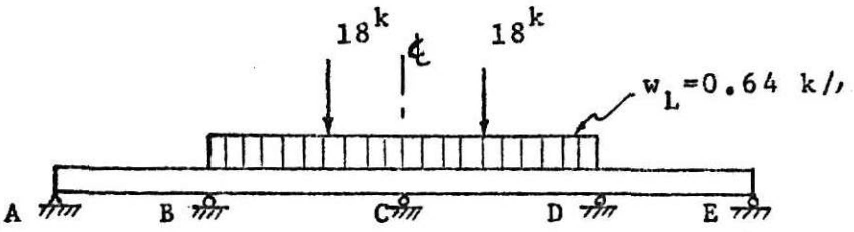
4. AASHO Specification 1965 Edition, p. 21.

load or loads shall be placed in such position as to produce maximum stresses."[5]

The lane loading which will produce the maximum stress due to negative moments and positive moments is shown in Fig. A-5.

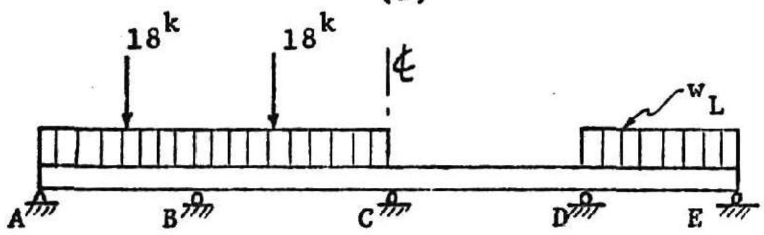
5. AASHO Specification 1965 Edition, p. 18.

(A)



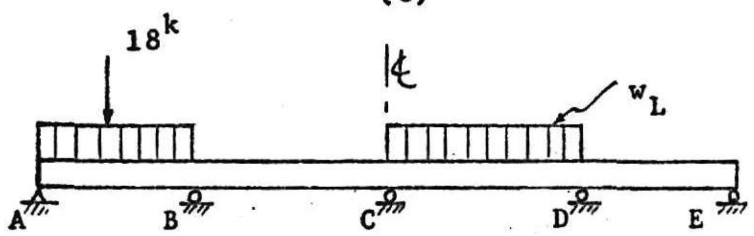
Loading for max. negative moment at C

(B)



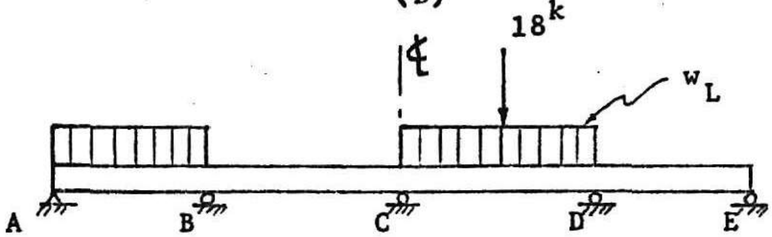
Loading for max. negative moment at B

(C)



Loading for max. positive moment in end span AB

(D)



Loading for max. positive moment in the interior span

Lane Loading For Maximum Stress

Fig. A-5

APPENDIX B

TABULAR DATA

Explanation of Tabulated Data

The tabulated data are either moment ordinates for the loading indicated or the ordinates for the influence lines for moment at the indicated sections corresponding to the position as shown in TABLE B-1. (origin at abutment A)

TABLE B-1 POSITION OF MOMENT ORDINATES (M_{ij})

i \ j	1	2	3	4	5
1	0'	5'	10'	15'	20'
2	25'	30'	35'	40'	45'
3	50'	55'	60'	65'	70'
4	75'	80'	85'	90'	95'
5	100'	105'	110'	115'	120'
6	125'	130'	135'	140'	145'
7	150'	155'	160'	165'	170'
8	175'	180'	185'	190'	195'
9	200'	205'	210'	215'	220'
10	225'	230'	235'	240'	245'
11	250'	255'	260'	265'	270'
12	275'	280'	285'	290'	295'
13	300'	305'	310'	315'	320'
14	325'	330'	335'	340'	345'
15	350'				

i : number of row

j : number of column

For example:

With N=1 and AL=80 find the influence line value for M_C 40' from A.

(Where N = the ratio of the moment of inertia of the girder haunch over the piers to the moment of inertia of the girder at mid-span

AL = length of the end span of the bridge in feet)

From TABLE B-1, it is found the position of 40' from A is i=2 and j=4.

The results of analysis for N=1 and AL=80 are in TABLES B-2, B-3, B-4 and B-5. From TABLE B-2(B)

M_C = 1.983477

Definitions of Computer Output Variables

MB = M_B, the moment at support B

MC = M_C, the moment at support C

MD = M_D, the moment at support D

ILLEGIBLE DOCUMENT

THE FOLLOWING DOCUMENT(S) IS OF POOR LEGIBILITY IN THE ORIGINAL

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TABLE B-2 INFLUENCE LINE FOR MB AND MC (N=1, AL=80)

(A) INFLUENCE LINE ORDINATES FOR MB

0.000000	-1.227768	-2.426651	-3.567764	-4.622223
-5.561096	-6.355499	-6.976624	-7.395569	-7.583328
-7.511093	-7.149994	-6.471085	-5.445587	-4.044464
-2.238897	0.000000	-2.308841	-4.186325	-5.663300
-6.770615	-7.539124	-7.999649	-8.183090	-8.120270
-7.842026	-7.379257	-6.762772	-6.023438	-5.192108
-4.299667	-3.376907	-2.454723	-1.563933	-0.735409
0.000000	0.617968	1.120269	1.515192	1.811038
2.016097	2.138655	2.187027	2.169514	2.094387
1.969954	1.804505	1.606345	1.383769	1.145063
0.898532	0.652460	0.415150	0.194898	0.000000
-0.162983	-0.294423	-0.396420	-0.471075	-0.520495
-0.546785	-0.552041	-0.538370	-0.507874	-0.462662
-0.404829	-0.336480	-0.259721	-0.176651	-0.089377
0.000000				

(B) INFLUENCE LINE ORDINATES FOR MC

0.000000	0.329284	0.650825	0.956867	1.239672
1.491485	1.704557	1.871139	1.983477	2.033838
2.014482	1.917633	1.735561	1.460502	1.084719
0.600466	0.000000	-0.718047	-1.529506	-2.403809
-3.310364	-4.218643	-5.098083	-5.918121	-6.648193
-7.257721	-7.716187	-7.992966	-8.057495	-7.879257
-7.427750	-6.672237	-5.582296	-4.127328	-2.276738
0.000000	-2.276733	-4.127304	-5.582291	-6.672241
-7.427734	-7.879242	-8.057465	-7.992935	-7.716141
-7.257721	-6.648193	-5.918137	-5.098099	-4.218674
-3.310361	-2.403801	-1.529503	-0.718047	0.000000
0.600467	1.084717	1.460500	1.735556	1.917626
2.014480	2.033847	1.983481	1.871136	1.704552
1.491484	1.239671	0.956866	0.650822	0.329283
0.000000				

TABLE B-3 MOMENT AT POINT J DUE TO A UNIT LOAD AT J (N=1, AL=80)

0.000000	4.610758	8.446655	11.518520	13.844420
15.449630	16.366630	16.635200	16.302210	15.421870
14.055560	12.271900	10.146710	7.763034	5.211120
2.588540	0.000000	2.511711	5.040686	7.482935
9.747334	11.755780	13.442910	14.756610	15.657430
16.118910	16.127620	15.682910	14.797120	13.495610
11.816570	9.811033	7.543132	5.089888	2.541229
0.000000	2.541229	5.089888	7.543132	9.811033
11.816570	13.495610	14.797120	15.682910	16.127620
16.118910	15.657430	14.756610	13.442910	11.755780
9.747334	7.482935	5.040686	2.511711	0.000000
2.588540	5.211120	7.763034	10.146710	12.271900
14.055560	15.421870	16.302210	16.635200	16.366630
15.449630	13.844420	11.518520	8.446655	4.610758
0.000000				

MAX. MOM. FOR MC DUE TO UNIT UNIFORM LIVE LOAD (N=1, AL=80)

MC= -950.983800

MB= -354.285800

MD= -354.287300

MAX. MOM. FOR MB DUE TO UNIT UNIFORM LIVE LOAD (N=1, AL=80)

MB= -906.489900

MC= -263.920800

MD= -294.080500

TABLE B-4 MOMENT ORDINATES DUE TO A UNIT UNIFORM DEAD LOAD (N=1, AL=80)

0.000000	138.910600	252.821200	341.731900	405.642500
444.553200	458.463800	447.374500	411.285400	350.196000
264.106600	153.017300	16.927970	-144.161300	-330.250700
-541.340000	-777.429100	-550.426200	-348.425700	-171.425000
-19.424070	107.576600	209.577300	286.578300	338.579100
365.579800	367.580800	344.581500	296.582200	223.583200
125.583900	2.584717	-145.414300	-318.413500	-516.415500
-739.415500	-516.415500	-318.413500	-145.414300	2.584717
125.583900	223.583200	296.582200	344.581500	367.580800
365.579800	338.579100	286.578300	209.577300	107.576600
-19.424070	-171.425000	-348.425700	-550.426200	-777.429100
-541.340000	-330.250700	-144.161300	16.927970	153.017300
264.106600	350.196000	411.285400	447.374500	458.463800
444.553200	405.642500	341.731900	252.821200	138.910600
0.000000				

MB= -777.429100
MC= -739.411600
MD= -777.428900

TABLE B-5 MOMENT ORDINATES DUE TO A UNIT UNIFORM LIVE LOAD IN SPANS AB AND CD (N=1,AL=80)

0.000000	170.914200	316.828300	437.742600	533.656700
604.571000	650.485300	671.399400	667.313700	638.228000
584.142000	505.056300	400.970700	271.884700	117.799000
-61.286620	-265.372300	-270.857400	-276.348800	-281.840500
-287.332000	-292.823700	-298.315100	-303.806800	-309.298300
-314.790000	-320.281400	-325.773100	-331.264600	-336.756100
-342.247800	-347.739200	-353.230900	-358.722400	-364.214100
-369.705500	-152.199900	40.307370	207.814900	350.322500
467.830000	560.337600	627.845200	670.352700	687.860300
680.367900	647.875400	590.383000	507.890600	400.398100
267.905700	110.413300	-72.079340	-279.574700	-512.066800
-480.057600	-448.053700	-416.049800	-384.046100	-352.042200
-320.038300	-288.034400	-256.031000	-224.027000	-192.023100
-160.019200	-128.015600	-96.011710	-64.007810	-32.003900
-0.000244				

MB= -265.371300
MC= -369.705800
MD= -512.062700

TABLE B-6 INFLUENCE LINE FOR MB AND MC (N=1, AL=80)

(A) INFLUENCE LINE ORDINATES FOR MB

0.000000	-1.143908	-2.252625	-3.290939	-4.223663
-5.015594	-5.631546	-6.036301	-6.194656	-6.071503
-5.631531	-4.839600	-3.660507	-2.059033	0.000000
-2.459569	-4.459290	-6.032120	-7.210938	-8.028687
-8.518250	-8.712616	-8.644653	-8.347336	-7.853500
-7.196136	-6.408112	-5.522430	-4.571960	-3.589602
-2.608314	-1.661003	-0.780585	0.000000	0.654827
1.185914	1.602253	1.912837	2.126673	2.252739
2.300056	2.277621	2.194416	2.059448	1.831715
1.670209	1.433936	1.181892	0.923070	0.666473
0.421098	0.195941	0.000000	-0.159681	-0.283877
-0.375319	-0.436734	-0.470855	-0.480407	-0.468124
-0.436734	-0.388967	-0.327551	-0.255217	-0.174694
-0.088712	0.000000			

(B) INFLUENCE LINE ORDINATES FOR MC

0.000000	0.308155	0.606837	0.886545	1.137815
1.351155	1.517089	1.626126	1.668794	1.635604
1.517088	1.303744	0.986105	0.554685	0.000000
-0.680638	-1.462766	-2.315140	-3.206451	-4.105530
-4.980988	-5.801758	-6.536438	-7.153885	-7.622696
-7.911728	-7.989639	-7.825272	-7.387360	-6.644573
-5.565710	-4.119500	-2.274666	0.000000	-2.274647
-4.119418	-5.565628	-6.644516	-7.387283	-7.825211
-7.989578	-7.911621	-7.622604	-7.153763	-6.536392
-5.801697	-4.980972	-4.105461	-3.206420	-2.315098
-1.462749	-0.680628	0.000000	0.554672	0.986089
1.303726	1.517065	1.635581	1.668769	1.626100
1.517063	1.351133	1.137800	0.886534	0.606825
0.308153	0.000000			

TABLE B-7 MOMENT AT POINT J DUE TO A UNIT LOAD AT J (N=1, AL=70)

0.000000	4.561150	8.249623	11.080510	13.078950
14.280150	14.729350	14.481840	13.603020	12.168310
10.263210	7.983195	5.433867	2.730901	0.000000
2.370894	4.803488	7.186383	9.421650	11.424940
13.125120	14.465090	15.400970	15.902290	15.952280
15.547570	14.698340	13.428320	11.774730	9.788173
7.532892	5.086687	2.540817	0.000000	2.540817
5.086687	7.532892	9.788173	11.774730	13.428320
14.698340	15.547570	15.952280	15.902290	15.400970
14.465090	13.125120	11.424940	9.421650	7.186383
4.803488	2.370894	0.000000	2.730901	5.433867
7.983195	10.263210	12.168310	13.603020	14.481840
14.729350	14.280150	13.078950	11.080510	8.249623
4.561150	0.000000			

MAX. MOM. FOR MC DUE TO UNIT UNIFORM LIVE LOAD (N=1, AL=70)

MC= -938.443600

MB= -379.371800

MD= -379.371800

MAX. MOM. FOR MB DUE TO UNIT UNIFORM LIVE LOAD (N=1, AL=70)

MB= -817.992100

MC= -317.453600

MD= -168.457500

TABLE B-8 MOMENT ORDINATES DUE TO A UNIT UNIFORM DEAD LOAD (N=1, AL=70)

0.000000	113.720500	202.441100	266.161600	304.882000
319.602500	307.323200	271.043700	209.764400	123.484800
12.205320	-124.073900	-285.353500	-471.633000	-682.912300
-463.372000	-268.833400	-99.294670	45.244140	164.782900
259.321700	328.860500	373.399400	392.938200	387.477000
357.015800	301.554600	221.093500	115.632300	-14.828850
-170.290000	-350.751400	-556.215500	-786.676500	-556.215500
-350.751400	-170.290000	-14.828850	115.632300	221.093500
301.554600	357.015800	387.477000	392.938200	373.399400
328.860500	259.321700	164.782900	45.244140	-99.294670
-268.833400	-463.372000	-682.912300	-471.633000	-285.353500
-124.073900	12.205320	123.484800	209.764400	271.043700
307.323200	318.602500	304.882000	266.161600	202.441100
113.720500	0.000000			
MB=	-682.911300			
MC=	-786.672300			
MD=	-682.908900			

TABLE B-9 MOMENT ORDINATES DUE TO A UNIT UNIFORM LIVE LOAD IN SPANS AB AND CD (N=1, AL=70)

0.000000	152.027400	279.054600	381.082200	458.109600
510.136900	537.164500	539.191800	516.219400	468.246800
395.274100	297.301700	174.329100	26.356440	-146.615900
-159.597100	-172.582400	-185.567700	-198.553000	-211.538300
-224.523600	-237.508900	-250.494200	-263.479400	-276.464800
-289.450100	-302.435300	-315.420600	-328.406000	-341.391300
-354.376700	-367.362000	-380.347100	-393.332500	-175.860400
16.614990	184.090500	326.565900	444.041500	536.517000
603.992400	646.468000	663.943600	656.418900	623.894500
565.370100	483.845400	376.321000	243.796600	86.272210
-96.252440	-303.777300	-536.304600	-497.989200	-459.682300
-421.375400	-383.068600	-344.761700	-306.454800	-268.148100
-229.841300	-191.534400	-153.227500	-114.920600	-76.613760
-38.307120	-0.000244			
MB=	-146.615500			
MC=	-393.332700			
MD=	-536.298500			

TABLE B-10 INFLUENCE LINE FOR MB AND MC (N=1, AL=65)

(A) INFLUENCE LINE ORDINATES FOR MB

0.000000	-1.097616	-2.156036	-3.136047	-3.998459
-4.704071	-5.213684	-5.488083	-5.488068	-5.174469
-4.508072	-3.449646	-1.960029	0.000000	-2.542588
-4.609619	-6.235229	-7.453384	-8.298203	-8.803711
-9.004028	-8.933212	-8.625259	-8.114288	-7.434357
-6.619537	-5.703888	-4.721466	-3.706319	-2.692550
-1.714195	-0.805318	0.000000	0.674946	1.221683
1.649574	1.968038	2.186463	2.314227	2.360736
2.335391	2.247570	2.106674	1.922090	1.703218
1.459442	1.200174	0.934791	0.672684	0.423259
0.195899	0.000000	-0.157133	-0.276554	-0.361405
-0.414832	-0.439974	-0.439973	-0.417974	-0.377120
-0.320552	-0.251412	-0.172846	-0.087994	0.000000

(B) INFLUENCE LINE ORDINATES FOR MC

0.000000	0.296400	0.582218	0.846868	1.079757
1.270304	1.407922	1.482023	1.482020	1.397334
1.217372	0.931554	0.529290	0.000000	-0.659870
-1.425713	-2.265900	-3.148773	-4.042694	-4.916000
-5.737091	-6.474411	-7.096146	-7.570709	-7.866562
-7.951935	-7.795258	-7.364899	-6.629147	-5.556463
-4.115121	-2.273506	0.000000	-2.273499	-4.115071
-5.556427	-6.629150	-7.364868	-7.795242	-7.951904
-7.866516	-7.570709	-7.096100	-6.474350	-5.737091
-4.915970	-4.042664	-3.148745	-2.265876	-1.425703
-0.659863	0.000000	0.529285	0.931545	1.217361
1.397321	1.482005	1.482007	1.407905	1.270292
1.079745	0.846857	0.582214	0.296399	0.000000

