Draft Final Report

ANALYSIS OF PRESTRESSED DOUBLE-TEE BRIDGE SLAB DECK

Precast/Prestress Concrete Institute
Chicago, Illinois

by
Timothy Lee Schmitz, Graduate Research Assistant
Chai (Jay) H. Yoo, Faculty Advisor
Auburn University
Highway Research Center
Auburn University, Alabama

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ABSTRACT

A double-tee bridge system, longitudinally pretensioned and transversely post-tensioned, is examined in this report for use in short span to medium span bridges. The use of double-tees provides an alternative design to the conventional state and federal prestressed girders with a cast in place deck. This alternative design is considered for two reasons. First, rerouting of traffic during construction results in added congestion and lost monetary resources. By limiting the down time, the number of congested days during construction is decreased. Secondly, city and county highway departments are unable to own equipment needed to repair and replace municipal bridges. By specifying a more manageable and completely plant cast cross section the municipalities are able to replace bridges with municipal workers.

Three cross sections of one, two, three and four lane bridge models ranging 20, 28, 36, 44, 52 and 60 feet in length were analyzed to determine their structural behavior using GRIDDBL, a stiffness method based grid analysis computer program.

The analysis revealed that the transverse prestressing did not significantly decrease the required longitudinal section. Substantial advantages are still

realized by using the transverse prestressing. The advantages are: added durability, adequate fatigue life, lower down time and increased two-way action between tees. Also, the shear requirement between double-tees is adequately met thereby eliminating the need for proprietary shear connectors.

ACKNOWLEDGEMENTS

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I. Introduction

1.1 Statement of Problem

The Federal Highway Administration (FHWA) reported in 1979 that 105,000 bridges in America were deficient.[1] As of June 1988, 23.5% of the 577,710 bridges surveyed in the nation were structurally deficient and 17.7% were functionally obsolete. In Alabama, greater than 25% of structural steel and timber bridges are structurally deficient.[2] Also, approximately two-thirds of the bridges in America are 20- to 60-feet in length.[3] The equipment currently available to many city, county and municipal engineering departments is not able to handle standard modular units longer than 34 feet.[4] The project reported here was initiated to examine a viable and efficient method for replacing short span bridges. In choosing a structural system consideration was given to: the duration of construction, the city and county equipment and skill required, the structural integrity, durability, fatigue life, economics of construction (including cost to the public due to congestion from rerouted traffic) and maintenance. An attractive structural system considered here is a pretensioned double-tee superstructure with a transverse (with respect to traffic direction) post-tensioned slab deck.

1.2 Literature Survey

There has been a substantial amount of research completed on the use of prestressed concrete in bridges. The first American use of Quastave Mendel's theory of prestressed concrete was the Walnut Lane Memorial Bridge in Philadelphia, Pennsylvania in 1950.[5] Since that time the use of prestressed concrete has grown by leaps and bounds. Today, nearly one-half of the new bridges constructed have a prestressed superstructure.[2] The amount of research conducted and the acceptability of prestressed concrete to the industry is immense due to the efficient use of valuable resources.

The application of transverse prestressing is relatively new in America. Elsewhere experimental testing began as early as 1963 at the Seato Graduate School of Engineering in Bangkok, India. Cusens and Abbassi tested square slabs with varying amounts of transverse prestressing.[6]

The first application of transverse post-tensioning in the United States was an interstate highway overpass in Dallas constructed in 1973. The Texas Highway Department engineers were faced with a problem of deck warping due to random locations of the columns. The odd placement of columns were governed by geometric constraints. In order to reduce tensile cracking in the new structure, designers called for longitudinal and transverse post-tensioning of the composite slab deck. The deck was supported by a steel superstructure.[7]

Later, Tedesko wrote an article commenting on the successes with transverse prestressing in Europe. He also commented on two box girder bridges (Pine Valley Creek Bridge, Eel River Bridge) in California and a bridge in Chicago, Illinois (Prefential Bridge) which also utilized the idea. He offered several solutions in his article to reducing moisture penetration which would reduce the damage of freeze-thaw cycles.[8]

Martin and Osburn examined longitudinal and transverse connections via case histories and laboratory experiments in a Federal Highway Administration Report published in August 1983. They concluded that a high strength or epoxy grout key with post-tensioned ties was a sufficient mechanism to transfer shear between precast units.[9]

In late 1985, Poston, Phillips, Almustafa, Breen and Carrasquillo in association with the Center for Transportation Research at the University of Texas at Austin produced three reports regarding transverse prestressing. Poston and his colleagues performed extensive analytical and experimental research focused on prestressed AASHTO girders with diaphragms and a cast in place post-tensioned deck. The first of the three reports summarized the laboratory experiments where the effects of corrosion from an aggressive deicing salt were investigated.[10]

The second report consisted of findings from an experimental and analytical examination of the bridge's structural integrity. From load tests, it was concluded that the transverse post-tensioning can effectively negate shrinkage and live load tensile stresses. Also, no substantial advantage results from using draped and straight strand configurations in the transverse direction as opposed to all strands being straight.[11] The final report collaborated findings from the first two reports and compared the findings with AASHTO Bridge Design Specification requirements.

In 1987, the Florida Department of Transportation funded a comprehensive analytical and experimental investigation of the longitudinally pre-tensioned and transversely post-tensioned bridge deck. The study included load testing a half scale model where data was collected to determine the joint behavior and overall behavior of the section. The study also included the examination of different straight and draped longitudinal strand profiles as well as an estimation of the fatigue life of the longitudinal V-joints between double-tees. It was concluded that an 150 psi average effective post-tensioning between double-tees will adequately provide a monolithic behavior of the slab deck[12] and will also provide adequate fatigue life of the joint.[13] They concluded from two bridges that were actually constructed using this idea, that the construction was speedier and labor costs were reduced. As a result of this research the Florida Department of Transportation has implemented the double-tee system into its specifications.[14]

1.3 Scope of Research

The research described in this report consists of analyses of bridge models with varying cross-sections, widths and lengths using a direct stiffness method computer program entitled GRIDDBL (grid - double precision). The data from 72 different bridge models show the longitudinal and transverse distribution of moments. The modeling technique is discussed in full and sample design calculations are given. Plots of the longitudinal moments along the transverse centerline are included to substantiate the conclusions.

II. Analysis of Double-Tee Bridge Slab Deck System

2.1 General Analysis

The analysis consisted of bridge models having 1, 2, 3, and 4 lane widths (32, 48, 56, 72 feet) and six lengths (20, 28, 36, 44, 52, 60 feet). All bridge models were non-skewed. Diaphragms are generally not used in double-tee bridges, so diaphragms were not included in the models. Each combination of the above widths and lengths were analyzed using three different cross sections (5 in. slab - 18 in. deep, 6 in. - 24 in. deep, 7 in. - 36 in. deep) for a total of 72 hypothetical bridge models.

Two models were used in the research reported here. The preliminary model was discarded after consultation with industry representatives. The results from the second model were used as the basis for this report. Both models are discussed in this chapter.

2.2 Grid Modeling Technique

It has been shown that a grid stiffness method of analysis will accurately model a bridge in which the primary action is the longitudinal bending moments and the axial forces and torsional moments are secondary in nature. This is opposed to a bridge with plate girders or deep wide flange sections which require a more accurate method of analysis.

The general grid model is directly dependent upon the software being used. The software used to analyze the models is written in FORTRAN coding and is based on the direct stiffness method. Dr. Yoo of Auburn University developed GRIDDBL (grid - double precision) based on an outline given by Gere and Weaver.[15] A sample input and output for the program can be found in Appendix A.

The general grid model consists of longitudinal and transverse members rigidly connected at points of intersection, or joints. The longitudinal members in the grid model used in this report represent a single tee. The transverse members represent the properties of the slab. The exterior joints along the first and last transverse rows are hinged to symbolize a simple span. Generally a minimum of five to eight longitudinal divisions should be made in order to maintain good (near 100%) accuracy. Past experience has shown that there is not a substantial increase in numerical accuracy if the number of longitudinal divisions is greater than ten. For simplicity, the preprocessor developed here, GEDATA, assumed longitudinal division four feet in length.

2.3 Preliminary Modeling

The first bridge modeling (see Figure 1) was based on the assumption that the loads are distributed by the deck in a full two-way action. The transverse and longitudinal prestressing was designed based on the maximum transverse and maximum longitudinal moments, respectively, as determined from GRIDDBL. The uniform prestress required to maintain full compression across the model's transverse section was on the order of 500 psi. In turn, this stress resulted in a transverse steel requirement of one 1/2 in. diameter strand per 10 inches.

After consultation with industry experts, it was determined that this strand configuration was highly impractical and uneconomical. Therefore, this model was discarded.

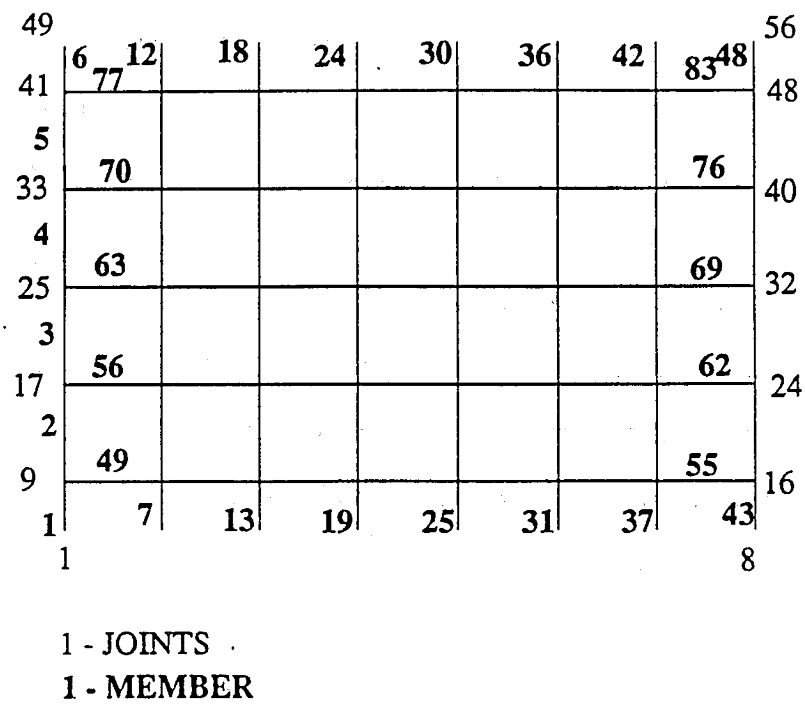

Figure 1 Preliminary Model

2.4 Final Model

After reconsideration it was determined that the next modeling should allow the recognition of how the transverse section contributes to the overall structural behavior. In the final grid model (see Figure 2), small (2 in.) fictitious transverse members, or hinges, were used at the real interior double-tee longitudinal joints. It was decided that if the rigidity (EI) of the fictitious members was varied, the effect of the prestressing force on the transverse moment resisting capacity of the section would be apparent. To vary the rigidity of the fictitious members the modulus of elasticity, E, was kept constant, and the moment of inertia was varied. To determine how a change in the transverse section's rigidity would affect the bridge behavior, each of the 72 bridge models was analyzed twice. These two models were identical except that the moment of inertia of the fictitious transverse members was adjusted to 10% and 0.5% of the full transverse slab section's moment of inertia. The purpose of adjusting the moment of inertia was to simulate the effect of the longitudinal joints (somewhat close to internal hinge connection, i.e., essentially no transverse moment but shearing force was transferred).

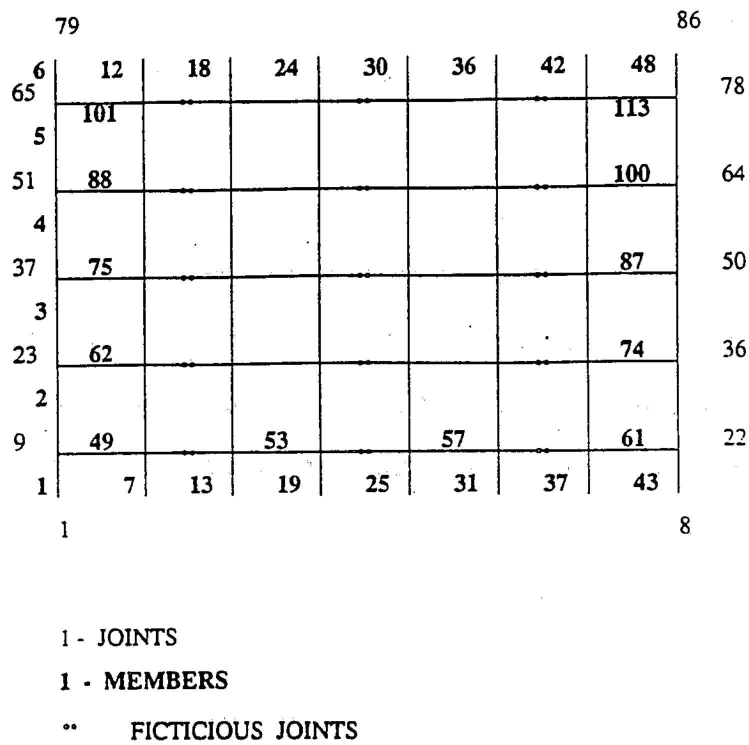

Figure 2 Sample Grid Model

2.5 Loading

The application of the live loads followed AASHTO's Standard Specifications for Highway Bridges[16] (1989). Specifically, sections 3.3 Dead Load, 3.8.2 Impact Formula, 3.11.4 Loading for Maximum Stress, 3.12 Reduction in Load Intensity, and 3.22 Combination of Loads were followed. The only deviation from the AASHTO recommendations was the use of a tri-axle dump truck (see Figure 3) instead of the HS20-44 truck loading. The tri-axle dump loading truck was used because it generally produces the largest moments in short bridge spans.

The exterior longitudinal members were also loaded with a rail dead load. The cross section of the rail used for calculating loads can be seen in Figure 4.

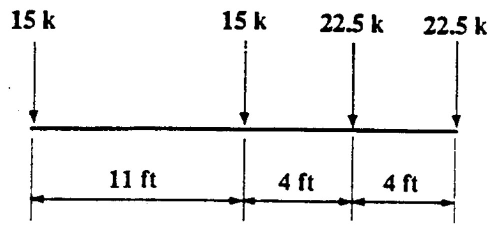

Figure 3 Tri-axle Dump Loading

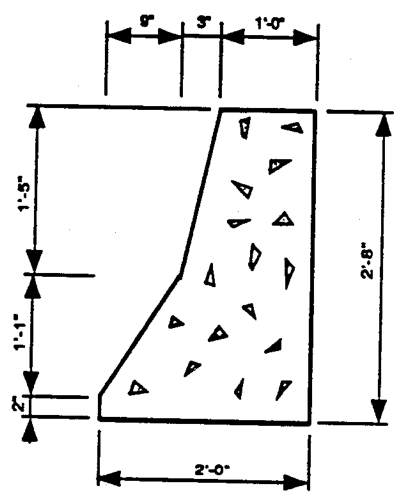

Figure 4 Precast Rail Cross-Section

The following calculations are used to determine the factored loads.

Dead Load:

Case 1 : Double Tee with 5 in. slab.

unit weight of concrete = 150 pcf (AASHTO 3.3.6)*
longitudinal member area = 369.2 in^2
grid spacing = 4 ft
DL = dead load
DL = (4 ft)(369.2 in^2)(150 pcf)(1 ft^2/144 in^2)
= 1538.3 lb
= 1.54 k

Case 2 : Double Tee with 6 in. slab.

unit weight of concrete = 150 pcf (AASHTO 3.3.6)*
longitudinal member area = 461.3 in^2
grid spacing = 4 ft
DL = dead load
DL = (4 ft)(461.3 in^2)(150 pcf)(1 ft^2/144 in^2)
= 1922.1 lb
= 1.92 k

Case 3 : Double Tee with 7 in. slab.

unit weight of concrete = 150 pcf (AASHTO 3.3.6)*
longitudinal member area = 597 in^2
grid spacing = 4 ft
DL = dead load
DL = (4 ft)(597 in^2)(150 pcf)(1 ft^2/144 in^2)
= 2487.5 lb
= 2.49 k

Rail Load:

rail area = 3.6875 ft^2
R = rail dead load
R = (4 ft)(3.6875 ft^2)(150 pcf)
= 2212.5 lb
= 2.2 k

Factored Dead Load:

D_f = factored dead load
γ = 1.3, load factor as per AASHTO Eq. 3-10
β_D = 1.0, coefficient as per AASHTO Table 3.22.1A

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* denotes AASHTO provision numbers.

$D_f = \gamma(\beta_D(DL+R))$ (AASHTO 3-10)**

Live Load:

Case 1: 1 or 2 lane bridge (AASHTO 3.12.1)*

LL = actual live load

= 7.5 k (front wheel)
= 11.25 k (rear wheel)

Case 2: 3 lane bridge (AASHTO 3.12.1)*

LL = 0.9 * actual live load
= 0.9*7.5 = 6.75 k (front wheel)
= 0.9*11.25 = 10.13 k (rear wheel)

Case 3: 4 lane bridge (AASHTO 3.12.1)*

LL = 0.75 * actual live load
= 0.75*7.5 = 5.63 k (front wheel)
= 0.75*11.25 = 8.44 k (rear wheel)

Impact:
L = live load
I_F = live load impact factor
I = live load impact
L_N = 20 ft = length of bridge

$$I_F = \frac{50}{L_N+125} \leq 0.30$$ (AASHTO 3-1)**

$$I_F = \frac{50}{20+125} = 0.345 > 0.3$$

Since I_F is greater than 0.3, therefore, I_F is set to 0.3.

** denotes AASHTO equation numbers.

* denotes AASHTO provision numbers.

Factored Live Load:

L_f = factored live load
γ = 1.3, load factor as per AASHTO Eq. 3-10.
β_L = 1.67, coefficient as per AASHTO Table 3.22.1A
$L_f = \gamma(\beta_L(LL+I)_n)$

The dead loads are distributed evenly to each intersecting joint. The live loads were distributed proportionally with respect to there location within the four cornered grid element. The maximum longitudinal moments (presented in Appendix B) for various hypothetical bridge models were generated using service load combinations so that they can be used for either service load design or load factor design. It should be noted that the maximum longitudinal moments do not reduce significantly due to the addition of the transverse post-tensioning in a bridge model, the capability of the transverse shear transfer is retained.

III. Double-Tee Shape

3.1 PCI Section

The standard sections listed in PCI Design Handbook[17] does not include double-tee sections for bridges. The main difference between a double-tee for a deck and a double-tee for a bridge is that the bridge section has a deeper slab and a wider flange. The industry has adopted proprietary shapes tailored to their individual design philosophies. One example is the NE KA MO IA double tee bridge beams shown in Figure 5. This section was developed by Wilson Concrete.[18]

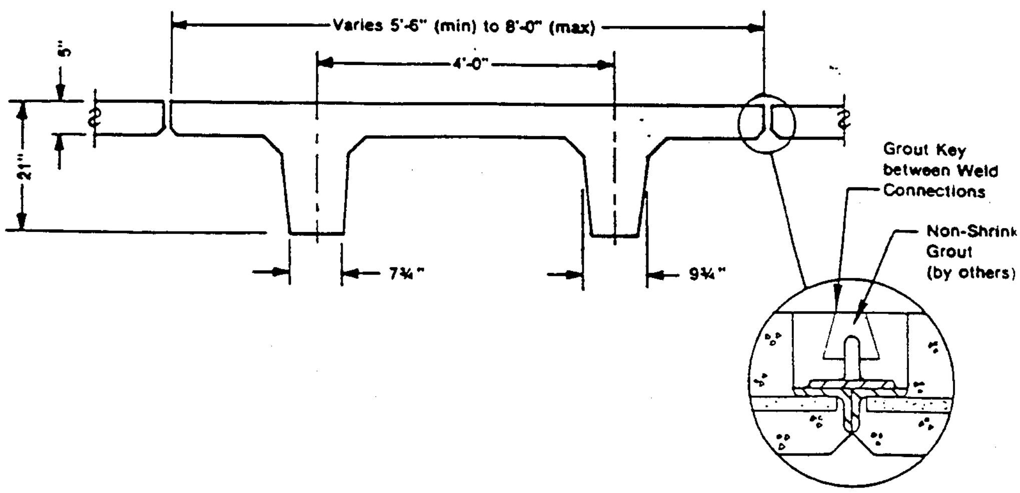

Figure 5 NE KA MO IA Double Tee Bridge Beam

The prototype beam used during the research by the Florida Department of Transportation,[13] is shown in Figure 6.

Using these two sections as a guide, three sections were chosen to be examined in this research as shown in Figures 7, 8 and 9.

The software developed by Yoo and Acra[19] was used to obtain the section properties for the three prototype cross sections.

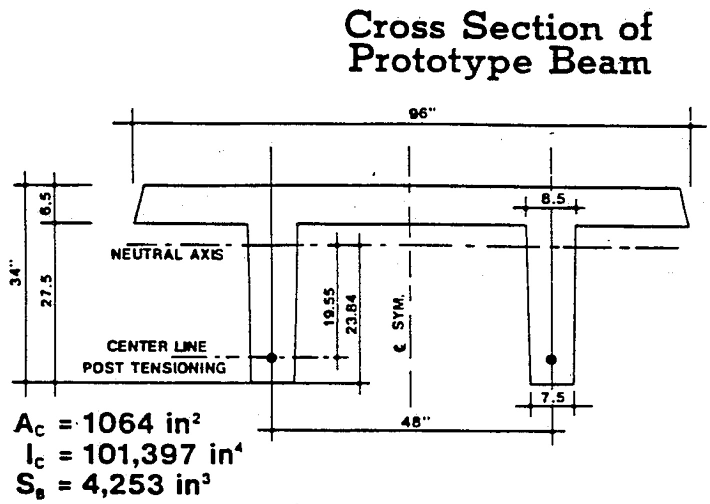

Figure 6 Florida Department of Transportation Prototype

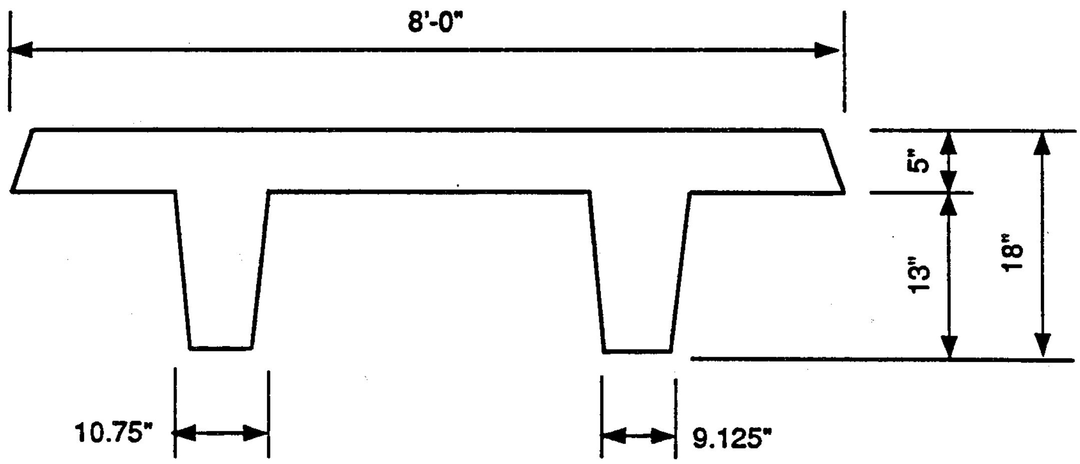

Figure 7 The 5" slab, 18" deep prototype double T-beam

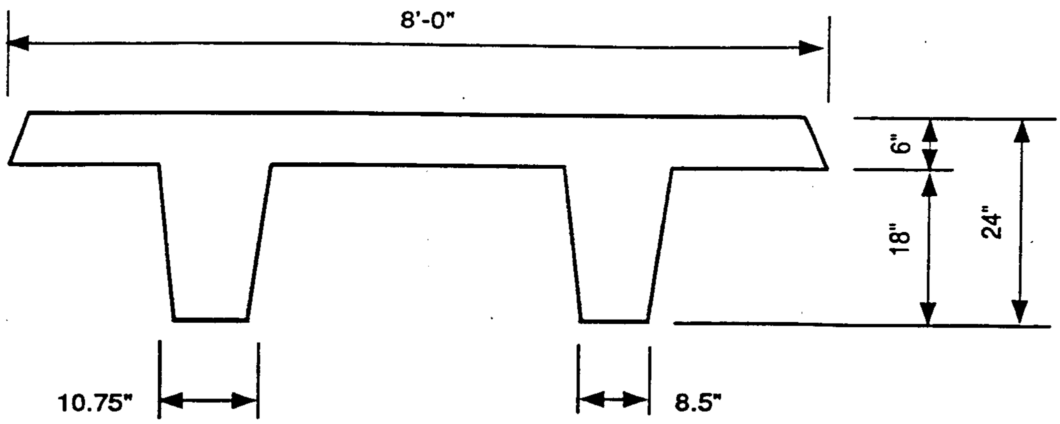

Figure 8 The 6" slab, 24" deep prototype double T-beam

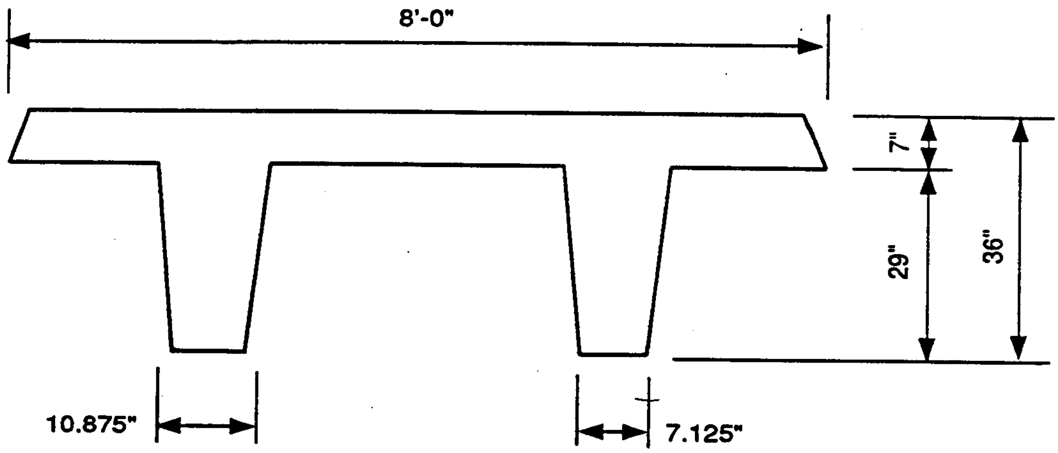

Figure 9 The 7" slab, 36" deep prototype double T-beam

The FORTRAN coded software, SECP (section property) will find the flexural and torsional properties of open, closed, and multi-celled cross sections. The information needed for this project was the cross sectional area, moment of inertia about the x-axis (principal bending axis) and the St. Venant's torsion constant. A sample of input and output data is included in Appendix A.

IV. Transverse Prestressing Design and Punching Shear

4.1 Transverse Action

As discussed earlier the original grid model was based on the hypothesis that the transverse post-tensioning design is determined by the transverse moment. Upon further examination of the analysis results, it was determined that the transverse post-tensioning design should also be based on the shear between precast components.

4.2 Grid Analysis Results

An examination of the distribution of transverse moment taken directly from the grid analysis computer output reveals that it is unrealistic. This unreasonable transverse moment distribution may be attributed to two major causes.

First, the idealization of the tandem truck wheel load as a concentrated load appears unsatisfactory. Although a concentrated load idealization is generally acceptable when the contact length of the distributed wheel load is relatively short as compared to the overall span length as in the case of the longitudinal moment distribution by invoking the St. Venant principle, it is far from satisfactory when the contact width of the wheel load is in the same order of magnitude as the spacing of the double tee ribs.

Second, the way in which work equivalent joint loads are evaluated using a double interpolation scheme considering only the vertical component of the wheel load is not considered ideal. This may be an inherent limitation of modeling the deck which is essentially a semi-infinite plate resting on a series of elastic foundations as a reticulated open grid. Arguably, there exists a genuine debate on how to adequately represent the work equivalent joint torque and bending moment resulting from a concentrated load located in-between grid joints. Again, neglecting these components do not affect the macroscopic analysis result (St. Venant principle) such as the longitudinal moment, but it appears that the localized response such as the transverse moment is affected.

Therefore, the punching shear resistance will be checked based on an equilibrium condition of an isolated local zone. Transverse post-tensioning design will also be based on an equilibrium condition of an isolated local zone. Since this equilibrium approach essentially neglects any continuity that exits between the two adjacent outstanding flanges of the double tees, a conservative result is assured.

A harped or draped tendon profile would neither be feasible nor practical. In addition, Post and others[11] determined that no appreciable advantage was achieved by a draped or harped profile for the transverse post-tensioning. A profile of constant eccentricity located at the flange's centroid will produce a relatively constant compressive force throughout the slab deck. The compressive force will serve two purposes. The first will aid in the shear transfer between precast components. Second, the force will aid in reducing the tensile stresses in the slab deck. With the reduction of the tensile stresses in the slab deck a reduction in crack propagation will also be achieved.[11]

4.3 Punching Shear

It appears that the current AASHTO Specifications[16] do not require checking the possibility of a punching shear failure caused by a heavy wheel load. However, a very thin roadway slab (5 inches being the thinnest considered in this research project) may present a potential weakness in this regard. Therefore, a punching shear check will be made using provisions presented in the current ACI Code[20]. The following calculations illustrate the determination of the punching shear strength.

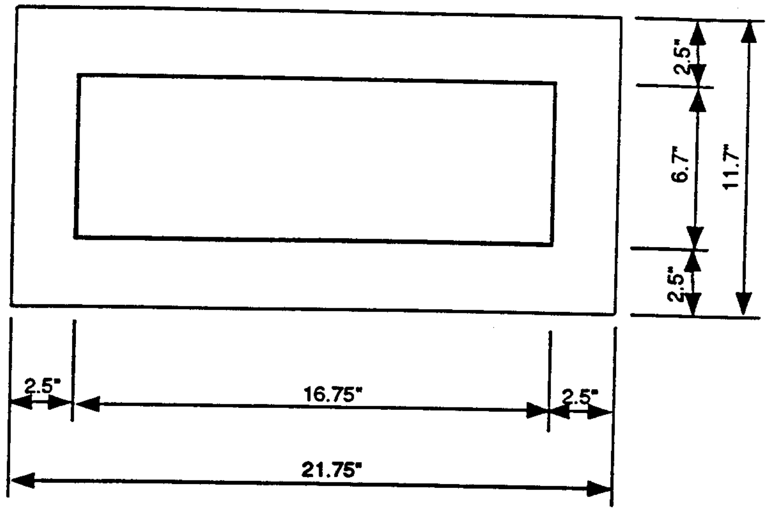

Figure 10 Punching Shear Area

Calculations:

The maximum rear wheel load = 22.5/2 = 11.25 k
A = Assumed tire contact area = 0.01 P (AASHTO 3.30)*
P = wheel load in pounds
A = 0.01(11.25 k)(1000 lb/k)
= 112.5 in^2
L = length of tire contact area
W = width of tire contact area

L = 2.5W (AASHTO 3.30)*
A = LxW = W*2.5W
W = $(A/2.5)^{1/2}$

W = 6.7 in
L = 2.5x6.7 = 16.75 in

Punching shear calculations are conservatively based on the

width area portion being controlled by the prestressed equations and the length area portion based on the

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* denotes AASHTO provision numbers

nonprestressed equations as shown in Figure 10, since longitudinal prestressing is concentrated on the lower stem.

t_s = flange thickness = 5 in.
W = W+t_s/2+t_s/2 = 6.7+5/2+5/2 = 11.7 in
L = L+t_s/2+t_s/2 = 16.75+5/2+5/2 = 21.75 in
w_o = effective width of tire contact area = 2*W
= 2x11.7 = 23.4 in
f'c = 8000 psi > 5000 psi therefore, f'c = 5000 psi

ACI Code 318-89[20] requires the punching shear strength of prestressed concrete with a concrete strength greater than 5000 psi to be calculated using the provisions in section 11.12.2.1 of the Code with f'c = 5000 psi.

Nonprestressed contribution:

$$\begin{aligned} V_c &= \left(2+\frac{4}{\beta_c}\right)\sqrt{f'c}\,b_o d \\ \beta_c &= \frac{L}{W} \\ &= 2.5\frac{W}{W} \\ &= 2.5 \\ V_c &= \left(2+\frac{4}{2.5}\right)\sqrt{8000}\,(43.5)\,(5) \\ &= 70k \end{aligned} \tag{4.1}$$

$$\begin{aligned} V_c &= \left(\frac{\alpha_s d}{b_o}+2\right)\sqrt{f'c}\,b_o d \\ \alpha_s &= 30 \\ V_c &= \left(\frac{30x5}{43.5}+2\right)\sqrt{8000}\,(43.5)\,(5) \\ &= 106k \end{aligned} \tag{4.2}$$

$$V_c=4\sqrt{f'c}\,b_o d$$
$$=4\sqrt{8000}(43.5)(5) \quad (4.3)$$
$$=77.8k$$

Equation 4.1 governs, therefore the nonprestressed contribution is 70.0 k.

Prestressed contribution:

$$V_c=(\beta_p\sqrt{f'c}+0.3f_{pc})b_o d+V_p \quad (4.4)$$
$$b_o=w_o=23.4inch$$
$$\alpha_s=30$$

$$\beta_p=\left(\frac{\alpha_s d}{b_o}+1.5\right)$$
$$=\left(\frac{30x5}{23.4}+1.5\right) \quad (4.5)$$
$$=7.9>3.5$$
$$=3.5$$

$$V_p=P_e\sin\theta=0,@midspan$$
$$f_{pc}=\frac{(1-.11)x106.34k}{369.2inch^2} \quad (4.6)$$
$$=0.256ksi$$

$$V_c=(3.5x\sqrt{5000}+0.3x256)b_o xd$$
$$=(247.5+76.9)x23.4x5 \quad (4.4)$$
$$=38k$$

V_n = 70.0 + 38.0
= 108.0 k
ϕ = 0.90, as per AASHTO provision 9.14
V_u = 31.75 k, factored rear wheel load
ϕV_n = (0.90)(108)
= 97.2 k

Since ϕV_n = 97.2 k is greater than V_n = 31.75 k, the punching shear requirement is met.

4.4 Transverse Post-Tensioning Design

The numerical calculation example presented in this section is based on a hypothetical bridge, 20 feet in span, 32 feet width of roadway (5 inch thick slab) including shoulders on both sides. Design summaries for other slab thicknesses are given in Table 1.

Recalling from elementary physics, the phenomenon of static friction is given by

$$F=\mu N. \tag{4.7}$$

Equation 4.7 states that the force, F, required to overcome the frictional resistance to slide a block as shown in Figure 11, is equal to the product of the static coefficient of friction, μ, multiplied by the normal force, N.

The actions between precast components are similar to the example of determining the force required to move a block on a flat table as shown in Figure 11. In this situation the unfactored normal force was determined from the output by GRIDDBL as the maximum shear force at the location of the fictitious joints. Recapping, the fictitious joints are located on the real bridge at the longitudinal joint between double-tee beams.

A static coefficient of friction was conservatively chosen to be 0.3. P_e, effective prestressing force after losses (assuming an 11% loss), is equal to the reduction, R, multiplied by the initial prestressing force P_i.

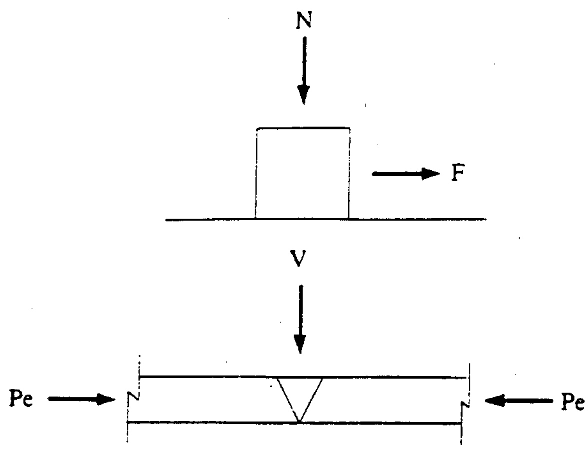

Figure 11 Graphic Relating Typical Friction and Precast Components

With the proper substitution in addition to the shear force, V, for the sliding force equation 4.7 now becomes:

$$P_e = RP_i$$
$$V = F \tag{4.8}$$
$$P_i = \frac{V}{Rx0.3}$$

Since the grid spacing for all cases is four feet, the initial prestressing force calculated is the force required for that four-foot width of flange. Also note that the method and calculations shown below assume that the grout filled V-joint will act as a butt joint between two adjacent double-tee flanges. Since this slip or friction is a serviceability requirement rather than a strength requirement, the maximum transverse shearing force due to service load will be used.

Sample calculations:

$F = V = 3.85$ k, the maximum transverse shear from GRIDDBL
$R = 0.89$

$$P_i = 4.32/(0.89x0.3) = 14.42 \text{ k} \quad (4.8)$$

$$f_{ps} = P_i/A \quad (4.9)$$
$t_s = 5$ in
$b_w = 48$ in
$A = t_s x b_w$
$$f_{ps} = (14.42 \text{ k})(1000 \text{ lb/k})/(5 \text{ inx}48 \text{ in}) = 60.1 \text{ psi}$$

$$P_i = f_{ps}xA = (60.1 \text{ psi})(5 \text{ in})(48 \text{ in}) = 14420 \text{ lb} = 14420 \text{ k} \quad (4.10)$$

$$A_{ps} = P_i / f_s \quad (4.11)$$
$f_{su} = 270$ ksi
$$f_s = 0.74 f_{su} = (0.74)(270) = 200 \text{ ksi} \quad (4.12)$$

$$A_{ps} = (16.176 \text{ k})/(200 \text{ ksi}) = 0.0721 \text{ in}^2$$

A_p/strand = 0.153 in^2 (1/2 in, 270 ksi, low-relaxation)

Number of strands required = $A_{ps}/(A_p/\text{strand})/4$ ft = 0.471 (4.12)

Use one (1/2 in.) strand / 4 ft (4.13)

Therefore, this transverse prestressing eliminates any proprietary shear connectors which are generally required as shown in Figure 5.

Finally a strength requirement will be made on the maximum negative moment in the flange of the double-tee beam. This negative moment can be calculated using statics, M = PL/2 assuming the transverse deck between two adjacent stems to be a clamped beam, where, P is half the wheel load (half to the other precast component) and L is the clear distance from the edge of the stem to the edge of the double-tee as shown in Figure 12. In order to ensure the validity and the conservatism of the proposed simplified equilibrium approach, a sample hypothetical bridge was analyzed using an eight noded brick element model as shown in Figure 13. The maximum normal stress developed in the finite element model is 500 psi which is considerably less than 678 psi based on the simplified equilibrium analysis as shown by equation 4.15 in the following calculations.

Calculations:

P_o = 31.75 k, the maximum factored wheel load.

P = $P_o/2$ = largest wheel load per precast flange as per Figure 12.
= 31.75/2
= 15.875 k

The following variables, L_s, L_o, L, L_1 and L_a, are defined as;

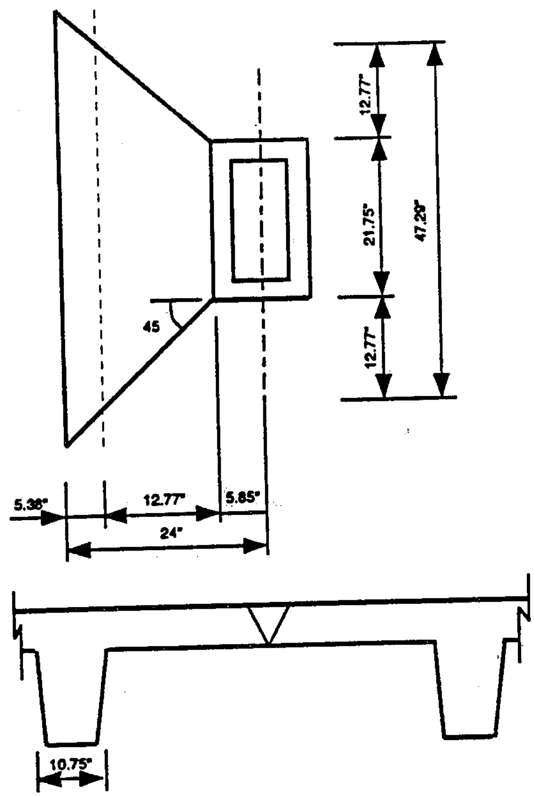

Figure 12 Contributing Area of Wheel Load

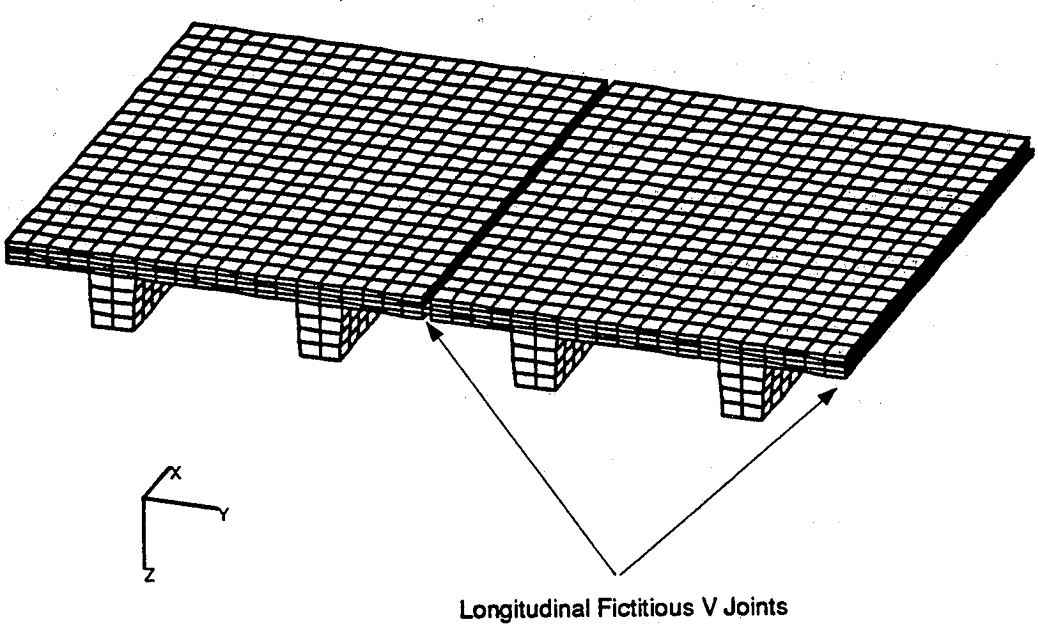

Figure 13 One Quarter Model of 20x32x5 Bridge

L_s = width of top of stem
= 10.75 in

L_o = distance from middle of stem to edge of outer flange
= 24 in

L = clear distance from stem to outer flange
= 24 - 10.75/2
= 18.6 in

L′ = moment arm length
= 18.6−3.35/2 = 16.9 in

L_1 = additional length due to distribution of forces at 45_o = L_o - W/2 - (stem width)/2
= 24 - 11.7/2 - 10.75/2
= 12.775 in.

L_a = contributing length
= 47.29 in
= 3.94 ft

M = PL′/2 - from statics (4.14)
= (15.875)(16.9)/2
= 134 lb-in
= 11.17 k-ft

M/ft = 11.17/3.94
= 2.83 k-ft/ft

σ = Mc/I (4.15)
I = $bh^3/12$ (4.16)
= $(12)(5)^3/12$
= 125 in^4

c = 2.5 in = half of the flange width.

σ = (2.83 k-ft/ft)(12 in/ft)(2.5 in) / 125 in^4 (4.15)
= 0.678 ksi
= 678 psi

f′c = 8000 psi
f_{ts} = AASHTO maximum allowable concrete tensile stress at service loads
= $6(f'c)^{1/2}$ = $6(8000)^{1/2}$ = 536 psi (4.16)

Allowing full tensile strength,
σ_p = 678 - 536 = stress needed by the tendons (4.17)
= 142 psi

$A = (t_s)(\text{Width}) / \text{ ft of flange}$ (4.18)
$= (5 \text{ in})(12 \text{ in})$
$= 60 \text{ in}^2$

$P_e = \sigma_p A$ = prestressing force at service loads (4.19)
$P_e = (142 \text{ psi})(60 \text{ in}_2)$
$= 8{,}520$ lb
$= 8.52$ k

P_i = prestressing force at transfer
$R = 0.89 = P_i/P_e$ - assume 11% loss
(4.20)
$P_i = P_e/R$
$= 8.52/0.89$
$= 9.57$ k

Revisiting equations (4.9) - (4.11) gives,

$A_{ps} = 9.57 \text{ k} / 200 \text{ ksi}$
(4.11)
$= 0.0479 \text{ in}^2$

again using 1/2 in, low-relaxation, 270 ksi strand yields

Number of strands/ ft = 0.0479/0.153 (4.12)
= 0.3127 strand/ft

Spacing = 1 - 1/2 in. strand / 38 in. (4.13)

For additional conservatism, consider 50% of full tensile strength of the concrete, and revisit equations 4.16 - 4.20 and equations 4.11 - 4.13 gives,

$0.50 f_{ts} = 268$ psi

Use one (1/2 in/.) strand/ 14 in. (4.13)

Similar calculations were carried out for the other two slab thicknesses and a heavier wheel. The results are summarized in Table 1.

It has been observed that the transverse shear and moment are not affected by the variation in span lengths.

Therefore, the design results given in Table 1 should be applicable to bridges regardless of their span length.

		Tansverse Shear				*Tansverse Moment*			
	Slab	$V_n(k)$	$V_u(k)$	$f_{ps}(psi)$	*NumStrand*	$M/ft(k-ft)$	$\sigma(psi)$	$M_{max}(k-ft)$	*NumStrand*
$11.25k$ (wheel)	5	108.0	31.75	60.1	0.471	2.83	678	6.416	0.87
	6	135.9	31.75	35.63	0.335	2.84	473	4.916	-
	7	153.3	31.75	16.75	0.158	2.84	355	2.045	-
$16k$ (wheel)	5	123.6	45.16	30.52	0.24	3.73	895	3.94	2.2
	6	154.7	45.16	18.67	0.176	3.80	633	3.664	0.69
	7	186.1	45.16	8.01	0.088	3.80	465	2.48	-

Table 1 Summary of transverse post-tensioning designs

It is apparent that the designer must allow tensile stresses equal to some fraction of the concrete's tensile strength to develop. The amount of tensile stress in which to allow to develop is to be based not a strength criteria but an economic criteria and is left to the designer's discretion.

V. Longitudinal Design

5.1 Design using PRESTRESS

In the longitudinal prestressing design, a standard design procedure was followed using Design of Prestressed Concrete[21], by Arthur H. Nilson and Prestressed Concrete: A Fundamental Approach[22], by Edward G. Nawy as a guide. The procedure was programmed in Pascal and entitled PRESTRESS.

The purpose of PRESTRESS is to give a general and rapid preliminary design. Upon completion of a successful run a more detailed analysis should be completed especially in the shear and deflection/camber calculations.

5.2 Mathematical Expressions and Variable Definitions

PRESTRESS program employs numerous mathematical expressions and equations, many of which are empirical equations adopted from reference[22]. In the following sections, some important expressions and variables are related and defined.

5.2.1 Prestress Reinforcement Calculation

In order to calculate the number of strands and prestress force required, the material adequacy of the provided double-tee section is first examined, it includes top and bottom section modulus.

Top Section Modulus

$St = I/C_t$

Bottom section Modulus

$S^b = I/C_b$

Lower Kern Point

$K_b = r^2/C_t$

Upper Kern Point

$K_t = r^2/C_b$

Where :

C_t is the distance from CG to top fiber

C_b is the distance from CG to bottom fiber

Maximum Allowable Stresses

(1) Transfer

tensile (f_{ti}) ---------- $3*(f'_{ci})$ (AASHTO 9.15.2.1)*

compression (f_{ci}) ------ $-0.6*f'_{ci}$

(2) Service

tensile (f_{ts}) ---------- $6.0*(f'_c)$ (AASHTO 9.15.2.2)*

compression (f_{cs}) ------ $-0.4*f'_c$

Top Section Modulus (required)

$$S^t \geq \frac{(1-\gamma)\times M_D + M_{SD} + M_L}{\gamma \times f_{ti} - fc}$$

Bottom Section Modulus (required)

---

* denote AASHTO provision numbers.

$$S^b \geq \frac{(1-\gamma)\times M_D + M_{SD} + M_L}{f_t - \gamma \times f_{ci}}$$

Where :

M_D ---- Dead load Moment

M_{SD} ---- Service Dead Load Moment

M_L ---- Live Load Moment

Initial Prestress (P_i)

$$f^t = -\frac{P_i}{A_c}\times\left(1-\frac{e\times c_t}{r^2}\right) - \frac{M_D}{S^t} \leq f_{ti}$$

$$P_i \geq -\frac{\left(f_{ti}+\frac{M_D}{S^t}\right)\times A_c}{(1-e\times c_t)}$$

Where :

A_c ---- Concrete Section Area

e ---- eccentricity

Effective Prestress (P_e)

$$P_e = \gamma \times P_i$$

Number of Strands Required (N)

$$N = \frac{A_p}{A_s} = \frac{P_i/f_{pe}}{A_s}$$
$$= \frac{P_i/(0.82\times f_{py})}{A_s}$$
$$= \frac{P_i/(0.82\times 0.7\times f_{pu})}{0.153}$$
$$= 11.39\times\left(\frac{p_i}{f_{pu}}\right)$$

Eccentricity Envelope

Upper Eccentricity (e_u)

$$\max\begin{cases} e=(f_{ti}-\overline{f}_{ci})\times\dfrac{S^t}{P_i}+\dfrac{M_D}{P_i},\ \overline{f}_{ci}=\dfrac{P_i}{A_c} \\ e=(-f_{ci}+\overline{f}_{ci})\times\dfrac{S^t}{P_i}+\dfrac{M_D}{P_i} \end{cases}$$

Lower Eccentricity (e_l)

$$\max\begin{cases} e=(f_{ti}-\overline{f}_{ci})\times(\dfrac{S^t}{P_e})+\dfrac{M_D}{P_i},\ \overline{f}_{ci}=\dfrac{P_e}{A_c} \\ e=(-f_{ci}+\overline{f}_{ci})\times\dfrac{S^t}{P_e}+\dfrac{M_D}{P_e} \end{cases}$$

5.2.2 Stress and Strain Checks

After the number of strands is determined, the stress and strain introduced by the service load are checked against the load carrying capacity of the double-tee beam prestressed with strands. At the same time, the final eccentricity of tendons is determined using a trial and error procedure.

Stresses (f_t, f_c)

$$f_{it}=-\frac{P_i}{A_c}\times(1-\frac{e\times c_t}{r^2})-\frac{M_D}{S^t}$$
$$f_{ic}=-\frac{P_i}{A_c}\times(1+\frac{e\times c_b}{r^2})+\frac{M_D}{S^b}$$
$$f_{st}=-\frac{P_e}{A_c}\times(1+\frac{e\times c_b}{r^2})+\frac{M_T}{S^t}$$
$$f_{sc}=-\frac{P_e}{A_c}\times(1+\frac{e\times c_t}{r^2})-\frac{M_T}{S^b}$$

Total Strain (e_{ps})

$$e_{ps} = e_1 + e_2 + e_3$$

$$e_1 = \frac{f_{pe}}{E_p}, \quad f_{pe} = 0.82 \times f_{py}$$

$$e_2 = \frac{P_e}{A_c \times E_c}\left(1 + \frac{e^2}{r^2}\right), P_e = N \times A_s \times f_{pe}$$

$$e_3 = \varepsilon_c \left(\frac{d-c}{c}\right)$$

$$c = \frac{a}{\beta_1}$$

$$\beta_1 = 0.85 - 0.05 \times (f_c - 4000)/1000$$

$$a = \frac{A_{ps} \times f_{ps} + A_s \times f_y}{0.85 f_c b}$$

$$d = h - \left(1.5' + 0.5' + \frac{5}{16}'\right) - 37.6'$$

5.2.3 Bending Moment Checks

The ultimate resisting moment and crack moment must satisfy the following conditions :

$$M_u \geq \Phi M_n, \quad \Phi = 0.9$$

$$1.2 M_{cr} \leq M_n$$

Nominal Moment (M_n)

$$M_n = A_{ps} \times f_{ps} \times \left(d_p - \frac{a}{2}\right) + A_s \times f_y \times \left(d - \frac{a}{2}\right) + A_s \times f_y \times \left(\frac{a}{2} - d'\right)$$

Factored Moment (M_u)

$$M_u = M_D + M_L$$

Crack Moment (M_{cr})

$$M_{cr} = \frac{I_g}{y_t}\left[-\frac{P_e}{A_c} \times \left(1 + \frac{e \times c_b}{r^2}\right) + 7.5\lambda\sqrt{f_c}\right]$$

5.2.4 Shear and Deflection Checks

Shear checking procedure is entirely based on the algorithm given in reference[22] and deflection checking is essentially based on the AASHTO governing criteria and empirical equations.

Shear (V_c)

When following condition is satisfied, no web reinforcement is needed.

$$\frac{V_u}{\phi} \leq \frac{1}{2} V_c$$

Where :

V_c = the nominal shear strength.

V_u = the factored shear force.

Deflection

$$\delta \leq \frac{L}{800} \qquad \text{(AASHTO 8.9.3.1)**}$$

The following is a sample output for the preliminary design.

```
                    Longitudinal Info
                 20ft long x 32ft wide
              -----------------------------

cross sectional area                    =   369.2 in2
Total Depth                             =   18.0
Flange Height                           =   5.0
Web Width                               =   9.9
Clear Distance b/w Webs                 =   38.1
moment of inertia                       =   9660.0 in4
St. Venant's torsion constant           =   7889.0 in3
Distance from CG to top fibers          =   5.7 in
```

Distance from CG to bottom fibers	=	12.3 in
Top Section Modulus	=	1709.7 in3
Bottom Section Modulus	=	782.2 in3
Radius of Gyration	=	26.2 in2
Upper Kern	=	2.1 in2
Lower Kern	=	4.6 in2
effectiveness ratio	=	0.89
f'ci	=	6.0 ksi
f'c	=	8.0 ksi

Strand data
- fpu = 270 ksi
- fe = 0.0 ksi
- dia = 0.5 in
- area = 0.2 in2
- low-relaxation steel

Maximum Allowable Stresses (psi)

Transfer	
tensile	232.4
compression	-3600.0
Service	
tensile	536.7
compression	-3600.0

Top Section Modulus
- required = 140.10 in3
- provided = 1709.73 in3

Bottom Modulus
- required = 142.71 in3
- provided = 782.19 in3

Initial Prestress = 106.34 k
maximum eccentricity = 10.85 in

5 strand(s) are required.

x (f)	Mo (k-f)	Mt (k-f)	e-ll (in)	e-ul(in)
0.0	.00	0.00	8.4	-6.6
2.0	17.00	33.00	10.3	-2.4
6.0	20.00	40.00	10.6	-1.5
10.0	21.00	53.00	10.7	0.2
14.0	22.00	64.00	10.8	1.6

****

		transfer		service	
x(in)	e(in)	ft	fc	ft	fc

0.0	0.0	-288.0	-288.0	-256.1	-256.1
2.0	5.4	-69.9	-764.7	-405.4	-187.7
6.0	10.8	246.4	-1456.2	-953.7	63.1
10.0	10.9	239.4	-1440.9	-754.3	-28.1
14.0	10.8	232.4	-1425.6	-585.5	-105.3
ACI Allow		232.4	-3600.0	536.7	-3600.0

```
eps           =  -0.0242500
Mn            =  166.39 kf
fps           =  200.00 ksi
Mu            =  102.20 kf
a             =  0.4 in
c             =  0.4 in
1.2*Mcr =   175.07 kf
Mn      =   166.39 kf
```

Shear Calculations

No web steel required.

Estimated Deflections

Initial deflection = 0.091 in
Service deflection = -0.276 in
Long-term live load deflection = -0.337 in
AASHTO maximum allowable live load deflection = -0.651 in

VI. Results, Conclusions and Recommendations for Further Research

6.1 Results and Conclusions

Upon examination of the Appendix B, it has been observed that no significant reduction in the longitudinal moment will be realized with the addition of the transverse post-tensioning. The additional post-tensioning does offer several other advantages such as: adequate shear transfer between precast components. Based on tests by other researchers transverse post-tensioning also provides adequate fatigue life, added durability and increased two way action between precast components. Other advantages associated with being a complete precast system are: better quality control, speedier construction, relative ease to assemble and economically competitive.

6.2 Recommendations for Further Research

The GRIDDBL software, being stiffness method based, was unable to calculate transverse moments and shearing forces accurately primarily due to its inability to model the distributed truck tire pressure on the deck. The software also was unable to accommodate the effects of the prestressing force other than the analogy used in this report which was adjusting the stiffness of the fictitious members. A reasonably simple software other than a complete finite element package with the capabilities of taking these two factors into account at a reasonable cost and effort will aid the designer considerably.

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APPENDIX A

SAMPLE INPUT AND OUTPUT

Input file for SECP.

```
T6D24.dat
5,4,0,0,1,3,0,
1,0.,0.,
2,24.,0.,
3,48.,0.,
4,24.,-10.5,
5,24.,-21.,
1,1,2,6.,0,0,0,0,
2,2,3,6.,0,0,0,0,
3,2,4,10.125,0,0,0,0,
4,4,5,9.,0,0,0,0,
```

SECTION PROPERTIES

TOTAL CROSS SECTIONAL AREA	= 0.48881D+03
MOMENT OF INERTIA ABOUT X-AXIS	= 0.20513D+05
MOMENT OF INERTIA ABOUT Y-AXIS	= 0.56842D+05
PRODUCT OF INERTIA	= 0.00000D+00
ANGLE IN DEGREES TO PRINCIPAL COORDINATES	= 0.00000D+00
MOMENT OF INERTIA ABOUT PRINCIPAL X-AXIS	= 0.20513D+05
MOMENT OF INERTIA ABOUT PRINCIPAL Y-AXIS	= 0.56842D+05
TORSION CONSTANT	= 0.96404D+04
WARPING CONSTANT	= 0.71709D+03
STABILITY PARAMETER BETAX	= 0.00000D+00
STABILITY PARAMETER BETAY	=-0.22892D+01
STABILITY PARAMETER UW	= 0.00000D+00
POLAR RADIUS OF GYRATION	= 0.13223D+02
RADIUS OF GYRATION ABOUT PRINCIPAL X-AXIS	= 0.64780D+01
RADIUS OF GYRATION ABOUT PRINCIPAL Y-AXIS	= 0.10784D+02

NORMALIZED WARPING FUNCTION, WN

MEMBER	NEAR END	FAR END
1	0.273D+01	0.000D+00
2	0.000D+00	-0.273D+01
3	0.000D+00	0.000D+00
4	0.000D+00	0.000D+00

WARPING STATICAL MOMENT, SW

MEMBER	NEAR END	FAR END	MID PT.
1	0.000D+00	0.197D+03	0.148D+03
2	0.197D+03	0.000D+00	0.148D+03
3	0.000D+00	0.000D+00	0.000D+00
4	0.000D+00	0.000D+00	0.000D+00

BENDING SHEAR FLOW, QY

SECTION LOADED IN Y DIRECTION

MEMBER	NEAR END	FAR END	MID PT.
1	0.000D+00	0.603D+03	0.301D+03
2	-0.603D+03	0.000D+00	-0.301D+03
3	0.121D+04	0.109D+04	0.129D+04
4	0.109D+04	0.866D-13	0.670D+03

BENDING SHEAR FLOW, QX

SECTION LOADED IN X DIRECTION

MEMBER	NEAR END	FAR END	MID PT.
1	0.000D+00	-0.173D+04	-0.130D+04
2	-0.173D+04	0.000D+00	-0.130D+04
3	0.000D+00	0.000D+00	0.000D+00
4	0.000D+00	0.000D+00	0.000D+00

NOTE: THE SW AND THE BENDING SHEAR VALUES ARE POSITIVE IF THE VALUES GO FROM THE NEAR END TO THE FAR END

Input for GEDATA.

```
"20x32,I=0.1I,5in slab"
5422.5,2259.4,5,41.67
0,0
240,0
0,384
240,384
14,6,n,y
48,23,2,23,48,23,2,23,48,23,2,23,48
9660,7889
0.00103
0
6
21.17,    69,  132
31.75,   117,  132
31.75,  165,   132
21.17,    69,  204
31.75,   117,  204
31.75,  165,   204
```

Output File from GEDATA and Input File for GRIDDBL.

```
"20x32,I=0.1I,5in slab"
        118         84          56          28        2259
5422          21
  1        0.000        0.000
  2       48.000        0.000
  3       96.000        0.000
  4      144.000        0.000
  5      192.000        0.000
  6      240.000        0.000
  7        0.000       48.000
  8       48.000       48.000
  9       96.000       48.000
 10      144.000       48.000
 11      192.000       48.000
 12      240.000       48.000
 13        0.000       71.000
 14       48.000       71.000
 15       96.000       71.000
 16      144.000       71.000
 17      192.000       71.000
 18      240.000       71.000
 19        0.000       73.000
 20       48.000       73.000
 21       96.000       73.000
 22      144.000       73.000
 23      192.000       73.000
 24      240.000       73.000
 25        0.000       96.000
 26       48.000       96.000
 27       96.000       96.000
 28      144.000       96.000
 29      192.000       96.000
 30      240.000       96.000
 31        0.000      144.000
 32       48.000      144.000
 33       96.000      144.000
 34      144.000      144.000
 35      192.000      144.000
 36      240.000      144.000
 37        0.000      167.000
 38       48.000      167.000
 39       96.000      167.000
 40      144.000      167.000
 41      192.000      167.000
 42      240.000      167.000
 43        0.000      169.000
 44       48.000      169.000
 45       96.000      169.000
```

46	144.000	169.000
47	192.000	169.000
48	240.000	169.000
49	0.000	192.000
50	48.000	192.000
51	96.000	192.000
52	144.000	192.000
53	192.000	192.000
54	240.000	192.000
55	0.000	240.000
56	48.000	240.000
57	96.000	240.000
58	144.000	240.000
59	192.000	240.000
60	240.000	240.000
61	0.000	263.000
62	48.000	263.000
63	96.000	263.000
64	144.000	263.000
65	192.000	263.000
66	240.000	263.000
67	0.000	265.000
68	48.000	265.000
69	96.000	265.000
70	144.000	265.000
71	192.000	265.000
72	240.000	265.000
73	0.000	288.000
74	48.000	288.000
75	96.000	288.000
76	144.000	288.000
77	192.000	288.000
78	240.000	288.000
79	0.000	336.000
80	48.000	336.000
81	96.000	336.000
82	144.000	336.000
83	192.000	336.000
84	240.000	336.000

1	1	2	7889.000	9660.000
2	2	3	7889.000	9660.000
3	3	4	7889.000	9660.000
4	4	5	7889.000	9660.000
5	5	6	7889.000	9660.000
6	7	8	7889.000	9660.000
7	8	9	7889.000	9660.000
8	9	10	7889.000	9660.000
9	10	11	7889.000	9660.000
10	11	12	7889.000	9660.000
11	25	26	7889.000	9660.000

12	26	27	7889.000	9660.000
13	27	28	7889.000	9660.000
14	28	29	7889.000	9660.000
15	29	30	7889.000	9660.000
16	31	32	7889.000	9660.000
17	32	33	7889.000	9660.000
18	33	34	7889.000	9660.000
19	34	35	7889.000	9660.000
20	35	36	7889.000	9660.000
21	49	50	7889.000	9660.000
22	50	51	7889.000	9660.000
23	51	52	7889.000	9660.000
24	52	53	7889.000	9660.000
25	53	54	7889.000	9660.000
26	55	56	7889.000	9660.000
27	56	57	7889.000	9660.000
28	57	58	7889.000	9660.000
29	58	59	7889.000	9660.000
30	59	60	7889.000	9660.000
31	73	74	7889.000	9660.000
32	74	75	7889.000	9660.000
33	75	76	7889.000	9660.000
34	76	77	7889.000	9660.000
35	77	78	7889.000	9660.000
36	79	80	7889.000	9660.000
37	80	81	7889.000	9660.000
38	81	82	7889.000	9660.000
39	82	83	7889.000	9660.000
40	83	84	7889.000	9660.000
41	1	7	2000.160	500.000
42	2	8	2000.160	500.000
43	3	9	2000.160	500.000
44	4	10	2000.160	500.000
45	5	11	2000.160	500.000
46	6	12	2000.160	500.000
47	7	13	2000.160	500.000
48	8	14	2000.160	500.000
49	9	15	2000.160	500.000
50	10	16	2000.160	500.000
51	11	17	2000.160	500.000
52	12	18	2000.160	500.000
53	13	19	2000.160	500.000
54	14	20	20.000	5.000
55	15	21	20.000	5.000
56	16	22	20.000	5.000
57	17	23	20.000	5.000
58	18	24	2000.160	500.000
59	19	25	2000.160	500.000
60	20	26	2000.160	500.000
61	21	27	2000.160	500.000

62	22	28	2000.160	500.000
63	23	29	2000.160	500.000
64	24	30	2000.160	500.000
65	25	31	2000.160	500.000
66	26	32	2000.160	500.000
67	27	33	2000.160	500.000
68	28	34	2000.160	500.000
69	29	35	2000.160	500.000
70	30	36	2000.160	500.000
71	31	37	2000.160	500.000
72	32	38	2000.160	500.000
73	33	39	2000.160	500.000
74	34	40	2000.160	500.000
75	35	41	2000.160	500.000
76	36	42	2000.160	500.000
77	37	43	2000.160	500.000
78	38	44	20.000	5.000
79	39	45	20.000	5.000
80	40	46	20.000	5.000
81	41	47	20.000	5.000
82	42	48	2000.160	500.000
83	43	49	2000.160	500.000
84	44	50	2000.160	500.000
85	45	51	2000.160	500.000
86	46	52	2000.160	500.000
87	47	53	2000.160	500.000
88	48	54	2000.160	500.000
89	49	55	2000.160	500.000
90	50	56	2000.160	500.000
91	51	57	2000.160	500.000
92	52	58	2000.160	500.000
93	53	59	2000.160	500.000
94	54	60	2000.160	500.000
95	55	61	2000.160	500.000
96	56	62	2000.160	500.000
97	57	63	2000.160	500.000
98	58	64	2000.160	500.000
99	59	65	2000.160	500.000
100	60	66	2000.160	500.000
101	61	67	2000.160	500.000
102	62	68	20.000	5.000
103	63	69	20.000	5.000
104	64	70	20.000	5.000
105	65	71	20.000	5.000
106	66	72	2000.160	500.000
107	67	73	2000.160	500.000
108	68	74	2000.160	500.000
109	69	75	2000.160	500.000
110	70	76	2000.160	500.000
111	71	77	2000.160	500.000

112	72	78	2000.160	500.000
113	73	79	2000.160	500.000
114	74	80	2000.160	500.000
115	75	81	2000.160	500.000
116	76	82	2000.160	500.000
117	77	83	2000.160	500.000
118	78	84	2000.160	500.000

1	1	0	1
6	1	0	1
7	1	0	1
12	1	0	1
13	1	0	1
18	1	0	1
19	1	0	1
24	1	0	1
25	1	0	1
30	1	0	1
31	1	0	1
36	1	0	1
37	1	0	1
42	1	0	1
43	1	0	1
48	1	0	1
49	1	0	1
54	1	0	1
55	1	0	1
60	1	0	1
61	1	0	1
66	1	0	1
67	1	0	1
72	1	0	1
73	1	0	1
78	1	0	1
79	1	0	1
84	1	0	1

2

84 0

1	0.000	0.000	0.593
2	0.000	0.000	1.187
3	0.000	0.000	1.187
4	0.000	0.000	1.187
5	0.000	0.000	1.187
6	0.000	0.000	0.593
7	0.000	0.000	0.878
8	0.000	0.000	1.755
9	0.000	0.000	1.755
10	0.000	0.000	1.755
11	0.000	0.000	1.755
12	0.000	0.000	0.878
13	0.000	0.000	0.309

14	0.000	0.000	0.618
15	0.000	0.000	0.618
16	0.000	0.000	0.618
17	0.000	0.000	0.618
18	0.000	0.000	0.309
19	0.000	0.000	0.309
20	0.000	0.000	0.618
21	0.000	0.000	0.618
22	0.000	0.000	0.618
23	0.000	0.000	0.618
24	0.000	0.000	0.309
25	0.000	0.000	0.878
26	0.000	0.000	1.755
27	0.000	0.000	1.755
28	0.000	0.000	1.755
29	0.000	0.000	1.755
30	0.000	0.000	0.878
31	0.000	0.000	0.878
32	0.000	0.000	1.755
33	0.000	0.000	1.755
34	0.000	0.000	1.755
35	0.000	0.000	1.755
36	0.000	0.000	0.878
37	0.000	0.000	0.309
38	0.000	0.000	0.618
39	0.000	0.000	0.618
40	0.000	0.000	0.618
41	0.000	0.000	0.618
42	0.000	0.000	0.309
43	0.000	0.000	0.309
44	0.000	0.000	0.618
45	0.000	0.000	0.618
46	0.000	0.000	0.618
47	0.000	0.000	0.618
48	0.000	0.000	0.309
49	0.000	0.000	0.878
50	0.000	0.000	1.755
51	0.000	0.000	1.755
52	0.000	0.000	1.755
53	0.000	0.000	1.755
54	0.000	0.000	0.878
55	0.000	0.000	0.878
56	0.000	0.000	1.755
57	0.000	0.000	1.755
58	0.000	0.000	1.755
59	0.000	0.000	1.755
60	0.000	0.000	0.878
61	0.000	0.000	0.309
62	0.000	0.000	0.618
63	0.000	0.000	0.618

64	0.000	0.000	0.618
65	0.000	0.000	0.618
66	0.000	0.000	0.309
67	0.000	0.000	0.309
68	0.000	0.000	0.618
69	0.000	0.000	0.618
70	0.000	0.000	0.618
71	0.000	0.000	0.618
72	0.000	0.000	0.309
73	0.000	0.000	0.878
74	0.000	0.000	1.755
75	0.000	0.000	1.755
76	0.000	0.000	1.755
77	0.000	0.000	1.755
78	0.000	0.000	0.878
79	0.000	0.000	0.593
80	0.000	0.000	1.187
81	0.000	0.000	1.187
82	0.000	0.000	1.187
83	0.000	0.000	1.187
84	0.000	0.000	0.593
	16 0		
26	0.000	0.000	2.977
27	0.000	0.000	6.780
28	0.000	0.000	7.938
29	0.000	0.000	3.473
32	0.000	0.000	8.931
33	0.000	0.000	20.341
34	0.000	0.000	23.813
35	0.000	0.000	10.418
50	0.000	0.000	8.931
51	0.000	0.000	20.341
52	0.000	0.000	23.813
53	0.000	0.000	10.418
56	0.000	0.000	2.977
57	0.000	0.000	6.780
58	0.000	0.000	7.938
59	0.000	0.000	3.473

Output File from GRIDDBL.