TABLE B-11 MOMENT AT POINT J DUE TO A UNIT LOAD AT J (N=1, AL=65)

0.000000	4.530951	8.129839	10.814760	12.615860
13.575370	13.747560	13.198750	12.007360	10.263880
8.070769	5.542625	2.806133	0.000000	2.293335
4.672873	7.023114	9.242374	11.242840	12.950310
14.304840	15.260010	15.783290	15.856010	15.473330
14.644210	13.391510	11.751880	9.775718	7.527363
5.084997	2.540612	0.000000	2.540612	5.084997
7.527363	9.775718	11.751880	13.391510	14.644210
15.473330	15.856010	15.783290	15.260010	14.304840
12.950310	11.242840	9.242374	7.023114	4.672873
2.293335	0.000000	2.806133	5.542625	8.070769
10.263880	12.007360	13.198750	13.747560	13.575370
12.615860	10.814760	8.129839	4.530951	0.000000

MAX. MOM. FOR MC DUE TO UNIT UNIFORM LIVE LOAD (N=1, AL=65)

MC= -931.480400

MB= -393.291200

MD= -393.293200

MAX. MOM. FOR MB DUE TO UNIT UNIFORM LIVE LOAD (N=1, AL=65)

MB= -783.508700

MC= -339.766800

MD= -113.681800

TABLE B-12 MOMENT ORDINATES DUE TO A UNIT UNIFORM DEAD LOAD (N=1, AL=65)

0.000000	100.365900	175.731800	226.097600	251.463600
251.829300	227.195300	177.561200	102.927200	3.292969
-121.341000	-270.975000	-445.609100	-645.243400	-428.677700
-237.112700	-70.547850	71.017080	187.582000	279.146900
345.711900	387.276800	403.841700	395.406700	361.971600
303.536600	220.101500	111.666500	-21.768550	-180.203600
-363.638600	-572.074700	-805.512200	-572.074700	-363.638600
-180.203600	-21.768550	111.666500	220.101500	303.536600
361.971600	395.406700	403.841700	387.276800	345.711900
279.146900	187.582000	71.017080	-70.547850	-237.112700
-428.677700	-645.243400	-445.609100	-270.975000	-121.341000
3.292969	102.927200	177.561200	227.195300	251.829300
251.463600	226.097600	175.731800	100.365900	0.000000
MB=	-645.242400			
MC=	-805.504800			
MD=	-645.241900			

TABLE B-13 MOMENT ORDINATES DUE TO A UNIT UNIFORM LIVE LOAD IN SPANS AB AND CD (N=1,AL=65)

0.000000	142.693500	260.386900	353.080500	420.774100
463.467700	481.161100	473.854700	441.548300	384.241900
301.935500	194.628900	62.322500	-94.983880	-111.180000
-127.378400	-143.576800	-159.775200	-175.973500	-192.171900
-208.370300	-224.568700	-240.767100	-256.965300	-273.163800
-289.362000	-305.560500	-321.759000	-337.957200	-354.155700
-370.354000	-386.552400	-402.750700	-185.517900	6.718262
173.954500	316.191100	433.427400	525.663800	592.900300
635.136700	652.373000	644.609600	611.845900	554.082200
471.318800	363.555100	230.791500	73.028070	-109.735500
-317.500400	-550.266100	-507.931600	-465.604000	-423.276300
-380.948700	-338.621000	-296.293400	-253.966000	-211.638400
-169.310700	-126.983100	-84.655510	-42.327880	-0.000244
MB=	-94.983470			
MC=	-402.750900			
MD=	-550.260200			

TABLE B-14 INFLUENCE LINE FOR MB AND MC (N=1, AL=60)

(A) INFLUENCE LINE ORDINATES FOR MB

0.000000	-1.047974	-2.051971	-2.968048	-3.752182
-4.360443	-4.748856	-4.873428	-4.690231	-4.155258
-3.224548	-1.854106	0.000000	-2.631458	-4.770546
-6.452621	-7.712875	-8.586639	-9.109161	-9.315826
-9.241852	-8.922562	-8.393204	-7.689087	-6.845505
-5.897781	-4.881195	-3.830976	-2.782457	-1.770936
-0.831675	0.000000	0.696342	1.259653	1.699751
2.026464	2.249604	2.378998	2.424479	2.395858
2.302961	2.155612	1.963639	1.736858	1.485092
1.218180	0.945922	0.678154	0.424695	0.195369
0.000000	-0.153835	-0.267538	-0.344760	-0.389149
-0.404349	-0.394013	-0.361786	-0.311318	-0.246258
-0.170253	-0.086950	0.000000		

(B) INFLUENCE LINE ORDINATES FOR MC

0.000000	0.283730	0.555559	0.803575	1.015878
1.180561	1.285722	1.319449	1.269849	1.125008
0.873018	0.501985	0.000000	-0.637520	-1.385840
-2.212911	-3.086670	-3.975082	-4.846024	-5.667587
-6.407608	-7.034027	-7.514832	-7.817963	-7.911331
-7.762970	-7.340759	-6.612591	-5.546530	-4.110421
-2.272263	0.000000	-2.272259	-4.110379	-5.546494
-6.612595	-7.340744	-7.762955	-7.911377	-7.817963
-7.514847	-7.034042	-6.407593	-5.667572	-4.846039
-3.975073	-3.086672	-2.212908	-1.385839	-0.637513
0.000000	0.501983	0.873016	1.125003	1.269844
1.319443	1.285715	1.180556	1.015875	0.803573
0.555555	0.283730	0.000000		

TABLE B-15 MOMENT AT POINT J DUE TO A UNIT LOAD AT J (N=1, AL=60)

0.000000	4.496000	7.991333	10.507980	12.082590
12.766470	12.625560	11.740480	10.206530	8.133590
5.646230	2.883739	0.000000	2.210314	4.533087
6.848422	9.050587	11.048080	12.763420	14.133540
15.109440	15.656250	15.753330	15.394220	14.586590
13.352370	11.727650	9.762538	7.521531	5.083227
2.540402	0.000000	2.540402	5.083227	7.521531
9.762538	11.727650	13.352370	14.586590	15.394220
15.753330	15.656250	15.109440	14.133540	12.763420
11.048080	9.050587	6.848422	4.533087	2.210314
0.000000	2.883739	5.646230	8.133590	10.206530
11.740480	12.625560	12.766470	12.082590	10.507980
7.991333	4.496000	0.000000		

MAX. MOM. FOR MC DUE TO UNIT UNIFORM LIVE LOAD (N=1, AL=60)

MC= -923.990700

MB= -408.274600

MD= -408.277000

MAX. MOM. FOR MB DUE TO UNIT UNIFORM LIVE LOAD (N=1, AL=60)

MB= -755.569300

MC= -359.139100

MD= -64.131830

TABLE B-16 MOMENT ORDINATES DUE TO A UNIT UNIFORM DEAD LOAD (N=1, AL=60)

0.000000	86.334380	147.668700	184.002900	195.337400
181.671800	143.006100	79.340570	-9.324951	-122.990700
-261.656200	-425.322000	-613.987500	-399.892000	-210.794600
-46.697020	92.400630	206.498000	295.595700	359.693300
398.791000	412.888400	401.986000	366.083700	305.181300
219.278800	108.376400	-27.525870	-188.428200	-374.330800
-585.233100	-821.138100	-585.233100	-374.330800	-188.428200
-27.525870	108.376400	219.278800	305.181300	366.083700
401.986000	412.888400	398.791000	359.693300	295.595700
206.498000	92.400630	-46.697020	-210.794600	-399.892000
-613.987500	-425.322000	-261.656200	-122.990700	-9.324951
79.340570	143.006100	181.671800	195.337400	184.002900
147.668700	86.334380	0.000000		
MB=	-613.986800			
MC=	-821.133000			
MD=	-613.990400			

TABLE B-17 MOMENT ORDINATES DUE TO A UNIT UNIFORM LIVE LOAD IN SPANS AB AND CD (N1,AL=60)

0.000000	133.468800	241.937500	325.406400	383.875200
417.344200	425.812900	409.281900	367.750700	301.219400
209.688400	93.157220	-48.373770	-67.434900	-86.497750
-105.560500	-124.623400	-143.686200	-162.749100	-181.811900
-200.874800	-219.937600	-239.000500	-258.063200	-277.125900
-296.188900	-315.251700	-334.314600	-353.377400	-372.440100
-391.503100	-410.565900	-193.728700	-1.889404	164.949900
306.789300	423.628600	515.468000	582.307300	624.146700
640.986000	632.825400	599.664700	541.504100	458.343500
350.182800	217.022200	58.861810	-124.298800	-332.462600
-565.622800	-518.481600	-471.346900	-424.212100	-377.077600
-329.942800	-282.808300	-235.673500	-188.538800	-141.404200
-94.269530	-47.134760	0.000000		
MB=	-48.373120			
MC=	-410.566100			
MD=	-565.618400			

TABLE B-18 INFLUENCE LINE FOR MB AND MC (N=1, AL=55)

(A) INFLUENCE LINE ORDINATES FOR MB

0.000000	-0.994599	-1.939461	-2.784882	-3.481140
-3.978424	-4.227081	-4.177353	-3.779510	-2.983810
-1.740556	0.000000	-2.726813	-4.943204	-6.685791
-7.991165	-8.895950	-9.436691	-9.650101	-9.572739
-9.241165	-8.692062	-7.961990	-7.087555	-6.105408
-5.052137	-3.964333	-2.878602	-1.831565	-0.859826
0.000000	0.719131	1.300040	1.753020	2.088353
2.316339	2.447258	2.491425	2.459125	2.360633
2.206250	2.006274	1.770989	1.510694	1.235685
0.956238	0.682655	0.425226	0.194244	0.000000
-0.149642	-0.256529	-0.324936	-0.359141	-0.363416
-0.342039	-0.299283	-0.239427	-0.166743	-0.085509
0.000000				

(B) INFLUENCE LINE ORDINATES FOR MC

0.000000	0.270026	0.526554	0.756083	0.945103
1.080119	1.147627	1.134125	1.026114	0.810085
0.472547	0.000000	-0.613396	-1.342813	-2.155732
-3.019684	-3.902130	-4.770584	-5.592560	-6.335556
-6.967041	-7.454559	-7.765564	-7.867615	-7.728088
-7.314667	-6.594753	-5.535803	-4.105371	-2.270925
0.000000	-2.270916	-4.105333	-5.535782	-6.594727
-7.314682	-7.728088	-7.867538	-7.765549	-7.454544
-6.967041	-6.335541	-5.592545	-4.770554	-3.902110
-3.019676	-2.155734	-1.342811	-0.613395	0.000000
0.472545	0.810083	1.026107	1.134120	1.147619
1.080114	0.945101	0.756078	0.526554	0.270025
0.000000				

TABLE B-19 MOMENT AT POINT J DUE TO A UNIT LOAD AT J (N=1, AL=55)

0.000000	4.455032	7.829178	10.149560	11.461400
11.827990	11.330690	10.069000	8.160397	5.740523
2.963133	0.000000	2.121257	4.383148	6.661083
8.844975	10.839340	12.563130	13.950050	14.948220
15.520270	15.643510	15.309670	14.525070	13.310640
11.701860	9.748588	7.515394	5.081369	2.540191
0.000000	2.540191	5.081369	7.515394	9.748588
11.701860	13.310640	14.525070	15.309670	15.643510
15.520270	14.948220	13.950050	12.563130	10.839340
8.844975	6.661083	4.383148	2.121257	0.000000
2.963133	5.740523	8.160397	10.069000	11.330690
11.827990	11.461400	10.149560	7.829178	4.455032
0.000000				

MAX. MOM. FOR MC DUE TO UNIT UNIFORM LIVE LOAD (N=1, AL=55)

MC= -915.906000

MB= -424.443600

MD= -424.445300

MAX. MOM. FOR MB DUE TO UNIT UNIFORM LIVE LOAD (N=1, AL=55)

MB= -734.190400

MC= -375.589300

MD= -19.708490

TABLE B-20 MOMENT ORDINATES DUE TO A UNIT UNIFORM DEAD LOAD (N=1, AL=55)

0.000000	71.438980	117.877900	139.316900	135.755800
107.194800	53.633780	-24.927240	-128.488200	-257.049300
-410.610300	-589.171300	-377.033900	-189.895900	-27.757560
109.380600	221.519000	308.657200	370.795600	407.933800
420.072000	407.210400	369.348600	306.487000	218.625200
105.763600	-32.098140	-194.959700	-382.821500	-595.683300
-833.547300	-595.683300	-382.821500	-194.959700	-32.098140
105.763600	218.625200	306.487000	369.348600	407.210400
420.072000	407.933800	370.795600	308.657200	221.519000
109.380600	-27.757560	-189.895900	-377.033900	-589.171300
-410.610300	-257.049300	-128.488200	-24.927240	53.633780
107.194800	135.755800	139.316900	117.877900	71.438980
0.000000				

MB= -589.170600
MC= -833.541700
MD= -589.171300

TABLE B-21 MOMENT ORDINATES DUE TO A UNIT UNIFORM LIVE LOAD IN SPANS AB AND CD (N=1,AL=55)

0.000000	124.393900	223.787800	298.181600	347.575600
371.969400	371.363500	345.757300	295.151300	219.545100
118.939200	-6.666992	-28.251550	-49.835890	-71.420210
-93.004540	-114.588800	-136.173200	-157.757500	-179.341800
-200.926100	-222.510500	-244.094800	-265.678900	-287.263400
-308.847600	-330.432100	-352.016300	-373.600800	-395.185000
-416.769200	-200.494600	-9.217773	157.059300	298.336400
414.613500	505.890600	572.167700	613.444800	629.721900
620.999000	587.276100	528.553200	444.830300	336.107400
202.384500	43.661620	-140.061500	-348.787300	-582.510000
-529.549500	-476.594400	-423.639600	-370.684500	-317.729900
-264.774900	-211.820000	-158.864900	-105.910100	-52.955070
-0.000244				

MB= -6.666092
MC= -416.769500
MD= -582.505800

TABLE B-22 INFLUENCE LINE FOR MB AND MC (N=1, AL=50)

(A) INFLUENCE LINE ORDINATES FOR MB

0.000000	-0.937031	-1.817267	-2.583923	-3.180252
-3.549377	-3.634552	-3.378998	-2.725907	-1.618508
0.000000	-2.829404	-5.128925	-6.936646	-8.290527
-9.228638	-9.788940	-10.009520	-9.928452	-9.583649
-9.013229	-8.255173	-7.347504	-6.328313	-5.235611
-4.107388	-2.981678	-1.896528	-0.889953	0.000000
0.743452	1.343078	1.809670	2.154036	2.386983
2.519302	2.561819	2.525340	2.420653	2.258575
2.049906	1.805450	1.536017	1.252425	0.965450
0.685920	0.424631	0.192389	0.000000	-0.144376
-0.243159	-0.301416	-0.324212	-0.316613	-0.283686
-0.230494	-0.162106	-0.083585	0.000000	

(B) INFLUENCE LINE ORDINATES FOR MC

0.000000	0.255155	0.494848	0.703615	0.865989
0.966504	0.989704	0.920114	0.742275	0.440723
0.000000	-0.587292	-1.296244	-2.093860	-2.947174
-3.823196	-4.688889	-5.511353	-6.257584	-6.894562
-7.389343	-7.708908	-7.820251	-7.690460	-7.286514
-6.575420	-5.524206	-4.099908	-2.269482	0.000000
-2.269461	-4.099829	-5.524170	-6.575363	-7.286438
-7.690369	-7.820160	-7.708801	-7.389236	-6.894485
-6.257507	-5.511276	-4.688828	-3.823113	-2.947127
-2.093829	-1.296221	-0.587282	0.000000	0.440718
0.742263	0.920098	0.989686	0.966489	0.865974
0.703603	0.494841	0.255151	0.000000	

TABLE B-23 MOMENT AT POINT J DUE TO A UNIT LOAD AT J (N=1, AL=50)

0.000000	4.406290	7.636536	9.724804	10.727880
10.725300	9.819270	8.134707	5.819271	3.043340
0.000000	2.025442	4.221884	6.459630	8.623951
10.615080	12.348020	13.753020	14.775190	15.374440
15.525770	15.219080	14.459220	13.266070	11.674370
9.733729	7.508872	5.079424	2.539972	0.000000
2.539972	5.079424	7.508872	9.733729	11.674370
13.266070	14.459220	15.219080	15.525770	15.374440
14.775190	13.753020	12.348020	10.615080	8.623951
6.459630	4.221884	2.025442	0.000000	3.043340
5.819271	8.134707	9.819270	10.725300	10.727880
9.724804	7.636536	4.406290	0.000000	

MAX. MOM. FOR MC DUE TO UNIT UNIFORM LIVE LOAD (N=1, AL=50)

MC= -907.154000

MB= -441.949400

MD= -441.947700

MAX. MOM. FOR MB DUE TO UNIT UNIFORM LIVE LOAD (N=1, AL=50)

MB= -719.401100

MC= -389.145900

MD= 19.721190

TABLE B-24 MOMENT ORDINATES DUE TO A UNIT UNIFORM DEAD LOAD (N=1, AL=50)