20x32,I=0.1I,5in slab

TOTAL BLANK COMMON ARRAY 16587

STRUCTURE DATA

M	NJ	NR	NRJ	E	G
118	84	56	28	2259.0	5422.0

COORDINATES OF JOINTS

JOINT	X	Y
1	0.0000E+00	0.0000E+00
2	0.4800E+02	0.0000E+00
3	0.9600E+02	0.0000E+00
4	0.1440E+03	0.0000E+00
5	0.1920E+03	0.0000E+00
6	0.2400E+03	0.0000E+00
7	0.0000E+00	0.4800E+02
8	0.4800E+02	0.4800E+02
9	0.9600E+02	0.4800E+02
10	0.1440E+03	0.4800E+02
11	0.1920E+03	0.4800E+02
12	0.2400E+03	0.4800E+02
13	0.0000E+00	0.7100E+02
14	0.4800E+02	0.7100E+02
15	0.9600E+02	0.7100E+02
16	0.1440E+03	0.7100E+02
17	0.1920E+03	0.7100E+02
18	0.2400E+03	0.7100E+02
19	0.0000E+00	0.7300E+02
20	0.4800E+02	0.7300E+02
21	0.9600E+02	0.7300E+02
22	0.1440E+03	0.7300E+02
23	0.1920E+03	0.7300E+02
24	0.2400E+03	0.7300E+02
25	0.0000E+00	0.9600E+02
26	0.4800E+02	0.9600E+02
27	0.9600E+02	0.9600E+02
28	0.1440E+03	0.9600E+02
29	0.1920E+03	0.9600E+02
30	0.2400E+03	0.9600E+02
31	0.0000E+00	0.1440E+03
32	0.4800E+02	0.1440E+03
33	0.9600E+02	0.1440E+03

34	0.1440E+03	0.1440E+03
35	0.1920E+03	0.1440E+03
36	0.2400E+03	0.1440E+03
37	0.0000E+00	0.1670E+03
38	0.4800E+02	0.1670E+03
39	0.9600E+02	0.1670E+03
40	0.1440E+03	0.1670E+03
41	0.1920E+03	0.1670E+03
42	0.2400E+03	0.1670E+03
43	0.0000E+00	0.1690E+03
44	0.4800E+02	0.1690E+03
45	0.9600E+02	0.1690E+03
46	0.1440E+03	0.1690E+03
47	0.1920E+03	0.1690E+03
48	0.2400E+03	0.1690E+03
49	0.0000E+00	0.1920E+03
50	0.4800E+02	0.1920E+03
51	0.9600E+02	0.1920E+03
52	0.1440E+03	0.1920E+03
53	0.1920E+03	0.1920E+03
54	0.2400E+03	0.1920E+03
55	0.0000E+00	0.2400E+03
56	0.4800E+02	0.2400E+03
57	0.9600E+02	0.2400E+03
58	0.1440E+03	0.2400E+03
59	0.1920E+03	0.2400E+03
60	0.2400E+03	0.2400E+03
61	0.0000E+00	0.2630E+03
62	0.4800E+02	0.2630E+03
63	0.9600E+02	0.2630E+03
64	0.1440E+03	0.2630E+03
65	0.1920E+03	0.2630E+03
66	0.2400E+03	0.2630E+03
67	0.0000E+00	0.2650E+03
68	0.4800E+02	0.2650E+03
69	0.9600E+02	0.2650E+03
70	0.1440E+03	0.2650E+03
71	0.1920E+03	0.2650E+03
72	0.2400E+03	0.2650E+03
73	0.0000E+00	0.2880E+03
74	0.4800E+02	0.2880E+03
75	0.9600E+02	0.2880E+03
76	0.1440E+03	0.2880E+03
77	0.1920E+03	0.2880E+03
78	0.2400E+03	0.2880E+03
79	0.0000E+00	0.3360E+03
80	0.4800E+02	0.3360E+03
81	0.9600E+02	0.3360E+03
82	0.1440E+03	0.3360E+03
83	0.1920E+03	0.3360E+03

84 0.2400E+03 0.3360E+03

MEMBER INFORMATION

MEMBER	JJ	JK	KT	FIY	AL
1	1	2	0.789E+04	0.966E+04	0.480E+02
2	2	3	0.789E+04	0.966E+04	0.480E+02
3	3	4	0.789E+04	0.966E+04	0.480E+02
4	4	5	0.789E+04	0.966E+04	0.480E+02
5	5	6	0.789E+04	0.966E+04	0.480E+02
6	7	8	0.789E+04	0.966E+04	0.480E+02
7	8	9	0.789E+04	0.966E+04	0.480E+02
8	9	10	0.789E+04	0.966E+04	0.480E+02
9	10	11	0.789E+04	0.966E+04	0.480E+02
10	11	12	0.789E+04	0.966E+04	0.480E+02
11	25	26	0.789E+04	0.966E+04	0.480E+02
12	26	27	0.789E+04	0.966E+04	0.480E+02
13	27	28	0.789E+04	0.966E+04	0.480E+02
14	28	29	0.789E+04	0.966E+04	0.480E+02
15	29	30	0.789E+04	0.966E+04	0.480E+02
16	31	32	0.789E+04	0.966E+04	0.480E+02
17	32	33	0.789E+04	0.966E+04	0.480E+02
18	33	34	0.789E+04	0.966E+04	0.480E+02
19	34	35	0.789E+04	0.966E+04	0.480E+02
20	35	36	0.789E+04	0.966E+04	0.480E+02
21	49	50	0.789E+04	0.966E+04	0.480E+02
22	50	51	0.789E+04	0.966E+04	0.480E+02
23	51	52	0.789E+04	0.966E+04	0.480E+02
24	52	53	0.789E+04	0.966E+04	0.480E+02
25	53	54	0.789E+04	0.966E+04	0.480E+02
26	55	56	0.789E+04	0.966E+04	0.480E+02
27	56	57	0.789E+04	0.966E+04	0.480E+02
28	57	58	0.789E+04	0.966E+04	0.480E+02
29	58	59	0.789E+04	0.966E+04	0.480E+02
30	59	60	0.789E+04	0.966E+04	0.480E+02
31	73	74	0.789E+04	0.966E+04	0.480E+02
32	74	75	0.789E+04	0.966E+04	0.480E+02
33	75	76	0.789E+04	0.966E+04	0.480E+02
34	76	77	0.789E+04	0.966E+04	0.480E+02
35	77	78	0.789E+04	0.966E+04	0.480E+02
36	79	80	0.789E+04	0.966E+04	0.480E+02
37	80	81	0.789E+04	0.966E+04	0.480E+02
38	81	82	0.789E+04	0.966E+04	0.480E+02
39	82	83	0.789E+04	0.966E+04	0.480E+02
40	83	84	0.789E+04	0.966E+04	0.480E+02
41	1	7	0.200E+04	0.500E+03	0.480E+02
42	2	8	0.200E+04	0.500E+03	0.480E+02
43	3	9	0.200E+04	0.500E+03	0.480E+02
44	4	10	0.200E+04	0.500E+03	0.480E+02
45	5	11	0.200E+04	0.500E+03	0.480E+02

46	6	12	0.200E+04	0.500E+03	0.480E+02
47	7	13	0.200E+04	0.500E+03	0.230E+02
48	8	14	0.200E+04	0.500E+03	0.230E+02
49	9	15	0.200E+04	0.500E+03	0.230E+02
50	10	16	0.200E+04	0.500E+03	0.230E+02
51	11	17	0.200E+04	0.500E+03	0.230E+02
52	12	18	0.200E+04	0.500E+03	0.230E+02
53	13	19	0.200E+04	0.500E+03	0.200E+01
54	14	20	0.200E+02	0.500E+01	0.200E+01
55	15	21	0.200E+02	0.500E+01	0.200E+01
56	16	22	0.200E+02	0.500E+01	0.200E+01
57	17	23	0.200E+02	0.500E+01	0.200E+01
58	18	24	0.200E+04	0.500E+03	0.200E+01
59	19	25	0.200E+04	0.500E+03	0.230E+02
60	20	26	0.200E+04	0.500E+03	0.230E+02
61	21	27	0.200E+04	0.500E+03	0.230E+02
62	22	28	0.200E+04	0.500E+03	0.230E+02
63	23	29	0.200E+04	0.500E+03	0.230E+02
64	24	30	0.200E+04	0.500E+03	0.230E+02
65	25	31	0.200E+04	0.500E+03	0.480E+02
66	26	32	0.200E+04	0.500E+03	0.480E+02
67	27	33	0.200E+04	0.500E+03	0.480E+02
68	28	34	0.200E+04	0.500E+03	0.480E+02
69	29	35	0.200E+04	0.500E+03	0.480E+02
70	30	36	0.200E+04	0.500E+03	0.480E+02
71	31	37	0.200E+04	0.500E+03	0.230E+02
72	32	38	0.200E+04	0.500E+03	0.230E+02
73	33	39	0.200E+04	0.500E+03	0.230E+02
74	34	40	0.200E+04	0.500E+03	0.230E+02
75	35	41	0.200E+04	0.500E+03	0.230E+02
76	36	42	0.200E+04	0.500E+03	0.230E+02
77	37	43	0.200E+04	0.500E+03	0.200E+01
78	38	44	0.200E+02	0.500E+01	0.200E+01
79	39	45	0.200E+02	0.500E+01	0.200E+01
80	40	46	0.200E+02	0.500E+01	0.200E+01
81	41	47	0.200E+02	0.500E+01	0.200E+01
82	42	48	0.200E+04	0.500E+03	0.200E+01
83	43	49	0.200E+04	0.500E+03	0.230E+02
84	44	50	0.200E+04	0.500E+03	0.230E+02
85	45	51	0.200E+04	0.500E+03	0.230E+02
86	46	52	0.200E+04	0.500E+03	0.230E+02
87	47	53	0.200E+04	0.500E+03	0.230E+02
88	48	54	0.200E+04	0.500E+03	0.230E+02
89	49	55	0.200E+04	0.500E+03	0.480E+02
90	50	56	0.200E+04	0.500E+03	0.480E+02
91	51	57	0.200E+04	0.500E+03	0.480E+02
92	52	58	0.200E+04	0.500E+03	0.480E+02
93	53	59	0.200E+04	0.500E+03	0.480E+02
94	54	60	0.200E+04	0.500E+03	0.480E+02
95	55	61	0.200E+04	0.500E+03	0.230E+02

96	56	62	0.200E+04	0.500E+03	0.230E+02
97	57	63	0.200E+04	0.500E+03	0.230E+02
98	58	64	0.200E+04	0.500E+03	0.230E+02
99	59	65	0.200E+04	0.500E+03	0.230E+02
100	60	66	0.200E+04	0.500E+03	0.230E+02
101	61	67	0.200E+04	0.500E+03	0.200E+01
102	62	68	0.200E+02	0.500E+01	0.200E+01
103	63	69	0.200E+02	0.500E+01	0.200E+01
104	64	70	0.200E+02	0.500E+01	0.200E+01
105	65	71	0.200E+02	0.500E+01	0.200E+01
106	66	72	0.200E+04	0.500E+03	0.200E+01
107	67	73	0.200E+04	0.500E+03	0.230E+02
108	68	74	0.200E+04	0.500E+03	0.230E+02
109	69	75	0.200E+04	0.500E+03	0.230E+02
110	70	76	0.200E+04	0.500E+03	0.230E+02
111	71	77	0.200E+04	0.500E+03	0.230E+02
112	72	78	0.200E+04	0.500E+03	0.230E+02
113	73	79	0.200E+04	0.500E+03	0.480E+02
114	74	80	0.200E+04	0.500E+03	0.480E+02
115	75	81	0.200E+04	0.500E+03	0.480E+02
116	76	82	0.200E+04	0.500E+03	0.480E+02
117	77	83	0.200E+04	0.500E+03	0.480E+02
118	78	84	0.200E+04	0.500E+03	0.480E+02

JOINT RESTRAINTS

JOINT	X	Y	Z
1	1	0	1
6	1	0	1
7	1	0	1
12	1	0	1
13	1	0	1
18	1	0	1
19	1	0	1
24	1	0	1
25	1	0	1
30	1	0	1
31	1	0	1
36	1	0	1
37	1	0	1
42	1	0	1
43	1	0	1
48	1	0	1
49	1	0	1
54	1	0	1
55	1	0	1
60	1	0	1
61	1	0	1
66	1	0	1
67	1	0	1

72	1	0	1
73	1	0	1
78	1	0	1
79	1	0	1
84	1	0	1

*****THE CORRECT BANDWIDTH IS 17*****

LOADING NO. 1

NLJ	NLM
84	0

ACTIONS APPLIED AT JOINTS

JOINT	A1	A2	A3
1	0.000000D+00	0.000000D+00	0.593000D+00
2	0.000000D+00	0.000000D+00	0.118700D+01
3	0.000000D+00	0.000000D+00	0.118700D+01
4	0.000000D+00	0.000000D+00	0.118700D+01
5	0.000000D+00	0.000000D+00	0.118700D+01
6	0.000000D+00	0.000000D+00	0.593000D+00
7	0.000000D+00	0.000000D+00	0.878000D+00
8	0.000000D+00	0.000000D+00	0.175500D+01
9	0.000000D+00	0.000000D+00	0.175500D+01
10	0.000000D+00	0.000000D+00	0.175500D+01
11	0.000000D+00	0.000000D+00	0.175500D+01
12	0.000000D+00	0.000000D+00	0.878000D+00
13	0.000000D+00	0.000000D+00	0.309000D+00
14	0.000000D+00	0.000000D+00	0.618000D+00
15	0.000000D+00	0.000000D+00	0.618000D+00
16	0.000000D+00	0.000000D+00	0.618000D+00
17	0.000000D+00	0.000000D+00	0.618000D+00
18	0.000000D+00	0.000000D+00	0.309000D+00
19	0.000000D+00	0.000000D+00	0.309000D+00
20	0.000000D+00	0.000000D+00	0.618000D+00
21	0.000000D+00	0.000000D+00	0.618000D+00
22	0.000000D+00	0.000000D+00	0.618000D+00
23	0.000000D+00	0.000000D+00	0.618000D+00
24	0.000000D+00	0.000000D+00	0.309000D+00
25	0.000000D+00	0.000000D+00	0.878000D+00
26	0.000000D+00	0.000000D+00	0.175500D+01
27	0.000000D+00	0.000000D+00	0.175500D+01
28	0.000000D+00	0.000000D+00	0.175500D+01
29	0.000000D+00	0.000000D+00	0.175500D+01
30	0.000000D+00	0.000000D+00	0.878000D+00
31	0.000000D+00	0.000000D+00	0.878000D+00

32	0.000000D+00	0.000000D+00	0.175500D+01
33	0.000000D+00	0.000000D+00	0.175500D+01
34	0.000000D+00	0.000000D+00	0.175500D+01
35	0.000000D+00	0.000000D+00	0.175500D+01
36	0.000000D+00	0.000000D+00	0.878000D+00
37	0.000000D+00	0.000000D+00	0.309000D+00
38	0.000000D+00	0.000000D+00	0.618000D+00
39	0.000000D+00	0.000000D+00	0.618000D+00
40	0.000000D+00	0.000000D+00	0.618000D+00
41	0.000000D+00	0.000000D+00	0.618000D+00
42	0.000000D+00	0.000000D+00	0.309000D+00
43	0.000000D+00	0.000000D+00	0.309000D+00
44	0.000000D+00	0.000000D+00	0.618000D+00
45	0.000000D+00	0.000000D+00	0.618000D+00
46	0.000000D+00	0.000000D+00	0.618000D+00
47	0.000000D+00	0.000000D+00	0.618000D+00
48	0.000000D+00	0.000000D+00	0.309000D+00
49	0.000000D+00	0.000000D+00	0.878000D+00
50	0.000000D+00	0.000000D+00	0.175500D+01
51	0.000000D+00	0.000000D+00	0.175500D+01
52	0.000000D+00	0.000000D+00	0.175500D+01
53	0.000000D+00	0.000000D+00	0.175500D+01
54	0.000000D+00	0.000000D+00	0.878000D+00
55	0.000000D+00	0.000000D+00	0.878000D+00
56	0.000000D+00	0.000000D+00	0.175500D+01
57	0.000000D+00	0.000000D+00	0.175500D+01
58	0.000000D+00	0.000000D+00	0.175500D+01
59	0.000000D+00	0.000000D+00	0.175500D+01
60	0.000000D+00	0.000000D+00	0.878000D+00
61	0.000000D+00	0.000000D+00	0.309000D+00
62	0.000000D+00	0.000000D+00	0.618000D+00
63	0.000000D+00	0.000000D+00	0.618000D+00
64	0.000000D+00	0.000000D+00	0.618000D+00
65	0.000000D+00	0.000000D+00	0.618000D+00
66	0.000000D+00	0.000000D+00	0.309000D+00
67	0.000000D+00	0.000000D+00	0.309000D+00
68	0.000000D+00	0.000000D+00	0.618000D+00
69	0.000000D+00	0.000000D+00	0.618000D+00
70	0.000000D+00	0.000000D+00	0.618000D+00
71	0.000000D+00	0.000000D+00	0.618000D+00
72	0.000000D+00	0.000000D+00	0.309000D+00
73	0.000000D+00	0.000000D+00	0.878000D+00
74	0.000000D+00	0.000000D+00	0.175500D+01
75	0.000000D+00	0.000000D+00	0.175500D+01
76	0.000000D+00	0.000000D+00	0.175500D+01
77	0.000000D+00	0.000000D+00	0.175500D+01
78	0.000000D+00	0.000000D+00	0.878000D+00
79	0.000000D+00	0.000000D+00	0.593000D+00
80	0.000000D+00	0.000000D+00	0.118700D+01
81	0.000000D+00	0.000000D+00	0.118700D+01

82	0.000000D+00	0.000000D+00	0.118700D+01
83	0.000000D+00	0.000000D+00	0.118700D+01
84	0.000000D+00	0.000000D+00	0.593000D+00
0TOTAL........................			0.830640E+02

JOINT DISPLACEMENTS

JOINT	D1	D2	D3
1	0.000000D+00	-0.999636D-03	0.000000D+00
2	0.226987D-04	-0.792541D-03	0.443334D-01
3	0.366751D-04	-0.297513D-03	0.711925D-01
4	0.366751D-04	0.297513D-03	0.711925D-01
5	0.226987D-04	0.792541D-03	0.443334D-01
6	0.000000D+00	0.999636D-03	0.000000D+00
7	0.000000D+00	-0.108406D-02	0.000000D+00
8	0.584104D-04	-0.864104D-03	0.486368D-01
9	0.913486D-04	-0.323205D-03	0.780620D-01
10	0.913486D-04	0.323205D-03	0.780620D-01
11	0.584104D-04	0.864104D-03	0.486368D-01
12	0.000000D+00	0.108406D-02	0.000000D+00
13	0.000000D+00	-0.110990D-02	0.000000D+00
14	0.212536D-03	-0.869095D-03	0.524582D-01
15	0.274281D-03	-0.325188D-03	0.830853D-01
16	0.274281D-03	0.325188D-03	0.830853D-01
17	0.212536D-03	0.869095D-03	0.524582D-01
18	0.000000D+00	0.110990D-02	0.000000D+00
19	0.000000D+00	-0.111214D-02	0.000000D+00
20	-0.773528D-04	-0.912495D-03	0.526033D-01
21	-0.439496D-04	-0.342434D-03	0.833330D-01
22	-0.439496D-04	0.342434D-03	0.833330D-01
23	-0.773528D-04	0.912495D-03	0.526033D-01
24	0.000000D+00	0.111214D-02	0.000000D+00
25	0.000000D+00	-0.113798D-02	0.000000D+00
26	-0.871284D-05	-0.917486D-03	0.512095D-01
27	-0.106358D-04	-0.344418D-03	0.824143D-01
28	-0.106358D-04	0.344418D-03	0.824143D-01
29	-0.871284D-05	0.917486D-03	0.512095D-01
30	0.000000D+00	0.113798D-02	0.000000D+00
31	0.000000D+00	-0.116314D-02	0.000000D+00
32	0.300447D-04	-0.933719D-03	0.522600D-01
33	0.451857D-04	-0.350309D-03	0.840377D-01
34	0.451857D-04	0.350309D-03	0.840377D-01
35	0.300447D-04	0.933719D-03	0.522600D-01
36	0.000000D+00	0.116314D-02	0.000000D+00
37	0.000000D+00	-0.116314D-02	0.000000D+00
38	0.142085D-03	-0.933719D-03	0.547942D-01
39	0.154395D-03	-0.350309D-03	0.868876D-01
40	0.154395D-03	0.350309D-03	0.868876D-01
41	0.142085D-03	0.933719D-03	0.547942D-01
42	0.000000D+00	0.116314D-02	0.000000D+00

```
43 0.000000D+00-0.116314D-02 0.000000D+00
44-0.142085D-03-0.933719D-03 0.547942D-01
45-0.154395D-03-0.350309D-03 0.868876D-01
46-0.154395D-03 0.350309D-03 0.868876D-01
47-0.142085D-03 0.933719D-03 0.547942D-01
48 0.000000D+00 0.116314D-02 0.000000D+00
49 0.000000D+00-0.116314D-02 0.000000D+00
50-0.300447D-04-0.933719D-03 0.522600D-01
51-0.451857D-04-0.350309D-03 0.840377D-01
52-0.451857D-04 0.350309D-03 0.840377D-01
53-0.300447D-04 0.933719D-03 0.522600D-01
54 0.000000D+00 0.116314D-02 0.000000D+00
55 0.000000D+00-0.113798D-02 0.000000D+00
56 0.871284D-05-0.917486D-03 0.512095D-01
57 0.106358D-04-0.344418D-03 0.824143D-01
58 0.106358D-04 0.344418D-03 0.824143D-01
59 0.871284D-05 0.917486D-03 0.512095D-01
60 0.000000D+00 0.113798D-02 0.000000D+00
61 0.000000D+00-0.111214D-02 0.000000D+00
62 0.773528D-04-0.912495D-03 0.526033D-01
63 0.439496D-04-0.342434D-03 0.833330D-01
64 0.439496D-04 0.342434D-03 0.833330D-01
65 0.773528D-04 0.912495D-03 0.526033D-01
66 0.000000D+00 0.111214D-02 0.000000D+00
67 0.000000D+00-0.110990D-02 0.000000D+00
68-0.212536D-03-0.869095D-03 0.524582D-01
69-0.274281D-03-0.325188D-03 0.830853D-01
70-0.274281D-03 0.325188D-03 0.830853D-01
71-0.212536D-03 0.869095D-03 0.524582D-01
72 0.000000D+00 0.110990D-02 0.000000D+00
73 0.000000D+00-0.108406D-02 0.000000D+00
74-0.584104D-04-0.864104D-03 0.486368D-01
75-0.913486D-04-0.323205D-03 0.780620D-01
76-0.913486D-04 0.323205D-03 0.780620D-01
77-0.584104D-04 0.864104D-03 0.486368D-01
78 0.000000D+00 0.108406D-02 0.000000D+00
79 0.000000D+00-0.999636D-03 0.000000D+00
80-0.226987D-04-0.792541D-03 0.443334D-01
81-0.366751D-04-0.297513D-03 0.711925D-01
82-0.366751D-04 0.297513D-03 0.711925D-01
83-0.226987D-04 0.792541D-03 0.443334D-01
84 0.000000D+00 0.999636D-03 0.000000D+00
```

MEMBER END ACTIONS

```
MEMBER      AM1            AM2            AM3            AM4
  AM5            AM6
   1   -0.168562D+01   -0.158948D+01   -0.260682D+00
0.168562D+01    0.141022D+02    0.260682D+00
```

2 -0.103790D+01 -0.154496D+02 -0.137695D+00
0.103790D+01 0.220590D+02 0.137695D+00
3 -0.491459D-13 -0.225427D+02 -0.236848D-14
0.491459D-13 0.225427D+02 0.236848D-14
4 0.103790D+01 -0.220590D+02 0.137695D+00
-0.103790D+01 0.154496D+02 -0.137695D+00
5 0.168562D+01 -0.141022D+02 0.260682D+00
-0.168562D+01 0.158948D+01 -0.260682D+00
6 -0.433759D+01 0.574253D+00 -0.371136D+00
0.433759D+01 0.172403D+02 0.371136D+00
7 -0.244602D+01 -0.160890D+02 -0.183463D+00
0.244602D+01 0.248953D+02 0.183463D+00
8 -0.869231D-12 -0.244894D+02 -0.378956D-13
0.869231D-12 0.244894D+02 0.378956D-13
9 0.244602D+01 -0.248953D+02 0.183463D+00
-0.244602D+01 0.160890D+02 -0.183463D+00
10 0.433759D+01 -0.172403D+02 0.371136D+00
-0.433759D+01 -0.574253D+00 -0.371136D+00
11 0.647022D+00 0.541541D+00 -0.370626D+00
-0.647022D+00 0.172485D+02 0.370626D+00
12 0.142798D+00 -0.173580D+02 -0.181369D+00
-0.142798D+00 0.260637D+02 0.181369D+00
13 0.876928D-12 -0.260967D+02 -0.426326D-13
-0.876928D-12 0.260967D+02 0.426326D-13
14 -0.142798D+00 -0.260637D+02 0.181369D+00
0.142798D+00 0.173580D+02 -0.181369D+00
15 -0.647022D+00 -0.172485D+02 0.370626D+00
0.647022D+00 -0.541541D+00 -0.370626D+00
16 -0.223114D+01 0.473691D+00 -0.381889D+00
0.223114D+01 0.178570D+02 0.381889D+00
17 -0.112438D+01 -0.175513D+02 -0.189639D+00
0.112438D+01 0.266540D+02 0.189639D+00
18 -0.233295D-12 -0.265431D+02 -0.947390D-14
0.233295D-12 0.265431D+02 0.947390D-14
19 0.112438D+01 -0.266540D+02 0.189639D+00
-0.112438D+01 0.175513D+02 -0.189639D+00
20 0.223114D+01 -0.178570D+02 0.381889D+00
-0.223114D+01 -0.473691D+00 -0.381889D+00
21 0.223114D+01 0.473691D+00 -0.381889D+00
-0.223114D+01 0.178570D+02 0.381889D+00
22 0.112438D+01 -0.175513D+02 -0.189639D+00
-0.112438D+01 0.266540D+02 0.189639D+00
23 0.328626D-12 -0.265431D+02 -0.142109D-13
-0.328626D-12 0.265431D+02 0.142109D-13
24 -0.112438D+01 -0.266540D+02 0.189639D+00
0.112438D+01 0.175513D+02 -0.189639D+00
25 -0.223114D+01 -0.178570D+02 0.381889D+00
0.223114D+01 -0.473691D+00 -0.381889D+00
26 -0.647022D+00 0.541541D+00 -0.370626D+00
0.647022D+00 0.172485D+02 0.370626D+00