0.000000	55.418540	85.837090	91.255640	71.674070
27.092520	-42.488760	-137.070300	-256.651600	-401.233100
-570.814600	-360.125900	-174.437000	-13.748040	121.941100
232.630100	318.319300	379.008300	414.697500	425.386400
411.075600	371.764600	307.453800	218.142800	103.832000
-35.479000	-199.789700	-389.100800	-603.411600	-842.725300
-603.411600	-389.100800	-199.789700	-35.479000	103.832000
218.142800	307.453800	371.764600	411.075600	425.386400
414.697500	379.008300	318.319300	232.630100	121.941100
-13.748040	-174.437000	-360.125900	-570.814600	-401.233100
-256.651600	-137.070300	-42.488760	27.092520	71.674070
91.255640	85.837090	55.418540	0.000000	

MB= -570.814400
MC= -842.720700
MD= -570.813400

TABLE B-25 MOMENT ORDINATES DUE TO A UNIT UNIFORM LIVE LOAD IN SPANS AB AND CD (N=1,AL=50)

0.000000	115.527300	206.054600	271.582000	312.109300
327.636700	318.164000	283.691400	224.218700	139.746000
30.273430	6.505264	-17.264860	-41.035000	-64.805130
-88.575250	-112.345300	-136.115500	-159.885600	-183.655700
-207.425900	-231.196000	-254.966000	-278.736000	-302.506300
-326.276300	-350.046600	-373.816600	-397.586900	-421.356900
-205.818400	-15.278070	150.262400	290.802900	406.343200
496.883700	562.424300	602.964800	618.505100	609.045600
574.586100	515.126700	430.666900	321.207500	186.748000
27.288570	-157.171100	-366.632300	-601.093200	-540.978200
-480.869600	-420.760900	-360.652000	-300.543700	-240.435000
-180.326100	-120.217500	-60.108880	-0.000244	

MB= 30.274330
MC= -421.357100
MD= -601.088800

TABLE B-26 INFLUENCE LINE FOR MB AND MC (N=[illegible], AL=45)

(A) INFLUENCE LINE ORDINATES FOR MB

0.000000	-0.874720	-1.683836	-2.361795	-2.842859
-3.061539	-2.952179	-2.449213	-1.487022	0.000000
-2.940069	-5.329270	-7.207170	-8.613327	-9.587296
-10.168600	-10.396890	-10.311730	-9.952621	-9.359161
-8.570908	-7.627370	-6.568214	-5.432991	-4.261196
-3.092436	-1.966274	-0.922273	0.000000	0.769471
1.389018	1.870016	2.223836	2.461833	2.595363
2.635848	2.594619	2.483049	2.312510	2.094371
1.840002	1.560765	1.268049	0.973206	0.687613
0.422632	0.189639	0.000000	-0.137822	-0.227002
-0.273619	-0.283753	-0.263485	-0.218894	-0.156064
-0.081072	0.000000			

(B) INFLUENCE LINE ORDINATES FOR MC

0.000000	0.232949	0.459977	0.645162	0.776587
0.836324	0.806455	0.669056	0.406212	0.000000
-0.558932	-1.245653	-2.026640	-2.868393	-3.737396
-4.600199	-5.423111	-6.172852	-6.815750	-7.318390
-7.647263	-7.768753	-7.649460	-7.255890	-6.554424
-5.511602	-4.093957	-2.267904	0.000000	-2.267888
-4.093890	-5.511566	-6.554382	-7.255829	-7.649414
-7.768723	-7.647186	-7.318359	-6.815735	-6.172791
-5.423096	-4.600113	-3.737364	-2.868372	-2.026623
-1.245643	-0.558928	0.000000	0.406208	0.669054
0.806445	0.836315	0.776576	0.645155	0.459970
0.232947	0.000000			

TABLE B-27 MOMENT AT POINT J DUE TO A UNIT LOAD AT J (N=1, AT=45)

0.000000	4.347247	7.403576	9.212738	9.847606
9.410250	8.031860	5.872826	3.122643	0.000000
1.922088	4.047956	6.242410	8.385670	10.373300
12.116210	13.540830	14.588910	15.217540	15.399200
15.121820	14.388630	13.218330	11.645010	9.717933
7.501994	5.077408	2.539765	0.000000	2.539765
5.077408	7.501994	9.717933	11.645010	13.218330
14.388630	15.121820	15.399200	15.217540	14.588910
13.540830	12.116210	10.373300	8.385670	6.242410
4.047956	1.922088	0.000000	3.122643	5.872826
8.031860	9.410250	9.847606	9.212738	7.403576
4.347247	0.000000			

MAX. MOM. FOR MC DUE TO UNIT UNIFORM LIVE LOAD (N=1, AT=45)

MC= -897.649600

MB= -460.956000

MD= -460.958700

MAX. MOM. FOR MB DUE TO UNIT UNIFORM LIVE LOAD (N=1, AT=45)

MB= -711.220900

MC= -399.834200

MD= 54.298330

TABLE B-28 MOMENT ORDINATES DUE TO A UNIT UNIFORM DEAD LOAD (N=1, AL=45)

0.000000	37.895590	50.791210	38.686820	1.582443
-60.521940	-147.626400	-259.730700	-396.835200	-558.939600
-349.189200	-164.437700	-4.686277	130.065400	239.816800
324.568600	384.320000	419.071700	428.823200	413.574900
373.326400	308.078100	217.829500	102.581200	-37.667230
-202.915500	-393.164000	-608.412300	-848.663500	-608.412300
-393.164000	-202.915500	-37.667230	102.581200	217.829500
308.078100	373.326400	413.574900	428.823200	419.071700
384.320000	324.568600	239.816900	130.065400	-4.686279
-164.437700	-349.189200	-558.939600	-396.835200	-259.730700
-147.626400	-60.521940	1.582443	38.686820	50.791210
37.895590	0.000000			
MB=	-558.939400			
MC=	-848.658200			
MC=	-558.939900			

TABLE B-29 MOMENT ORDINATES DUE TO A UNIT UNIFORM LIVE LOAD IN SPANS AB AND CD (N=1, AL=45)

0.000000	106.956400	188.912900	245.869300	277.825900
284.782200	266.738700	223.675300	155.651800	62.608150
36.981360	11.353100	-14.275160	-39.903420	-65.531670
-91.159940	-116.788200	-142.416400	-168.044700	-193.672800
-219.301000	-244.929400	-270.557600	-296.186000	-321.814200
-347.442300	-373.070800	-398.698900	-424.327100	-209.710200
-20.090570	144.529200	284.149100	398.769000	468.388600
553.008500	592.628400	607.248200	596.868100	561.487700
501.107600	415.727500	305.347400	169.967200	9.587158
-175.793200	-386.173300	-621.556600	-552.487700	-483.426700
-414.365700	-345.304900	-276.244100	-207.183100	-138.122000
-69.061030	-0.000244			
MB=	62.609050			
MC=	-424.327300			
MD=	-621.549500			

TABLE B-30 INFLUENCE LINE FOR MB AND MC (H=1.5, AL=80)

(A) INFLUENCE LINE ORDINATES FOR MB

0.000000	-1.484291	-2.931778	-4.305527	-5.568756
-6.684540	-7.616028	-8.326523	-8.778854	-8.936554
-8.762543	-8.220108	-7.272202	-5.957779	-4.324005
-2.346252	0.000000	-2.269230	-4.172409	-5.736450
-6.988403	-7.955200	-8.601563	-8.901169	-8.894516
-8.622086	-8.124359	-7.441818	-6.614929	-5.684219
-4.690109	-3.674683	-2.670944	-1.705943	-0.806624
0.000000	0.692818	1.274163	1.752226	2.135176
2.431244	2.629562	2.722137	2.721191	2.639038
2.487976	2.280258	2.028214	1.744093	1.440199
1.129383	0.821759	0.525529	0.248878	0.000000
-0.214656	-0.395597	-0.545070	-0.665325	-0.752044
-0.801689	-0.817599	-0.803177	-0.761787	-0.696785
-0.611561	-0.509479	-0.393908	-0.268224	-0.135796
0.000000				

(B) INFLUENCE LINE ORDINATES FOR MC

0.000000	0.451881	0.892550	1.310781	1.695356
2.035049	2.318649	2.534943	2.672699	2.720688
2.667709	2.502533	2.213943	1.813787	1.316403
0.714300	0.000000	-0.828179	-1.748771	-2.734512
-3.758179	-4.792465	-5.803696	-6.749130	-7.587891
-8.279053	-8.781769	-9.055130	-9.058212	-8.750244
-8.090225	-7.105068	-5.830740	-4.239953	-2.305453
0.000000	-2.305420	-4.239883	-5.830673	-7.105011
-8.090164	-8.750137	-9.058136	-9.055038	-8.781677
-8.278992	-7.587830	-6.749054	-5.803619	-4.792389
-3.758102	-2.734473	-1.748746	-0.828165	0.000000
0.714284	1.316381	1.813769	2.213924	2.502499
2.667671	2.720648	2.672645	2.534904	2.318621
2.035024	1.695333	1.310764	0.892538	0.451877
0.000000				

TABLE B-31 MOMENT AT POINT J DUE TO A UNIT LOAD AT J (N=1.5, AL=80)

0.000000	4.594727	8.383516	11.380190	13.607800
15.098570	15.893960	16.044660	15.610520	14.660680
13.273420	11.536260	9.545971	7.346869	4.966529
2.487891	0.000000	2.543418	5.030060	7.369100
9.481129	11.298180	12.808270	13.996910	14.813490
15.224560	15.213810	14.782030	13.947150	12.744320
11.225660	9.406669	7.299806	4.974183	2.510281
0.000000	2.510281	4.974183	7.299806	9.406669
11.225660	12.744320	13.947150	14.782030	15.213810
15.224560	14.813490	13.996910	12.808270	11.298180
9.481129	7.369100	5.030060	2.543418	0.000000
2.487891	4.966529	7.346869	9.545971	11.536260
13.273420	14.660680	15.610520	16.044660	15.893960
15.098570	13.607800	11.380190	8.383516	4.594727
0.000000				

MAX. MOM. FOR MC DUE TO UNIT UNIFORM LIVE LOAD (N=1.5, AL=80)

MC= -1057.707000

MB= -360.183800

MD= -360.184000

MAX. MOM. FOR MB DUE TO UNIT UNIFORM LIVE LOAD (N=1.5, AL=80)

MB= -1020.390000

MC= -249.224400

MD= -342.346400

TABLE B-32 MOMENT ORDINATES DUE TO A UNIT UNIFORM DEAD LOAD (N=1.5, AL=80)

0.000000	133.658700	242.317300	325.976000	384.635000
418.293700	426.952300	410.611000	369.270000	302.928700
211.587400	95.246090	-46.094970	-212.436200	-403.777500
-620.118800	-861.459900	-632.069300	-427.681100	-248.292700
-93.904050	35.484370	139.872800	219.261400	273.649900
303.038300	307.427000	286.815400	241.203800	170.592500
74.980950	-45.630610	-191.241900	-361.856400	-557.465800
-778.079100	-557.465800	-361.856400	-191.241900	-45.630610
74.980950	170.592500	241.203800	286.815400	307.427000
303.038300	273.649900	219.261400	139.872800	35.484370
-93.904050	-248.292700	-427.681100	-632.069300	-861.459900
-620.118800	-403.777500	-212.436200	-46.094970	95.246090
211.587400	302.928700	369.270000	410.611000	426.952300
418.293700	384.635000	325.976000	242.317300	133.658700
0.000000				

MB= -861.459200
MC= -778.073400
MD= -861.459900

TABLE B-33 MOMENT ORDINATES DUE TO A UNIT UNIFORM LIVE LOAD IN SPANS AB AND CD (N=1.5,AL=80)

0.000000	168.729100	312.458200	431.187500	524.916500
593.645700	637.375000	656.104000	649.833200	618.562500
562.291500	481.020700	374.750000	243.479000	87.208250
-94.062500	-300.333200	-304.995100	-309.663800	-314.332500
-319.001200	-323.669900	-328.338600	-333.007500	-337.676200
-342.344900	-347.013600	-351.682300	-356.351000	-361.020000
-365.688700	-370.357400	-375.026100	-379.694800	-384.363500
-389.032200	-173.097900	17.844480	183.786800	324.729200
440.671600	531.614000	597.556300	638.498700	654.441100
645.383500	611.325900	552.268300	468.210600	359.153000
225.095400	66.037840	-118.019700	-327.079300	-561.137900
-526.054600	-490.984300	-455.914000	-420.843700	-385.773400
-350.703100	-315.632800	-280.562700	-245.492400	-210.422100
-175.351800	-140.281400	-105.211100	-70.140860	-35.070550
-0.000244				

MB= -300.333200
MC= -389.032400
MD= -561.134000

TABLE B-34 INFLUENCE LINE FOR MB AND MC (N=1.5, AL=20)

(A) INFLUENCE LINE ORDINATES FOR MB

0.000000	-1.380997	-2.716492	-3.960922	-5.068848
-5.994659	-6.692932	-7.118088	-7.224670	-6.967102
-6.299911	-5.255951	-3.878204	-2.136346	0.000000
-2.448776	-4.501984	-6.188782	-7.538437	-8.580093
-9.275742	-9.597061	-9.587921	-9.292038	-8.753326
-8.015533	-7.122528	-6.118073	-5.046021	-3.951706
-2.870734	-1.832323	-0.865671	0.000000	0.741866
1.362602	1.871276	2.276940	2.588662	2.795006
2.887619	2.880081	2.785960	2.618876	2.392413
2.120141	1.815663	1.492571	1.164527	0.842183
0.534613	0.250863	0.000000	-0.210930	-0.382913
-0.518945	-0.622020	-0.687893	-0.713323	-0.702800
-0.660824	-0.591882	-0.500470	-0.391081	-0.268210
-0.136352	0.000000			

(B) INFLUENCE LINE ORDINATES FOR MC

0.000000	0.423217	0.832489	1.213866	1.553396
1.837118	2.051117	2.181412	2.214081	2.135147
1.930664	1.610742	1.188512	0.654700	0.000000
-0.778650	-1.659371	-2.614029	-3.614532	-4.632736
-5.635574	-6.580627	-7.425705	-8.128632	-8.647293
-8.939346	-8.962784	-8.675308	-8.034836	-7.067318
-5.808203	-4.229348	-2.302654	0.000000	-2.302643
-4.229309	-5.808151	-7.067276	-8.034805	-8.675278
-8.962738	-8.939346	-8.647232	-8.128647	-7.425690
-6.580597	-5.635544	-4.632721	-3.614502	-2.614024
-1.659361	-0.778648	0.000000	0.654695	1.188508
1.610725	1.930660	2.135123	2.214057	2.181394
2.051102	1.837112	1.553387	1.213861	0.832485
0.423217	0.000000			

TABLE B-35 MOMENT AT POINT J DUE TO A UNIT LOAD AT J (N=1.5, AL=70)

0.000000	4.544213	8.183359	10.936940	12.837480
13.930470	14.274470	13.940950	13.014480	11.592570
9.785815	7.656075	5.247268	2.659115	0.000000
2.375939	4.744574	7.007205	9.077122	10.879680
12.400010	13.619420	14.480310	14.943160	14.986640
14.607450	13.820450	12.658530	11.172810	9.378160
7.287232	4.970366	2.509823	0.000000	2.509823
4.970366	7.287232	9.378160	11.172810	12.658530
13.820450	14.607450	14.986640	14.943160	14.480310
13.619420	12.400010	10.879680	9.077122	7.007205
4.744574	2.375939	0.000000	2.659115	5.247268
7.656075	9.785815	11.592570	13.014480	13.940950
14.274470	13.930470	12.837480	10.936940	8.183359
4.544213	0.000000			

MAX. MOM. FOR MC DUE TO UNIT UNIFORM LIVE LOAD (N=1.5, AL=70)

MC= -1040.052000

MB= -391.836400

MD= -391.839800

MAX. MOM. FOR MB DUE TO UNIT UNIFORM LIVE LOAD (N=1.5, AL=70)

MB= -916.498500

MC= -320.810500

MD= -189.575900

TABLE B-36 MOMENT ORDINATES DUE TO A UNIT UNIFORM DEAD LOAD (N=1.5, AL=70)

0.000000	109.002900	193.005900	252.008700	286.011900
295.014800	279.017800	238.020700	172.023900	81.026850
-34.970210	-175.967200	-341.964100	-532.961100	-748.958200
-528.792700	-333.628600	-163.464300	-18.300040	101.864200
197.028300	267.192600	312.356900	332.521200	327.685500
297.849600	243.013900	163.178200	58.342520	-71.493160
-226.328800	-406.164700	-611.003900	-840.839800	-611.003900
-406.164700	-226.328800	-71.493160	58.342520	163.178200
243.013900	297.849600	327.685500	332.521200	312.356900
267.192600	197.028300	101.864200	-18.300040	-163.464300
-333.628600	-528.792700	-748.958200	-532.961100	-341.964100
-175.967200	-34.970210	81.026850	177.023900	238.020700
279.017800	295.014800	286.011900	252.008700	193.005900
109.002900	0.000000			
MB=	-748.957700			
MC=	-840.835600			
MD=	-748.957200			

TABLE B-37 MOMENT ORDINATES DUE TO A UNIT UNIFORM LIVE LOAD IN SPANS AB AND CD (N=1.5, AL=70)

0.000000	151.250300	277.500700	378.750900	455.001400
506.251700	532.502100	533.752400	510.002900	461.253400
387.503600	288.754100	165.004300	16.254880	-157.494800
-171.322600	-185.161000	-198.999500	-212.838000	-226.676500
-240.514900	-254.353400	-268.191800	-282.030200	-295.868800
-309.707200	-323.545600	-337.384200	-351.222600	-365.061200
-378.899600	-392.738000	-406.576600	-420.415000	-204.422100
-13.425040	152.572000	293.569000	409.566100	500.563200
566.560300	607.557300	623.554400	614.551500	580.548500
521.545600	437.542700	328.539700	194.536800	35.534170
-148.468700	-357.473800	-591.477700	-549.221400	-506.973600
-464.725800	-422.478000	-380.230200	-337.982400	-295.734800
-253.487000	-211.239200	-168.991400	-126.743600	-84.495840
-42.248040	-0.000244			
MB=	-157.493400			
MC=	-420.415200			
MD=	-591.471900			