27 -0.142798D+00 -0.173580D+02 -0.181369D+00
0.142798D+00 0.260637D+02 0.181369D+00
28 0.355419D-12 -0.260967D+02 0.165793D-13
-0.355419D-12 0.260967D+02 -0.165793D-13
29 0.142798D+00 -0.260637D+02 0.181369D+00
-0.142798D+00 0.173580D+02 -0.181369D+00
30 0.647022D+00 -0.172485D+02 0.370626D+00
-0.647022D+00 -0.541541D+00 -0.370626D+00
31 0.433759D+01 0.574253D+00 -0.371136D+00
-0.433759D+01 0.172403D+02 0.371136D+00
32 0.244602D+01 -0.160890D+02 -0.183463D+00
-0.244602D+01 0.248953D+02 0.183463D+00
33 -0.358824D-12 -0.244894D+02 0.236848D-13
0.358824D-12 0.244894D+02 -0.236848D-13
34 -0.244602D+01 -0.248953D+02 0.183463D+00
0.244602D+01 0.160890D+02 -0.183463D+00
35 -0.433759D+01 -0.172403D+02 0.371136D+00
0.433759D+01 -0.574253D+00 -0.371136D+00
36 0.168562D+01 -0.158948D+01 -0.260682D+00
-0.168562D+01 0.141022D+02 0.260682D+00
37 0.103790D+01 -0.154496D+02 -0.137695D+00
-0.103790D+01 0.220590D+02 0.137695D+00
38 -0.355271D-13 -0.225427D+02 0.000000D+00
0.355271D-13 0.225427D+02 0.000000D+00
39 -0.103790D+01 -0.220590D+02 0.137695D+00
0.103790D+01 0.154496D+02 -0.137695D+00
40 -0.168562D+01 -0.141022D+02 0.260682D+00
0.168562D+01 0.158948D+01 -0.260682D+00
41 0.158948D+01 0.000000D+00 0.000000D+00
-0.158948D+01 0.000000D+00 0.000000D+00
42 0.134738D+01 0.647718D+00 -0.240704D-01
-0.134738D+01 0.507661D+00 0.240704D-01
43 0.483731D+00 0.103790D+01 -0.387787D-01
-0.483731D+00 0.823477D+00 0.387787D-01
44 -0.483731D+00 0.103790D+01 -0.387787D-01
0.483731D+00 0.823477D+00 0.387787D-01
45 -0.134738D+01 0.647718D+00 -0.240704D-01
0.134738D+01 0.507661D+00 0.240704D-01
46 -0.158948D+01 0.000000D+00 0.000000D+00
0.158948D+01 0.000000D+00 0.000000D+00
47 0.101523D+01 0.000000D+00 0.000000D+00
-0.101523D+01 0.000000D+00 0.000000D+00
48 0.196098D+00 0.138392D+01 -0.654936D-01
-0.196098D+00 0.122435D+00 0.654936D-01
49 0.779241D-01 0.162254D+01 -0.759920D-01
-0.779241D-01 0.125275D+00 0.759920D-01
50 -0.779241D-01 0.162254D+01 -0.759920D-01
0.779241D-01 0.125275D+00 0.759920D-01
51 -0.196098D+00 0.138392D+01 -0.654936D-01
0.196098D+00 0.122435D+00 0.654936D-01

```
   52  -0.101523D+01   0.000000D+00   0.000000D+00
0.101523D+01   0.000000D+00   0.000000D+00
   53   0.101523D+01   0.000000D+00   0.000000D+00
-0.101523D+01   0.000000D+00   0.000000D+00
   54   0.196098D+00  -0.122435D+00  -0.139936D-01
-0.196098D+00   0.150422D+00   0.139936D-01
   55   0.779241D-01  -0.125275D+00  -0.244920D-01
-0.779241D-01   0.174259D+00   0.244920D-01
   56  -0.779241D-01  -0.125275D+00  -0.244920D-01
0.779241D-01   0.174259D+00   0.244920D-01
   57  -0.196098D+00  -0.122435D+00  -0.139936D-01
0.196098D+00   0.150422D+00   0.139936D-01
   58  -0.101523D+01   0.000000D+00   0.000000D+00
0.101523D+01   0.000000D+00   0.000000D+00
   59   0.101523D+01   0.000000D+00   0.000000D+00
-0.101523D+01   0.000000D+00   0.000000D+00
   60   0.196098D+00  -0.150422D+00   0.375064D-01
-0.196098D+00  -0.712226D+00  -0.375064D-01
   61   0.779241D-01  -0.174259D+00   0.270080D-01
-0.779241D-01  -0.446926D+00  -0.270080D-01
   62  -0.779241D-01  -0.174259D+00   0.270080D-01
0.779241D-01  -0.446926D+00  -0.270080D-01
   63  -0.196098D+00  -0.150422D+00   0.375064D-01
0.196098D+00  -0.712226D+00  -0.375064D-01
   64  -0.101523D+01   0.000000D+00   0.000000D+00
0.101523D+01   0.000000D+00   0.000000D+00
   65   0.473691D+00   0.000000D+00   0.000000D+00
-0.473691D+00   0.000000D+00   0.000000D+00
   66   0.305631D+00   0.208002D+00  -0.550003D-02
-0.305631D+00   0.559996D-01   0.550003D-02
   67   0.110916D+00   0.304128D+00  -0.811106D-02
-0.110916D+00   0.852031D-01   0.811106D-02
   68  -0.110916D+00   0.304128D+00  -0.811106D-02
0.110916D+00   0.852031D-01   0.811106D-02
   69  -0.305631D+00   0.208002D+00  -0.550003D-02
0.305631D+00   0.559996D-01   0.550003D-02
   70  -0.473691D+00   0.000000D+00   0.000000D+00
0.473691D+00   0.000000D+00   0.000000D+00
   71  -0.142109D-12   0.000000D+00   0.000000D+00
0.142109D-12   0.000000D+00   0.000000D+00
   72  -0.615804D-13   0.105076D+01  -0.515000D-01
0.615804D-13   0.133737D+00   0.515000D-01
   73  -0.378956D-13   0.103918D+01  -0.515000D-01
0.378956D-13   0.145324D+00   0.515000D-01
   74   0.236848D-14   0.103918D+01  -0.515000D-01
-0.236848D-14   0.145324D+00   0.515000D-01
   75   0.568434D-13   0.105076D+01  -0.515000D-01
-0.568434D-13   0.133737D+00   0.515000D-01
   76   0.445273D-12   0.000000D+00   0.000000D+00
-0.445273D-12   0.000000D+00   0.000000D+00
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   77  -0.227374D-12   0.000000D+00   0.000000D+00
0.227374D-12   0.000000D+00   0.000000D+00
   78  -0.491459D-13  -0.133737D+00   0.947390D-14
0.491459D-13   0.133737D+00  -0.947390D-14
   79  -0.313823D-13  -0.145324D+00   0.000000D+00
0.313823D-13   0.145324D+00   0.000000D+00
   80   0.106581D-13  -0.145324D+00  -0.189478D-13
-0.106581D-13   0.145324D+00   0.189478D-13
   81   0.526986D-13  -0.133737D+00   0.947390D-14
-0.526986D-13   0.133737D+00  -0.947390D-14
   82   0.303165D-12   0.000000D+00   0.000000D+00
-0.303165D-12   0.000000D+00   0.000000D+00
   83  -0.161056D-12   0.000000D+00   0.000000D+00
0.161056D-12   0.000000D+00   0.000000D+00
   84  -0.378956D-13  -0.133737D+00   0.515000D-01
0.378956D-13  -0.105076D+01  -0.515000D-01
   85  -0.260532D-13  -0.145324D+00   0.515000D-01
0.260532D-13  -0.103918D+01  -0.515000D-01
   86   0.947390D-14  -0.145324D+00   0.515000D-01
-0.947390D-14  -0.103918D+01  -0.515000D-01
   87   0.473695D-13  -0.133737D+00   0.515000D-01
-0.473695D-13  -0.105076D+01  -0.515000D-01
   88   0.151582D-12   0.000000D+00   0.000000D+00
-0.151582D-12   0.000000D+00   0.000000D+00
   89  -0.473691D+00   0.000000D+00   0.000000D+00
0.473691D+00   0.000000D+00   0.000000D+00
   90  -0.305631D+00  -0.559996D-01   0.550003D-02
0.305631D+00  -0.208002D+00  -0.550003D-02
   91  -0.110916D+00  -0.852031D-01   0.811106D-02
0.110916D+00  -0.304128D+00  -0.811106D-02
   92   0.110916D+00  -0.852031D-01   0.811106D-02
-0.110916D+00  -0.304128D+00  -0.811106D-02
   93   0.305631D+00  -0.559996D-01   0.550003D-02
-0.305631D+00  -0.208002D+00  -0.550003D-02
   94   0.473691D+00   0.000000D+00   0.000000D+00
-0.473691D+00   0.000000D+00   0.000000D+00
   95  -0.101523D+01   0.000000D+00   0.000000D+00
0.101523D+01   0.000000D+00   0.000000D+00
   96  -0.196098D+00   0.712226D+00  -0.375064D-01
0.196098D+00   0.150422D+00   0.375064D-01
   97  -0.779241D-01   0.446926D+00  -0.270080D-01
0.779241D-01   0.174259D+00   0.270080D-01
   98   0.779241D-01   0.446926D+00  -0.270080D-01
-0.779241D-01   0.174259D+00   0.270080D-01
   99   0.196098D+00   0.712226D+00  -0.375064D-01
-0.196098D+00   0.150422D+00   0.375064D-01
  100   0.101523D+01   0.000000D+00   0.000000D+00
-0.101523D+01   0.000000D+00   0.000000D+00
  101  -0.101523D+01   0.000000D+00   0.000000D+00
0.101523D+01   0.000000D+00   0.000000D+00
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  102  -0.196098D+00   -0.150422D+00    0.139936D-01
0.196098D+00    0.122435D+00   -0.139936D-01
  103  -0.779241D-01   -0.174259D+00    0.244920D-01
0.779241D-01    0.125275D+00   -0.244920D-01
  104   0.779241D-01   -0.174259D+00    0.244920D-01
-0.779241D-01    0.125275D+00   -0.244920D-01
  105   0.196098D+00   -0.150422D+00    0.139936D-01
-0.196098D+00    0.122435D+00   -0.139936D-01
  106   0.101523D+01    0.000000D+00    0.000000D+00
-0.101523D+01    0.000000D+00    0.000000D+00
  107  -0.101523D+01    0.000000D+00    0.000000D+00
0.101523D+01    0.000000D+00    0.000000D+00
  108  -0.196098D+00   -0.122435D+00    0.654936D-01
0.196098D+00   -0.138392D+01   -0.654936D-01
  109  -0.779241D-01   -0.125275D+00    0.759920D-01
0.779241D-01   -0.162254D+01   -0.759920D-01
  110   0.779241D-01   -0.125275D+00    0.759920D-01
-0.779241D-01   -0.162254D+01   -0.759920D-01
  111   0.196098D+00   -0.122435D+00    0.654936D-01
-0.196098D+00   -0.138392D+01   -0.654936D-01
  112   0.101523D+01    0.000000D+00    0.000000D+00
-0.101523D+01    0.000000D+00    0.000000D+00
  113  -0.158948D+01    0.000000D+00    0.000000D+00
0.158948D+01    0.000000D+00    0.000000D+00
  114  -0.134738D+01   -0.507661D+00    0.240704D-01
0.134738D+01   -0.647718D+00   -0.240704D-01
  115  -0.483731D+00   -0.823477D+00    0.387787D-01
0.483731D+00   -0.103790D+01   -0.387787D-01
  116   0.483731D+00   -0.823477D+00    0.387787D-01
-0.483731D+00   -0.103790D+01   -0.387787D-01
  117   0.134738D+01   -0.507661D+00    0.240704D-01
-0.134738D+01   -0.647718D+00   -0.240704D-01
  118   0.158948D+01    0.000000D+00    0.000000D+00
-0.158948D+01    0.000000D+00    0.000000D+00

 SUPPORT REACTIONS

 JOINT        AR1             AR2             AR3
     1-0.202274D+02 0.000000D+00-0.372119D+01
     6-0.202274D+02 0.000000D+00-0.372119D+01
     7-0.520511D+02 0.000000D+00-0.533164D+01
    12-0.520511D+02 0.000000D+00-0.533164D+01
    13 0.000000D+00 0.000000D+00-0.309000D+00
    18 0.000000D+00 0.000000D+00-0.309000D+00
    19 0.000000D+00 0.000000D+00-0.309000D+00
    24 0.000000D+00 0.000000D+00-0.309000D+00
    25 0.776426D+01 0.000000D+00-0.532551D+01
    30 0.776426D+01 0.000000D+00-0.532551D+01
    31-0.267737D+02 0.000000D+00-0.546067D+01
    36-0.267737D+02 0.000000D+00-0.546067D+01
```

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   37 0.000000D+00 0.000000D+00-0.309000D+00
   42 0.000000D+00 0.000000D+00-0.309000D+00
   43 0.000000D+00 0.000000D+00-0.309000D+00
   48 0.000000D+00 0.000000D+00-0.309000D+00
   49 0.267737D+02 0.000000D+00-0.546067D+01
   54 0.267737D+02 0.000000D+00-0.546067D+01
   55-0.776426D+01 0.000000D+00-0.532551D+01
   60-0.776426D+01 0.000000D+00-0.532551D+01
   61 0.000000D+00 0.000000D+00-0.309000D+00
   66 0.000000D+00 0.000000D+00-0.309000D+00
   67 0.000000D+00 0.000000D+00-0.309000D+00
   72 0.000000D+00 0.000000D+00-0.309000D+00
   73 0.520511D+02 0.000000D+00-0.533164D+01
   78 0.520511D+02 0.000000D+00-0.533164D+01
   79 0.202274D+02 0.000000D+00-0.372119D+01
   84 0.202274D+02 0.000000D+00-0.372119D+01
0TOTAL.........................-0.830640D+02

 LOADING NO.    2

  NLJ  NLM
   16    0

 ACTIONS APPLIED AT JOINTS

 JOINT      A1            A2            A3
   26 0.000000D+00 0.000000D+00 0.297700D+01
   27 0.000000D+00 0.000000D+00 0.678000D+01
   28 0.000000D+00 0.000000D+00 0.793800D+01
   29 0.000000D+00 0.000000D+00 0.347300D+01
   32 0.000000D+00 0.000000D+00 0.893100D+01
   33 0.000000D+00 0.000000D+00 0.203410D+02
   34 0.000000D+00 0.000000D+00 0.238130D+02
   35 0.000000D+00 0.000000D+00 0.104180D+02
   50 0.000000D+00 0.000000D+00 0.893100D+01
   51 0.000000D+00 0.000000D+00 0.203410D+02
   52 0.000000D+00 0.000000D+00 0.238130D+02
   53 0.000000D+00 0.000000D+00 0.104180D+02
   56 0.000000D+00 0.000000D+00 0.297700D+01
   57 0.000000D+00 0.000000D+00 0.678000D+01
   58 0.000000D+00 0.000000D+00 0.793800D+01
   59 0.000000D+00 0.000000D+00 0.347300D+01
0TOTAL......................... 0.169342E+03

 JOINT DISPLACEMENTS

 JOINT      D1            D2            D3
    1 0.000000D+00-0.187630D-02 0.000000D+00
    2 0.109261D-03-0.144191D-02 0.810863D-01
    3 0.175675D-03-0.541525D-03 0.129566D+00
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4	0.176031D-03	0.536644D-03	0.129691D+00
5	0.109861D-03	0.144333D-02	0.813028D-01
6	0.000000D+00	0.188377D-02	0.000000D+00
7	0.000000D+00	-0.238590D-02	0.000000D+00
8	0.351689D-03	-0.179438D-02	0.103191D+00
9	0.576222D-03	-0.676617D-03	0.164420D+00
10	0.578670D-03	0.665053D-03	0.164738D+00
11	0.355436D-03	0.179764D-02	0.103742D+00
12	0.000000D+00	0.240473D-02	0.000000D+00
13	0.000000D+00	-0.285525D-02	0.000000D+00
14	0.127688D-02	-0.189335D-02	0.125128D+00
15	0.226298D-02	-0.720344D-03	0.202930D+00
16	0.229614D-02	0.705051D-03	0.203764D+00
17	0.132208D-02	0.189844D-02	0.126387D+00
18	0.000000D+00	0.289197D-02	0.000000D+00
19	0.000000D+00	-0.289606D-02	0.000000D+00
20	0.141103D-02	-0.275406D-02	0.128026D+00
21	0.248437D-02	-0.110060D-02	0.208063D+00
22	0.251944D-02	0.105289D-02	0.208972D+00
23	0.145901D-02	0.277507D-02	0.129388D+00
24	0.000000D+00	0.293434D-02	0.000000D+00
25	0.000000D+00	-0.336540D-02	0.000000D+00
26	0.516696D-03	-0.285304D-02	0.153404D+00
27	0.848538D-03	-0.114433D-02	0.252250D+00
28	0.853337D-03	0.109289D-02	0.253725D+00
29	0.523871D-03	0.287588D-02	0.155545D+00
30	0.000000D+00	0.342159D-02	0.000000D+00
31	0.000000D+00	-0.432926D-02	0.000000D+00
32	0.271746D-03	-0.368846D-02	0.201384D+00
33	0.443913D-03	-0.150670D-02	0.332758D+00
34	0.446618D-03	0.141401D-02	0.335644D+00
35	0.275770D-03	0.373076D-02	0.205400D+00
36	0.000000D+00	0.442829D-02	0.000000D+00
37	0.000000D+00	-0.432926D-02	0.000000D+00
38	0.220932D-03	-0.368846D-02	0.207049D+00
39	0.360905D-03	-0.150670D-02	0.342014D+00
40	0.363104D-03	0.141401D-02	0.344956D+00
41	0.224203D-03	0.373076D-02	0.211150D+00
42	0.000000D+00	0.442829D-02	0.000000D+00
43	0.000000D+00	-0.432926D-02	0.000000D+00
44	-0.220932D-03	-0.368846D-02	0.207049D+00
45	-0.360905D-03	-0.150670D-02	0.342014D+00
46	-0.363104D-03	0.141401D-02	0.344956D+00
47	-0.224203D-03	0.373076D-02	0.211150D+00
48	0.000000D+00	0.442829D-02	0.000000D+00
49	0.000000D+00	-0.432926D-02	0.000000D+00
50	-0.271746D-03	-0.368846D-02	0.201384D+00
51	-0.443913D-03	-0.150670D-02	0.332758D+00
52	-0.446618D-03	0.141401D-02	0.335644D+00
53	-0.275770D-03	0.373076D-02	0.205400D+00

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54 0.000000D+00 0.442829D-02 0.000000D+00
55 0.000000D+00-0.336540D-02 0.000000D+00
56-0.516696D-03-0.285304D-02 0.153404D+00
57-0.848538D-03-0.114433D-02 0.252250D+00
58-0.853337D-03 0.109289D-02 0.253725D+00
59-0.523871D-03 0.287588D-02 0.155545D+00
60 0.000000D+00 0.342159D-02 0.000000D+00
61 0.000000D+00-0.289606D-02 0.000000D+00
62-0.141103D-02-0.275406D-02 0.128026D+00
63-0.248437D-02-0.110060D-02 0.208063D+00
64-0.251944D-02 0.105289D-02 0.208972D+00
65-0.145901D-02 0.277507D-02 0.129388D+00
66 0.000000D+00 0.293434D-02 0.000000D+00
67 0.000000D+00-0.285525D-02 0.000000D+00
68-0.127688D-02-0.189335D-02 0.125128D+00
69-0.226298D-02-0.720344D-03 0.202930D+00
70-0.229614D-02 0.705051D-03 0.203764D+00
71-0.132208D-02 0.189844D-02 0.126387D+00
72 0.000000D+00 0.289197D-02 0.000000D+00
73 0.000000D+00-0.238590D-02 0.000000D+00
74-0.351689D-03-0.179438D-02 0.103191D+00
75-0.576222D-03-0.676617D-03 0.164420D+00
76-0.578670D-03 0.665053D-03 0.164738D+00
77-0.355436D-03 0.179764D-02 0.103742D+00
78 0.000000D+00 0.240473D-02 0.000000D+00
79 0.000000D+00-0.187630D-02 0.000000D+00
80-0.109261D-03-0.144191D-02 0.810863D-01
81-0.175675D-03-0.541525D-03 0.129566D+00
82-0.176031D-03 0.536644D-03 0.129691D+00
83-0.109861D-03 0.144333D-02 0.813028D-01
84 0.000000D+00 0.188377D-02 0.000000D+00
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MEMBER END ACTIONS

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 MEMBER      AM1           AM2           AM3           AM4
   AM5           AM6
     1   -0.811381D+01  -0.959465D+01  -0.285933D+00
0.811381D+01   0.233194D+02   0.285933D+00
     2   -0.493195D+01  -0.299556D+02  -0.173163D+00
0.493195D+01   0.382674D+02   0.173163D+00
     3   -0.264455D-01  -0.408109D+02  -0.149383D-02
0.264455D-01   0.408826D+02   0.149383D-02
     4    0.491383D+01  -0.384649D+02   0.171453D+00
-0.491383D+01   0.302352D+02  -0.171453D+00
     5    0.815838D+01  -0.235643D+02   0.286578D+00
-0.815838D+01   0.980855D+01  -0.286578D+00
     6   -0.261166D+02  -0.884735D+01  -0.565116D+00
0.261166D+02   0.359729D+02   0.565116D+00
     7   -0.166740D+02  -0.332258D+02  -0.380036D+00
0.166740D+02   0.514675D+02   0.380036D+00
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   8  -0.181778D+00  -0.506421D+02  -0.781141D-02
0.181778D+00   0.510171D+02   0.781141D-02
   9   0.165775D+02  -0.518631D+02   0.373118D+00
-0.165775D+02   0.339534D+02  -0.373118D+00
  10   0.263949D+02  -0.366634D+02   0.569307D+00
-0.263949D+02   0.933666D+01  -0.569307D+00
  11  -0.383702D+02   0.294658D+00  -0.821075D+00
0.383702D+02   0.391170D+02   0.821075D+00
  12  -0.246429D+02  -0.509572D+02  -0.574073D+00
0.246429D+02   0.785127D+02   0.574073D+00
  13  -0.356365D+00  -0.836172D+02  -0.475224D-01
0.356365D+00   0.858983D+02   0.475224D-01
  14   0.244664D+02  -0.814239D+02   0.578116D+00
-0.244664D+02   0.536744D+02  -0.578116D+00
  15   0.389030D+02  -0.415396D+02   0.869390D+00
-0.389030D+02  -0.191085D+00  -0.869390D+00
  16  -0.201801D+02   0.181473D+02  -0.176768D+01
0.201801D+02   0.667011D+02   0.176768D+01
  17  -0.127853D+02  -0.509719D+02  -0.132019D+01
0.127853D+02   0.114341D+03   0.132019D+01
  18  -0.200841D+00  -0.107519D+03  -0.130556D+00
0.200841D+00   0.113785D+03   0.130556D+00
  19   0.126873D+02  -0.119831D+03   0.133585D+01
-0.126873D+02   0.557106D+02  -0.133585D+01
  20   0.204789D+02  -0.718063D+02   0.189084D+01
-0.204789D+02  -0.189541D+02  -0.189084D+01
  21   0.201801D+02   0.181473D+02  -0.176768D+01
-0.201801D+02   0.667011D+02   0.176768D+01
  22   0.127853D+02  -0.509719D+02  -0.132019D+01
-0.127853D+02   0.114341D+03   0.132019D+01
  23   0.200841D+00  -0.107519D+03  -0.130556D+00
-0.200841D+00   0.113785D+03   0.130556D+00
  24  -0.126873D+02  -0.119831D+03   0.133585D+01
0.126873D+02   0.557106D+02  -0.133585D+01
  25  -0.204789D+02  -0.718063D+02   0.189084D+01
0.204789D+02  -0.189541D+02  -0.189084D+01
  26   0.383702D+02   0.294658D+00  -0.821075D+00
-0.383702D+02   0.391170D+02   0.821075D+00
  27   0.246429D+02  -0.509572D+02  -0.574073D+00
-0.246429D+02   0.785127D+02   0.574073D+00
  28   0.356365D+00  -0.836172D+02  -0.475224D-01
-0.356365D+00   0.858983D+02   0.475224D-01
  29  -0.244664D+02  -0.814239D+02   0.578116D+00
0.244664D+02   0.536744D+02  -0.578116D+00
  30  -0.389030D+02  -0.415396D+02   0.869390D+00
0.389030D+02  -0.191085D+00  -0.869390D+00
  31   0.261166D+02  -0.884735D+01  -0.565116D+00
-0.261166D+02   0.359729D+02   0.565116D+00
  32   0.166740D+02  -0.332258D+02  -0.380036D+00
-0.166740D+02   0.514675D+02   0.380036D+00
```

33	0.181778D+00	-0.506421D+02	-0.781141D-02
-0.181778D+00	0.510171D+02	0.781141D-02	
34	-0.165775D+02	-0.518631D+02	0.373118D+00
0.165775D+02	0.339534D+02	-0.373118D+00	
35	-0.263949D+02	-0.366634D+02	0.569307D+00
0.263949D+02	0.933666D+01	-0.569307D+00	
36	0.811381D+01	-0.959465D+01	-0.285933D+00
-0.811381D+01	0.233194D+02	0.285933D+00	
37	0.493195D+01	-0.299556D+02	-0.173163D+00
-0.493195D+01	0.382674D+02	0.173163D+00	
38	0.264455D-01	-0.408109D+02	-0.149383D-02
-0.264455D-01	0.408826D+02	0.149383D-02	
39	-0.491383D+01	-0.384649D+02	0.171453D+00
0.491383D+01	0.302352D+02	-0.171453D+00	
40	-0.815838D+01	-0.235643D+02	0.286578D+00
0.815838D+01	0.980855D+01	-0.286578D+00	
41	0.959465D+01	0.000000D+00	0.000000D+00
-0.959465D+01	0.000000D+00	0.000000D+00	
42	0.663614D+01	0.318186D+01	-0.112770D+00
-0.663614D+01	0.223109D+01	0.112770D+00	
43	0.254351D+01	0.490551D+01	-0.171669D+00
-0.254351D+01	0.333461D+01	0.171669D+00	
44	-0.241768D+01	0.494028D+01	-0.172947D+00
0.241768D+01	0.336118D+01	0.172947D+00	
45	-0.667087D+01	0.324454D+01	-0.115124D+00
0.667087D+01	0.228143D+01	0.115124D+00	
46	-0.980855D+01	0.000000D+00	0.000000D+00
0.980855D+01	0.000000D+00	0.000000D+00	
47	0.184420D+02	0.000000D+00	0.000000D+00
-0.184420D+02	0.000000D+00	0.000000D+00	
48	0.388899D+01	0.721151D+01	-0.297849D+00
-0.388899D+01	-0.360985D+00	0.297849D+00	
49	0.171814D+01	0.131576D+02	-0.543894D+00
-0.171814D+01	-0.648088D+00	0.543894D+00	
50	-0.157165D+01	0.133981D+02	-0.553876D+00
0.157165D+01	-0.658970D+00	0.553876D+00	
51	-0.396092D+01	0.753597D+01	-0.311314D+00
0.396092D+01	-0.375761D+00	0.311314D+00	
52	-0.191452D+02	0.000000D+00	0.000000D+00
0.191452D+02	0.000000D+00	0.000000D+00	
53	0.184420D+02	0.000000D+00	0.000000D+00
-0.184420D+02	0.000000D+00	0.000000D+00	
54	0.388899D+01	0.360985D+00	-0.297849D+00
-0.388899D+01	0.234714D+00	0.297849D+00	
55	0.171814D+01	0.648088D+00	-0.543894D+00
-0.171814D+01	0.439700D+00	0.543894D+00	
56	-0.157165D+01	0.658970D+00	-0.553876D+00
0.157165D+01	0.448783D+00	0.553876D+00	
57	-0.396092D+01	0.375761D+00	-0.311314D+00
0.396092D+01	0.246866D+00	0.311314D+00	

```
  58  -0.191452D+02   0.000000D+00   0.000000D+00
0.191452D+02   0.000000D+00   0.000000D+00
  59   0.184420D+02   0.000000D+00   0.000000D+00
-0.184420D+02   0.000000D+00   0.000000D+00
  60   0.388899D+01  -0.234714D+00  -0.297849D+00
-0.388899D+01   0.708524D+01   0.297849D+00
  61   0.171814D+01  -0.439700D+00  -0.543894D+00
-0.171814D+01   0.129493D+02   0.543894D+00
  62  -0.157165D+01  -0.448783D+00  -0.553876D+00
0.157165D+01   0.131879D+02   0.553876D+00
  63  -0.396092D+01  -0.246866D+00  -0.311314D+00
0.396092D+01   0.740708D+01   0.311314D+00
  64  -0.191452D+02   0.000000D+00   0.000000D+00
0.191452D+02   0.000000D+00   0.000000D+00
  65   0.181473D+02   0.000000D+00   0.000000D+00
-0.181473D+02   0.000000D+00   0.000000D+00
  66   0.157292D+02   0.664210D+01  -0.296768D+00
-0.157292D+02   0.760276D+01   0.296768D+00
  67   0.682266D+01   0.113372D+02  -0.505445D+00
-0.682266D+01   0.129241D+02   0.505445D+00
  68  -0.604600D+01   0.116348D+02  -0.518014D+00
0.604600D+01   0.132299D+02   0.518014D+00
  69  -0.160956D+02   0.702960D+01  -0.313171D+00
0.160956D+02   0.800263D+01   0.313171D+00
  70  -0.189541D+02   0.000000D+00   0.000000D+00
0.189541D+02   0.000000D+00   0.000000D+00
  71  -0.473695D-12   0.000000D+00   0.000000D+00
0.473695D-12   0.000000D+00   0.000000D+00
  72  -0.189478D-12  -0.207952D+00   0.710543D-14
0.189478D-12   0.207952D+00  -0.710543D-14
  73  -0.284217D-13  -0.339702D+00   0.203689D-12
0.284217D-13   0.339702D+00  -0.203689D-12
  74  -0.947390D-14  -0.341772D+00   0.378956D-13
0.947390D-14   0.341772D+00  -0.378956D-13
  75   0.151582D-12  -0.211031D+00   0.111318D-12
-0.151582D-12   0.211031D+00  -0.111318D-12
  76   0.132635D-11   0.000000D+00   0.000000D+00
-0.132635D-11   0.000000D+00   0.000000D+00
  77  -0.909495D-12   0.000000D+00   0.000000D+00
0.909495D-12   0.000000D+00   0.000000D+00
  78  -0.142109D-12  -0.207952D+00   0.378956D-13
0.142109D-12   0.207952D+00  -0.378956D-13
  79  -0.675016D-13  -0.339702D+00   0.000000D+00
0.675016D-13   0.339702D+00   0.000000D+00
  80   0.355271D-13  -0.341772D+00  -0.757912D-13
-0.355271D-13   0.341772D+00   0.757912D-13
  81   0.137372D-12  -0.211031D+00  -0.378956D-13
-0.137372D-12   0.211031D+00   0.378956D-13
  82   0.909495D-12   0.000000D+00   0.000000D+00
-0.909495D-12   0.000000D+00   0.000000D+00
```

83 -0.473695D-12 0.000000D+00 0.000000D+00
0.473695D-12 0.000000D+00 0.000000D+00
84 -0.132635D-12 -0.207952D+00 0.000000D+00
0.132635D-12 0.207952D+00 0.000000D+00
85 -0.473695D-13 -0.339702D+00 -0.175267D-12
0.473695D-13 0.339702D+00 0.175267D-12
86 0.284217D-13 -0.341772D+00 0.236848D-13
-0.284217D-13 0.341772D+00 -0.236848D-13
87 0.132635D-12 -0.211031D+00 -0.805282D-13
-0.132635D-12 0.211031D+00 0.805282D-13
88 0.189478D-12 0.000000D+00 0.000000D+00
-0.189478D-12 0.000000D+00 0.000000D+00
89 -0.181473D+02 0.000000D+00 0.000000D+00
0.181473D+02 0.000000D+00 0.000000D+00
90 -0.157292D+02 -0.760276D+01 0.296768D+00
0.157292D+02 -0.664210D+01 -0.296768D+00
91 -0.682266D+01 -0.129241D+02 0.505445D+00
0.682266D+01 -0.113372D+02 -0.505445D+00
92 0.604600D+01 -0.132299D+02 0.518014D+00
-0.604600D+01 -0.116348D+02 -0.518014D+00
93 0.160956D+02 -0.800263D+01 0.313171D+00
-0.160956D+02 -0.702960D+01 -0.313171D+00
94 0.189541D+02 0.000000D+00 0.000000D+00
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95 -0.184420D+02 0.000000D+00 0.000000D+00