TABLE B-38 INFLUENCE LINE FOR MB AND MC (N=1.5, AL=65)

(A) INFLUENCE LINE ORDINATES FOR MB

0.000000	-1.321260	-2.591492	-3.759583	-4.774536
-5.585266	-6.140747	-6.389923	-6.281693	-5.765060
-4.868362	-3.631317	-2.019865	0.000000	-2.548433
-4.684875	-6.439743	-7.843521	-8.926651	-9.649506
-9.982758	-9.972107	-9.663116	-9.101517	-8.333008
-7.403229	-6.357849	-5.242599	-4.104584	-2.980886
-1.901918	-0.898136	0.000000	0.768712	1.410392
1.936094	2.353374	2.673783	2.884080	2.976265
2.964642	2.863539	2.687311	2.450274	2.166767
1.851125	1.517687	1.180556	0.850662	0.537570
0.250332	0.000000	-0.207542	-0.373123	-0.500231
-0.592368	-0.645452	-0.656571	-0.630971	-0.573895
-0.490589	-0.386303	-0.266277	-0.135762	0.000000

(B) INFLUENCE LINE ORDINATES FOR MC

0.000000	0.406387	0.797087	1.156372	1.468542
1.717914	1.888753	1.965393	1.932111	1.773202
1.497406	1.116908	0.621264	0.000000	-0.750844
-1.609179	-2.546402	-3.533905	-4.543091	-5.541199
-6.486038	-7.334671	-8.044266	-8.571762	-8.874435
-8.909180	-8.633301	-8.003754	-7.046139	-5.795538
-4.223413	-2.301088	0.000000	-2.301073	-4.223373
-5.795502	-7.046097	-8.003708	-8.633224	-8.909149
-8.874374	-8.571747	-8.044205	-7.334671	-6.486008
-5.541153	-4.543045	-3.533859	-2.546382	-1.609166
-0.750840	0.000000	0.621263	1.116899	1.497393
1.773204	1.932101	1.965385	1.888754	1.717904
1.468536	1.156360	0.797076	0.406389	0.000000

TABLE B-39 MOMENT AT POINT J DUE TO A UNIT LOAD AT J (M=1.5, AL=65)

0.000000	4.513746	8.062841	10.670860	12.377060
13.236430	13.319660	12.713110	11.518970	9.854997
7.793610	5.388900	2.750896	0.000000	2.283001
4.586236	6.806540	8.853230	10.647990	12.174050
13.410630	14.296180	14.787840	14.861410	14.511380
13.750820	12.611540	11.143960	9.362669	7.280478
4.968342	2.509596	0.000000	2.509596	4.968342
7.280478	9.362669	11.143960	12.611540	13.750820
14.511380	14.861410	14.787840	14.296180	13.410630
12.174050	10.647990	8.853230	6.806540	4.586236
2.283001	0.000000	2.750896	5.388900	7.793610
9.854997	11.518970	12.713110	13.319660	13.236430
12.377060	10.670860	8.062841	4.513746	0.000000

MAX. MOM. FOR MC DUE TO UNIT UNIFORM LIVE LOAD (M=1.5, AL=65)

MC= -1030.136000

MB= -409.604700

MD= -409.607600

MAX. MOM. FOR MB DUE TO UNIT UNIFORM LIVE LOAD (M=1.5, AL=65)

MB= -876.250000

MC= -350.743400

MD= -122.507000

TABLE B-40 MOMENT ORDINATES DUE TO A UNIT UNIFORM DEAD LOAD (N=1.5, AL=65)

0.000000	95.831980	166.663900	212.495800	233.327800
229.159900	199.991600	145.823700	66.655760	-37.512200
-166.680100	-320.848300	-500.016300	-704.184300	-487.691800
-296.198700	-129.705300	11.788080	128.281400	219.774900
286.268300	327.761700	344.254800	335.748200	302.241600
243.735100	160.228500	51.721920	-81.784660	-240.291200
-423.798000	-632.306300	-865.814200	-632.306300	-423.798000
-240.291200	-81.784660	51.721920	160.228500	243.735100
302.241600	335.748200	344.254800	327.761700	286.268300
219.774900	128.281400	11.788080	-129.705300	-296.198700
-487.691800	-704.184300	-500.016300	-320.848300	-166.680100
-37.512200	66.655760	145.823700	199.991600	229.159900
233.327800	212.495800	166.663900	95.831980	0.000000
MB=	-704.183800			
MC=	-865.808800			
MD=	-704.183800			

TABLE B-41 MOMENT ORDINATES DUE TO A UNIT UNIFORM LIVE LOAD IN SPANS AB AND CD (N=1.5,AL=65)

0.000000	142.687300	260.374500	353.061700	420.749000
463.436200	481.123700	473.811000	441.498200	384.185500
301.872800	194.560300	62.247550	-95.065180	-112.840700
-130.622000	-148.403200	-166.184400	-183.965700	-201.746900
-219.528100	-237.309400	-255.090600	-272.871800	-290.653000
-308.434300	-326.215500	-343.996800	-361.778000	-379.559000
-397.340300	-415.121500	-432.902800	-217.178400	-26.453360
139.271700	279.996800	395.721900	486.447000	552.172100
592.897200	608.622300	599.347400	565.072500	505.797600
421.522700	312.247800	177.972900	18.697990	-165.576900
-374.852700	-609.130100	-562.265800	-515.410100	-468.554600
-421.699200	-374.843700	-327.988500	-281.133000	-234.277500
-187.422100	-140.566600	-93.711180	-46.855710	-0.000244
MB=	-95.064040			
MC=	-432.903000			
MD=	-609.124500			

TABLE B-42 INFLUENCE LINE FOR MB AND MC (N=1.5, AL=60)

(A) INFLUENCE LINE ORDINATES FOR MB

0.000000	-1.255056	-2.452438	-3.534454	-4.443436
-5.121704	-5.511566	-5.555359	-5.195404	-4.454117
-3.366760	-1.894862	0.000000	-2.655425	-4.881195
-6.709106	-8.170944	-9.298508	-10.050520	-10.396480
-10.384070	-10.060910	-9.474701	-8.673126	-7.703827
-6.614532	-5.452896	-4.268051	-3.098576	-1.976211
-0.932749	0.000000	0.797253	1.462125	2.004716
2.435117	2.763432	2.977601	3.068938	3.052593
2.943724	2.757466	2.508966	2.213374	1.885852
1.541549	1.195026	0.857512	0.539105	0.249901
0.000000	-0.202868	-0.360451	-0.476867	-0.556229
-0.594767	-0.590077	-0.548339	-0.475721	-0.378405
-0.262562	-0.134368	0.000000		

(B) INFLUENCE LINE ORDINATES FOR MC

0.000000	0.387536	0.757269	1.091375	1.372055
1.581491	1.701873	1.715392	1.604248	1.375350
1.039590	0.585097	0.000000	-0.720752	-1.554856
-2.473190	-3.446640	-4.446045	-5.439056	-6.383667
-7.236191	-7.952866	-8.490082	-8.804092	-8.851212
-8.587769	-7.970108	-7.023159	-5.781881	-4.216973
-2.299397	0.000000	-2.299379	-4.216949	-5.781830
-7.023163	-7.970078	-8.587753	-8.851196	-8.804062
-8.490067	-7.952866	-7.236160	-6.383636	-5.439026
-4.446014	-3.446594	-2.473176	-1.554849	-0.720750
0.000000	0.585097	1.039583	1.375339	1.604239
1.715384	1.701864	1.581481	1.372046	1.091369
0.757257	0.387536	0.000000		

TABLE B-43 MOMENT AT POINT J DUE TO A UNIT LOAD AT J (N=1.5, AL=60)

0.000000	4.478743	7.924591	10.366380	11.852170
12.449270	12.244180	11.342680	9.869739	7.909438
5.527717	2.846375	0.000000	2.183236	4.416299
6.591299	8.613148	10.399610	11.932010	13.187130
14.099220	14.621820	14.727710	14.408950	13.676750
12.561670	11.113430	9.346366	7.273426	4.966285
2.509379	0.000000	2.509379	4.966285	7.273426
9.346366	11.113430	12.561670	13.676750	14.408950
14.727710	14.621820	14.099220	13.187130	11.932010
10.399610	8.613148	6.591299	4.416299	2.183236
0.000000	2.846375	5.527717	7.909438	9.869739
11.342680	12.244180	12.449270	11.852170	10.366380
7.924591	4.478743	0.000000		

MAX. MOM. FOR MC DUE TO UNIT UNIFORM LIVE LOAD (N=1.5, AL=60)

MC= -1019.406000

MB= -428.844900

MD= -428.846900

MAX. MOM. FOR MB DUE TO UNIT UNIFORM LIVE LOAD (N=1.5, AL=60)

MB= -843.957700

MC= -376.721900

MD= -61.659420

TABLE B-44 MOMENT ORDINATES DUE TO A UNIT UNIFORM DEAD LOAD (N=1.5, AL=60)

0.000000	81.897270	138.794500	170.691600	177.589100
159.486300	116.383500	48.280760	-44.821770	-162.924500
-306.027300	-474.130100	-667.232600	-453.770200	-265.306800
-101.843200	36.620360	150.083900	238.547600	302.011200
340.474800	353.938200	342.401800	305.865400	244.329100
157.792700	46.256340	-90.280020	-251.816400	-438.353000
-649.889400	-886.429100	-649.889400	-438.353000	-251.816400
-90.280020	46.256340	157.792700	244.329100	305.865400
342.401800	353.938200	340.474800	302.011200	238.547600
150.083900	36.620360	-101.843200	-265.306800	-453.770200
-667.232600	-474.130100	-306.027300	-162.924500	-44.821770
48.280760	116.383500	159.486300	177.589100	170.691600
138.794500	81.897270	0.000000		
MB=	-667.231900			
MC=	-886.423300			
MD=	-667.233600			

TABLE B-45 MOMENT ORDINATES DUE TO A UNIT UNIFORM LIVE LOAD IN SPANS AB AND CD (N=1.5,AL=60)

0.000000	134.282700	243.565400	327.848100	387.130800
421.413500	430.696500	414.979200	374.261900	308.544600
217.827300	102.110300	-38.606930	-59.900430	-81.195400
-102.490300	-123.785300	-145.080300	-166.375200	-187.670200
-208.965200	-230.260100	-251.555100	-272.850000	-294.145000
-315.439900	-336.734800	-358.029700	-379.324900	-400.619800
-421.914700	-443.209700	-227.974700	-37.733640	127.507800
267.749000	382.990400	473.231600	538.473100	578.714300
593.955500	584.197000	549.438200	489.679600	404.920800
295.162300	160.403500	0.645020	-184.113700	-393.876200
-628.634000	-576.239900	-523.854400	-471.468900	-419.083400
-366.698200	-314.312900	-261.927400	-209.541900	-157.156400
-104.770900	-52.385490	-0.000244		
MB=	-38.606520			
MC=	-443.209900			
MD=	-628.626700			

TABLE B-46 INFLUENCE LINE FOR MB AND MC (N=1.5, AL=50)

(A) INFLUENCE LINE ORDINATES FOR MB

0.000000	-1.099040	-2.122528	-2.994888	-3.640549
-3.983932	-3.949509	-3.541458	-2.780777	-1.617072
0.000000	-2.893357	-5.317729	-7.307892	-8.898590
-10.124630	-10.941160	-11.314980	-11.298350	-10.943260
-10.301970	-9.426605	-8.369324	-7.182297	-5.917709
-4.629010	-3.358112	-2.139796	-1.008831	0.000000
0.859623	1.573697	2.153581	2.610618	2.956159
3.177453	3.265553	3.237492	3.110278	2.900951
2.626522	2.304026	1.950492	1.582943	1.216941
0.864302	0.536366	0.244481	0.000000	-0.188598
-0.324318	-0.413036	-0.460628	-0.464640	-0.424590
-0.349288	-0.247547	-0.128180	0.000000	

(B) INFLUENCE LINE ORDINATES FOR MC

0.000000	0.342296	0.661062	0.932757	1.133849
1.240799	1.230083	1.102996	0.866077	0.503639
0.000000	-0.652873	-1.432337	-2.308075	-3.249786
-4.227158	-5.208694	-6.152771	-7.013977	-7.746811
-8.305817	-8.645538	-8.720474	-8.485168	-7.894241
-6.971508	-5.751013	-4.202477	-2.295572	0.000000
-2.295549	-4.202438	-5.750946	-6.971436	-7.894165
-8.485092	-8.720367	-8.645447	-8.305710	-7.746735
-7.013901	-6.152679	-5.208603	-4.227112	-3.249734
-2.308043	-1.432317	-0.652865	0.000000	0.503633
0.866063	1.102977	1.230063	1.240784	1.133832
0.932744	0.661053	0.342292	0.000000	

TABLE 3-47 MOMENT AT POINT J DUE TO A UNIT LOAD AT J (N=1.5, AL=50)

0.000000	4.390091	7.575485	9.601529	10.543780
10.508020	9.630305	8.020988	5.775377	3.044632
0.000000	1.961394	4.038620	6.113129	8.080112
9.848419	11.395340	12.692040	13.663450	14.255010
14.432800	14.183470	13.514120	12.452540	11.047010
9.311225	7.258427	4.962037	2.508997	0.000000
2.508997	4.962037	7.258427	9.311225	11.047010
12.452540	13.514120	14.183470	14.432800	14.255010
13.663450	12.692040	11.395340	9.848419	8.080112
6.113129	4.038620	1.961394	0.000000	3.044632
5.775377	8.020988	9.630305	10.508020	10.543780
9.601529	7.575485	4.390091	0.000000	

MAX. MOM. FOR MC DUE TO UNIT UNIFORM LIVE LOAD (N=1.5, AL=50)

MC= -995.204100

MB= -472.228000

MD= -472.229700

MAX. MOM. FOR MB DUE TO UNIT UNIFORM LIVE LOAD (N=1.5, AL=50)

MB= -803.600800

MC= -416.699400

MD= 41.304440

TABLE B-48 MOMENT ORDINATES DUE TO A UNIT UNIFORM DEAD LOAD (N=1.5, AL=50)

0.000000	50.773620	76.547250	77.320870	53.094510
3.867920	-70.358390	-169.584700	-293.811000	-443.037300
-617.263900	-407.897200	-223.531000	-64.164550	70.202140
179.568600	263.935000	323.301700	357.668200	367.034600
351.401300	310.767800	245.134200	154.500900	38.867430
-101.766100	-267.399400	-458.032900	-673.666500	-914.302900
-673.666500	-458.032900	-267.399400	-101.766100	38.867430
154.500900	245.134200	310.767800	351.401300	367.034600
357.668200	323.301700	263.935000	179.568600	70.202140
-64.164550	-223.531000	-407.897200	-617.263900	-443.037300
-293.811000	-169.584700	-70.358390	3.867920	53.094510
77.320870	76.547250	50.773620	0.000000	
MB=	-617.263600			
MC=	-914.297600			
MD=	-617.264800			

TABLE B-49 MOMENT ORDINATES DUE TO A UNIT UNIFORM LIVE LOAD IN SPANS AB AND CD (N=1.5,AL=50)

0.000000	118.145000	211.290000	279.435000	322.580000
340.725000	333.870300	302.015300	245.160400	163.305400
56.450430	29.421400	2.389923	-24.641550	-51.673030
-78.704510	-105.735900	-132.767400	-159.798900	-186.830400
-213.861800	-240.893300	-267.924800	-294.956200	-321.987700
-349.019200	-376.050700	-403.082000	-430.113500	-457.145000
-243.545400	-54.944330	108.656900	247.258300	360.859600
449.460900	513.062200	551.663500	565.264800	553.866200
517.467500	456.068800	369.670100	258.271400	121.872800
-39.525870	-225.924800	-437.323400	-673.724800	-606.343700
-538.972100	-471.600500	-404.229200	-336.857900	-269.486300
-202.114700	-134.743100	-67.371580	-0.000244	
MB=	56.451090			
MC=	-457.145200			
MD=	-673.718000			

TABLE B-50 INFLUENCE LINE FOR MB AND MC (N=1.5, AL=45)

(A) INFLUENCE LINE ORDINATES FOR MB

0.000000	-1.006783	-1.925690	-2.668854	-3.148376
-3.276398	-3.043137	-2.458359	-1.463519	0.000000
-3.025057	-5.559286	-7.639145	-9.301041	-10.581420
-11.433450	-11.822490	-11.803260	-11.430320	-10.758360
-9.842041	-8.735947	-7.494843	-6.173311	-4.827277
-3.500493	-2.229394	-1.050415	0.000000	0.893505
1.634083	2.233814	2.704745	3.058949	3.283339
3.368834	3.333556	3.195582	2.973034	2.683988
2.346564	1.978862	1.598985	1.223027	0.863085
0.531220	0.239504	0.000000	-0.178424	-0.299710
-0.370999	-0.399436	-0.383829	-0.325368	-0.234769
-0.122741	0.000000			

(B) INFLUENCE LINE ORDINATES FOR MC

0.000000	0.315046	0.602593	0.835150	0.985204
1.025263	0.952275	0.769291	0.457972	0.000000
-0.614750	-1.363519	-2.215332	-3.139221	-4.104218
-5.079285	-6.023071	-6.889175	-7.631058	-8.202301
-8.556442	-8.646988	-8.427536	-7.851593	-6.942440
-5.733679	-4.194329	-2.293423	0.000000	-2.293404
-4.194290	-5.733643	-6.942383	-7.851563	-8.427460
-8.646927	-8.556396	-8.202240	-7.631012	-6.889099
-6.023041	-5.079239	-4.104187	-3.139191	-2.215318
-1.363507	-0.614744	0.000000	0.457969	0.769279
0.952266	1.025257	0.985194	0.835141	0.602592
0.315044	0.000000			