0.184420D+02 0.000000D+00 0.000000D+00
96 -0.388899D+01 -0.708524D+01 0.297849D+00
0.388899D+01 0.234714D+00 -0.297849D+00
97 -0.171814D+01 -0.129493D+02 0.543894D+00
0.171814D+01 0.439700D+00 -0.543894D+00
98 0.157165D+01 -0.131879D+02 0.553876D+00
-0.157165D+01 0.448783D+00 -0.553876D+00
99 0.396092D+01 -0.740708D+01 0.311314D+00
-0.396092D+01 0.246866D+00 -0.311314D+00
100 0.191452D+02 0.000000D+00 0.000000D+00
-0.191452D+02 0.000000D+00 0.000000D+00
101 -0.184420D+02 0.000000D+00 0.000000D+00
0.184420D+02 0.000000D+00 0.000000D+00
102 -0.388899D+01 -0.234714D+00 0.297849D+00
0.388899D+01 -0.360985D+00 -0.297849D+00
103 -0.171814D+01 -0.439700D+00 0.543894D+00
0.171814D+01 -0.648088D+00 -0.543894D+00
104 0.157165D+01 -0.448783D+00 0.553876D+00
-0.157165D+01 -0.658970D+00 -0.553876D+00
105 0.396092D+01 -0.246866D+00 0.311314D+00
-0.396092D+01 -0.375761D+00 -0.311314D+00
106 0.191452D+02 0.000000D+00 0.000000D+00
-0.191452D+02 0.000000D+00 0.000000D+00
107 -0.184420D+02 0.000000D+00 0.000000D+00
0.184420D+02 0.000000D+00 0.000000D+00

108 -0.388899D+01 0.360985D+00 0.297849D+00
0.388899D+01 -0.721151D+01 -0.297849D+00
109 -0.171814D+01 0.648088D+00 0.543894D+00
0.171814D+01 -0.131576D+02 -0.543894D+00
110 0.157165D+01 0.658970D+00 0.553876D+00
-0.157165D+01 -0.133981D+02 -0.553876D+00
111 0.396092D+01 0.375761D+00 0.311314D+00
-0.396092D+01 -0.753597D+01 -0.311314D+00
112 0.191452D+02 0.000000D+00 0.000000D+00
-0.191452D+02 0.000000D+00 0.000000D+00
113 -0.959465D+01 0.000000D+00 0.000000D+00
0.959465D+01 0.000000D+00 0.000000D+00
114 -0.663614D+01 -0.223109D+01 0.112770D+00
0.663614D+01 -0.318186D+01 -0.112770D+00
115 -0.254351D+01 -0.333461D+01 0.171669D+00
0.254351D+01 -0.490551D+01 -0.171669D+00
116 0.241768D+01 -0.336118D+01 0.172947D+00
-0.241768D+01 -0.494028D+01 -0.172947D+00
117 0.667087D+01 -0.228143D+01 0.115124D+00
-0.667087D+01 -0.324454D+01 -0.115124D+00
118 0.980855D+01 0.000000D+00 0.000000D+00
-0.980855D+01 0.000000D+00 0.000000D+00

SUPPORT REACTIONS

JOINT	AR1	AR2	AR3
1	-0.973657D+02	0.000000D+00	-0.343119D+01
6	-0.979005D+02	0.000000D+00	-0.343893D+01
7	-0.313400D+03	0.000000D+00	-0.678139D+01
12	-0.316739D+03	0.000000D+00	-0.683168D+01
13	0.000000D+00	0.000000D+00	0.000000D+00
18	0.000000D+00	0.000000D+00	0.000000D+00
19	0.000000D+00	0.000000D+00	0.000000D+00
24	0.000000D+00	0.000000D+00	0.000000D+00
25	-0.460442D+03	0.000000D+00	-0.985291D+01
30	-0.466837D+03	0.000000D+00	-0.104327D+02
31	-0.242161D+03	0.000000D+00	-0.212121D+02
36	-0.245747D+03	0.000000D+00	-0.226901D+02
37	0.000000D+00	0.000000D+00	0.000000D+00
42	0.000000D+00	0.000000D+00	0.000000D+00
43	0.000000D+00	0.000000D+00	0.000000D+00
48	0.000000D+00	0.000000D+00	0.000000D+00
49	0.242161D+03	0.000000D+00	-0.212121D+02
54	0.245747D+03	0.000000D+00	-0.226901D+02
55	0.460442D+03	0.000000D+00	-0.985291D+01
60	0.466837D+03	0.000000D+00	-0.104327D+02
61	0.000000D+00	0.000000D+00	0.000000D+00
66	0.000000D+00	0.000000D+00	0.000000D+00
67	0.000000D+00	0.000000D+00	0.000000D+00
72	0.000000D+00	0.000000D+00	0.000000D+00

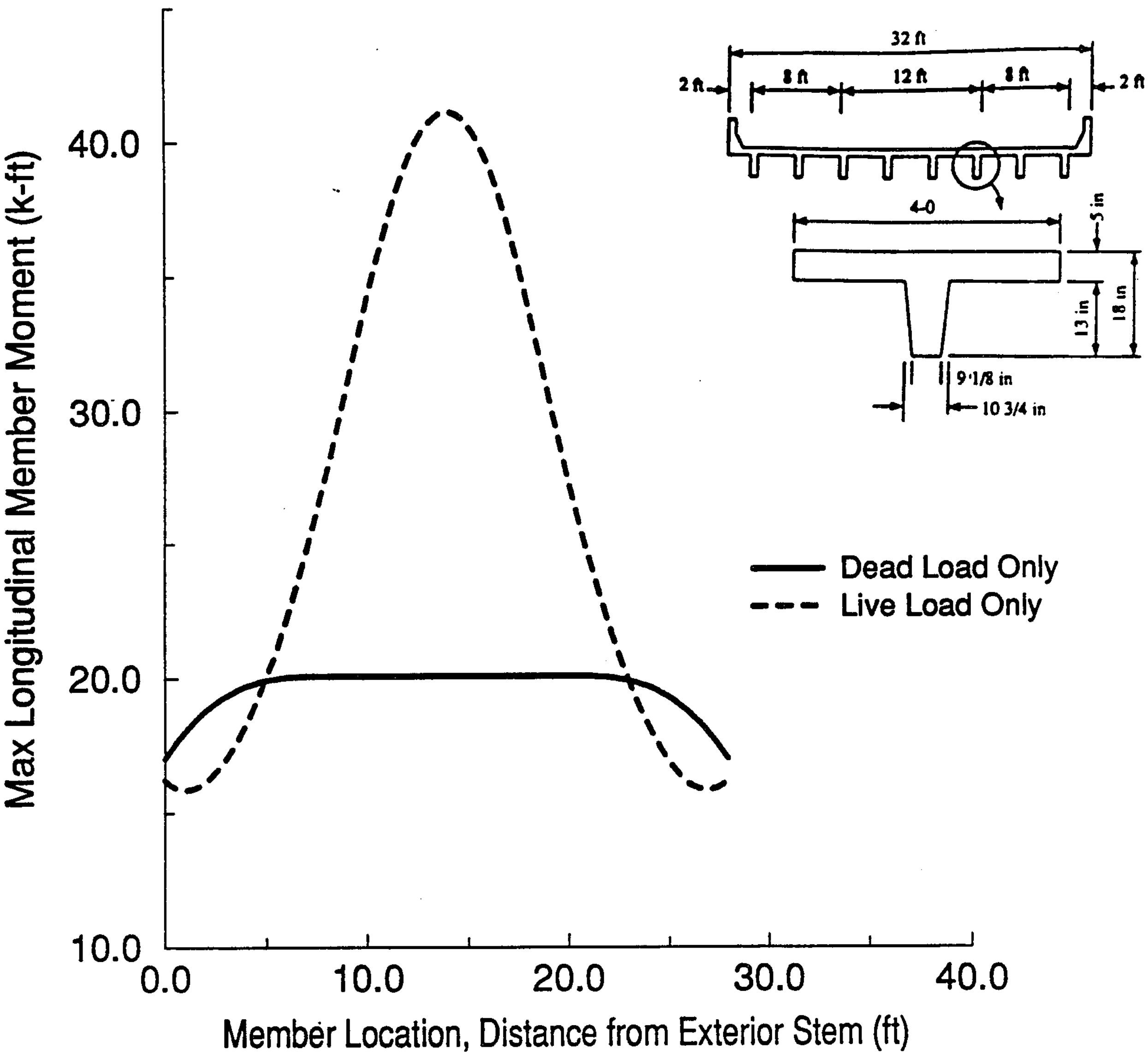
```
   73 0.313400D+03 0.000000D+00-0.678139D+01
   78 0.316739D+03 0.000000D+00-0.683168D+01
   79 0.973657D+02 0.000000D+00-0.343119D+01
   84 0.979005D+02 0.000000D+00-0.343893D+01
OTOTAL........................-0.169342D+03