TABLE B-51 MOMENT AT POINT J DUE TO A UNIT LOAD AT J (N=1.5, AL=45)

0.000000	4.332574	7.349834	9.110372	9.711814
9.290885	7.971234	5.865706	3.143535	0.000000
1.838633	3.829719	5.848822	7.785679	9.544174
11.099410	12.419320	13.423690	14.053490	14.271100
14.060130	13.425450	12.393300	11.011160	9.292405
7.250556	4.959895	2.508845	0.000000	2.508845
4.959895	7.250556	9.292405	11.011160	12.393300
13.425450	14.060130	14.271100	14.053490	13.423690
12.419320	11.099410	9.544174	7.785679	5.848822
3.829719	1.838633	0.000000	3.143535	5.865706
7.971234	9.290885	9.711814	9.110372	7.349834
4.332574	0.000000			

MAX. MOM. FOR MC DUE TO UNIT UNIFORM LIVE LOAD (N=1.5, AL=45)

MC= -981.611300

MB= -496.594700

MD= -496.597400

MAX. MOM. FOR MB DUE TO UNIT UNIFORM LIVE LOAD (N=1.5, AL=45)

MB= -795.622500

MC= -430.665200

MD= 83.404540

TABLE B-52 MOMENT ORDINATES DUE TO A UNIT UNIFORM DEAD LOAD (N=1.5, AL=45)

0.000000	32.843610	40.687220	23.530830	-18.625540
-85.781930	-177.938400	-295.094700	-437.251200	-604.407700
-396.094900	-212.782900	-54.470700	78.841550	187.153800
270.466000	328.778300	362.090500	370.402500	353.714800
312.027000	245.339300	153.651600	36.963860	-104.723800
-271.411600	-463.099600	-679.787300	-921.477500	-679.787300
-463.099600	-271.411600	-104.723800	36.963860	153.651600
245.339300	312.027000	353.714800	370.402500	362.090500
328.778300	270.466000	187.153800	78.841550	-54.470700
-212.782900	-396.094900	-604.407700	-437.251200	-295.094700
-177.938400	-85.781930	-18.625540	23.530830	40.687220
32.843610	0.000000			
MB=	-604.407400			
MC=	-921.470400			
MD=	-604.407700			

TABLE B-53 MOMENT ORDINATES DUE TO A UNIT UNIFORM LIVE LOAD IN SPANS AB AND CD (N=1.5,AL=45)

0.000000	110.568700	196.137500	256.706200	292.274900
302.843700	288.412500	248.981200	184.550000	95.118890
65.865440	36.610030	7.354630	-21.900780	-51.156180
-80.411600	-109.667000	-138.922400	-168.177700	-197.433100
-226.688400	-255.943800	-285.199400	-314.454800	-343.710200
-372.965500	-402.220900	-431.476300	-460.731600	-248.302400
-60.870840	101.560700	238.992600	351.424300	438.855900
501.287800	538.719400	551.151100	538.583000	501.014600
438.446200	350.878100	238.309800	100.741400	-61.826660
-249.395000	-461.963300	-699.534900	-621.801500	-544.076400
-466.351000	-388.626200	-310.900800	-233.175700	-155.450400
-77.725340	-0.000244			
MB=	95.119300			
MC=	-460.731900			
MD=	-699.529200			

TABLE B-54 INFLUENCE LINE FOR MB AND MC (N=2, AL=80)

(A) INFLUENCE LINE ORDINATES FOR MB

0.000000	-1.677429	-3.311996	-4.860977	-6.281433
-7.530594	-8.565598	-9.343597	-9.821854	-9.957504
-9.707733	-9.029617	-7.880402	-6.349304	-4.539795
-2.430511	0.000000	-2.234451	-4.150284	-5.771576
-7.122284	-8.226440	-9.000778	-9.378082	-9.406372
-9.133698	-8.608078	-7.877548	-6.990143	-5.993896
-4.936844	-3.866211	-2.813171	-1.801799	-0.856063
0.000000	0.747695	1.389612	1.933655	2.387726
2.759735	3.021835	3.151413	3.164322	3.076370
2.903336	2.661072	2.365326	2.031998	1.676825
1.315850	0.959768	0.616493	0.293938	0.000000
-0.259108	-0.483974	-0.676878	-0.840112	-0.962628
-1.034920	-1.061551	-1.047092	-0.996105	-0.913159
-0.802816	-0.669643	-0.518215	-0.353085	-0.178824
0.000000				

(B) INFLUENCE LINE ORDINATES FOR MC

0.000000	0.556593	1.098989	1.612956	2.084290
2.498795	2.842239	3.100403	3.259094	3.304092
3.221207	2.996216	2.614868	2.106812	1.506385
0.806487	0.000000	-0.914888	-1.918854	-2.987289
-4.095612	-5.219177	-6.324615	-7.362167	-8.282608
-9.036682	-9.575226	-9.849014	-9.808838	-9.405457
-8.589722	-7.431820	-6.018484	-4.325173	-2.327212
0.000000	-2.327154	-4.325073	-6.018402	-7.431671
-8.589554	-9.405304	-9.808670	-9.848846	-9.575073
-9.036514	-8.282425	-7.362000	-6.324463	-5.219040
-4.095490	-2.987213	-1.918805	-0.914861	0.000000
0.806460	1.506348	2.106752	2.614786	2.996109
3.221115	3.304016	3.259003	3.100296	2.842133
2.498717	2.084235	1.612913	1.098957	0.556581
0.000000				

TABLE B-55 MOMENT AT POINT J DUE TO A UNIT LOAD AT J (N=2, AL=80)

0.000000	4.582658	8.335986	11.276050	13.429630
14.834170	15.537900	15.599660	15.089070	14.086420
12.682750	10.979710	9.089803	7.028782	4.777709
2.408909	0.000000	2.571823	5.031912	7.299566
9.304295	10.985880	12.370460	13.469700	14.224510
14.596270	14.566920	14.138820	13.334770	12.198090
10.792630	9.108348	7.119193	4.887821	2.487061
0.000000	2.487061	4.887821	7.119193	9.108348
10.792630	12.198090	13.334770	14.138820	14.566920
14.596270	14.224510	13.469700	12.370460	10.985880
9.304295	7.299566	5.031912	2.571823	0.000000
2.408909	4.777709	7.028782	9.089803	10.979710
12.682750	14.086420	15.089070	15.599660	15.537900
14.834170	13.429630	11.276050	8.335986	4.582658
0.000000				

MAX. MOM. FOR MC DUE TO UNIT UNIFORM LIVE LOAD (N=2, AL=80)

MC= -1137.520000

MB= -359.440600

MD= -359.441100

MAX. MOM. FOR MB DUE TO UNIT UNIFORM LIVE LOAD (N=2, AL=80)

MB= -1104.582000

MC= -231.489500

MD= -379.667900

TABLE B-56 MOMENT ORDINATES DUE TO A UNIT UNIFORM DEAD LOAD (N=2, AL=80)

0.000000	129.884400	234.768700	314.653300	369.537800
399.422300	404.306800	384.191400	339.075900	268.960200
173.844700	53.729240	-91.386230	-261.501700	-456.617100
-676.732600	-921.848100	-690.445000	-484.045400	-302.645500
-146.245600	-14.845940	91.553950	172.953800	229.353700
260.753400	267.153300	248.553200	204.953100	136.352700
42.752680	-75.847410	-219.447500	-388.048000	-581.649600
-800.251200	-581.649600	-388.048000	-219.447500	-75.847410
42.752680	136.352700	204.953100	248.553200	267.153300
260.753400	229.353700	172.953800	91.553950	-14.845940
-146.245600	-302.645500	-484.045400	-690.445000	-921.848100
-676.732600	-456.617100	-261.501700	-91.386230	53.729240
173.844700	268.960200	339.075900	384.191400	404.306800
399.422300	369.537800	314.653300	234.768700	129.884400
0.000000				

MB= -921.847900
MC= -800.245600
MD= -921.844900

TABLE B-57 MOMENT ORDINATES DUE TO A UNIT UNIFORM LIVE LOAD IN SPANS AB AND CD (N=2,AL=80)

0.000000	167.156600	309.312900	426.469700	518.626200
585.782900	627.939400	645.096100	637.252600	604.409100
546.565900	463.722400	355.879100	223.035600	65.192380
-117.651100	-325.494300	-329.415700	-333.343500	-337.270900
-341.198700	-345.126200	-349.053900	-352.981600	-356.909100
-360.836900	-364.764400	-368.692100	-372.619600	-376.547300
-380.475000	-384.402500	-388.330300	-392.257800	-396.185500
-400.113000	-185.450400	4.221191	168.893000	308.564900
423.236800	512.908600	577.580500	617.252400	631.924300
621.596100	586.268000	525.939900	440.611800	330.283600
194.955500	34.627440	-150.700900	-361.029000	-596.360500
-559.079500	-521.807600	-484.535600	-447.263600	-409.991600
-372.719700	-335.447900	-298.176000	-260.904000	-223.632000
-186.360100	-149.088100	-111.816100	-74.544180	-37.272210
-0.000244				

MB= -325.493400
MC= -400.113200
MD= -596.356600

TABLE B-58 INFLUENCE LINE FOR MB AND MC (N=2, AL=70)

(A) INFLUENCE LINE ORDINATES FOR MB

0.000000	-1.564209	-3.074982	-4.478806	-5.722290
-6.751923	-7.514313	-7.955933	-8.023392	-7.663208
-6.821930	-5.584183	-4.052429	-2.199936	0.000000
-2.434692	-4.521515	-6.286728	-7.756577	-8.957413
-9.798431	-10.206570	-10.234340	-9.934296	-9.358994
-8.561050	-7.593018	-6.507462	-5.356979	-4.192825
-3.048737	-1.951085	-0.926064	0.000000	0.806685
1.497024	2.079872	2.564133	2.958694	3.233459
3.364319	3.369019	3.265335	3.070999	2.803772
2.481430	2.121737	1.742459	1.360298	0.986084
0.628716	0.297061	0.000000	-0.255586	-0.470805
-0.648762	-0.792558	-0.890298	-0.932146	-0.924308
-0.873004	-0.784428	-0.664804	-0.520340	-0.357244
-0.181726	0.000000			

(B) INFLUENCE LINE ORDINATES FOR MC

0.000000	0.523515	1.029149	1.499001	1.915192
2.259796	2.514954	2.662766	2.685333	2.564774
2.283218	1.868958	1.356299	0.736295	0.000000
-0.855780	-1.811218	-2.840729	-3.918747	-5.019669
-6.112335	-7.148544	-8.077103	-8.846924	-9.406754
-9.705429	-9.691864	-9.314911	-8.523346	-7.386791
-5.991705	-4.312600	-2.323892	0.000000	-2.323868
-4.312531	-5.991608	-7.386642	-8.523254	-9.314774
-9.691742	-9.705307	-9.406586	-8.846756	-8.076981
-7.148422	-6.112228	-5.019577	-3.918655	-2.840668
-1.811174	-0.855758	0.000000	0.736279	1.356268
1.868923	2.283175	2.564722	2.685263	2.662689
2.514889	2.259748	1.915138	1.498967	1.029127
0.523509	0.000000			

TABLE B-59 MOMENT AT POINT J DUE TO A UNIT LOAD AT I (N=2, AL=70)

0.000000	4.531126	8.132143	10.825970	12.650780
13.660030	13.922450	13.522020	12.558050	11.145070
9.412930	7.398167	5.097930	2.600056	0.000000
2.385217	4.711108	6.888927	8.840809	10.499840
11.891720	13.025150	13.831700	14.264840	14.299940
13.934160	13.186500	12.097850	10.730900	9.075117
7.104545	4.883341	2.486517	0.000000	2.486517
4.883341	7.104545	9.075117	10.730900	12.097850
13.186500	13.934160	14.299940	14.264840	13.831700
13.025150	11.891720	10.499840	8.840809	6.888927
4.711108	2.385217	0.000000	2.600056	5.097930
7.398167	9.412930	11.145070	12.558050	13.522020
13.922450	13.660030	12.650780	10.825970	8.132143
4.531126	0.000000			

MAX. MOM. FOR MC DUE TO UNIT UNIFORM LIVE LOAD (N=2, AL=70)

MC= -1115.622000

MB= -395.954300

MC= -395.954500

MAX. MOM. FOR MB DUE TO UNIT UNIFORM LIVE LOAD (N=2, AL=70)

MB= -989.941400

MC= -317.719900

MC= -206.719900

TABLE B-60 MOMENT ORDINATES DUE TO A UNIT UNIFORM DEAD LOAD (N=2, AL=70)

0.000000	165.620500	186.241100	241.861500	272.482100
278.102700	258.723300	214.343900	144.964500	50.584960
-68.794430	-213.173800	-382.553200	-576.932600	-796.312000
-575.480900	-379.650600	-208.820000	-62.989500	57.841060
153.671600	224.502100	270.332700	291.163000	286.993600
257.824200	203.654700	124.485300	20.315910	-108.853500
-263.022900	-442.192600	-646.362300	-875.534100	-646.362300
-442.192600	-263.022900	-108.853500	20.315910	124.485300
203.654700	257.824200	286.993600	291.163000	270.332700
224.502100	153.671600	57.841060	-62.989500	-208.820000
-379.650600	-575.480900	-796.312000	-576.932600	-382.553200
-213.173800	-68.794430	50.584960	144.964500	214.343900
258.723300	278.102700	272.482100	241.861500	186.241100
105.620500	0.000000			
MB=	-796.311000			
MC=	-875.528500			
MD=	-796.309800			

TABLE B-61 MOMENT ORDINATES DUE TO A UNIT UNIFORM LIVE LOAD IN SPANS AB AND CD (N=2,AL=70)

0.000000	150.710500	276.420800	377.131300	452.842000
503.552400	529.262900	529.973600	505.684000	456.394500
382.105200	282.815600	158.526100	9.236816	-165.052700
-179.402100	-193.755400	-208.108700	-222.462000	-236.815300
-251.168600	-265.521900	-279.875200	-294.226500	-308.581700
-322.935000	-337.288300	-351.641600	-365.995100	-380.348300
-394.701600	-409.054900	-423.408200	-437.761400	-222.950800
-33.135000	131.680900	271.497000	386.312700	476.128900
540.944800	580.760900	595.576900	585.392800	550.208700
490.024900	404.840800	294.656700	159.472600	-0.711182
-185.895200	-396.079300	-631.266800	-586.167900	-541.078100
-495.988200	-450.898400	-405.808500	-360.718900	-315.629100
-270.539300	-225.449400	-180.359600	-135.269700	-90.179930
-45.090080	-0.000244			
MB=	-165.052000			
MC=	-437.761700			
MD=	-631.262900			

TABLE B-62 INFLUENCE LINE FOR MB AND MC (N=2, AL=65)

(A) INFLUENCE LINE ORDINATES FOR MB

0.000000	-1.496567	-2.942846	-4.248520	-5.383316
-6.276932	-6.869049	-7.099411	-6.907760	-6.233643
-5.157593	-3.780075	-2.070923	0.000000	-2.546785
-4.729218	-6.574960	-8.111282	-9.366043	-10.244240
-10.669370	-10.696590	-10.381010	-9.777756	-8.941956
-7.928680	-6.793152	-5.590469	-4.374161	-3.179382
-2.033749	-0.964752	0.000000	0.839123	1.555900
2.159757	2.660145	3.066513	3.347610	3.478394
3.477829	3.364777	3.158066	2.876678	2.539435
2.165256	1.773013	1.379817	0.996460	0.632421
0.297117	0.000000	-0.251672	-0.459381	-0.626787
-0.757557	-0.839473	-0.862765	-0.834775	-0.762816
-0.654217	-0.516309	-0.356419	-0.181871	0.000000

(B) INFLUENCE LINE ORDINATES FOR MC

0.000000	0.503274	0.986283	1.428735	1.810349
2.110855	2.309998	2.387466	2.322983	2.096298
1.734437	1.271197	0.696425	0.000000	-0.822176
-1.750031	-2.757416	-3.818222	-4.906281	-5.991669
-7.027115	-7.960281	-8.738968	-9.310974	-9.623764
-9.625366	-9.263428	-8.485657	-7.361156	-5.976461
-4.305474	-2.322021	0.000000	-2.321988	-4.305405
-5.976379	-7.361069	-8.485565	-9.263321	-9.625305
-9.623718	-9.310837	-8.738922	-7.960220	-7.027023
-5.991592	-4.906189	-3.818130	-2.757364	-1.750000
-0.822169	0.000000	0.696417	1.271175	1.734416
2.096267	2.322946	2.387413	2.309946	2.110826
1.810314	1.428707	0.986264	0.503267	0.000000

TABLE B-63 MOMENT AT POINT J DUE TO A UNIT LOAD AT J (N=2, AL=65)

0.000000	4.500260	8.010324	10.558020	12.189750
12.970400	12.983500	12.331090	11.133720	9.530593
7.571120	5.263022	2.703763	0.000000	2.280807
4.531711	6.659421	8.581913	10.228510	11.624790
12.777540	13.613200	14.080780	14.151970	13.821020
13.104800	12.042860	10.697250	9.057148	7.096754
4.881032	2.486257	0.000000	2.486257	4.881032
7.096754	9.057148	10.697250	12.042860	13.104800
13.821020	14.151970	14.080780	13.613200	12.777540
11.624790	10.228510	8.581913	6.659421	4.531711
2.280807	0.000000	2.703763	5.263022	7.571120
9.530593	11.133720	12.331090	12.983500	12.970400
12.189750	10.558020	8.010324	4.500260	0.000000

MAX. MOM. FOR MC DUE TO UNIT UNIFORM LIVE LOAD (N=2, AL=65)

MC= -1103.178000

MB= -416.702800

MD= -416.704500

MAX. MOM. FOR MB DUE TO UNIT UNIFORM LIVE LOAD (N=2, AL=65)