```

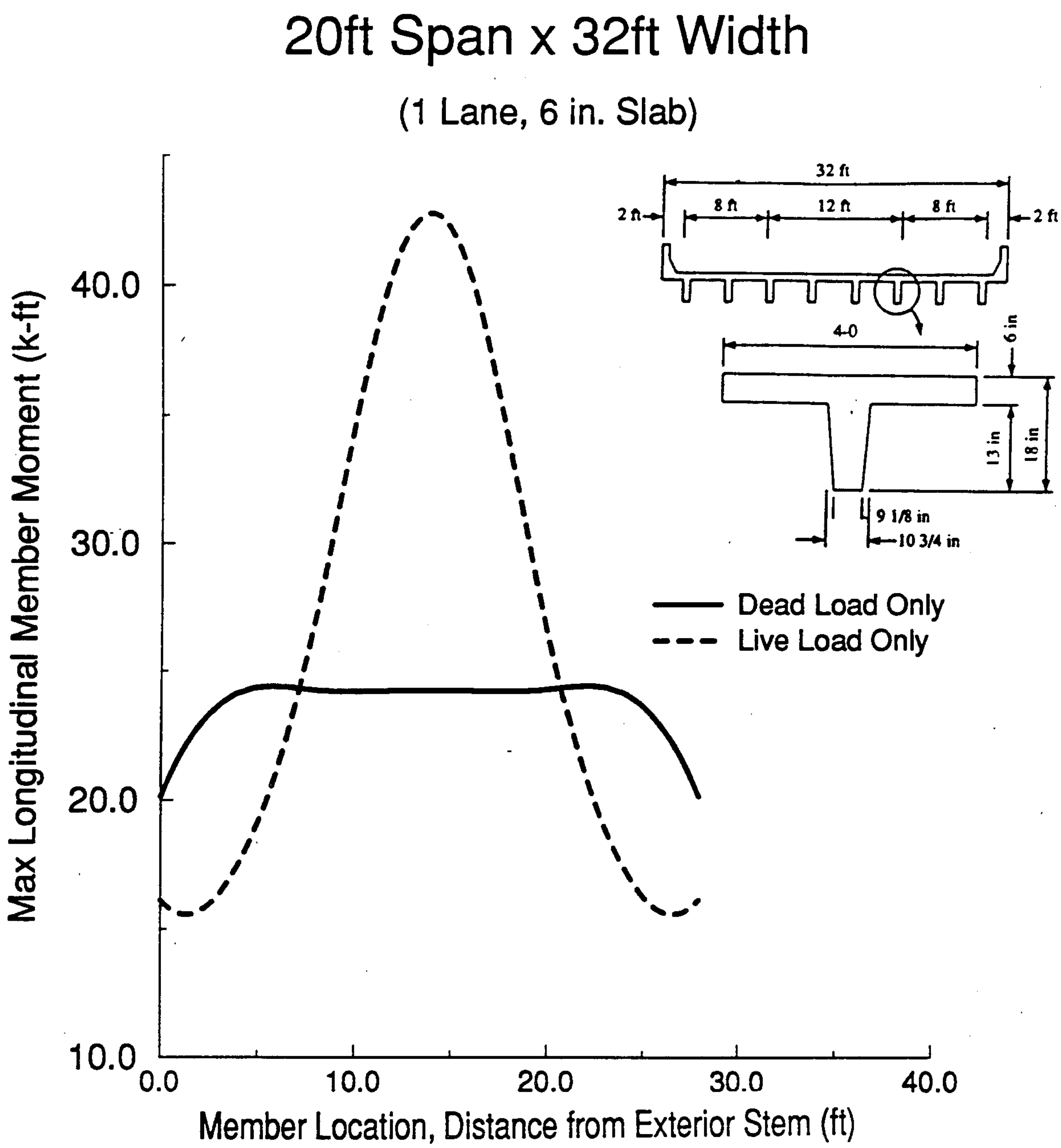
APPENDIX B

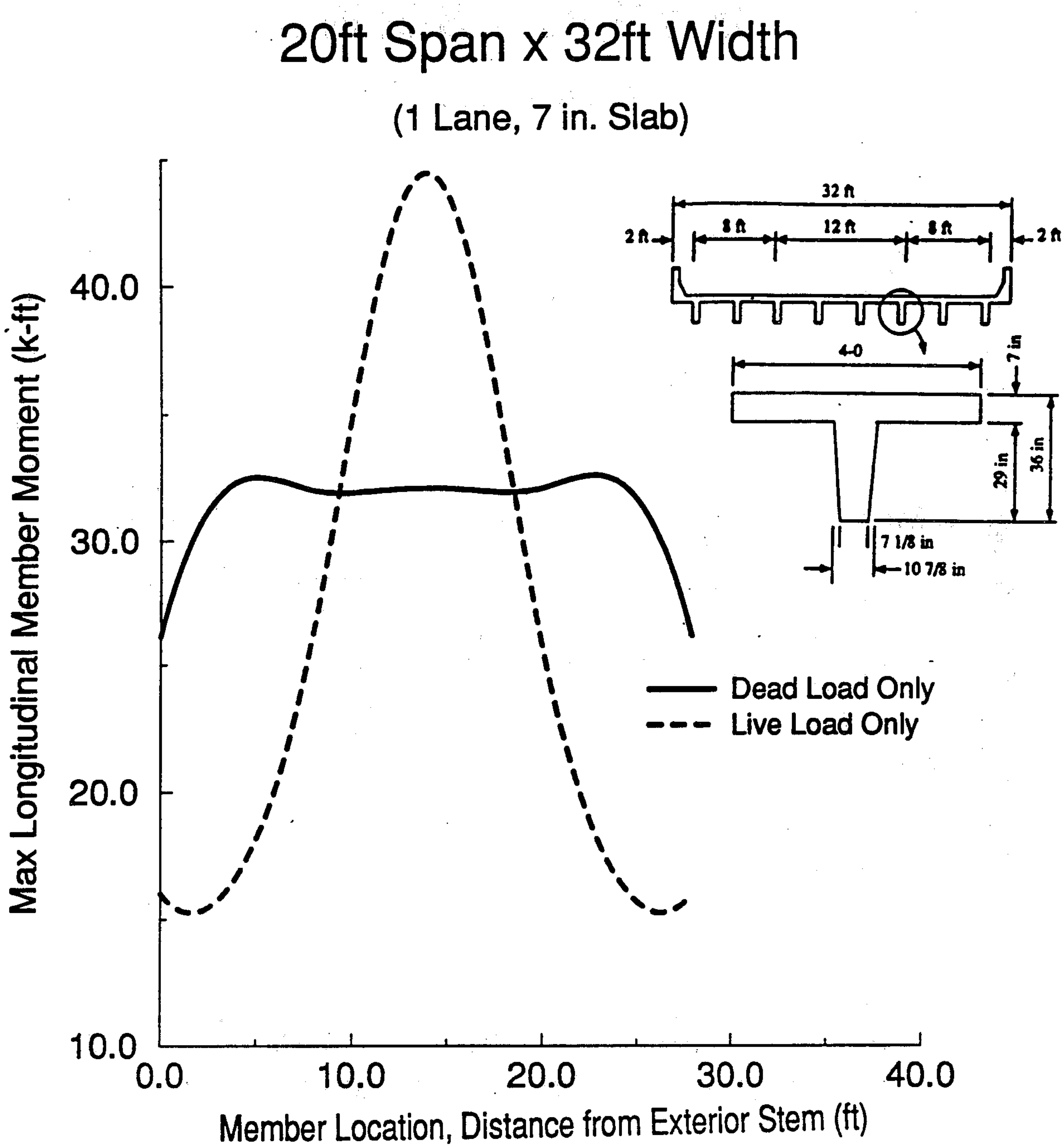
MAXIMUM LONGITUDINAL MOMENTS

20ft Span x 32ft Width

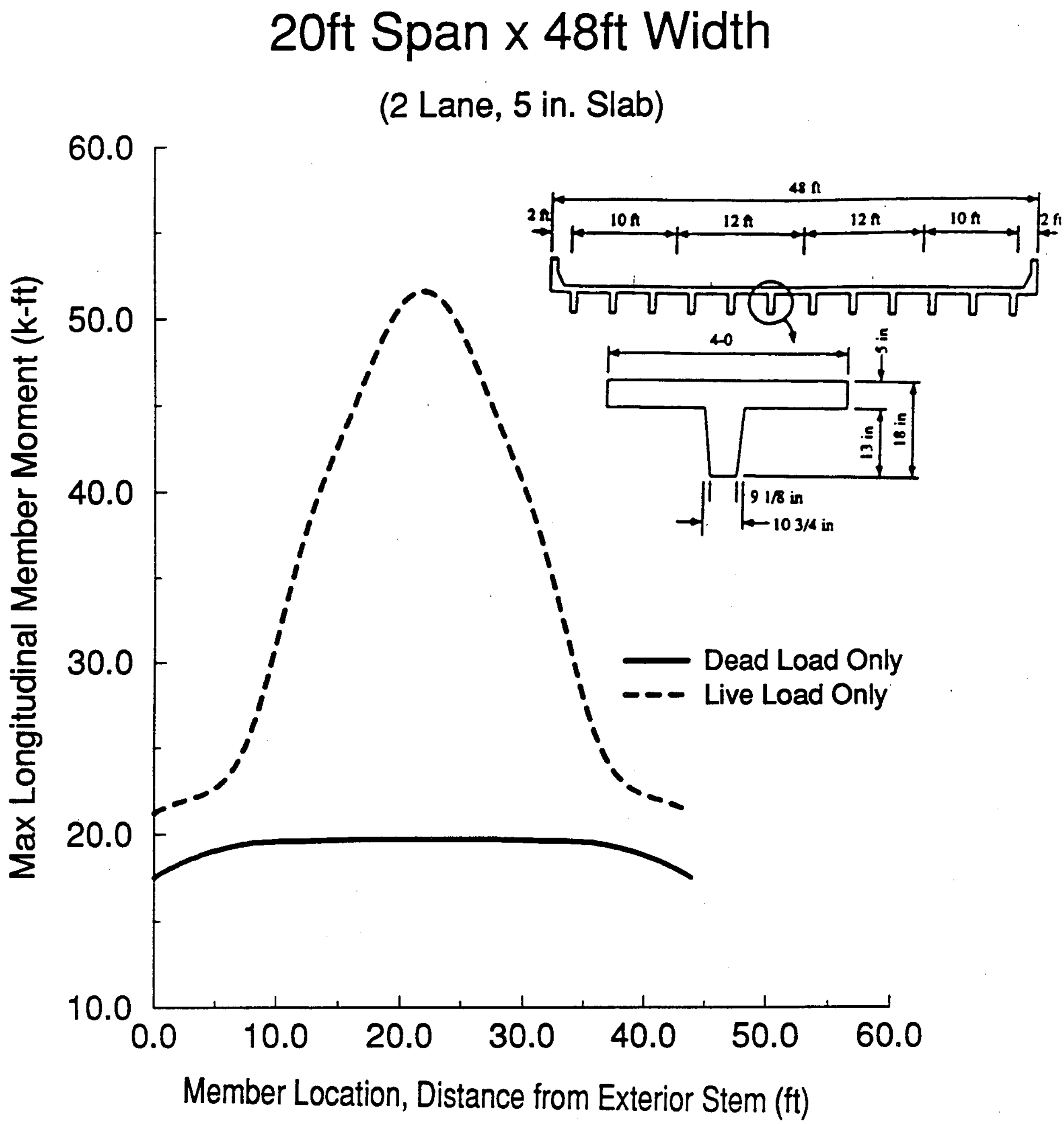
(1 Lane, 5 in. Slab)

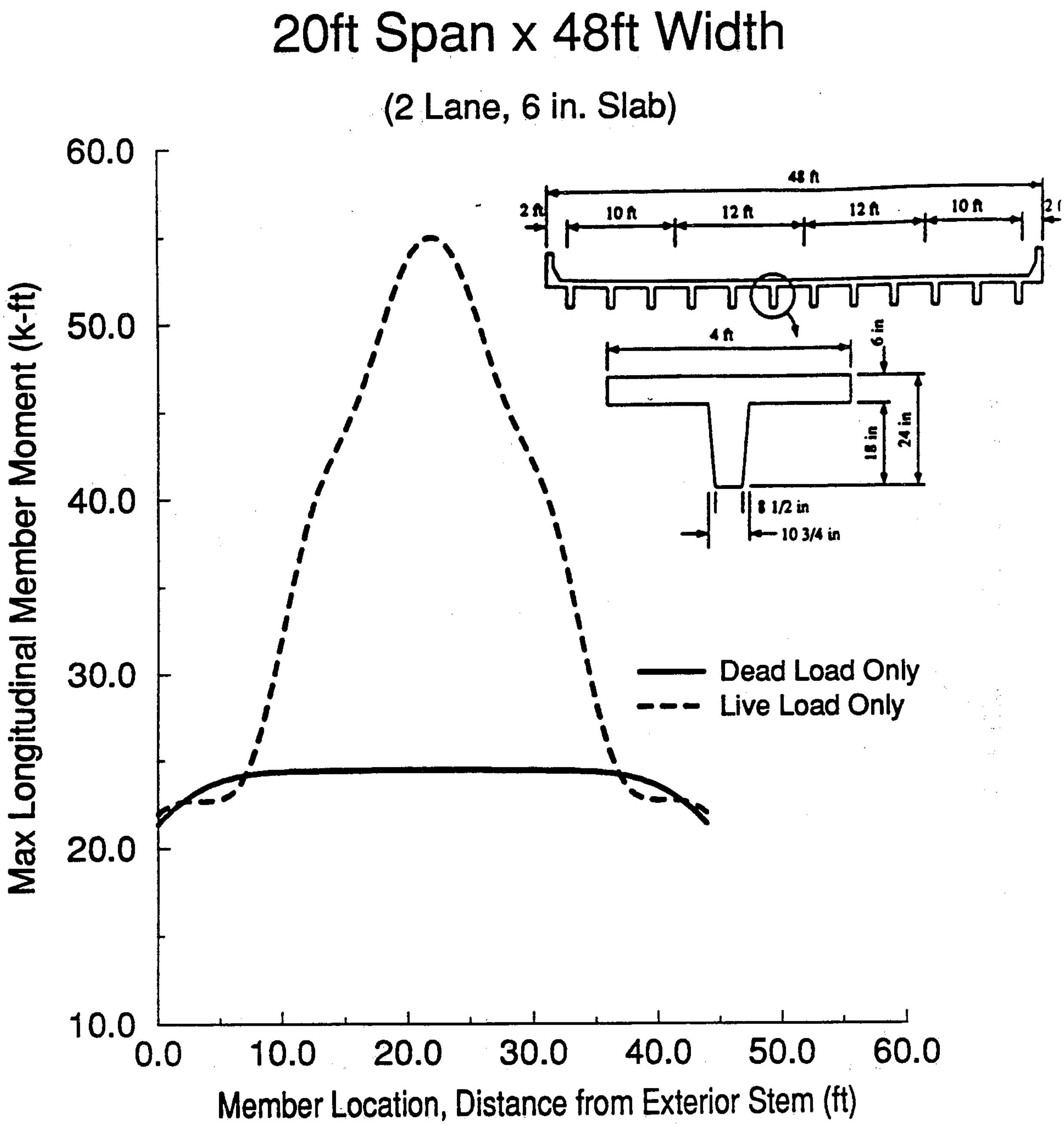



20ft Span x 32ft Width
(1 Lane, 6 in. Slab)
32 ft
2 ft
8 ft
12 ft
8 ft
2 ft
4-0
6 in
13 in
18 in
9 1/8 in
10 3/4 in
Dead Load Only
Live Load Only
Max Longitudinal Member Moment (k-ft)
40.0
30.0
20.0
10.0
0.0
10.0
20.0
30.0
40.0
Member Location, Distance from Exterior Stem (ft)



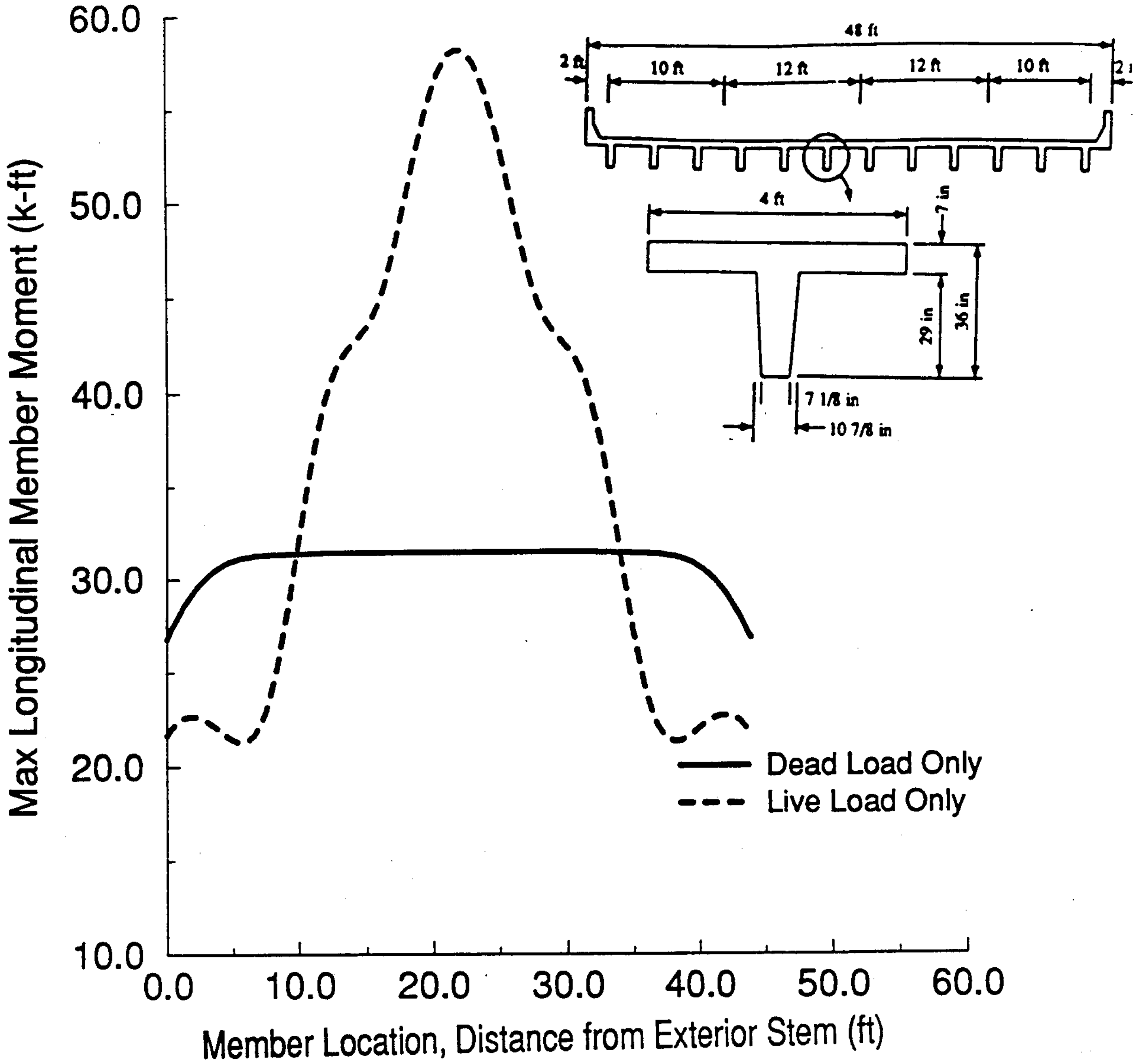
20ft Span x 32ft Width
(1 Lane, 7 in. Slab)
Max Longitudinal Member Moment (k-ft)
40.0
30.0
20.0
10.0
0.0
10.0
20.0
30.0
40.0
Member Location, Distance from Exterior Stem (ft)
Dead Load Only
Live Load Only
32 ft
2 ft
8 ft
12 ft
8 ft
2 ft
4-0
7 in
29 in
36 in
7 1/8 in
10 7/8 in

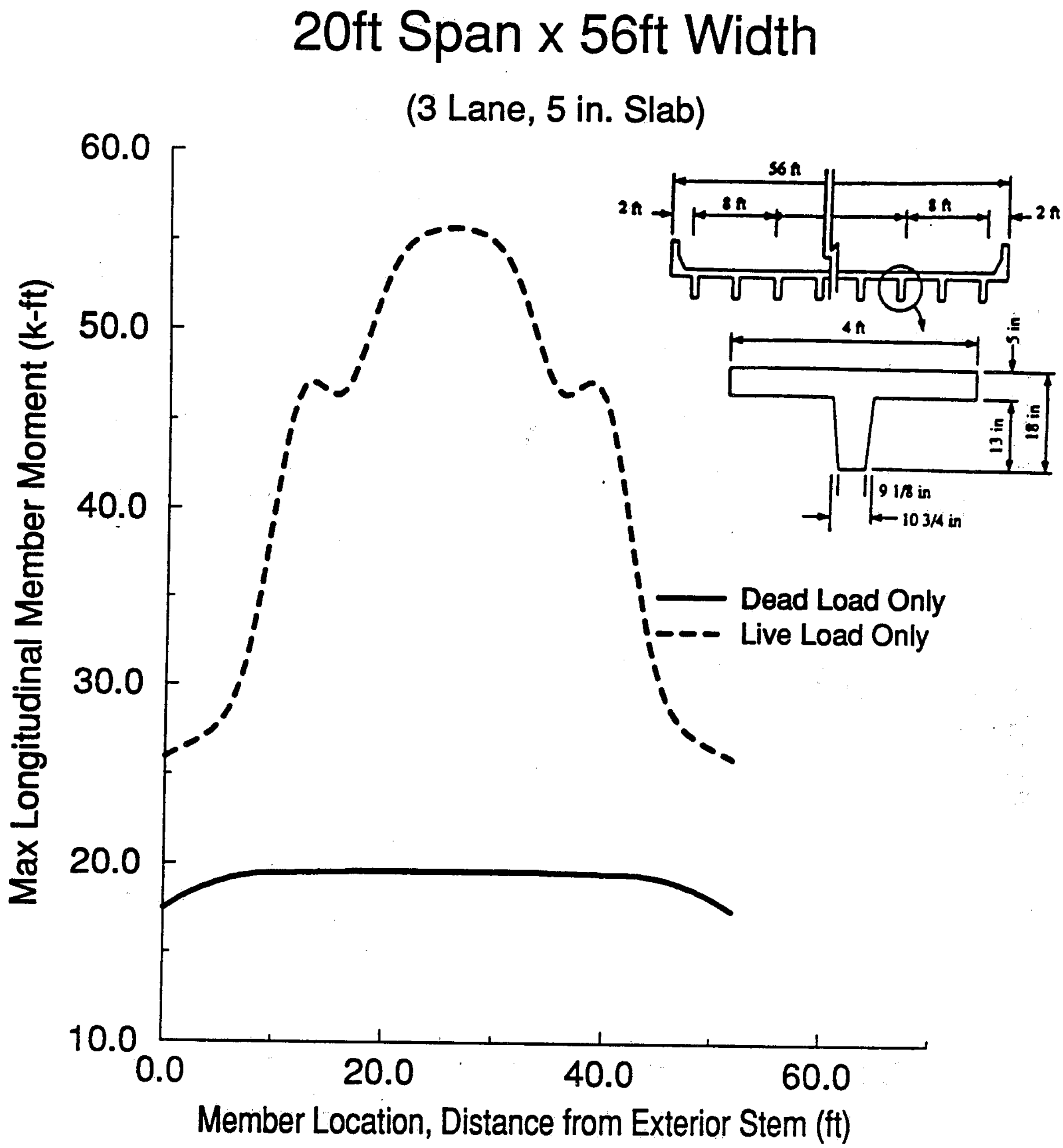

20ft Span x 48ft Width
(2 Lane, 5 in. Slab)
Max Longitudinal Member Moment (k-ft)
Member Location, Distance from Exterior Stem (ft)
Dead Load Only
Live Load Only
48 ft
2 ft
10 ft
12 ft
12 ft
10 ft
2 ft
4-0
5 in
13 in
18 in
9 1/8 in
10 3/4 in
60.0
50.0
40.0
30.0
20.0
10.0
0.0
10.0
20.0
30.0
40.0
50.0
60.0


20ft Span x 48ft Width
(2 Lane, 6 in. Slab)
Max Longitudinal Member Moment (k-ft)
60.0
50.0
40.0
30.0
20.0
10.0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
Member Location, Distance from Exterior Stem (ft)
Dead Load Only
Live Load Only
48 ft
2 ft
10 ft
12 ft
12 ft
10 ft
4 ft
6 in
18 in
24 in
8 1/2 in
10 3/4 in

20ft Span x 48ft Width

(2 Lane, 7 in. Slab)

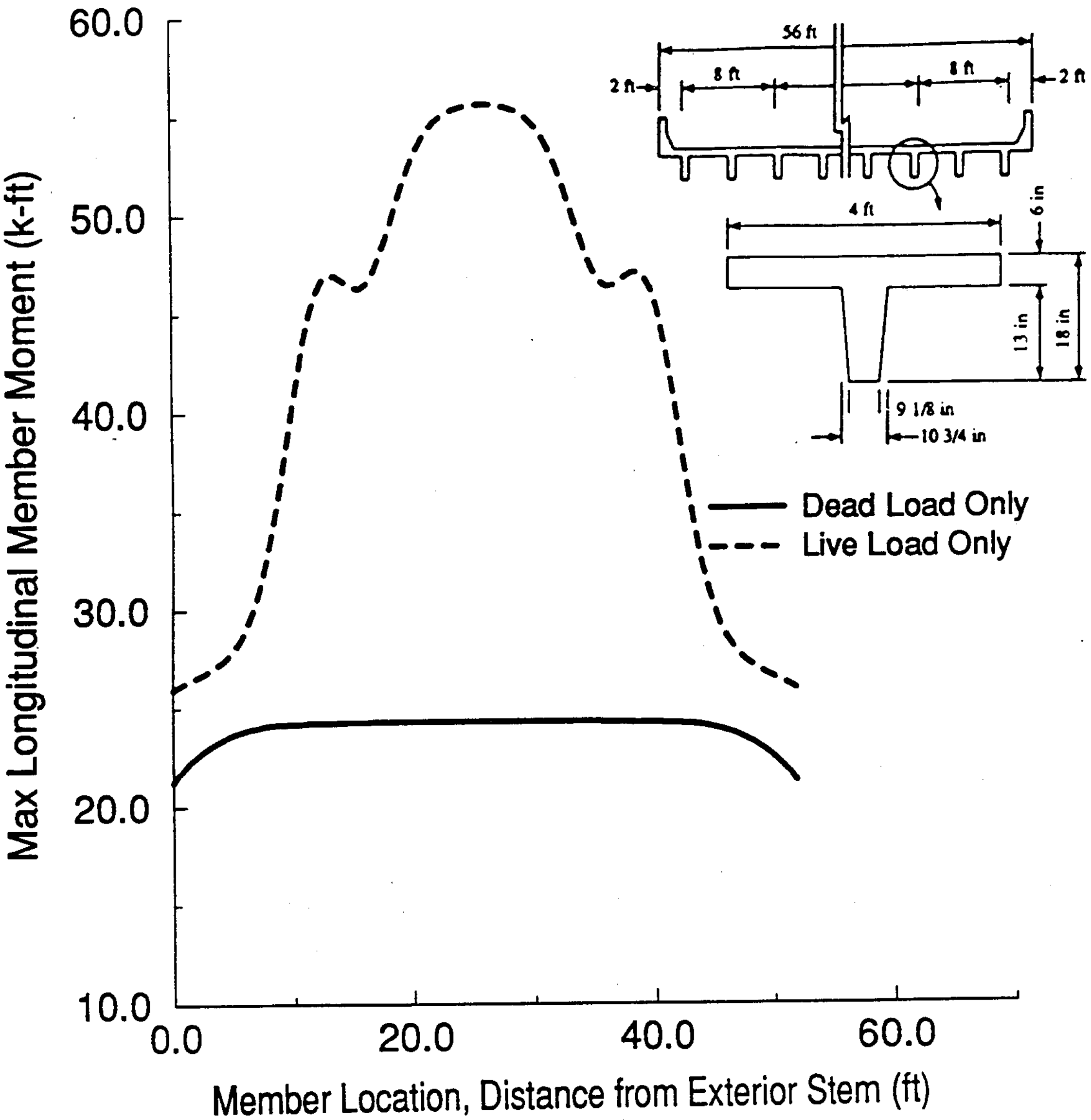


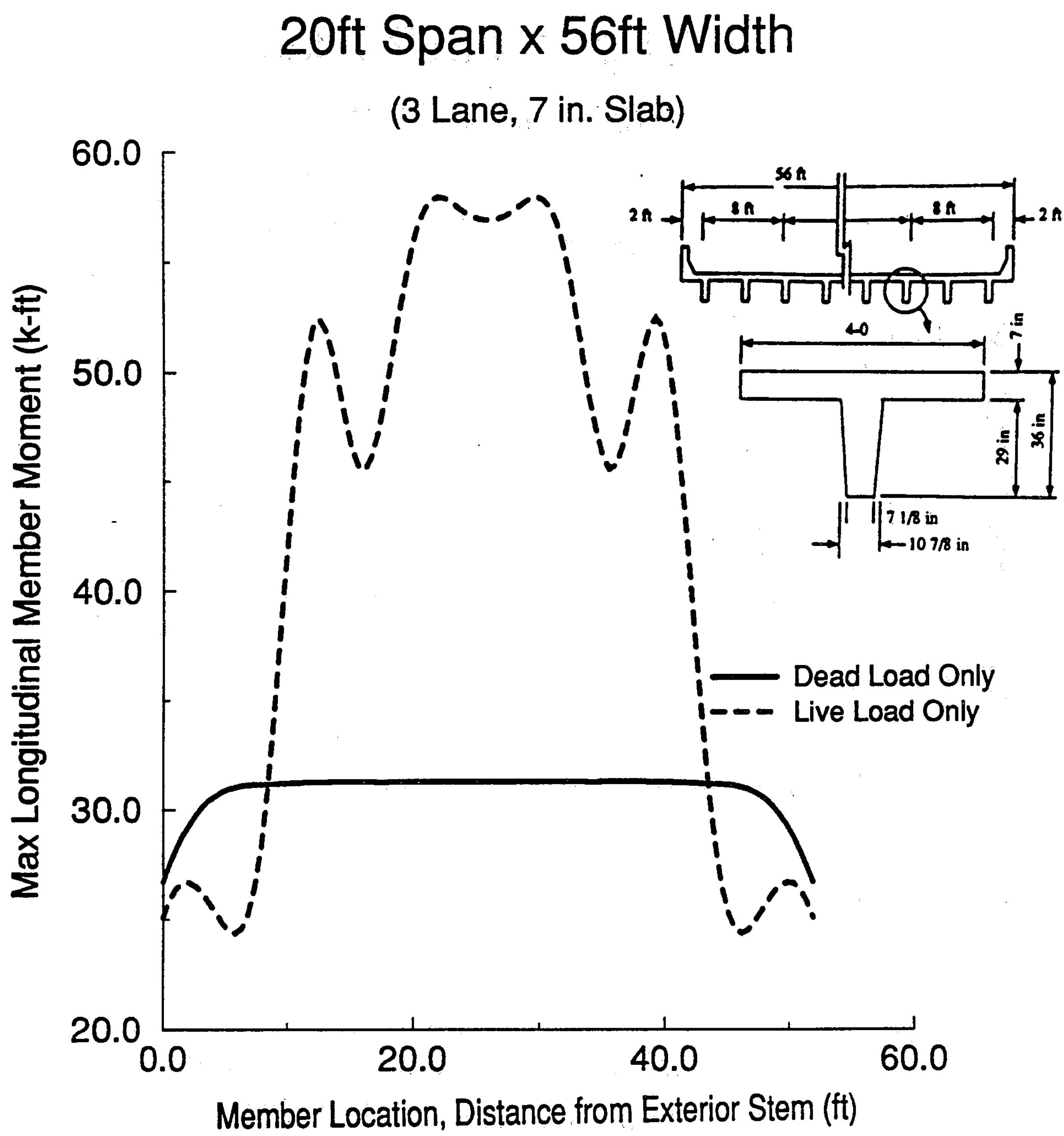


20ft Span x 56ft Width
(3 Lane, 5 in. Slab)
Max Longitudinal Member Moment (k-ft)
60.0
50.0
40.0
30.0
20.0
10.0
0.0
20.0
40.0
60.0
Member Location, Distance from Exterior Stem (ft)
Dead Load Only
Live Load Only
56 ft
2 ft
8 ft
8 ft
2 ft
4 ft
5 in
13 in
18 in
9 1/8 in
10 3/4 in

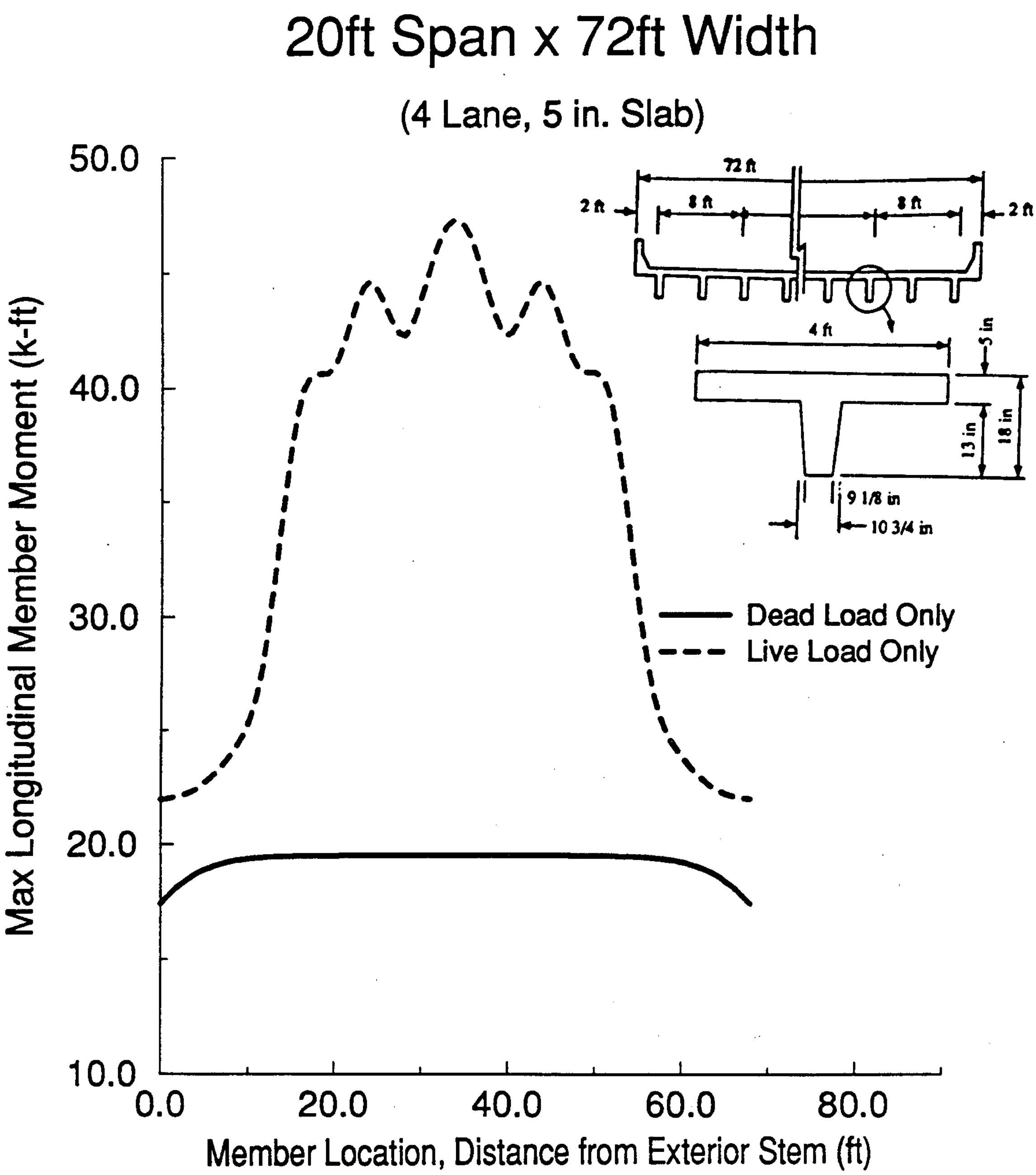
20ft Span x 56ft Width

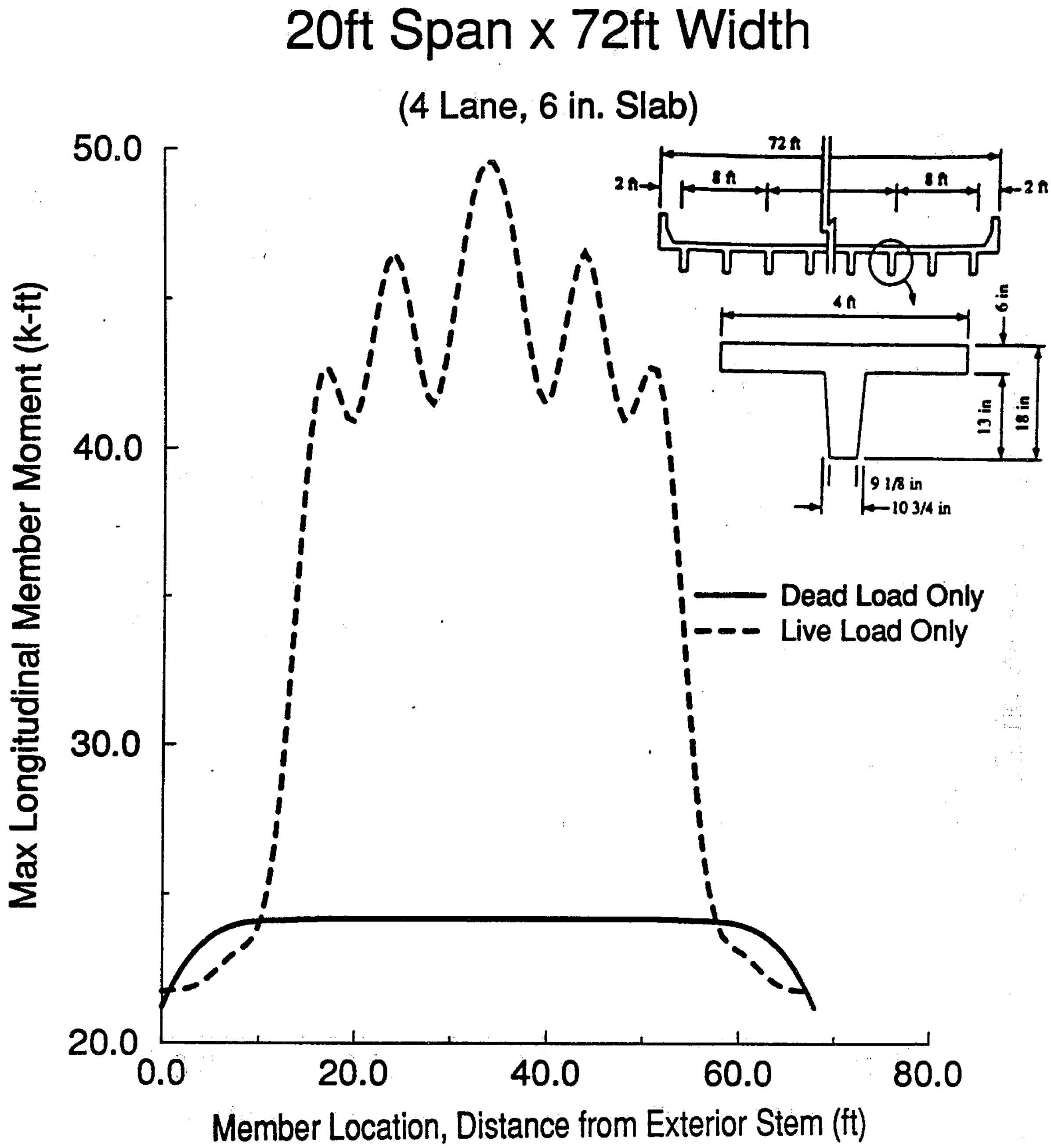
(3 Lane, 6 in. Slab)





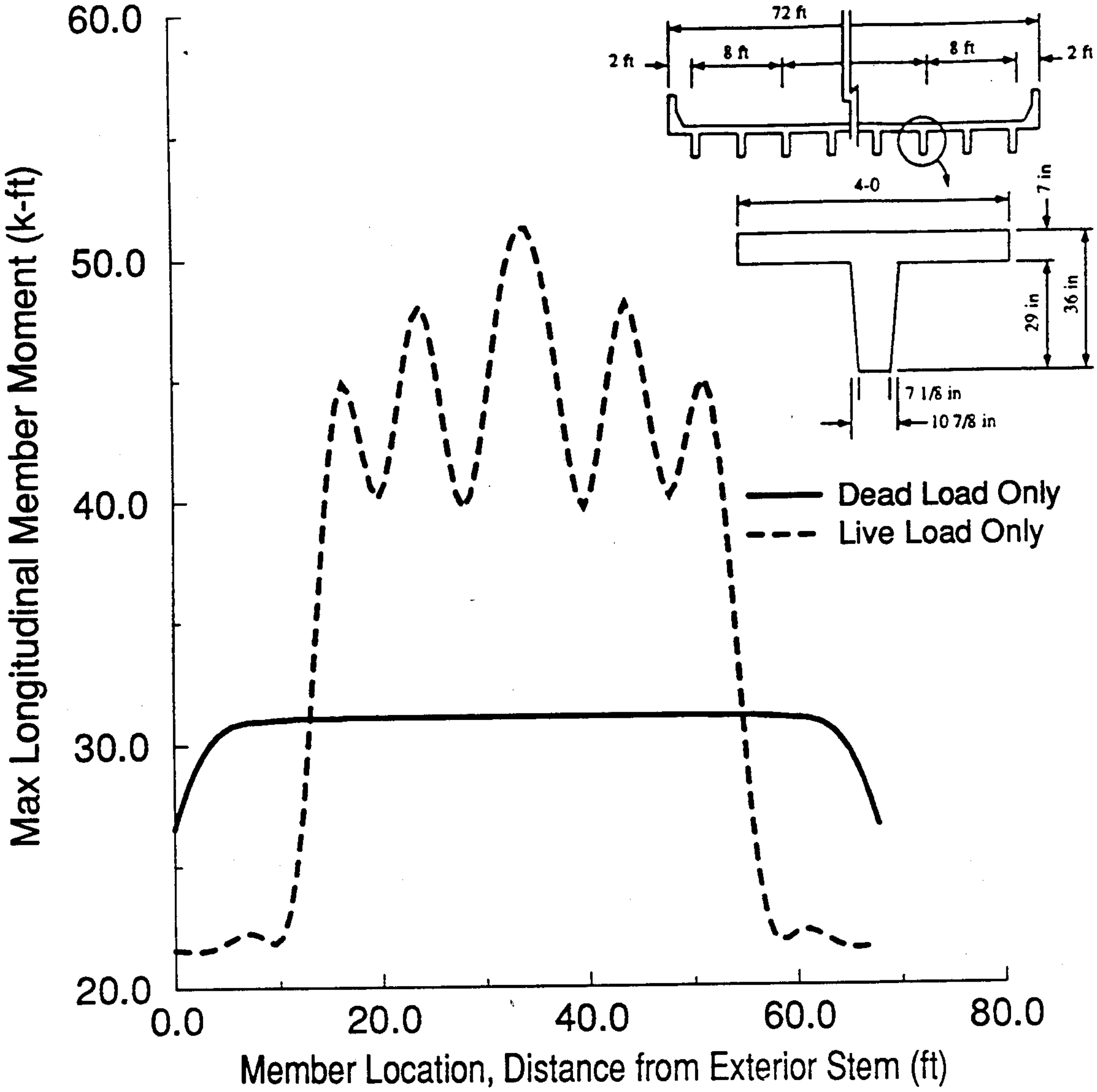
20ft Span x 56ft Width
(3 Lane, 7 in. Slab)
60.0
50.0
40.0
30.0
20.0
0.0
20.0
40.0
60.0
Max Longitudinal Member Moment (k-ft)
Member Location, Distance from Exterior Stem (ft)
Dead Load Only
Live Load Only
56 ft
2 ft
8 ft
8 ft
2 ft
4-0
7 in
29 in
36 in
7 1/8 in
10 7/8 in


20ft Span x 72ft Width
(4 Lane, 5 in. Slab)
Max Longitudinal Member Moment (k-ft)
Member Location, Distance from Exterior Stem (ft)
Dead Load Only
Live Load Only
72 ft
2 ft
8 ft
4 ft
5 in
13 in
18 in
9 1/8 in
10 3/4 in


20ft Span x 72ft Width
(4 Lane, 6 in. Slab)
50.0
40.0
30.0
20.0
Max Longitudinal Member Moment (k-ft)
0.0
20.0
40.0
60.0
80.0
Member Location, Distance from Exterior Stem (ft)
72 ft
2 ft
8 ft
8 ft
2 ft
4 ft
6 in
13 in
18 in
9 1/8 in
10 3/4 in
Dead Load Only
Live Load Only

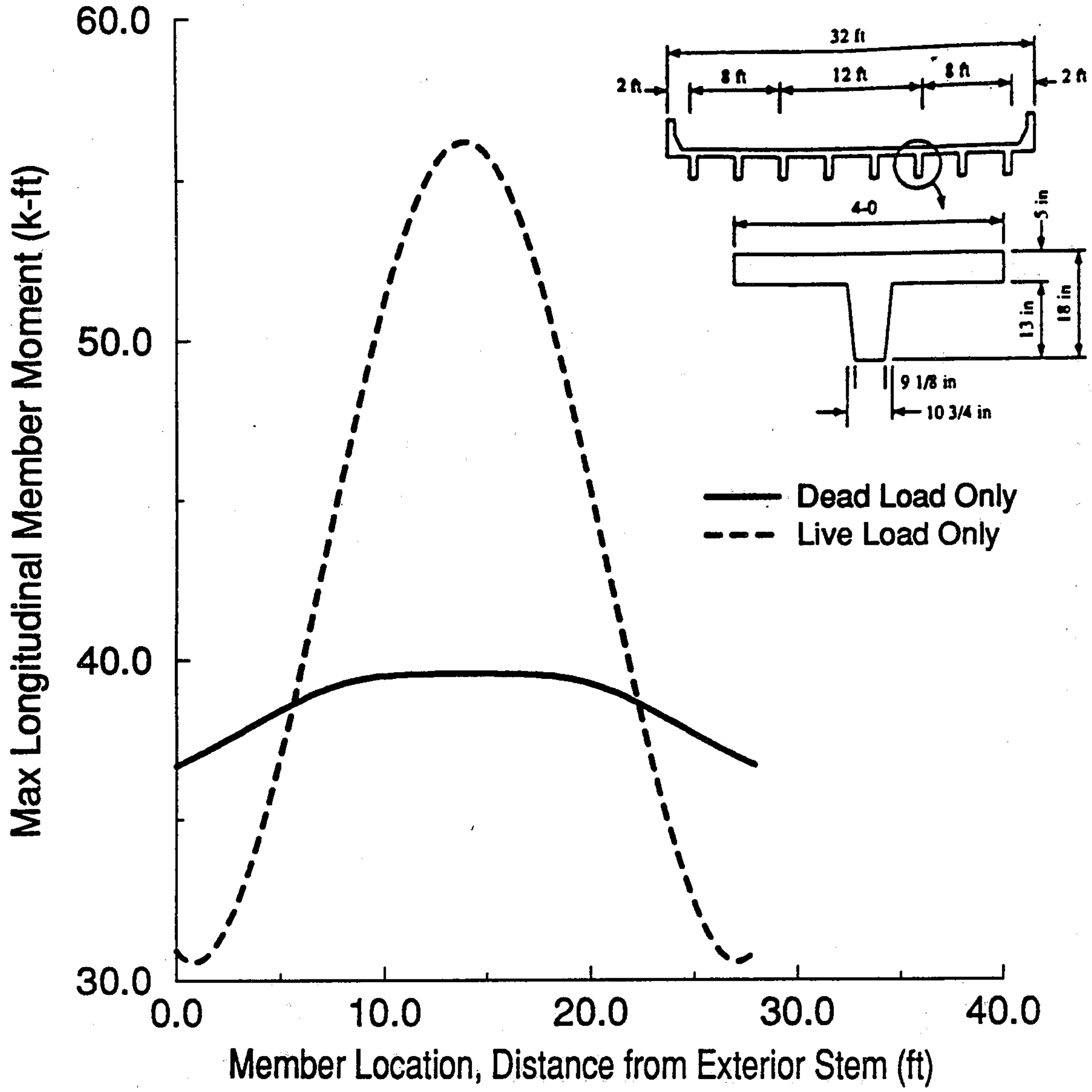
20ft Span x 72ft Width

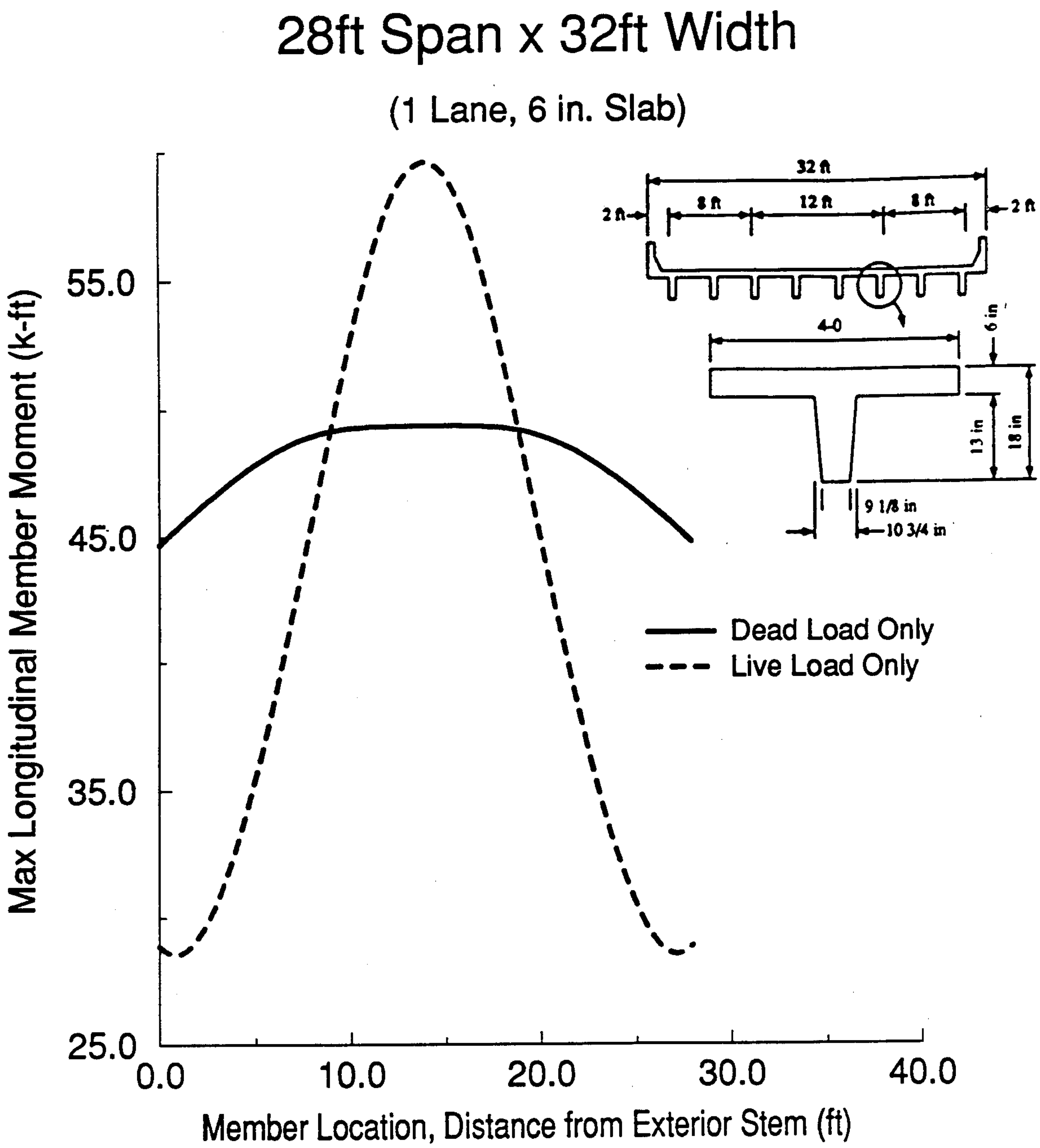
(4 Lane, 7 in. Slab)

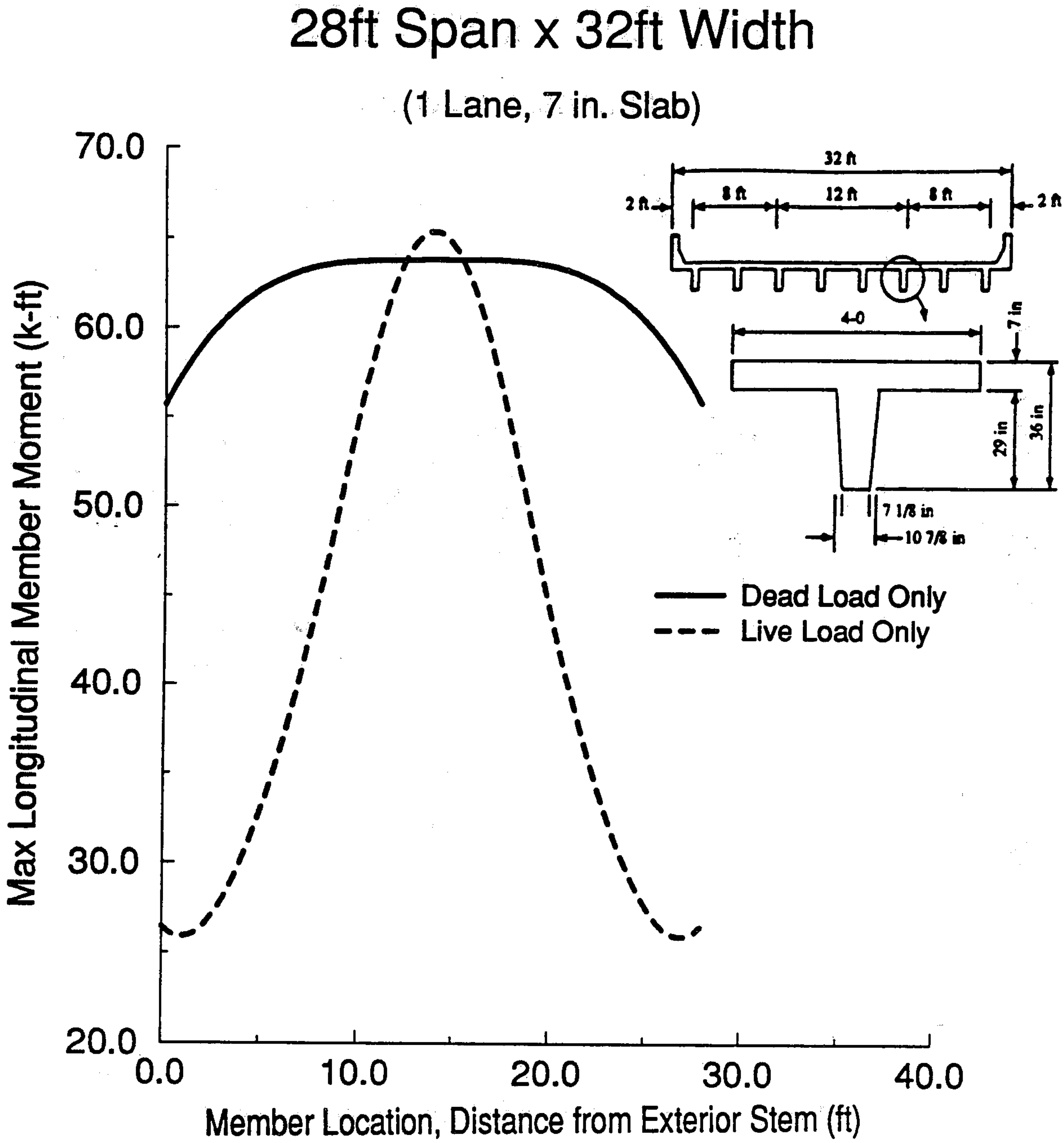


28ft Span x 32ft Width

(1 Lane, 5 in. Slab)

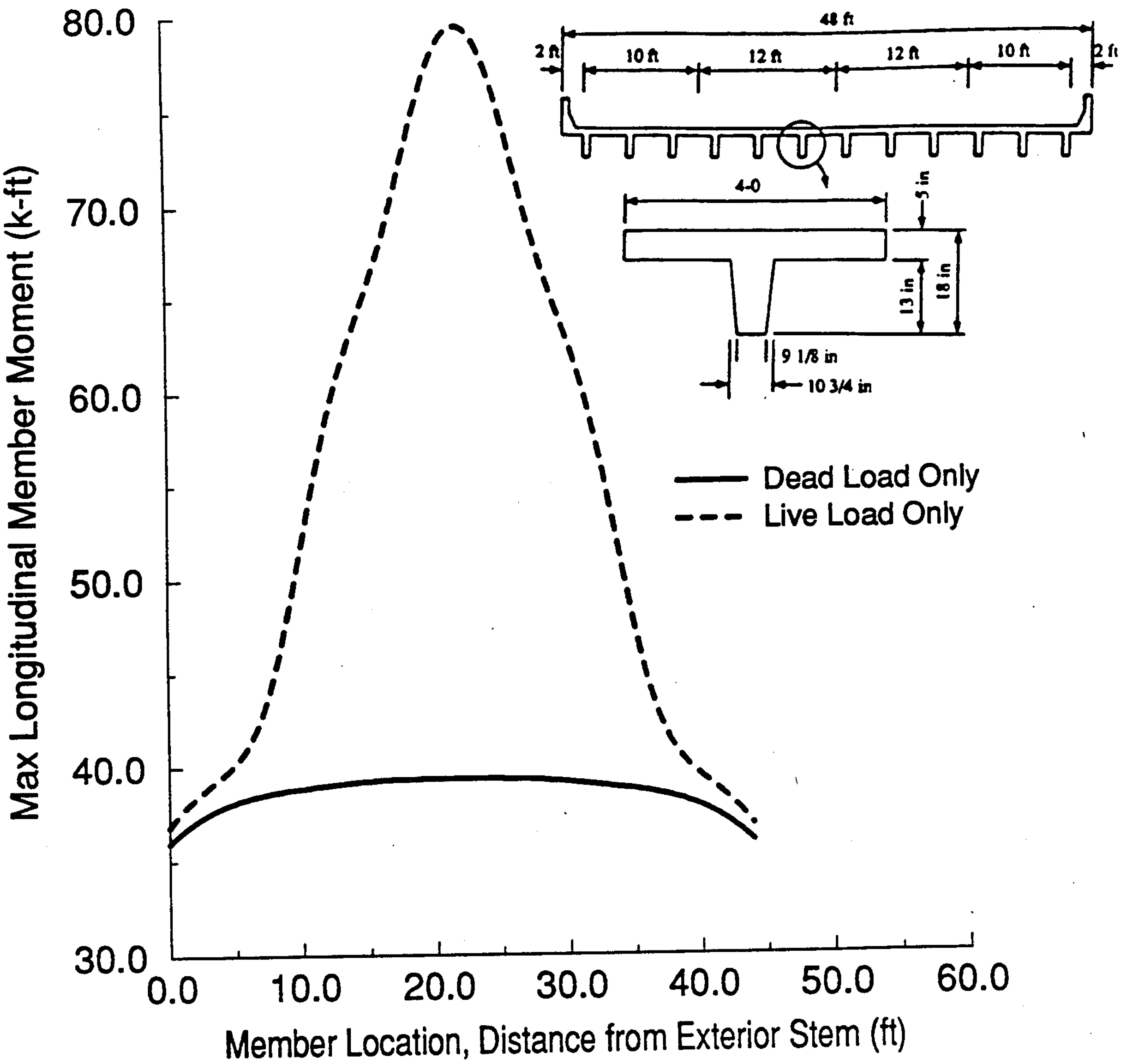


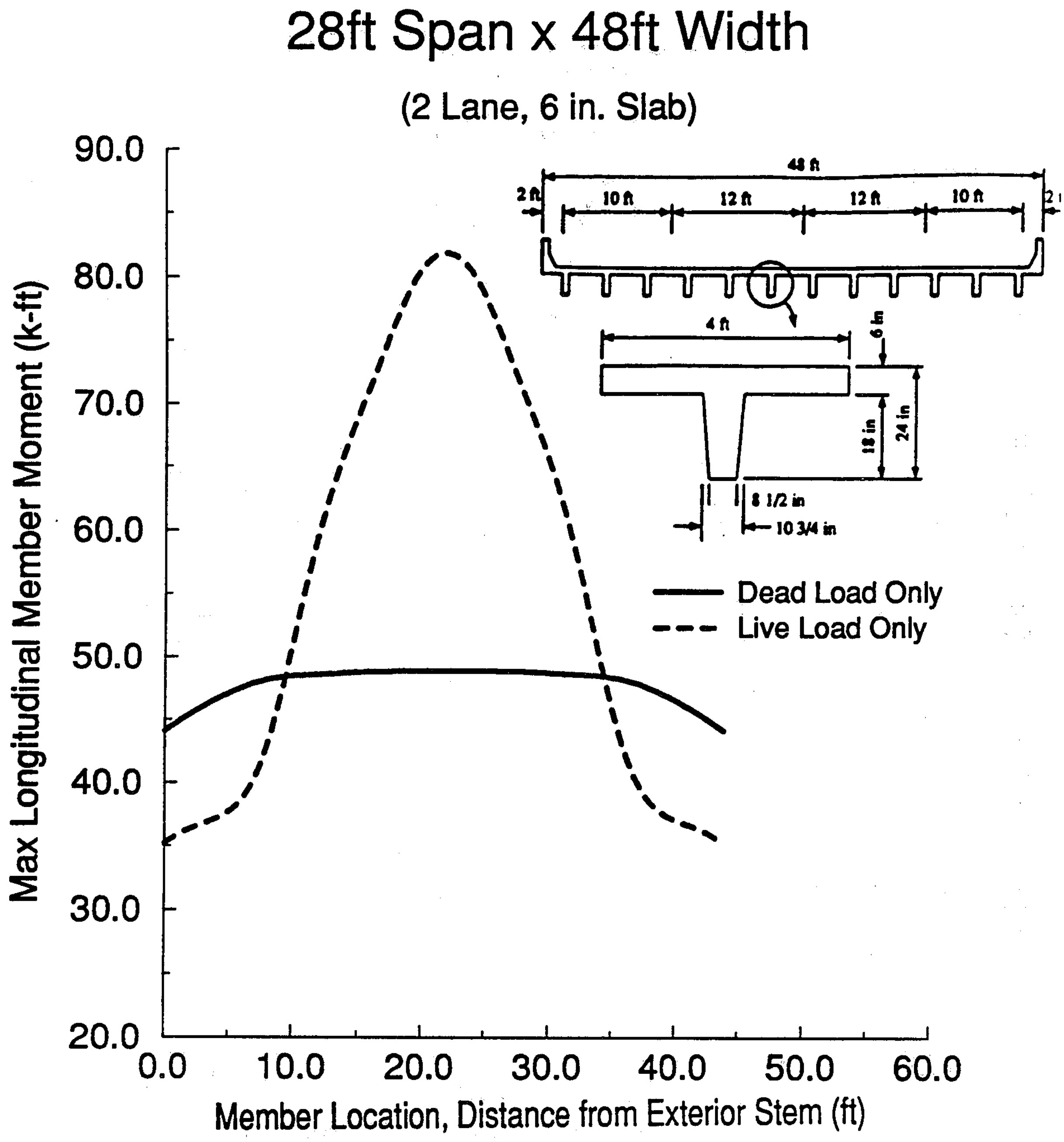

28ft Span x 32ft Width
(1 Lane, 6 in. Slab)
Max Longitudinal Member Moment (k-ft)
55.0
45.0
35.0
25.0
0.0
10.0
20.0
30.0
40.0
Member Location, Distance from Exterior Stem (ft)