MB= -945.597100

MC= -353.954300

MD= -130.226500

TABLE B-64 MOMENT ORDINATES DUE TO A UNIT UNIFORM DEAD LOAD (N=2, AL=65)

0.000000	92.594830	160.189600	202.784400	220.379100
212.974100	180.568800	123.163800	40.758540	-66.646720
-199.051700	-356.457000	-538.862000	-746.267300	-529.650100
-338.033200	-171.416000	-29.798820	86.818110	178.435300
245.052400	286.669600	303.286600	294.903800	261.520900
203.138100	119.755100	11.372310	-122.010400	-280.393300
-463.776300	-672.161800	-905.544600	-672.161800	-463.776300
-280.393300	-122.010400	11.372310	119.755100	203.138100
261.520900	294.903800	303.286600	286.669600	245.052400
178.435300	86.818110	-29.798820	-171.416000	-338.033200
-529.650100	-746.267300	-538.862000	-356.457000	-199.051700
-66.646720	40.758540	123.163800	180.568800	212.974100
220.379100	202.784400	160.189600	92.594830	0.000000
MB=	-746.267000			
MC=	-905.538500			
MD=	-746.265800			

TABLE B-65 MOMENT ORDINATES DUE TO A UNIT UNIFORM LIVE LOAD IN SPANS AB AND CD (N=2, AL=65)

0.000000	142.729100	260.458000	353.187200	420.916200
463.645500	481.374500	474.103700	441.832700	384.561700
302.291000	195.020000	62.749260	-94.521720	-113.369800
-132.225000	-151.080200	-169.935300	-188.790500	-207.645700
-226.500900	-245.356100	-264.211100	-283.066400	-301.921600
-320.776800	-339.631800	-358.487000	-377.342200	-396.197500
-415.052700	-433.907900	-452.762900	-238.243200	-48.715820
115.811700	255.339100	369.866600	459.394200	523.921600
563.449200	577.976800	567.504100	532.031700	471.559300
386.086600	275.614200	140.141800	-20.330560	-205.803200
-416.275600	-651.751200	-601.606900	-551.472900	-501.339100
-451.205000	-401.071200	-350.937500	-300.803700	-250.669600
-200.535800	-150.401800	-100.268000	-50.134030	-0.000244
MB=	-94.520820			
MC=	-452.763100			
MD=	-651.747300			

TABLE B-66 INFLUENCE LINE FOR MB AND MC (N=2, AL=60)

(A) INFLUENCE LINE ORDINATES FOR MB

0.000000	-1.419792	-2.771088	-3.985321	-4.994034
-5.728668	-6.120728	-6.101685	-5.603043	-4.699036
-3.486710	-1.931760	0.000000	-2.667680	-4.953217
-6.885559	-8.493683	-9.806488	-10.724600	-11.167920
-11.194390	-10.861900	-10.228280	-9.351486	-8.289429
-7.099976	-5.841064	-4.568634	-3.319351	-2.122201
-1.006092	0.000000	0.873641	1.618399	2.244335
2.761511	3.179993	3.467239	3.597397	3.590561
3.466934	3.246597	2.949688	2.596375	2.206758
1.801012	1.396550	1.004156	0.633888	0.295814
0.000000	-0.245892	-0.443815	-0.598133	-0.713205
-0.776675	-0.779098	-0.729195	-0.635681	-0.507286
-0.352726	-0.180724	0.000000		

(B) INFLUENCE LINE ORDINATES FOR MC

0.000000	0.479910	0.936676	1.347109	1.688058
1.936386	2.068909	2.062485	1.893936	1.588342
1.178564	0.652966	0.000000	-0.785539	-1.683314
-2.666565	-3.708588	-4.782608	-5.860107	-6.894730
-7.832962	-8.621368	-9.206467	-9.534851	-9.552917
-9.207291	-8.444519	-7.333248	-5.959860	-4.297692
-2.319968	0.000000	-2.319946	-4.297623	-5.959793
-7.333160	-8.444473	-9.207245	-9.552826	-9.534760
-9.206406	-8.621307	-7.832886	-6.894638	-5.860031
-4.782547	-3.708527	-2.666530	-1.683288	-0.785530
0.000000	0.652960	1.178542	1.588337	1.893910
2.062452	2.068891	1.936370	1.688046	1.347089
0.936659	0.479909	0.000000		

TABLE B-67 MOMENT AT POINT J DUE TO A UNIT LOAD AT J (N=2, AL=60)

0.000000	4.465014	7.871478	10.253650	11.668640
12.196360	11.939590	11.023960	9.597937	7.725722
5.427749	2.812549	0.000000	2.168203	4.338330
6.412130	8.303135	9.936584	11.337730	12.511490
13.378660	13.883450	13.993540	13.700110	13.017690
11.984340	10.661570	9.038255	7.088646	4.878675
2.486023	0.000000	2.486023	4.878675	7.088646
9.038255	10.661570	11.984340	13.017690	13.700110
13.993540	13.883450	13.378660	12.511490	11.337730
9.936584	8.303135	6.412130	4.338330	2.168203
0.000000	2.812549	5.427749	7.725722	9.597937
11.023960	11.939590	12.196360	11.668640	10.253650
7.871478	4.465014	0.000000		

MAX. MOM. FOR MC DUE TO UNIT UNIFORM LIVE LOAD (N=2, AL=60)

MC= -1089.603000

MB= -439.337800

MD= -439.340300

MAX. MOM. FOR MB DUE TO UNIT UNIFORM LIVE LOAD (N=2, AL=60)

MB= -910.188400

MC= -385.466000

MD= -60.532710

TABLE B-68 MOMENT ORDINATES DUE TO A UNIT UNIFORM DEAD LOAD (N=2, AL=60)

0.000000	78.747400	132.494800	161.242100	164.989500
143.736800	97.484370	26.231680	-70.020750	-191.273400
-337.526100	-508.778500	-705.031200	-491.887400	-303.742400
-140.597100	-2.451904	110.693300	198.838600	261.983800
300.129300	313.274600	301.419900	264.565100	202.710400
115.855700	4.000977	-132.853700	-294.708200	-481.562900
-693.417700	-930.275100	-693.417700	-481.562900	-294.708200
-132.853700	4.000977	115.855700	202.710400	264.565100
301.419900	313.274600	300.129300	261.983800	198.838600
110.693300	-2.451904	-140.597100	-303.742400	-491.887400
-705.031200	-508.778500	-337.526100	-191.273400	-70.020750
26.231680	97.484370	143.736800	164.989500	161.242100
132.494800	78.747400	0.000000		
MB=	-705.030700			
MC=	-930.268500			
MD=	-705.032900			

TABLE B-69 MOMENT ORDINATES DUE TO A UNIT UNIFORM LIVE LOAD IN SPANS AB AND CD (N=2,AL=60)

0.000000	134.955500	244.910800	329.866400	389.822000
424.777500	434.732900	419.688400	379.644000	314.599600
224.555100	109.510400	-30.533930	-53.405710	-76.279200
-99.152690	-122.026100	-144.899600	-167.773100	-190.646600
-213.520100	-236.393600	-259.267000	-282.140600	-305.013900
-327.887400	-350.760900	-373.634500	-396.508000	-419.381500
-442.254800	-465.128400	-251.157000	-62.176260	101.804400
240.785400	354.766300	443.747000	507.728000	546.708900
560.689600	549.670600	513.651300	452.632300	366.613200
255.593900	119.574900	-41.444090	-227.463300	-438.482400
-674.505100	-618.287100	-562.079100	-505.871300	-449.663300
-393.455500	-337.247800	-281.039700	-224.831700	-168.624000
-112.416000	-56.208000	-0.000244		
MB=	-30.533030			
MC=	-465.128600			
MD=	-674.501200			

TABLE B-70 INFLUENCE LINE FOR MB AND MC (M=2, AL=55)

(A) INFLUENCE LINE ORDINATES FOR MB

0.000000	-1.332298	-2.586105	-3.682877	-4.544113
-5.091324	-5.245941	-4.929535	-4.207474	-3.171387
-1.781947	0.000000	-2.797861	-5.194366	-7.219986
-8.905136	-10.280330	-11.241160	-11.703880	-11.729370
-11.378400	-10.711970	-9.790939	-8.676208	-7.428711
-6.109344	-4.776657	-3.468925	-2.216619	-1.050150
0.000000	0.910258	1.684528	2.333544	2.868084
3.298383	3.592030	3.720739	3.706573	3.571024
3.335571	3.021776	2.651128	2.245143	1.825372
1.409563	1.008364	0.632534	0.292826	0.000000
-0.237855	-0.423312	-0.561612	-0.657994	-0.700229
-0.679588	-0.606547	-0.491589	-0.345192	-0.177835
0.000000				

(B) INFLUENCE LINE ORDINATES FOR MC

0.000000	0.452807	0.878940	1.251705	1.544420
1.730382	1.782959	1.675407	1.430002	1.077859
0.605633	0.000000	-0.745605	-1.610580	-2.567551
-3.589096	-4.647827	-5.716690	-6.750412	-7.694107
-8.493149	-9.092667	-9.437836	-9.473953	-9.146194
-8.399734	-7.302837	-5.941763	-4.289208	-2.317743
0.000000	-2.317719	-4.289139	-5.941681	-7.302719
-8.399673	-9.146088	-9.473846	-9.437744	-9.092560
-8.493073	-7.694061	-6.750305	-5.716614	-4.647766
-3.589035	-2.567504	-1.610563	-0.745598	0.000000
0.605628	1.077841	1.429986	1.675395	1.782933
1.730377	1.544401	1.251691	0.878929	0.452806
0.000000				

TABLE B-71 MOMENT AT POINT J DUE TO A UNIT LOAD AT J (N=2, AL=55)

0.000000	4.424332	7.711607	9.904666	11.074850
11.322140	10.774940	9.590339	7.849151	5.587082
2.925501	0.000000	2.046976	4.130203	6.146146
8.003452	9.622910	11.029480	12.226100	13.127360
13.672290	13.824310	13.571210	12.925060	11.922390
10.623980	9.018482	7.080256	4.876331	2.485813
0.000000	2.485813	4.876331	7.080256	9.018482
10.623980	11.922390	12.925060	13.571210	13.824310
13.672290	13.127360	12.226100	11.029480	9.622910
8.003452	6.146146	4.130203	2.046976	0.000000
2.925501	5.587082	7.849151	9.590339	10.774940
11.322140	11.074850	9.904666	7.711607	4.424332
0.000000				

MAX. MOM. FOR MC DUE TO UNIT UNIFORM LIVE LOAD (N=2, AL=55)

MC= -1074.810000

MB= -464.004100

MD= -464.006800

MAX. MOM. FOR MB DUE TO UNIT UNIFORM LIVE LOAD (N=2, AL=55)

MB= -883.910600

MC= -412.161300

MD= 2.214111

TABLE B-72 MOMENT ORDINATES DUE TO A UNIT UNIFORM DEAD LOAD (N=2, AL=55)

0.000000	63.831640	102.663200	116.494900	105.326400
69.158200	7.989746	-78.178460	-189.346900	-325.515100
-486.683500	-672.852000	-462.418400	-276.982400	-116.546100
18.890130	129.326400	214.762600	275.198900	310.635200
321.071200	306.507500	266.943800	202.380100	112.816400
-1.747314	-141.311000	-305.874700	-495.438700	-710.002400
-949.569500	-710.002400	-495.438700	-305.874700	-141.311000
-1.747314	112.816400	202.380100	266.943800	306.507500
321.071200	310.635200	275.198900	214.762600	129.326400
18.890130	-116.546100	-276.982400	-462.418400	-672.852000
-486.683500	-325.515100	-189.346900	-78.178460	7.989746
69.158200	105.326400	116.494900	102.663200	63.831640
0.000000				

MB= -672.851800
MC= -949.564600
MD= -672.854000

TABLE B-73 MOMENT ORDINATES DUE TO A UNIT UNIFORM LIVE LOAD IN SPANS AB AND CD (N=2, AL=55)

0.000000	127.436600	229.873200	307.309800	359.746500
387.183300	389.619800	367.056600	319.493400	246.924900
149.366600	26.803220	0.409958	-25.989610	-52.388790
-78.788160	-105.187500	-131.586900	-157.986200	-184.385600
-210.785000	-237.184300	-263.583700	-289.983100	-316.382300
-342.781700	-369.181100	-395.580500	-421.979900	-448.379300
-474.778500	-261.621800	-73.457510	89.706780	227.371300
341.035600	429.200100	492.364500	530.529000	543.693600
531.857900	495.022400	433.186700	346.351300	234.515600
97.680170	-64.155270	-250.990900	-462.826400	-699.665200
-636.053200	-572.447900	-508.842500	-445.237300	-381.632000
-318.026800	-254.421300	-190.816100	-127.210900	-63.605460
-0.000244				

MB= 26.803630
MC= -474.778800
MD= -699.661300

TABLE B-74 INFLUENCE LINE FOR MB AND MC (N=2, AL=50)

(A) INFLUENCE LINE ORDINATES FOR MB

0.000000	-1.232149	-2.373505	-3.333176	-4.020386
-4.344315	-4.214157	-3.682846	-2.833649	-1.621164
0.000000	-2.937640	-5.453232	-7.578888	-9.346634
-10.788570	-11.795180	-12.278500	-12.302610	-11.931620
-11.229700	-10.261010	-9.089661	-7.779831	-6.395660
-4.998474	-3.628233	-2.317035	-1.096930	0.000000
0.948952	1.754185	2.427218	2.979566	3.422754
3.721382	3.847764	3.824956	3.675980	3.423873
3.091661	2.702399	2.279126	1.844881	1.417763
1.008201	0.627705	0.287797	0.000000	-0.227149
-0.397036	-0.516020	-0.590465	-0.608705	-0.563316
-0.467026	-0.332559	-0.172642	0.000000	

(B) INFLUENCE LINE ORDINATES FOR MC

0.000000	0.421224	0.811399	1.139486	1.374424
1.485158	1.440660	1.259027	0.968717	0.554214
0.000000	-0.702187	-1.531519	-2.459869	-3.459167
-4.501282	-5.560760	-6.593491	-7.543243	-8.353775
-8.968887	-9.332397	-9.388046	-9.079666	-8.351044
-7.269726	-5.922079	-4.279992	-2.315315	0.000000
-2.315289	-4.279922	-5.922012	-7.269653	-8.350967
-9.079590	-9.387970	-9.332306	-8.968796	-8.353683
-7.543152	-6.593399	-5.560684	-4.501205	-3.459106
-2.459843	-1.531499	-0.702181	0.000000	0.554211
0.968704	1.259007	1.440638	1.485139	1.374403
1.139469	0.811394	0.421218	0.000000	

TABLE B-75 MOMENT AT POINT J DUE TO A UNIT LOAD AT J (N=2, AL=50)

0.000000	4.376780	7.525299	9.500040	10.391840
10.327820	9.471533	7.922035	5.733085	3.040948
0.000000	1.916840	3.906899	5.860918	7.682255
9.286972	10.699690	11.921040	12.859050	13.447170
13.644220	13.434330	12.826980	11.856980	10.584530
8.997895	7.071678	4.874006	2.485651	0.000000
2.485651	4.874006	7.071678	8.997895	10.584530
11.856980	12.826980	13.434330	13.644220	13.447170
12.859050	11.921040	10.699690	9.286972	7.682255
5.860918	3.906899	1.916840	0.000000	3.040948
5.733085	7.922035	9.471533	10.327820	10.391840
9.500040	7.525299	4.376780	0.000000	

MAX. MOM. FOR MC DUE TO UNIT UNIFORM LIVE LOAD (N=2, AL=50)

MC= -1058.727000

MB= -490.825600

MD= -490.829100

MAX. MOM. FOR MB DUE TO UNIT UNIFORM LIVE LOAD (N=2, AL=50)

MB= -866.907900

MC= -433.946500

MC= 57.848630

TABLE B-76 MOMENT ORDINATES DUE TO A UNIT UNIFORM DEAD LOAD (N=2, AL=50)

0.000000	47.505590	70.011210	67.516830	40.022440
-12.472160	-89.966550	-192.460900	-319.955300	-472.449700
-649.944000	-441.437000	-257.930100	-99.423090	34.084220
142.591300	226.098300	284.605700	318.112700	326.619800
310.127100	268.634200	202.141300	110.648600	-5.844238
-147.337100	-313.829800	-505.322700	-721.815600	-963.311500
-721.815600	-505.322700	-313.829800	-147.337100	-5.844238
110.648600	202.141300	268.634200	310.127100	326.619800
318.112700	284.605700	226.098300	142.591300	34.084220
-99.423090	-257.930100	-441.437000	-649.944000	-472.449700
-319.955300	-192.460900	-89.966550	-12.472160	40.022440
67.516830	70.011210	47.505590	0.000000	
MB=	-649.943800			
MC=	-963.304400			
MD=	-649.944500			

TABLE B-77 MOMENT ORDINATES DUE TO A UNIT UNIFORM LIVE LOAD IN SPANS AB AND CD (N=2,AL=50)

0.000000	120.240100	215.480200	285.720400	330.960600
351.200600	346.440900	316.681100	261.921300	182.161300
77.401610	47.980220	18.556390	-10.867430	-40.291250
-69.715080	-99.138910	-128.562700	-157.986500	-187.410400
-216.834200	-246.258000	-275.681800	-305.105700	-334.529500
-363.953300	-393.377100	-422.801000	-452.224800	-481.648600
-269.584700	-82.516350	79.552240	216.620800	328.689400
415.758000	477.826600	514.895500	526.964100	514.032700
476.101300	413.169900	325.238500	212.307100	74.375730
-88.555410	-276.486800	-489.418200	-727.352700	-654.611800
-581.877100	-509.142500	-436.408200	-363.673500	-290.938700
-218.204100	-145.469400	-72.734860	-0.000244	
MB=	77.402020			
MC=	-481.648600			
MD=	-727.348800			

APPENDIX C

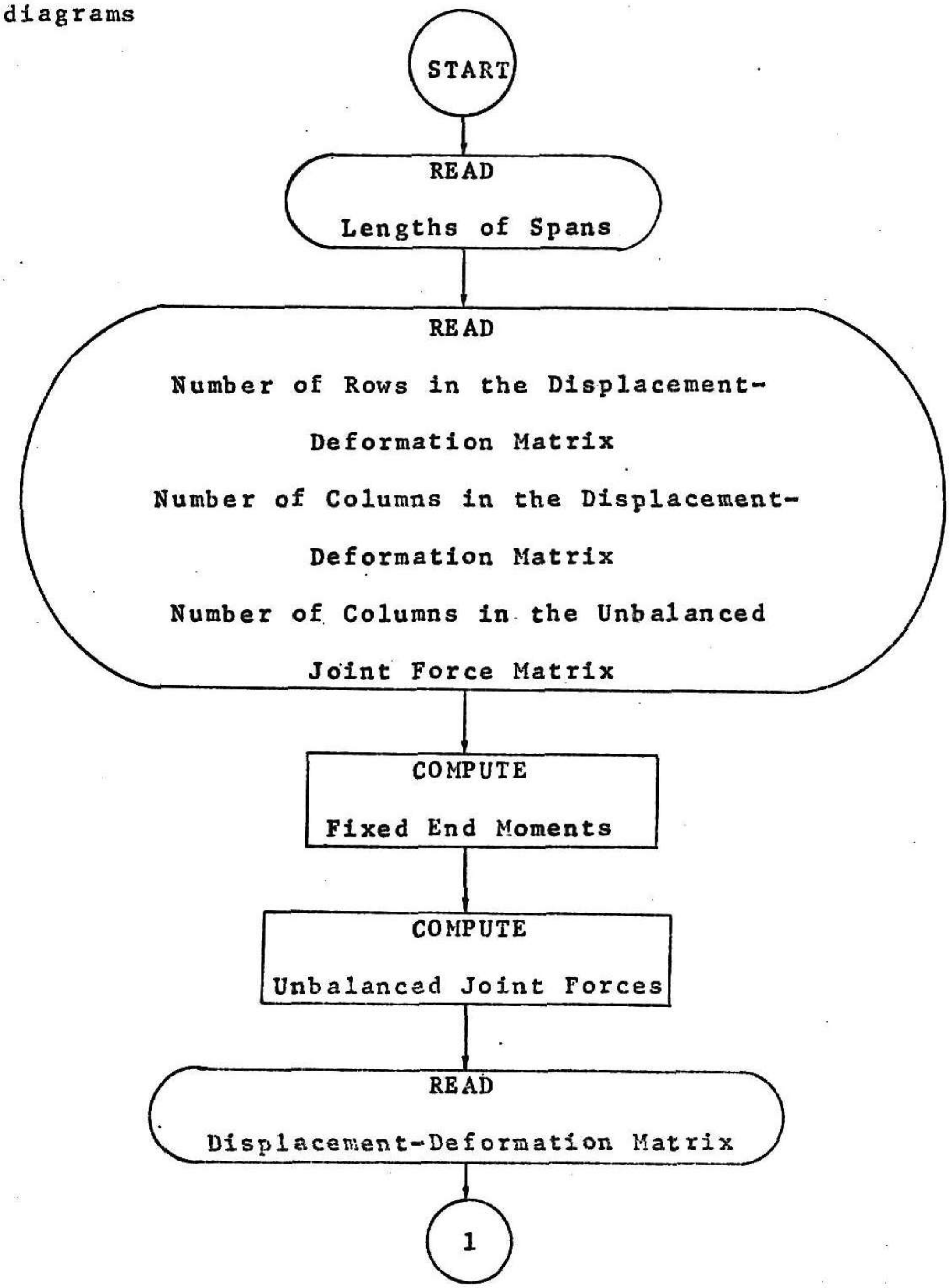
Variable definitions

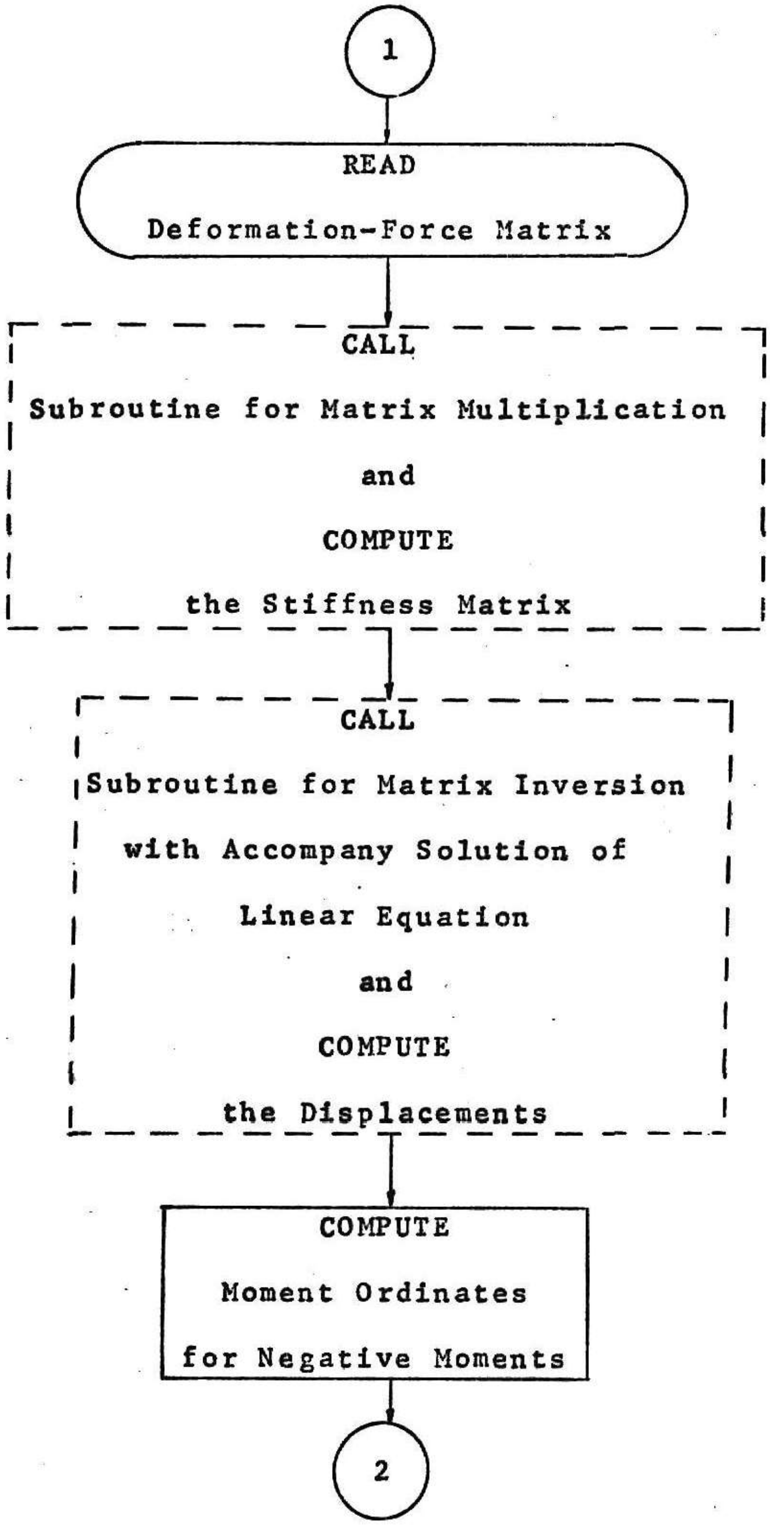
Variables used in the programs are defined as follows:

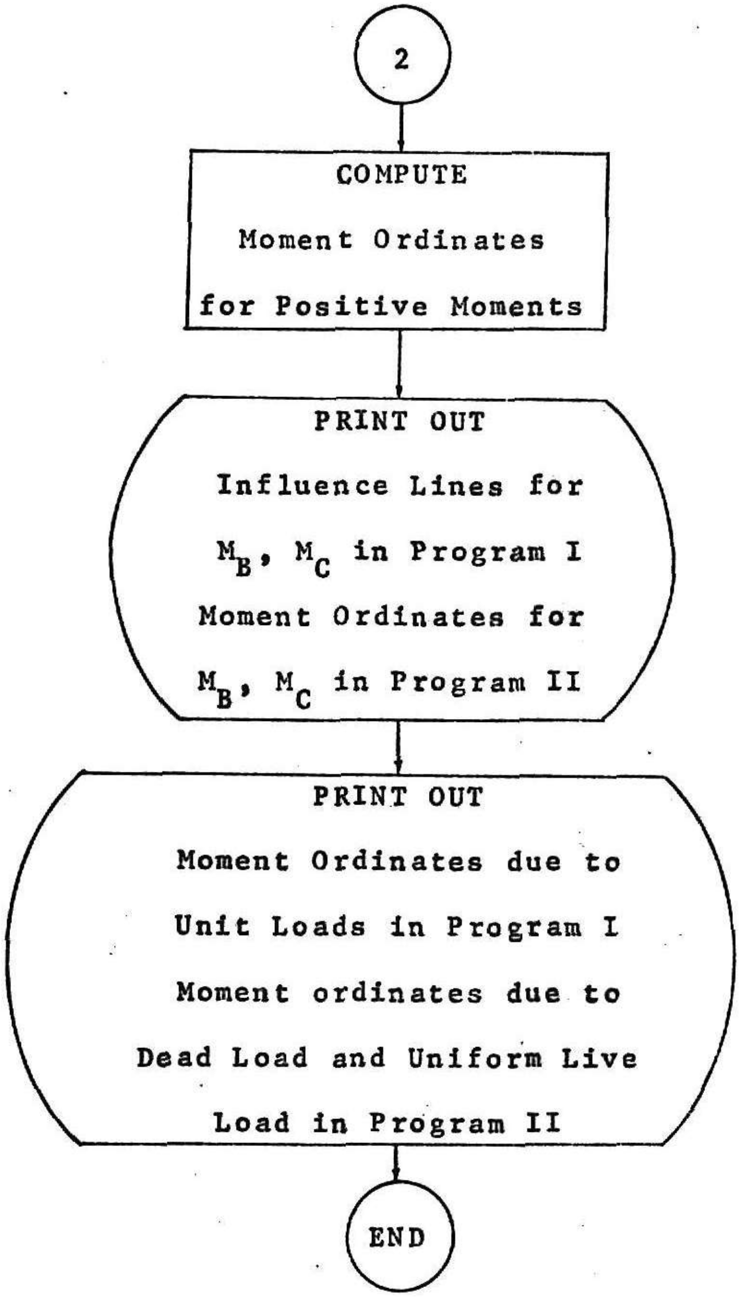
SPAN(I)	= the span length (subdivided full bridge into 10 spans)
INA	= number of rows in (A)
IMA	= number of columns in (A)
IMP	= number of columns in (QF)
FEM(I,J)	= fixed end moments
QF(I,J)	= unbalanced joint forces
A(I,J)	= displacement-deformation matrix
STIF(I,J)	= deformation-force matrix or stiffness matrix
TRAN	= subroutine for matrix transposition
AMM	= subroutine for matrix multiplication
MATINV	= subroutine for matrix inverse with accompanying solution of linear equations
AM(I,J)	= moments at subdivided points
PM(J)	= moment ordinates along the bridge length

FLOW DIAGRAMS AND COMPUTER PROGRAMS

Flow diagrams




1
READ
Deformation-Force Matrix
CALL
Subroutine for Matrix Multiplication
and
COMPUTE
the Stiffness Matrix
CALL
Subroutine for Matrix Inversion
with Accompany Solution of
Linear Equation
and
COMPUTE
the Displacements
COMPUTE
Moment Ordinates
for Negative Moments
2


2
COMPUTE
Moment Ordinates
for Positive Moments
PRINT OUT
Influence Lines for
M_B, M_C in Program I
Moment Ordinates for
M_B, M_C in Program II
PRINT OUT
Moment Ordinates due to
Unit Loads in Program I
Moment ordinates due to
Dead Load and Uniform Live
Load in Program II
END

ILLEGIBLE DOCUMENT

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Computer programs

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C       PROGRAM  1
C       COMPUTE INFLUENCE LINE VALUES FOR NEGATIVE AND POSITIVE
C       MOMENT
C       PART 1 DETERMINE FIXED END MOMENTS AND JOINT UNBALANCED
C       FORCES
        DIMENSION FEM(20,80),QF(20,80),A(20,80),B(20,80),STIF(20,80)
        DIMENSION P(20,80),AM(20,80),PM(80),SPAN(20)
      1 FORMAT (3I8)
      2 FORMAT (5F14.6)
    100 FORMAT (5F14.6)
        READ (1,102) (SPAN(I),I=1,10)
        PFSN=(SPAN(1)/5.)+1.
        IFSN=PFSN
    101 READ (1,1) INA,IMA,IMP
    102 FORMAT (5F10.2)
        DO 20 I=1,17
        DO 20 J=1,IMP
        QF(I,J)=0.0
     20 CONTINUE
        DO 21 I=1,20
        DO 21 J=1,IMP
        FEM(I,J)=0.0
     21 CONTINUE
        X=0.0
        DO 31 J=1,IFSN
        FEM(1,J)=+X*(SPAN(1)-X)**2/(SPAN(1)**2)
        FEM(2,J)=-(SPAN(1)-X)*X**2/(SPAN(1)**2)
        QF(12,J)=(X-FEM(1,J)-FEM(2,J))/SPAN(1)
        X=X+5.0
     31 CONTINUE
        X=5.0
        DO 36 M=1,4
        J=M+IFSN
        FEM(3,J)=+X*(SPAN(2)-X)**2/(SPAN(2)**2)
        FEM(4,J)=-(SPAN(2)-X)*X**2/(SPAN(2)**2)
        QF(12,J)=((SPAN(2)-X)+FEM(3,J)+FEM(4,J))/SPAN(2)
        X=X+5.0
     36 CONTINUE
        X=5.0
        DO 41 M=1,9
        J=M+IFSN+4
        FEM(5,J)=+X*(SPAN(3)-X)**2/(SPAN(3)**2)
        FEM(6,J)=-(SPAN(3)-X)*X**2/(SPAN(3)**2)
        QF(13,J)=(X-FEM(5,J)-FEM(6,J))/SPAN(3)
        X=X+5.0
     41 CONTINUE
```

```
      X=5.0
      DO 46 N=1,9
      J=N+IFSN+9
      FEM(7,J)=+X*(SPAN(4)-X)**2/(SPAN(4)**2)
      FEM(8,J)=-(SPAN(4)-X)*X**2/(SPAN(4)**2)
      QF(13,J)=((SPAN(4)-X)+FEM(7,J)+FEM(8,J))/SPAN(4)
      QF(14,J)=(X-FEM(7,J)-FEM(8,J))/SPAN(4)
      X=X+5.
   46 CONTINUE
      X=5.0
      DO 51 N=1,5
      J=N+IFSN+18
      FEM(9,J)=+X*(SPAN(5)-X)**2/(SPAN(5)**2)
      FEM(10,J)=-(SPAN(5)-X)*X**2/(SPAN(5)**2)
      QF(14,J)=((SPAN(5)-X)+FEM(9,J)+FEM(10,J))/SPAN(5)
      X=X+5.0
   51 CONTINUE
      KMN=IMP/2+1
      DO 55 N=1,5
      J=N+IFSN+23
      K=KMN-N
      FEM(11,J)=-FEM(10,K)
      FEM(12,J)=-FEM(9,K)
      QF(15,J)=QF(14,K)
   55 CONTINUE
      DO 60 N=1,9
      J=N+IFSN+28
      K=KMN-N-5
      FEM(13,J)=-FEM(8,K)
      FEM(14,J)=-FEM(7,K)
      QF(15,J)=QF(14,K)
      QF(16,J)=QF(13,K)
   60 CONTINUE
      DO 65 N=1,5
      J=N+IFSN+37
      K=KMN-N-14
      FEM(15,J)=-FEM(6,K)
      FEM(16,J)=-FEM(5,K)
      QF(16,J)=QF(13,K)
   65 CONTINUE
      DO 70 N=1,4
      J=N+IFSN+42
      K=KMN-N-19
      FEM(17,J)=-FEM(4,K)
      FEM(18,J)=-FEM(3,K)
      QF(17,J)=QF(12,K)
   70 CONTINUE
      NN=IFSN-1
      DO 75 N=1,NN
      J=N+IFSN+46
      K=KMN-N-23
```

```
      FEM(19,J)=-FEM(2,K)
      FEM(20,J)=-FEM(1,K)
      QF(17,J)=QF(12,K)
   75 CONTINUE
      DO 76 J=1,IMP
      QF(1,J)=-FEM(1,J)
      QF(2,J)=-(FEM(2,J)+FEM(3,J))
      QF(3,J)=-(FEM(4,J)+FEM(5,J))
      QF(4,J)=-(FEM(6,J)+FEM(7,J))
      QF(5,J)=-(FEM(8,J)+FEM(9,J))
      QF(6,J)=-(FEM(10,J)+FEM(11,J))
      QF(7,J)=-(FEM(12,J)+FEM(13,J))
      QF(8,J)=-(FEM(14,J)+FEM(15,J))
      QF(9,J)=-(FEM(16,J)+FEM(17,J))
      QF(10,J)=-(FEM(18,J)+FEM(19,J))
      QF(11,J)=-FEM(20,J)
   76 CONTINUE
C     PART 2  BY DISPLACEMENT  METHOD
      READ (1,2) ((A(I,J),I=1,INA),J=1,IMA)
      READ (1,2) ((STIF(I,J),I=1,INA),J=1,INA)
      CALL TRAN (A,INA,IMA,B)
      CALL AMM (STIF,A,INA,IMA,INA,P)
      DO 5 I=1,INA
      DO 5 J=1,IMA
    5 A(I,J)=P(I,J)
      CALL AMM(B,A,IMA,IMA,INA,STIF)
      DO 8 J=1,IMP
      DO 8 I=1,IMA
    8 P(I,J)=QF(I,J)
      CALL MATINV (STIF,INA,P,IMP,DET)
      CALL AMM(A,P,INA,IMP,IMA,B)
      DO 10 J=1,IMP
      DO 10 I=1,INA
   10 AM(I,J)=B(I,J)+FEM(I,J)
      X=0.0
      DO 80 J=1,IFSN
      PM(J)=(AM(2,J)+(SPAN(1)-X))*X/SPAN(1)
      X=X+5.
   80 CONTINUE
      Y=5.0
      DO 85 N=1,4
      J=N+IFSN
      PM(J)=((AM(3,J)+AM(4,J)+(SPAN(2)-Y))/SPAN(2))*Y-AM(3,J)
      Y=Y+5.0
   85 CONTINUE
      Y=5.0
      DO 90 N=1,5
      J=N+IFSN+4
      PM(J)=((AM(5,J)+AM(6,J)+(SPAN(3)-Y))/SPAN(3))*Y-AM(5,J)
      Y=Y+5.0
   90 CONTINUE
```

```
      Y=5.0
      DO 95 N=1,9
      J=N+IFSN+9
      PM(J)=((AM(7,J)+AM(8,J)+(SPAN(4)-Y))/SPAN(4))*Y-AM(7,J)
      Y=Y+5.0
   95 CONTINUE
      Y=5.0
      DO 96 N=1,5
      J=N+IFSN+18
      PM(J)=((AM(9,J)+AM(10,J)+(SPAN(5)-Y))/SPAN(5))*Y-AM(9,J)
      Y=Y+5.
   96 CONTINUE
      KMN=KMN-1
      DO 110 KI=1,KMN
      J=KMN+1+KI
      KJ=KMN+1-KI
      PM(J)=PM(KJ)
  110 CONTINUE
  200 FORMAT ( 5X,5F14.6)
  210 FORMAT ('1',12X,'INFLUENCE LINE FOR MB AND MC')
      WRITE (3,210)
  211 FORMAT ('0',10X,'INFLUENCE LINE ORDINATES FOR MB')
      WRITE (3,211)
      WRITE (3,200) (AM(4,J),J=1,IMP)
  212 FORMAT ('0',10X,'INFLUENCE LINE ORDINATES FOR MC')
      WRITE (3,212)
      WRITE (3,200) (AM(10,J),J=1,IMP)
  213 FORMAT ('1',10X,'MOMENT AT POINT J DUE TO A UNIT LOAD AT J')
      WRITE (3,213)
      WRITE (3,200) (PM(J),J=1,IMP)
      STOP
      END


C0050  MATRIX MULTIPLY
      SUBROUTINE AMM (A,B,N,M,L,C)
      DIMENSION A(20,80),B(20,80),C(20,80)
      DO2I=1,N
      DO2J=1,M
      SUM=0.
      DO1K=1,L
    1 SUM=SUM+A(I,K)*B(K,J)
      C(I,J)=SUM
    2 CONTINUE
      RETURN
      END
```

```
C0050  MATRIX TRANSPOSE
       SUBROUTINE TRAN (A,N,M,B)
       DIMENSION A(30,30),B(30,30)
       DO4J=1,M
       DO4I=1,N
       B(J,I)=A(I,J)
     4 CONTINUE
       RETURN
       END
```

```
C0050 MATRIX INVERSION WITH ACCOMPANYING SOLUTION OF LINEAR
C      EQUATIONS
       SUBROUTINE MATINV(A,N,B,M,DETERM)
       EQUIVALENCE (IROW,JROW), (ICOLUM,JCOLUM), (AMAX, T, SWAP)
       DIMENSION IPIVOT(30),A(30,30),B(30,30),INDEX(30,2),PIVOT(30)
C*****INITIALIZATION
10     DETERM = 1.0
15     DO 20 J = 1,N
20     IPIVOT(J) = 0
30     DO 550 I = 1,N
C*****SEARCH FOR PIVOT ELEMENT
40     AMAX = 0.0
45     DO 105 J = 1,N
50     IF(IPIVOT(J)-1) 60,105,60
60     DO 100 K = 1, N
70     IF (IPIVOT(K)-1) 80, 100, 740
80     IF (ABS(AMAX)-ABS(A(J,K))) 85, 100, 100
85     IROW = J
90     ICOLUM = K
95     AMAX = A(J,K)
100    CONTINUE
105    CONTINUE
110    IPIVOT(ICOLUM) = IPIVOT(ICOLUM)+1
C*****INTERCHANGE ROWS TO PUT PIVOT ELEMENT ON DIAGONAL
130    IF (IROW-ICOLUM) 140, 260, 140
140    DETERM = - DETERM
150    DO 200 L = 1, N
160    SWAP = A(IROW,L)
170    A(IROW,L) = A(ICOLUM,L)
200    A(ICOLUM,L) = SWAP
205    IF (M) 260, 260, 210
210    DO 250 L = 1, M
220    SWAP = B(IROW,L)
230    B(IROW,L) = B(ICOLUM,L)
250    B(ICOLUM,L) = SWAP
260    INDEX(I,1) = IROW
270    INDEX(I,2) = ICOLUM
```

```
310    PIVOT(I) = A(ICOLUM,ICOLUM)
320    DETERM= DETERM*PIVOT(I)
C*****DIVIDE PIVOT ROW BY PIVOT ELEMENT
330    A(ICOLUM,ICOLUM) = 1.0
340    DO 350 L = 1, N
350    A(ICOLUM,L) = A(ICOLUM,L)/PIVOT(I)
355    IF(M) 380, 380, 360
360    DO 370 L = 1, M
370    B(ICOLUM,L) = B(ICOLUM,L)/PIVOT(I)
C*****REDUCE NON-PIVOT ROWS
380    DO 550 L1 = 1, N
390    IF (L1 - ICOLUM) 400, 550, 400
400    T = A(L1,ICOLUM)
420    A(L1,ICOLUM) = 0.0
430    DO 450 L = 1, N
450    A(L1,L) = A(L1,L) - A(ICOLUM,L) * T
455    IF (M) 550, 550, 460
460    DO 500 L = 1, M
500    B(L1,L) = B(L1,L) - B(ICOLUM,L) * T
550    CONTINUE
C*****INTERCHANGE COLUMNS
600    DO 710 I = 1, N
610    L = N + 1 - I
620    IF (INDEX(L,1) - INDEX(L,2)) 630, 710, 630
630    JROW = INDEX(L,1)
640    JCOLUM = INDEX(L,2)
650    DO 705 K = 1, N
660    SWAP = A(K,JROW)
670    A(K,JROW) = A(K,JCOLUM)
700    A(K,JCOLUM) = SWAP
705    CONTINUE
710    CONTINUE
740    RETURN
750    END
```

```
C       PROGRAM    2
C       COMPUTE MOMENT ORDINATES DUE TO A UNIT UNIFORM DEAD LOAD
C       COMPUTE MAXIMUM MOMENT AT C DUE TO UNIT UNIFORM
C       LIVE LOAD
C       COMPUTE MAXIMUM MOMENT AT B DUE TO UNIT UNIFORM
C       LIVE LOAD
C       COMPUTE MOMENT ORDINATES DUE TO A UNIT UNIFORM
C       LIVE LOAD IN SPANS AB AND CD
C       PART 1 DETERMINE FIXED END MOMENTS AND JOINT UNBALANCED
C       FORCES
        DIMENSION FEM(20,80),OF(20,80),A(20,80),B(20,80),STIF(20,20)
        DIMENSION P(20,80),AM(20,80),SPAN(20),PM(80)
      1 FORMAT (3I8)
      2 FORMAT (5F14.6)
      9 FORMAT (5F10.2)
    100 FORMAT (5F14.6)
        READ (1,9) (SPAN(I),I=1,10)
        SFSN=(SPAN(1)+SPAN(2))/5.+1.
        IFSN=SFSN
        ISSN=95/5
        STI=(SPAN(1)+SPAN(2)+SPAN(3)+SPAN(4)+SPAN(5))*2./5.+1.
        ITI=STI
        DO 20 I=1,20
        DO 20 J=1,4
        FEM(I,J)=0.0
     20 CONTINUE
        DO 21 I=1,17
        DO 21 J=1,4
        OF(I,J)=0.0
     21 CONTINUE
        DO 30 I=1,10
        K=2*I-1
        L=2*I
        FEM(K,1)=+SPAN(I)**2/12.
        FEM(L,1)=-SPAN(I)**2/12.
     30 CONTINUE
        DO 45 I=3,6
        K=2*I-1
        L=2*I
        FEM(K,2)=+SPAN(I)**2/12.
        FEM(L,2)=-SPAN(I)**2/12.
     45 CONTINUE
        DO 55 I=1,5
        K=2*I-1
        L=2*I
        FEM(K,3)=+SPAN(I)**2/12.
        FEM(L,3)=-SPAN(I)**2/12.
     55 CONTINUE
        DO 60 I=9,10
        K=2*I-1
        L=2*I
        FEM(K,3)=+SPAN(I)**2/12.
        FEM(L,3)=-SPAN(I)**2/12.
     60 CONTINUE
```

```
      DO 70 I=1,2
      K=2*I-1
      L=2*I
      FEM(K,4)=+SPAN(I)**2/12.
      FEM(L,4)=-SPAN(I)**2/12.
   70 CONTINUE
      DO 75 I=6,8
      K=2*I-1
      L=2*I
      FEM(K,4)=+SPAN(I)**2/12.
      FEM(L,4)=-SPAN(I)**2/12.
   75 CONTINUE
      DO 80 J=1,4
      QF(1,J)=-FEM(1,J)
      QF(11,J)=-FEM(20,J)
   80 CONTINUE
      DO 81 J=1,4
      DO 81 I=2,10
      M=2*I-2
      N=2*I-1
      QF(I,J)=-(FEM(M,J)+FEM(N,J))
   81 CONTINUE
      DO 85 M=1,2
      I=11+M
      K=2*M-1
      L=2*M
      QF(I,1)=(SPAN(K)+SPAN(L))/2.
   85 CONTINUE
      QF(14,1)=(SPAN(4)+SPAN(5))/2.
      QF(15,1)=QF(14,1)
      QF(16,1)=QF(13,1)
      QF(17,1)=QF(12,1)
      QF(13,2)=(SPAN(3)+SPAN(4))/2.
      QF(14,2)=(SPAN(4)+SPAN(5))/2.
      QF(15,2)=QF(14,2)
      QF(16,2)=QF(13,2)
      QF(12,3)=(SPAN(1)+SPAN(2))/2.
      QF(13,3)=(SPAN(3)+SPAN(4))/2.
      QF(14,3)=(SPAN(4)+SPAN(5))/2.
      QF(17,3)=QF(12,3)
      QF(12,4)=(SPAN(1)+SPAN(2))/2.
      QF(15,4)=(SPAN(6)+SPAN(7))/2.
      QF(16,4)=(SPAN(7)+SPAN(8))/2.
C     PART 2  BY DISPLACEMENT METHOD
  101 READ (1,1) INA,IMA,INP
      READ (1,2) ((A(I,J),I=1,INA),J=1,IMA)
      READ (1,2) ((STIF(I,J),I=1,INA),J=1,INA)
      CALL TRAM (A,INA,IMA,B)
      CALL AMM (STIF,A,INA,IMA,INA,P)
      DO 5 I=1,IMA
      DO 5 J=1,IMA
    5 A(I,J)=P(I,J)
```

```
      CALL AMM(B,A,IMA,IMA,INA,STIF)
      DO 8 J=1,IMP
      DO 8 I=1,IMA
    8 P(I,J)=CF(I,J)
      CALL MATINV (STIF,INA,P,IMP,DET)
      CALL AMM(A,P,INA,IMP,IMA,B)
      DO 10 J=1,IMP
      DO 10 I=1,INA
   10 AM(I,J)=B(I,J)+FEM(I,J)
      X=0.
      SPN=SPAN(1)+SPAN(2)
      R=(AM(4,1)+SPN**2/2.)/SPN
      DO 110 J=1,IFSN
      PM(J)=R*X-X**2/2.
      X=X+5.
  110 CONTINUE
      X=5.0
      SPN=(SPAN(3)+SPAN(4)+SPAN(5))
      R=(AM(10,1)+AM(5,1)+SPN**2/2.)/SPN
      DO 120 N=1,ISSN
      J=N+IFSN
      PM(J)=R*X-AM(5,1)-X**2/2.0
      X=X+5.
  120 CONTINUE
      MN=III/2
      DO 121 KI=1,MN
      J=MN+1+KI
      KJ=MN+1-KI
      PM(J)=PM(KJ)
  121 CONTINUE
  300 FORMAT (     10X,5F14.6)
  302 FORMAT (     20X,'MC=',F14.6)
  303 FORMAT (     20X,'MB=',F14.6)
  304 FORMAT (     20X,'MD=',F14.6)
  280 FORMAT ('1',10X,'MOMENT ORDINATES DUE TO A UNIT UNIFORM
     1 DEAD LOAD')
      WRITE (3,280)
      WRITE (3,300) (PM(J),J=1,III)
      WRITE (3,303) AM(4,1)
      WRITE (3,302) AM(10,1)
      WRITE (3,304) AM(16,1)
      X=0.0
      SPN=SPAN(1)+SPAN(2)
      R=(AM(4,4)+SPN**2/2.)/SPN
      DO 130 J=1,IFSN
      PM(J)=R*X-X**2/2.0
      X=X+5.
  130 CONTINUE
      X=5.0
      SPN=SPAN(3)+SPAN(4)+SPAN(5)
      R=(AM(5,4)+AM(10,4))/SPN
      DO 131 N=1,ISSN
      J=IFSN+N
```

```
      PM(J)=R*X-AM(5,4)
      X=X+5.
  131 CONTINUE
      X=5.0
      SPN=SPAN(6)+SPAN(7)+SPAN(8)
      R=(AM(16,4)+AM(11,4)+SPN**2/2.)/SPN
      DO 140 N=1,ISSN
      J=N+IFSN+ISSN
      PM(J)=R*X-AM(11,4)-X**2/2.
      X=X+5.
  140 CONTINUE
      X=5.0
      SPN=SPAN(9)+SPAN(10)
      R=AM(17,4)/SPN
      KMN=IFSN-1
      DO 141 N=1,KMN
      J=N+IFSN+2*ISSN
      PM(J)=R*X-AM(17,4)
      X=X+5.0
  141 CONTINUE
  350 FORMAT ('0',10X,'MOMENT ORDINATES DUE TO A UNIT
     1 UNIFORM LIVE LOAD IN SPANS AB AND CD')
      WRITE (3,350)
      WRITE (3,300) (PM(J),J=1,ITI)
      WRITE (3,303) AM(4,4)
      WRITE (3,302) AM(10,4)
      WRITE (3,304) AM(16,4)
  301 FORMAT ('1',5X,'MAX. MOM. FOR MC DUE TO UNIT UNIFORM
     1 LIVE LOAD')
  307 FORMAT ('0',20X,'MC=',F14.6)
  308 FORMAT ('0',20X,'MC=',F14.6)
  309 FORMAT ('0',20X,'MD=',F14.6)
      WRITE (3,301)
      WRITE (3,307) AM(10,2)
      WRITE (3,308) AM(4,2)
      WRITE (3,309) AM(16,2)
  310 FORMAT ('0',5X,'MAX. MOM. FOR MB DUE TO UNIT UNIFORM
     1 LIVE LOAD')
      WRITE (3,310)
      WRITE (3,308) AM(4,3)
      WRITE (3,307) AM(10,3)
      WRITE (3,309) AM(16,3)
      STOP
      END
```

* THE SUBROUTINES USED IN THIS PROGRAM ARE THE SAME AS THOSE USED IN PROGRAM 1.

A STUDY TO DETERMINE THE OPTIMUM END SPAN LENGTH FOR A STANDARD FOUR SPAN INTER-STATE HIGHWAY GRADE SEPARATION

by

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AN ABSTRACT OF A MASTER'S REPORT

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MASTER OF SCIENCE

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In the design of highway grade separation structures, there has been considerable discussion as to the economical advantage of shortening the end span almost to the point where uplift would occur at the abutment. This study used a trial and error method to determine the optimum end span lengths for girders with prismatic haunches for various ratios of the moment of inertia over the piers to the moment of inertia at mid-span. The dead load of the girder was taken as the average weight of the girder and the design of stiffeners and diaphrams was omitted for purposes of simplifying the calculations.

The criteria which governed this study are as follows:

1. The interior spans are 95 feet each.
2. There is to be no uplift at the abutments.
3. H20-44 loading is to be used.
4. The girders are to have a prismatic haunch over the interior supports. (The ratios of the moment of inertia at the supports to the moment of inertia in the positive moment regions of the girders investigated are 1.0, 1.5, and 2.0.)
5. Use the AASHO Specification 1965 Edition.
6. A non-composite reinforced concrete deck is to be used on the welded girders.
7. For design, use the uplift resulting from the loading which includes the concentrated loads for moment but not for shear.
8. Use A-36 steel.

Since this report was confined to working only with the superstructure, the most economical structural length was not necessarily found. To determine this length the cost of the structural steel, the reinforced concrete and the substructure would have to be considered. The minimum girder weight occurred for n_i=2 and AL=52' (where AL is the end span length). However, the quantity of reinforced concrete will increase as the span length increases, therefore if the whole superstructure is considered the optimum length might well be different from that indicated for the girders alone.

The study indicates that the range of lengths in which the minimum weight of girders will fall, with no uplift at the abutments, is relatively narrow. This range appears to be from approximately 47' to 52' for the range of parameters studied.