32 ft
2 ft
8 ft
12 ft
8 ft
2 ft
4-0
6 in
13 in
18 in
9 1/8 in
10 3/4 in
Dead Load Only
Live Load Only

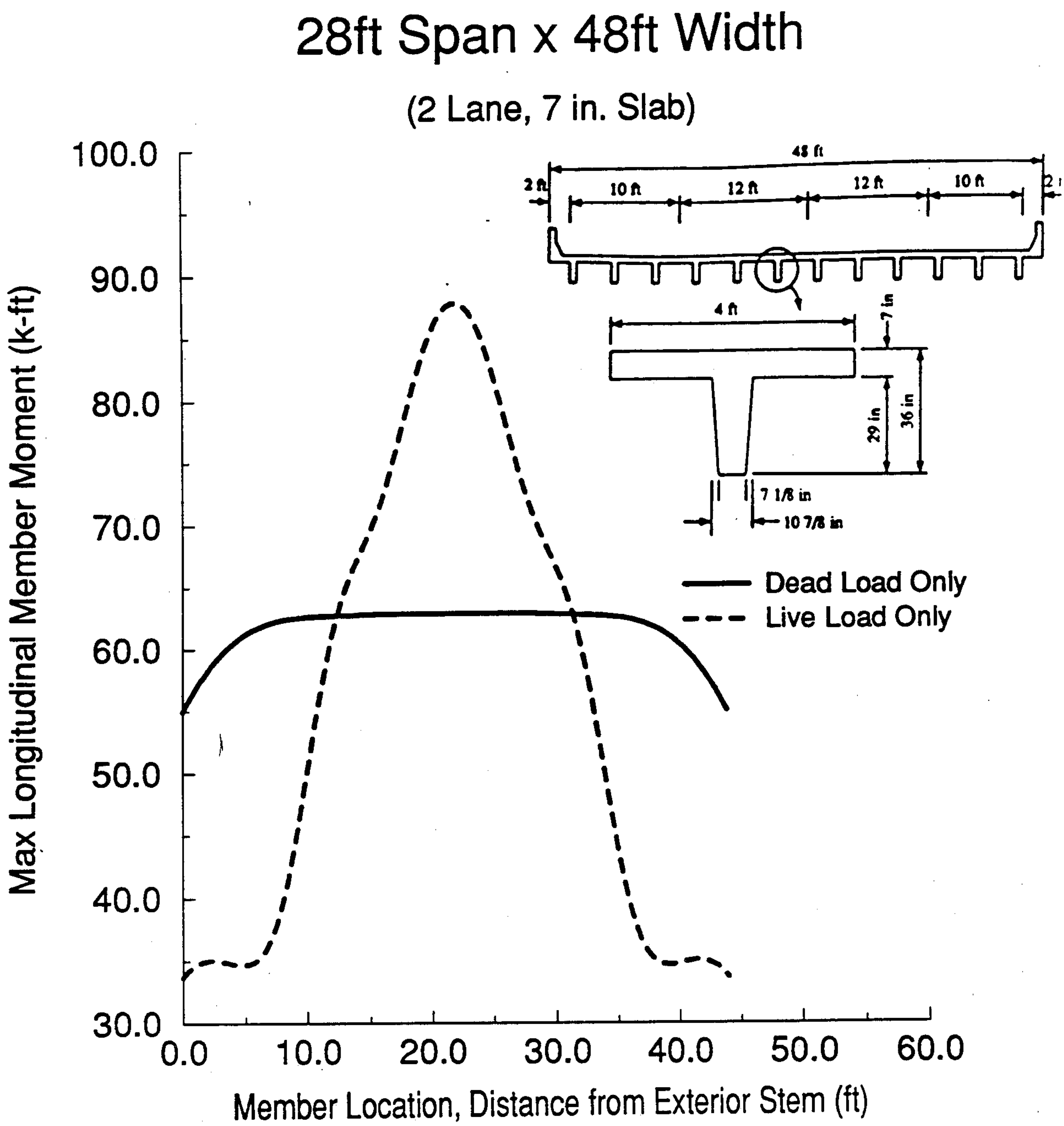

28ft Span x 32ft Width
(1 Lane, 7 in. Slab)
Max Longitudinal Member Moment (k-ft)
70.0
60.0
50.0
40.0
30.0
20.0
0.0
10.0
20.0
30.0
40.0
Member Location, Distance from Exterior Stem (ft)
32 ft
2 ft
8 ft
12 ft
8 ft
2 ft
4-0
7 in
29 in
36 in
7 1/8 in
10 7/8 in
Dead Load Only
Live Load Only

28ft Span x 48ft Width

(2 Lane, 5 in. Slab)

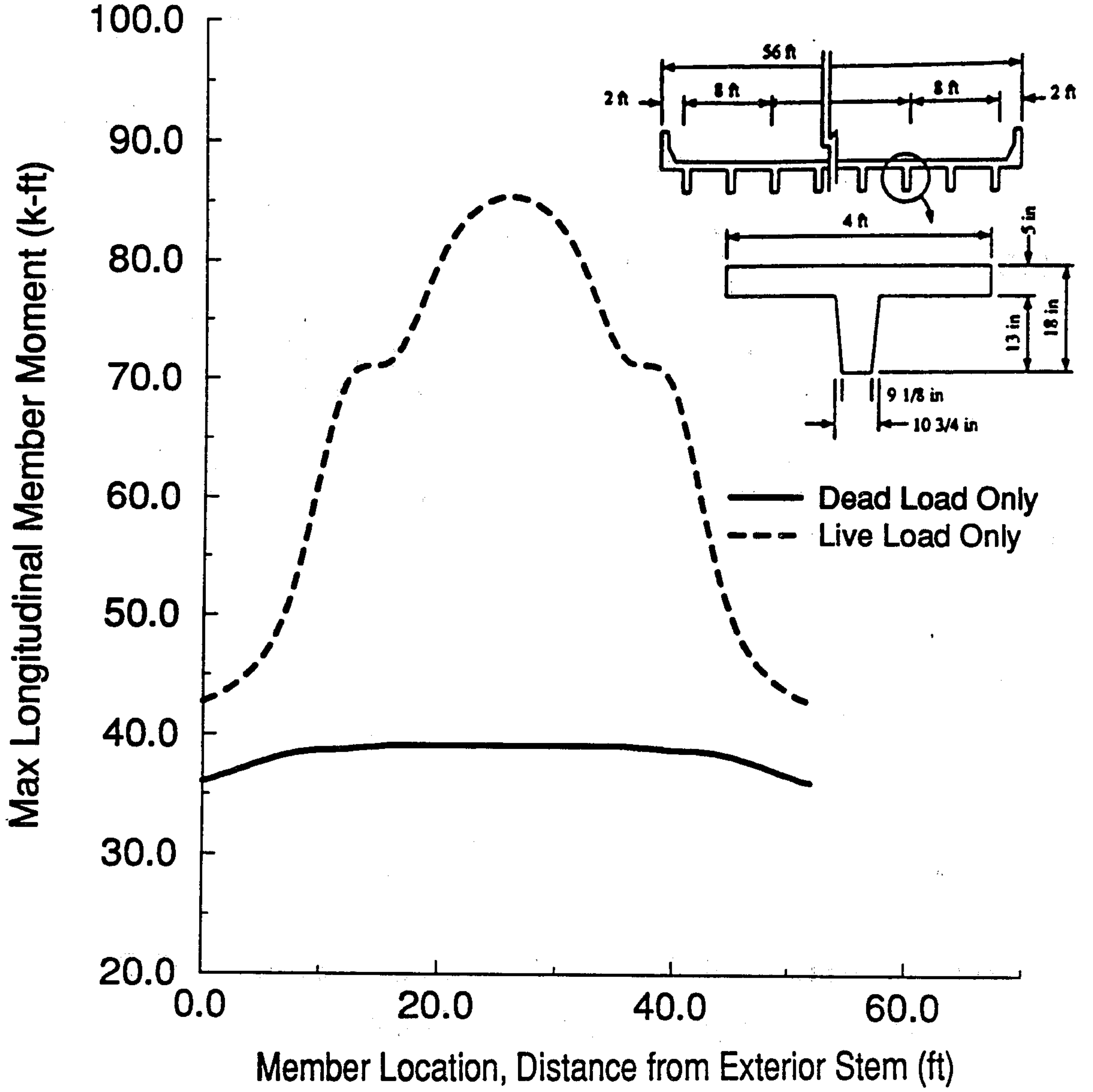



28ft Span x 48ft Width
(2 Lane, 6 in. Slab)
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
Max Longitudinal Member Moment (k-ft)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
Member Location, Distance from Exterior Stem (ft)
Dead Load Only
Live Load Only


28ft Span x 48ft Width
(2 Lane, 7 in. Slab)
Max Longitudinal Member Moment (k-ft)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
Member Location, Distance from Exterior Stem (ft)
48 ft
2 ft
10 ft
12 ft
12 ft
10 ft
4 ft
7 in
29 in
36 in
7 1/8 in
10 7/8 in
Dead Load Only
Live Load Only

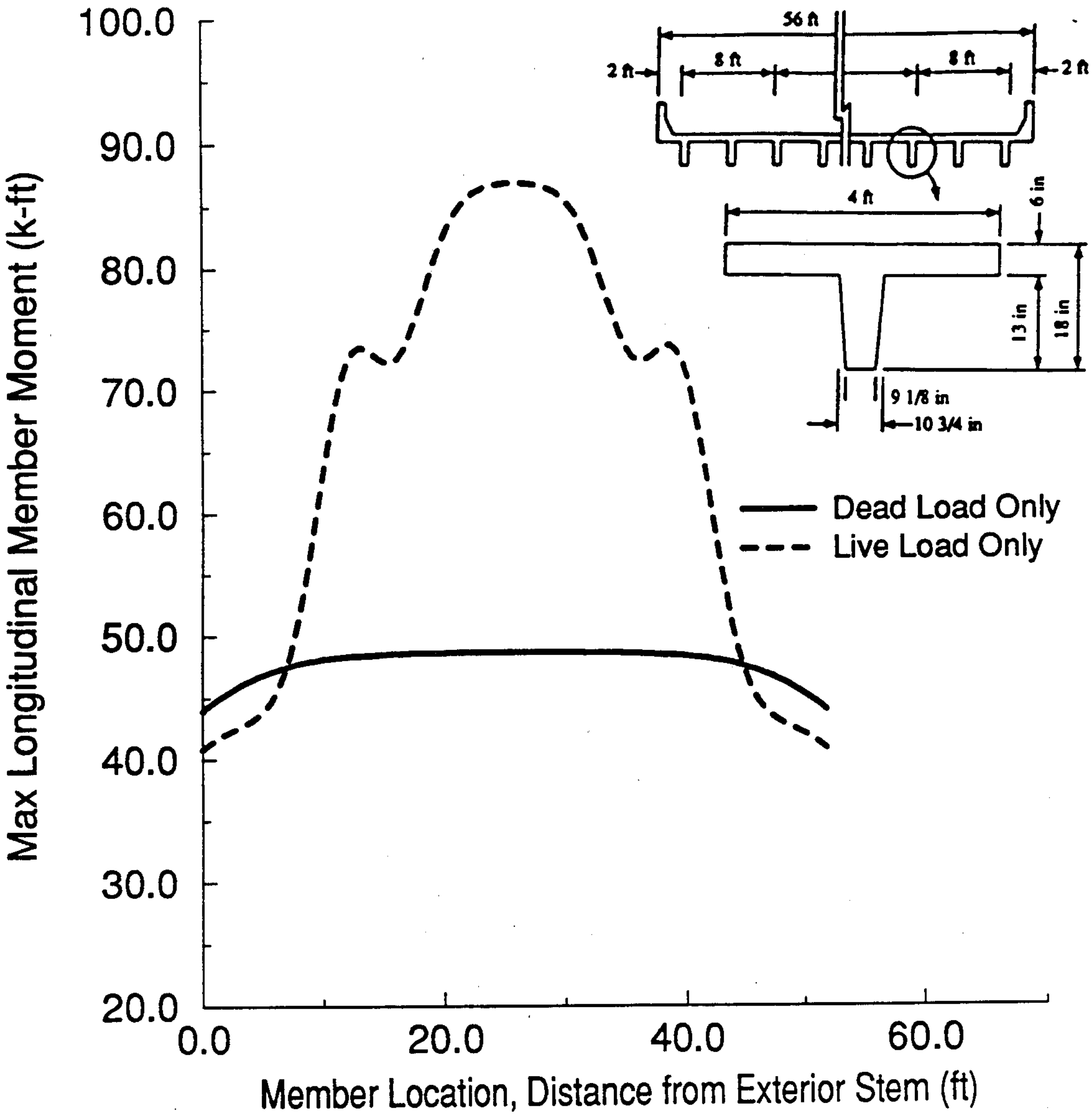
28ft Span x 56ft Width

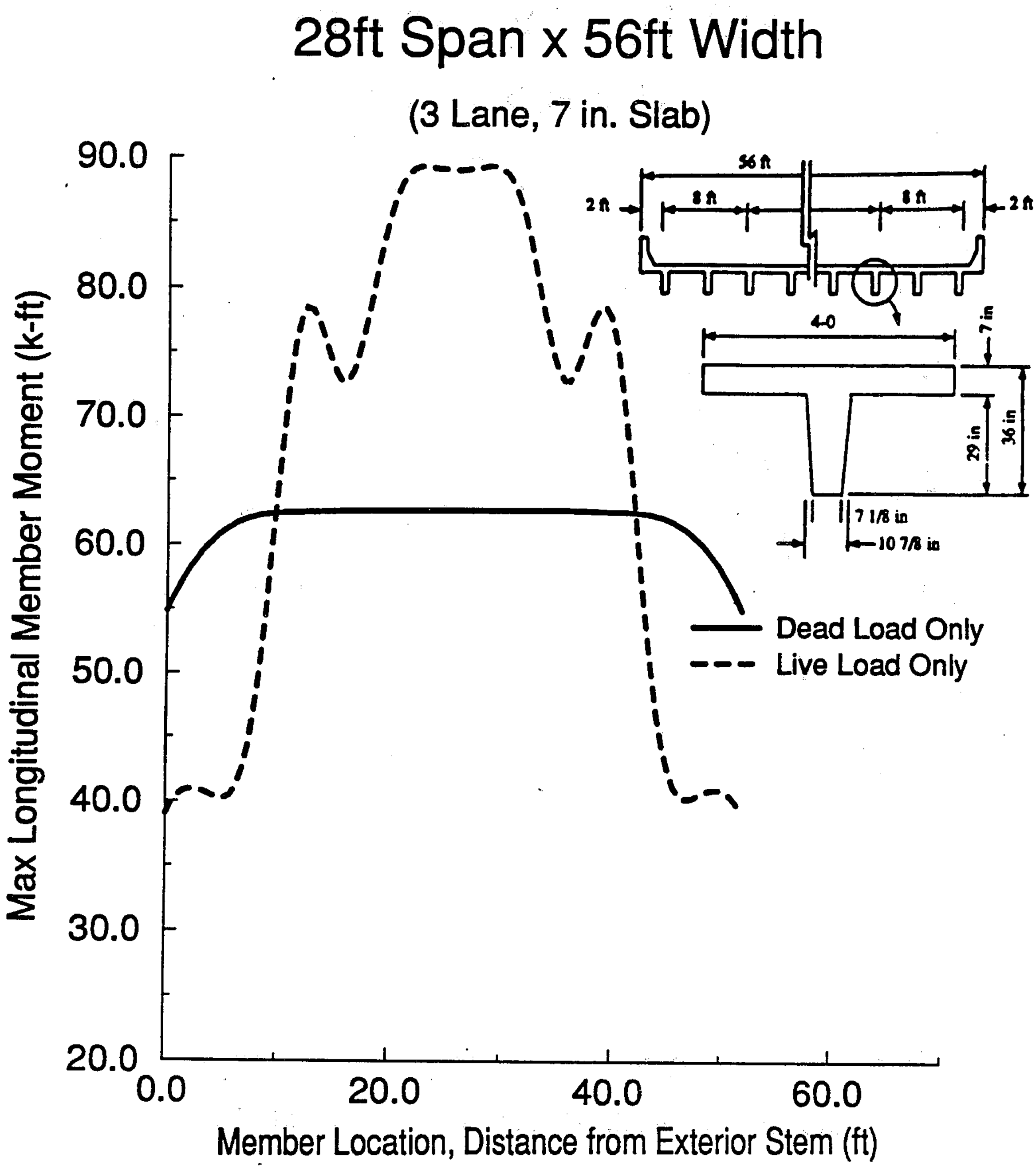
(3 Lane, 5 in. Slab)



28ft Span x 56ft Width

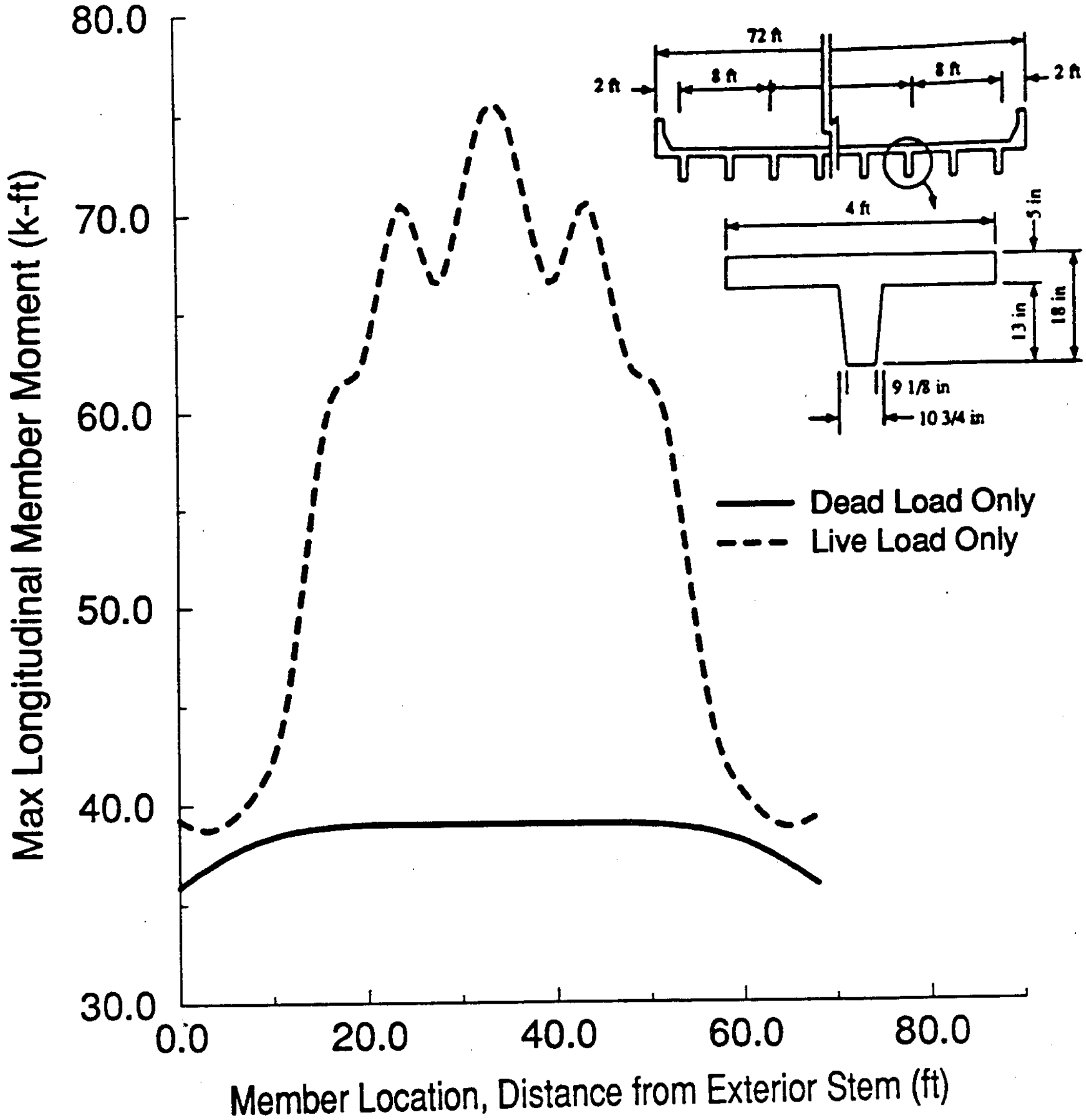
(3 Lane, 6 in. Slab)




28ft Span x 56ft Width
(3 Lane, 7 in. Slab)
Max Longitudinal Member Moment (k-ft)
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
0.0
20.0
40.0
60.0
Member Location, Distance from Exterior Stem (ft)
Dead Load Only
Live Load Only
56 ft
2 ft
8 ft
8 ft
2 ft
4-0
7 in
29 in
36 in
7 1/8 in
10 7/8 in

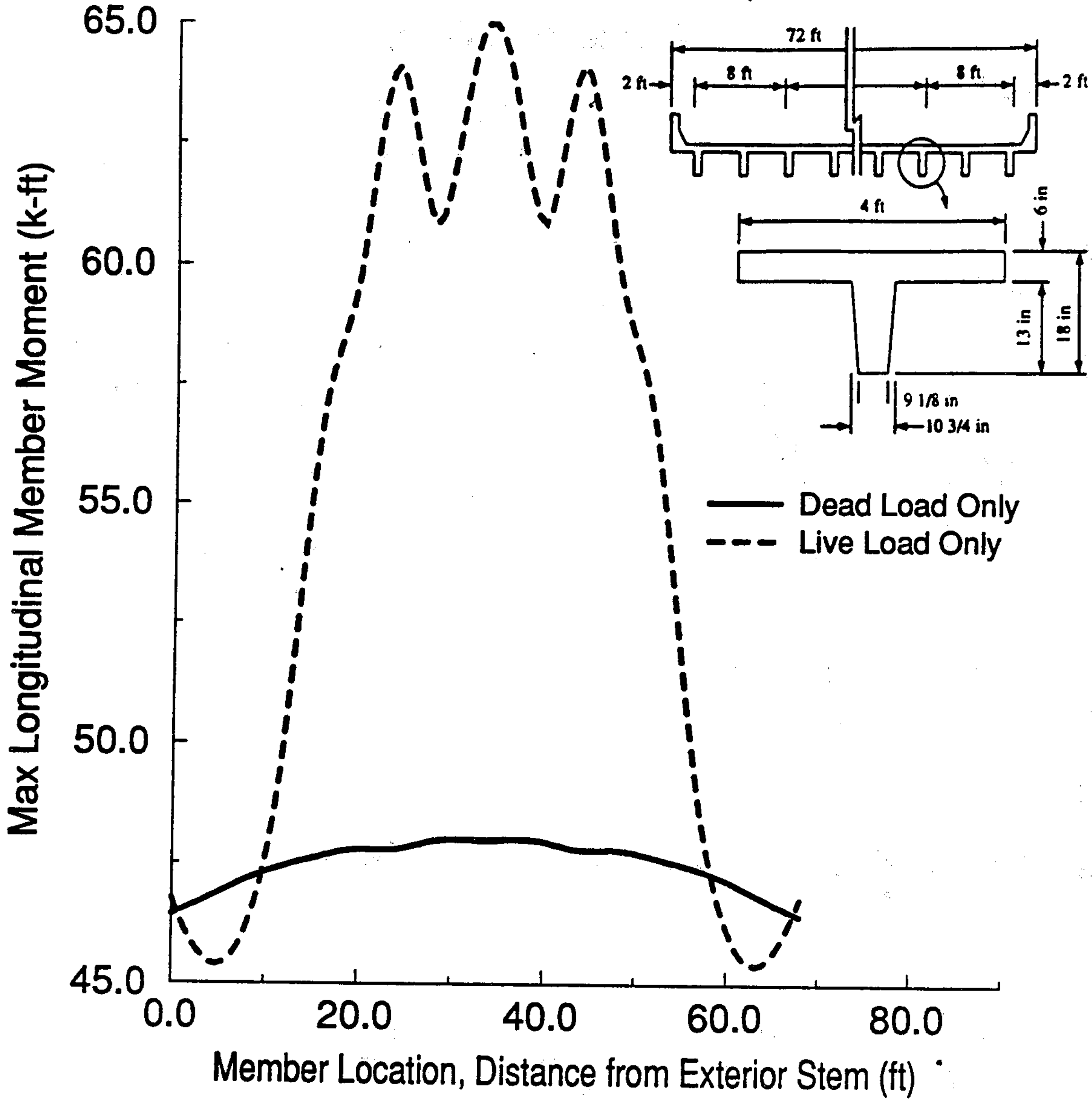
28ft Span x 72ft Width

(4 Lane, 5 in. Slab)



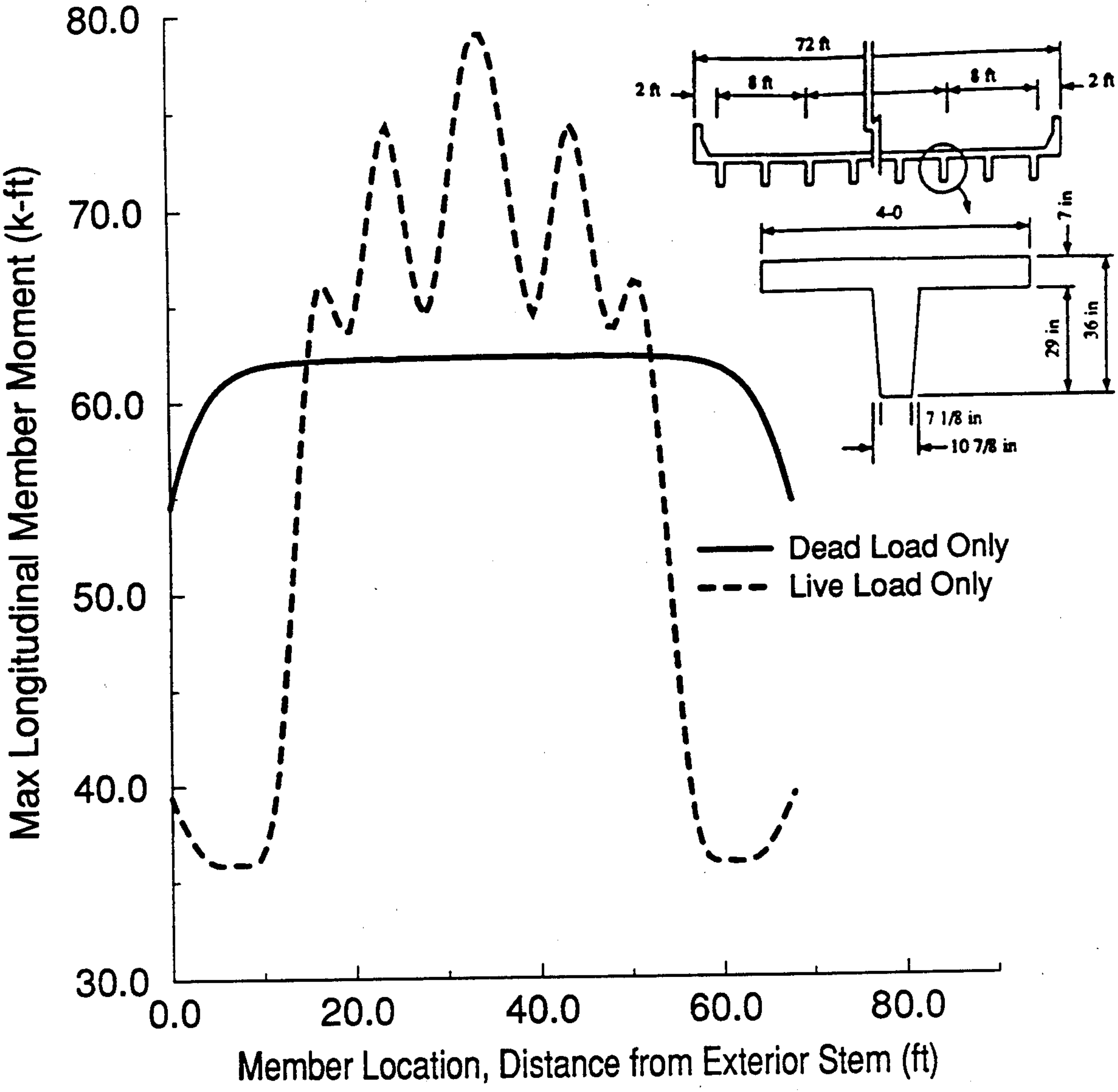
28ft Span x 72ft Width

(4 Lane, 6 in. Slab)



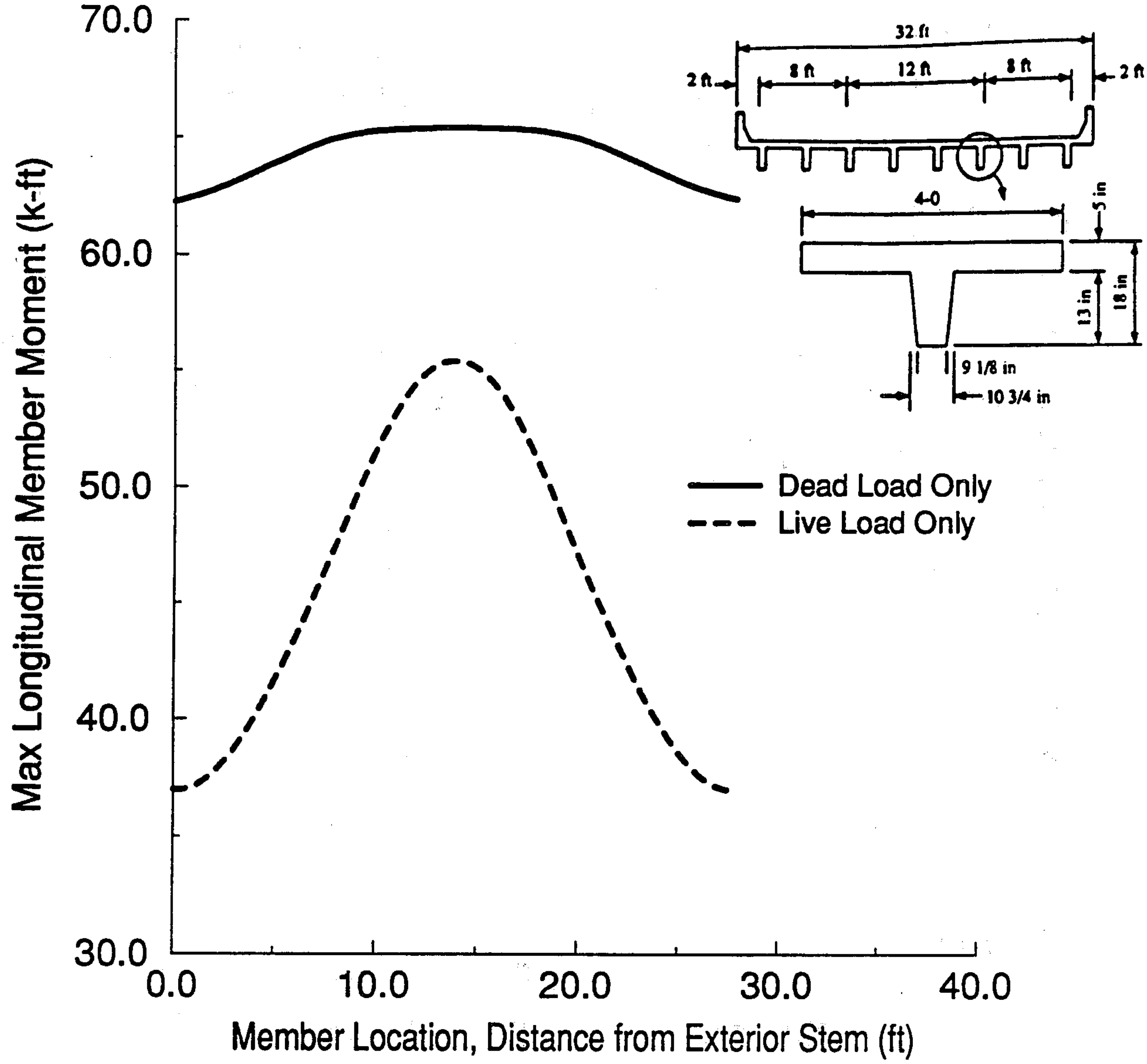
28ft Span x 72ft Width

(4 Lane, 7 in. Slab)



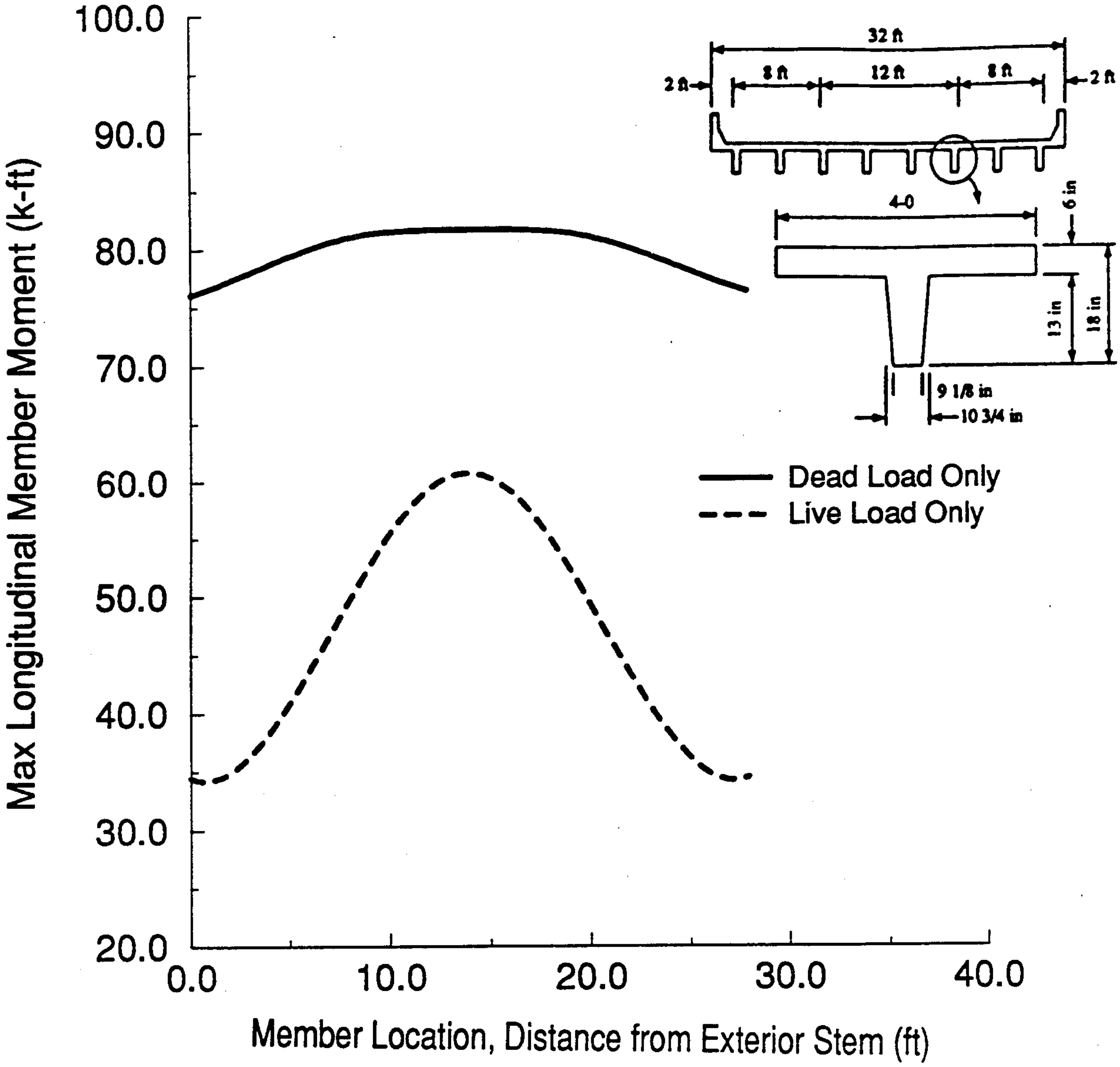
36ft Span x 32ft Width

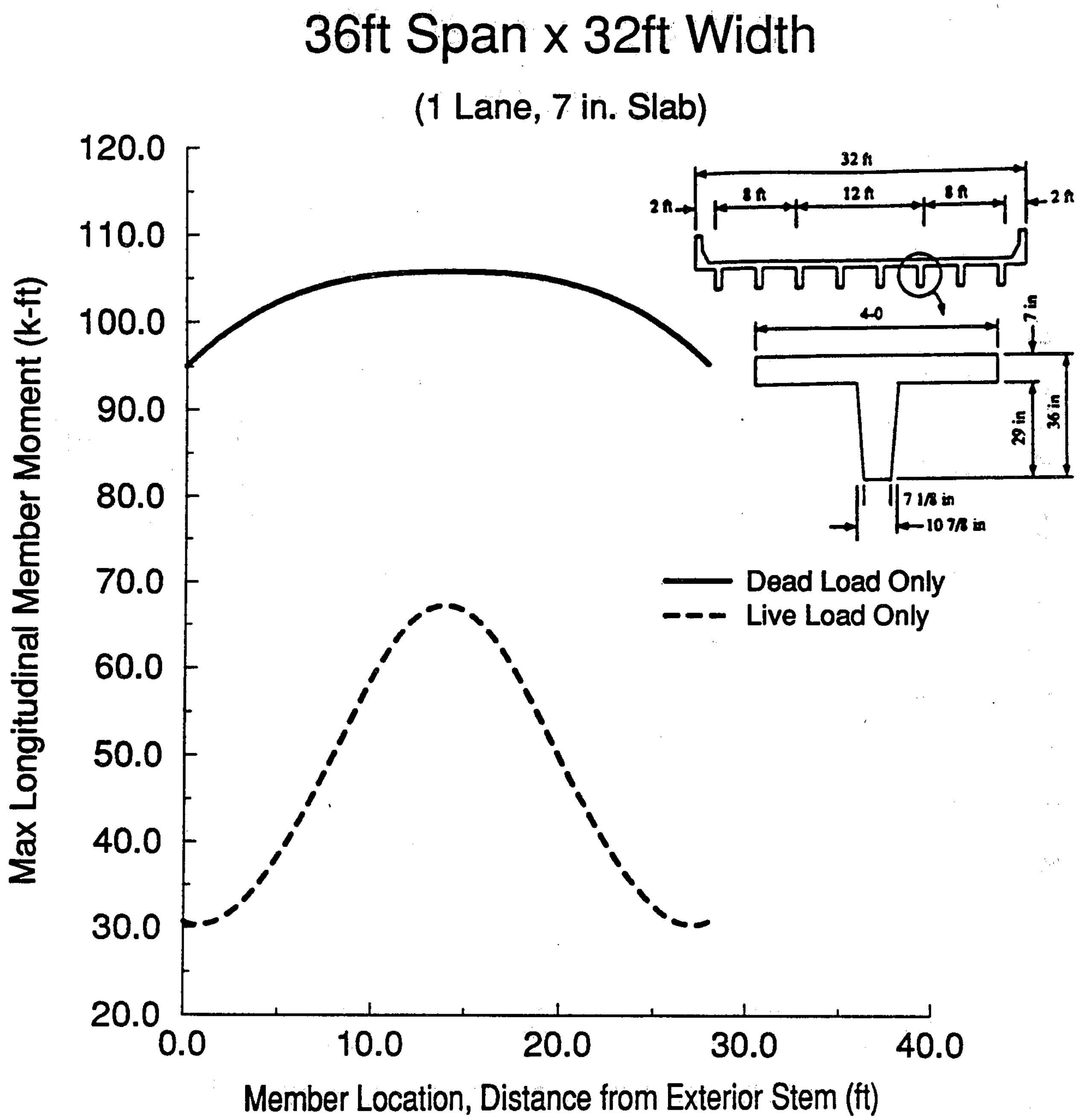
(1 Lane, 5 in. Slab)

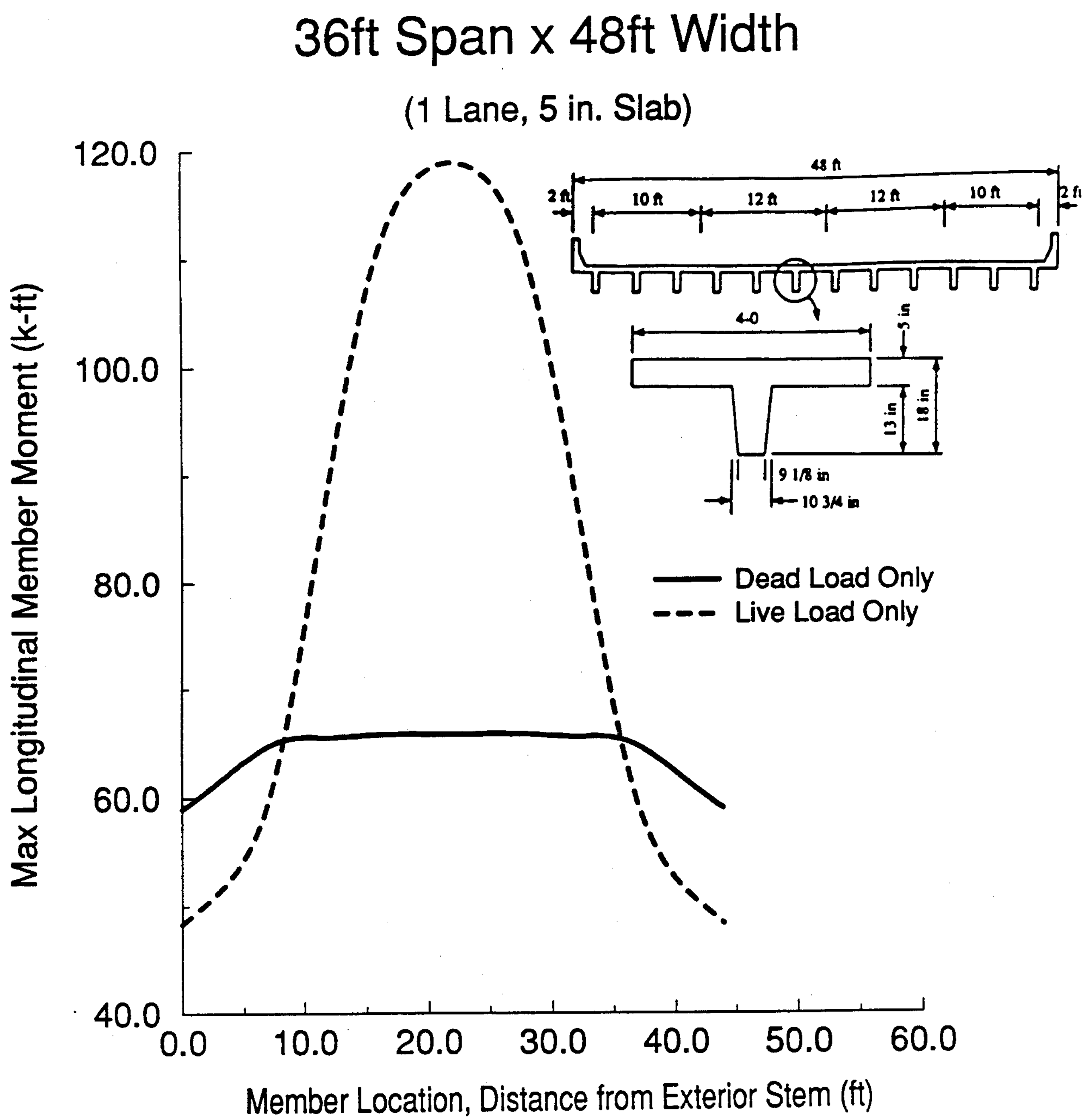


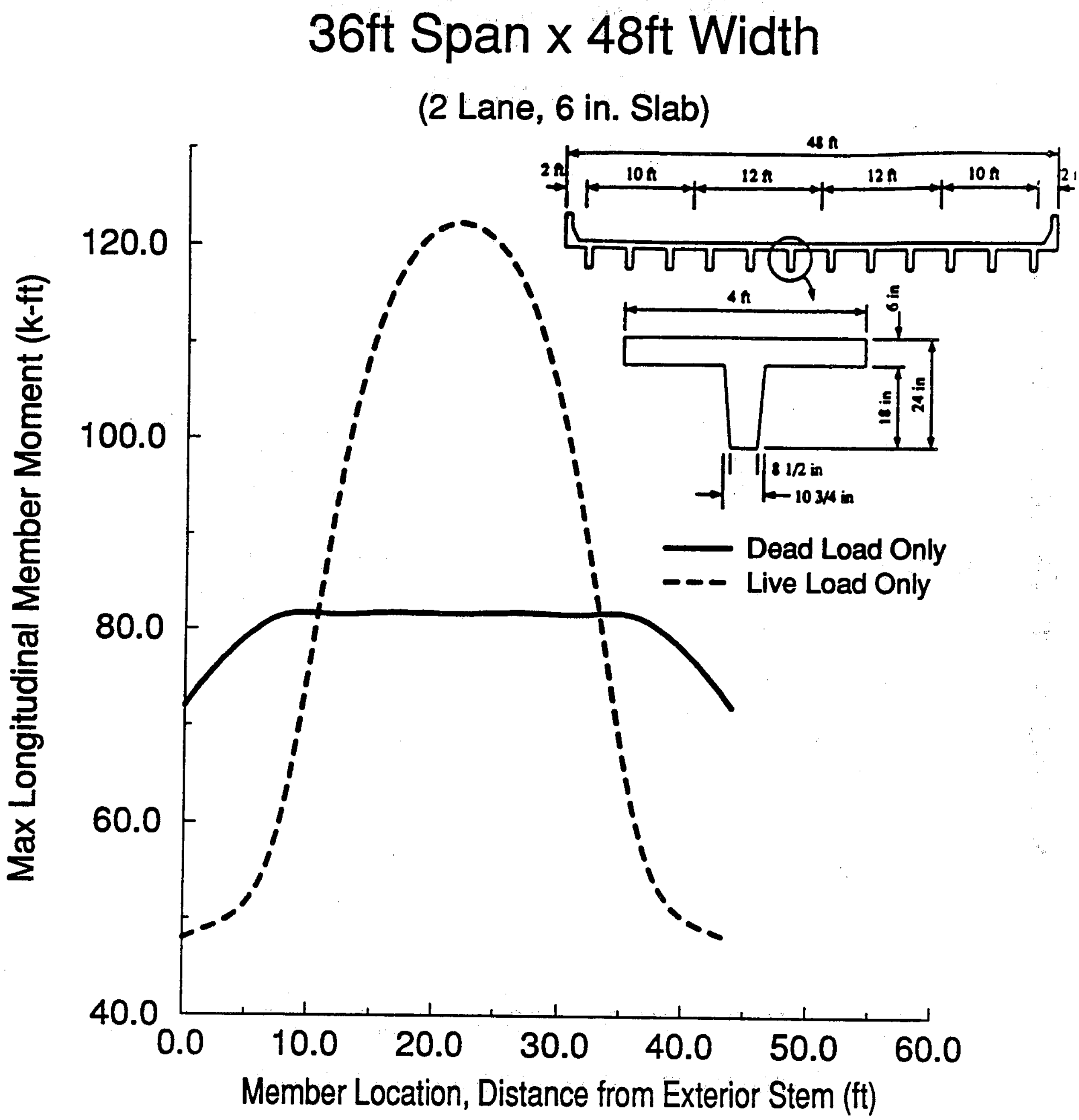
36ft Span x 32ft Width

(1 Lane, 6 in. Slab)




36ft Span x 32ft Width
(1 Lane, 7 in. Slab)
Max Longitudinal Member Moment (k-ft)
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
0.0
10.0
20.0
30.0
40.0
Member Location, Distance from Exterior Stem (ft)
32 ft
2 ft
8 ft
12 ft
8 ft
2 ft
4-0
7 in
29 in
36 in
7 1/8 in
10 7/8 in
Dead Load Only
Live Load Only

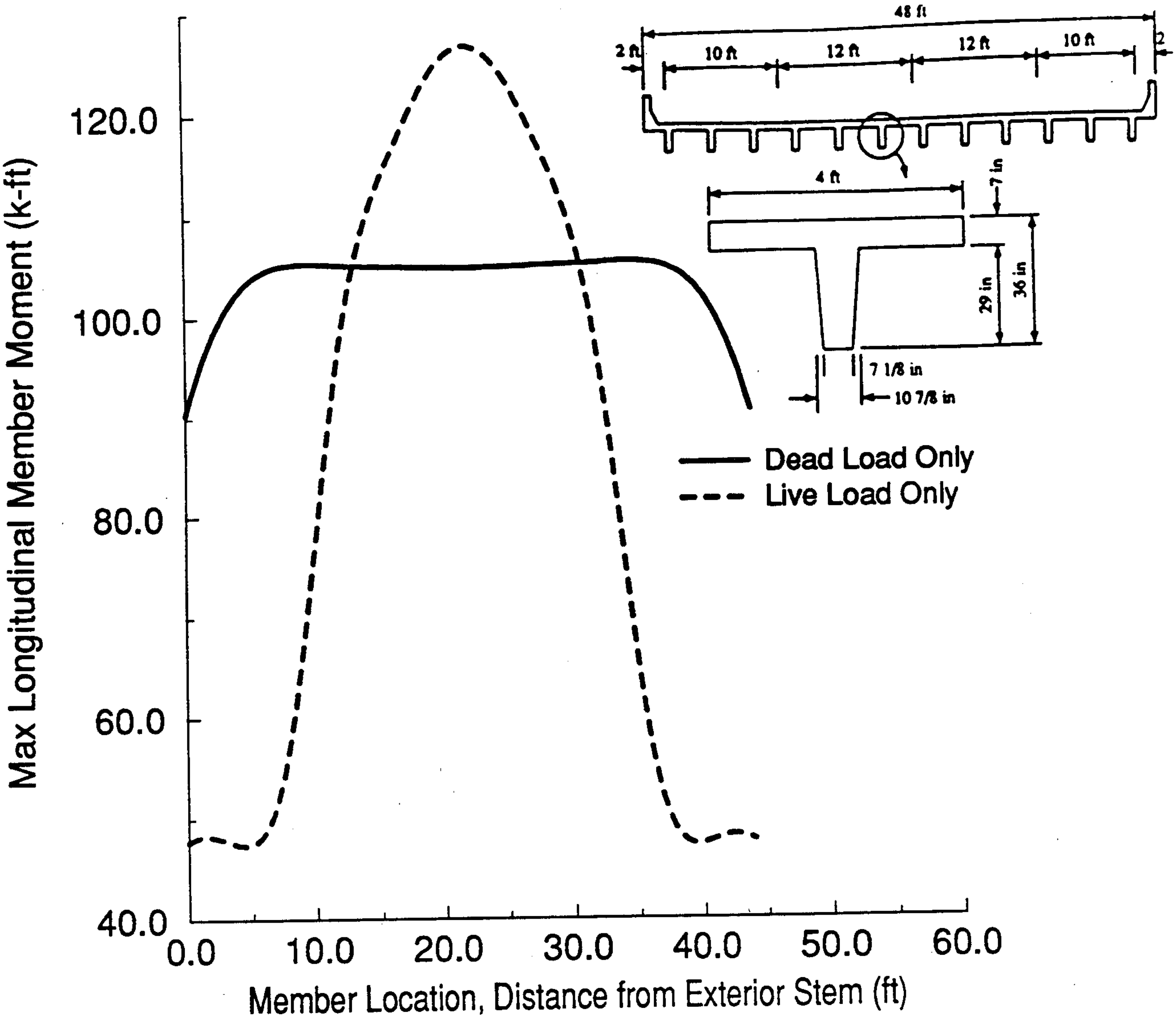

36ft Span x 48ft Width
(1 Lane, 5 in. Slab)
Max Longitudinal Member Moment (k-ft)
120.0
100.0
80.0
60.0
40.0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
Member Location, Distance from Exterior Stem (ft)
48 ft
2 ft
10 ft
12 ft
12 ft
10 ft
2 ft
4-0
5 in
13 in
18 in
9 1/8 in
10 3/4 in
Dead Load Only
Live Load Only

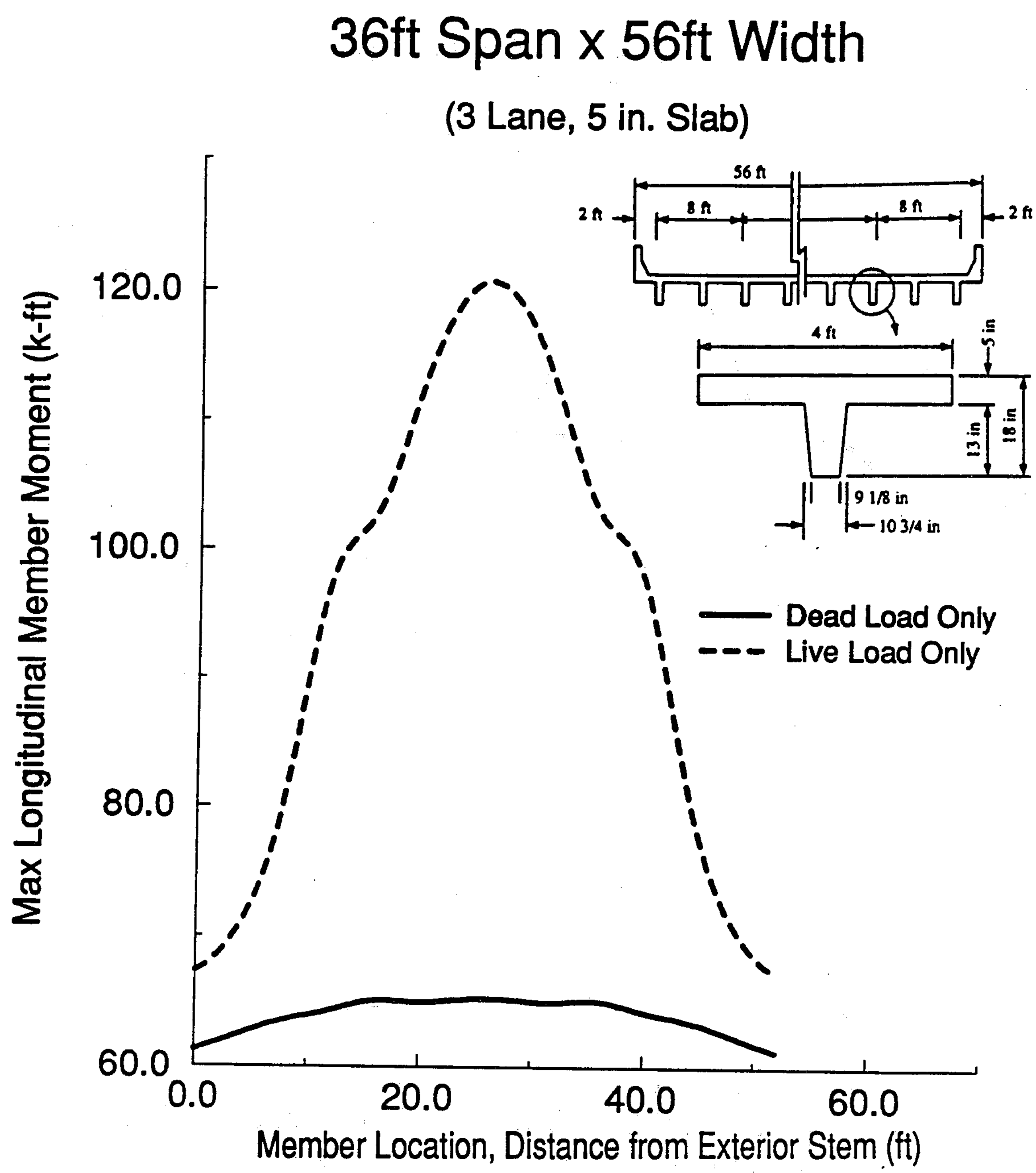


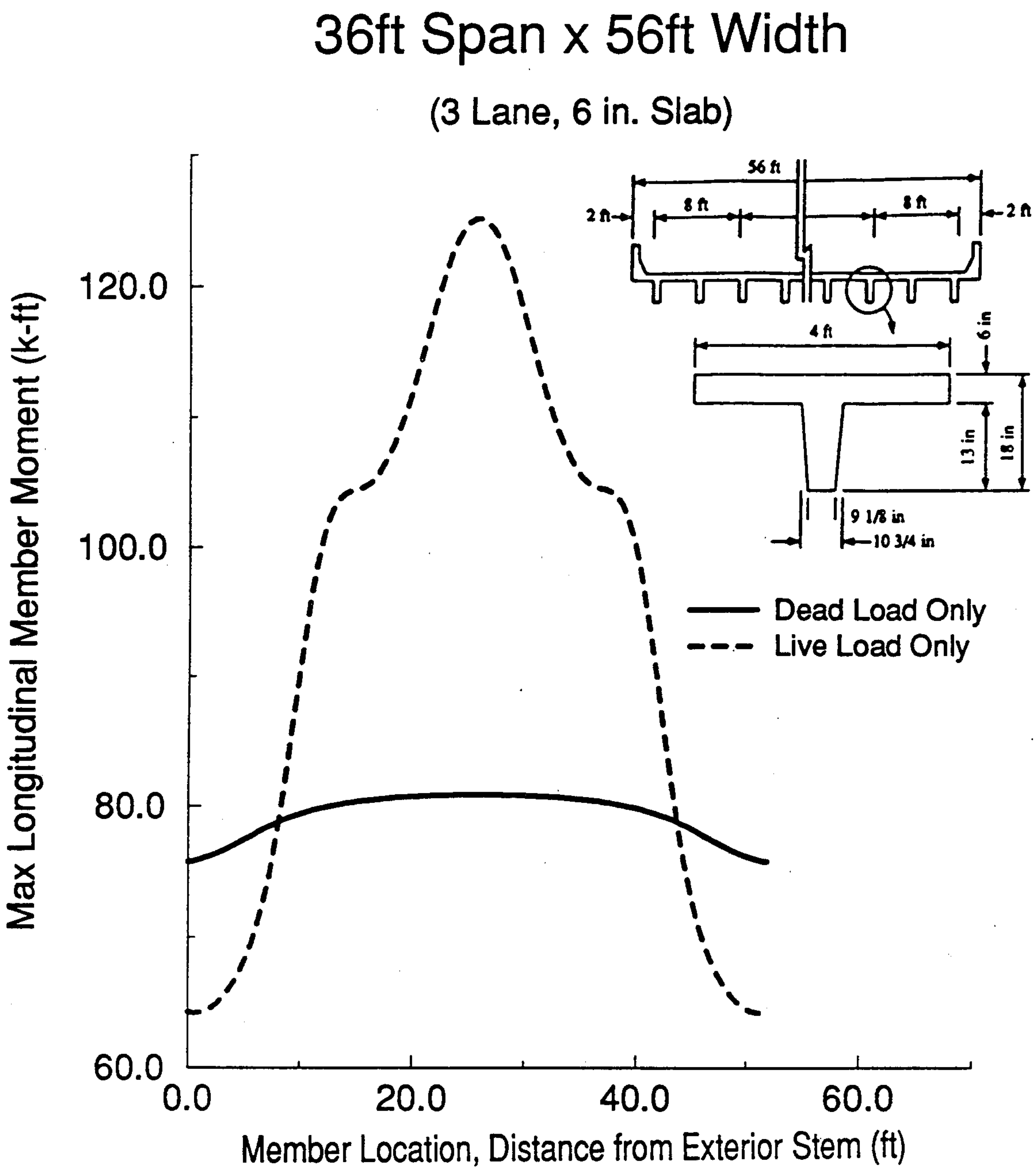
36ft Span x 48ft Width
(2 Lane, 6 in. Slab)
48 ft
2 ft
10 ft
12 ft
12 ft
10 ft
4 ft
6 in
18 in
24 in
8 1/2 in
10 3/4 in
Dead Load Only
Live Load Only
120.0
100.0
80.0
60.0
40.0
Max Longitudinal Member Moment (k-ft)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
Member Location, Distance from Exterior Stem (ft)

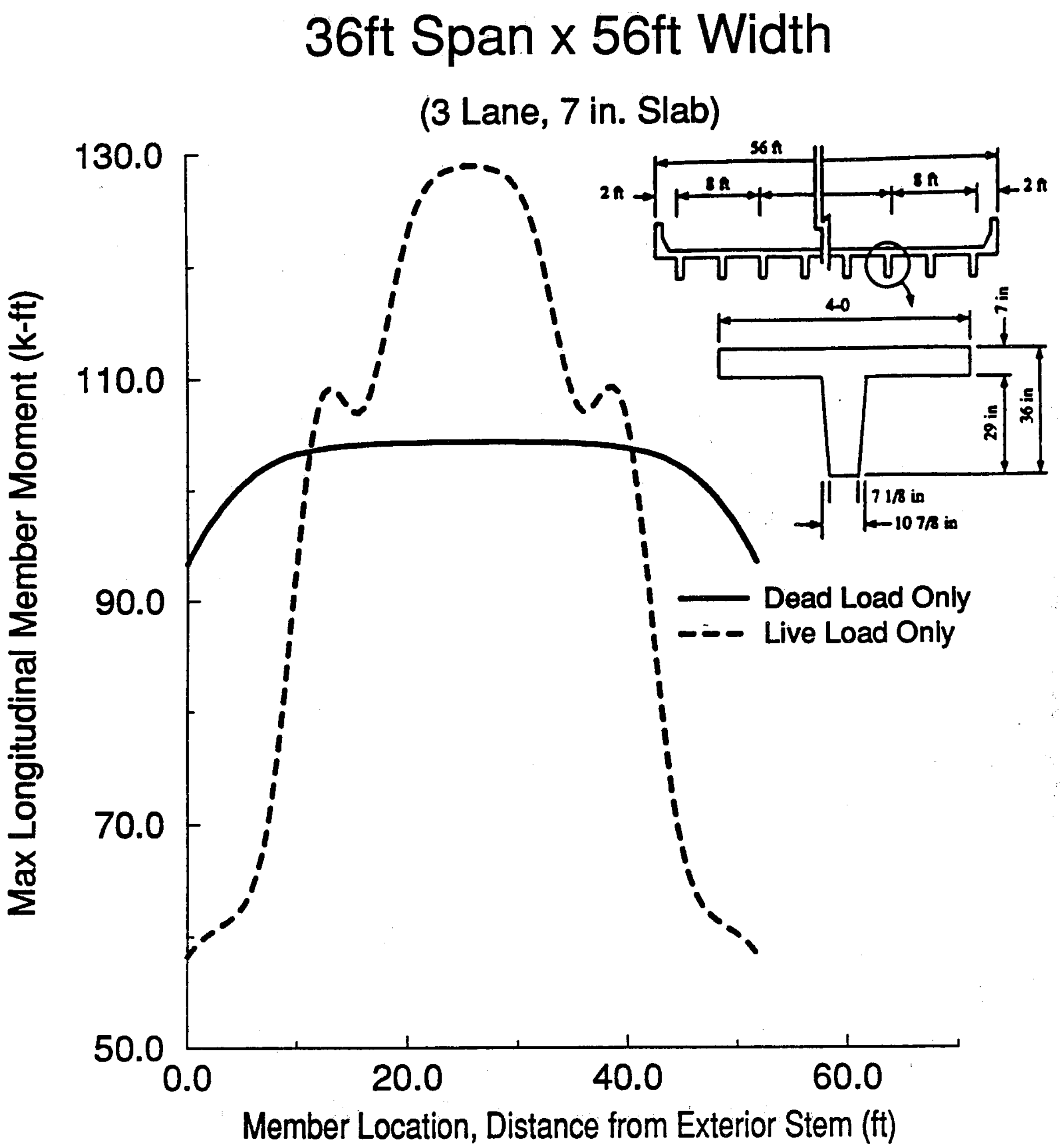
36ft Span x 48ft Width

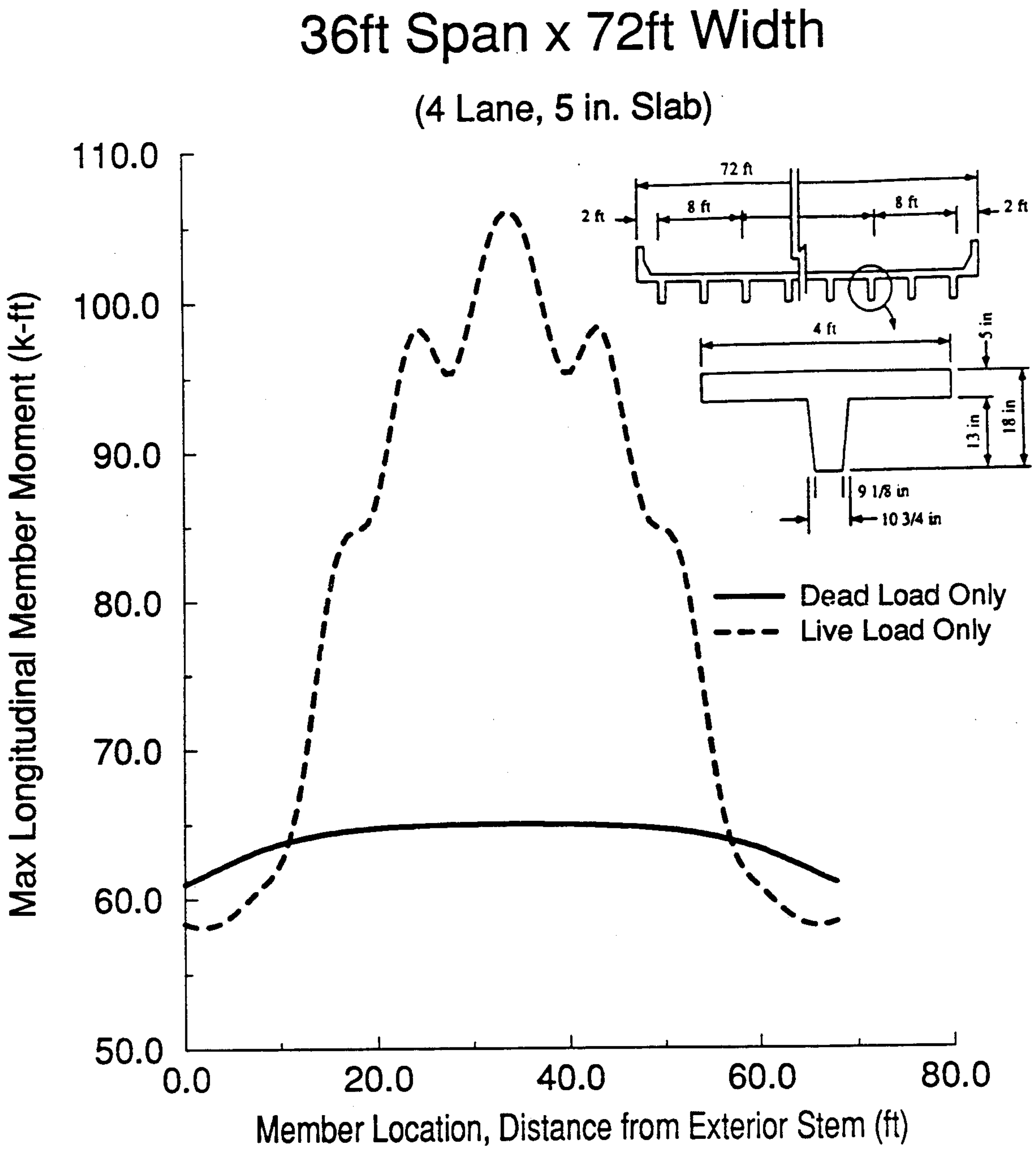
(2 Lane, 7 in. Slab)

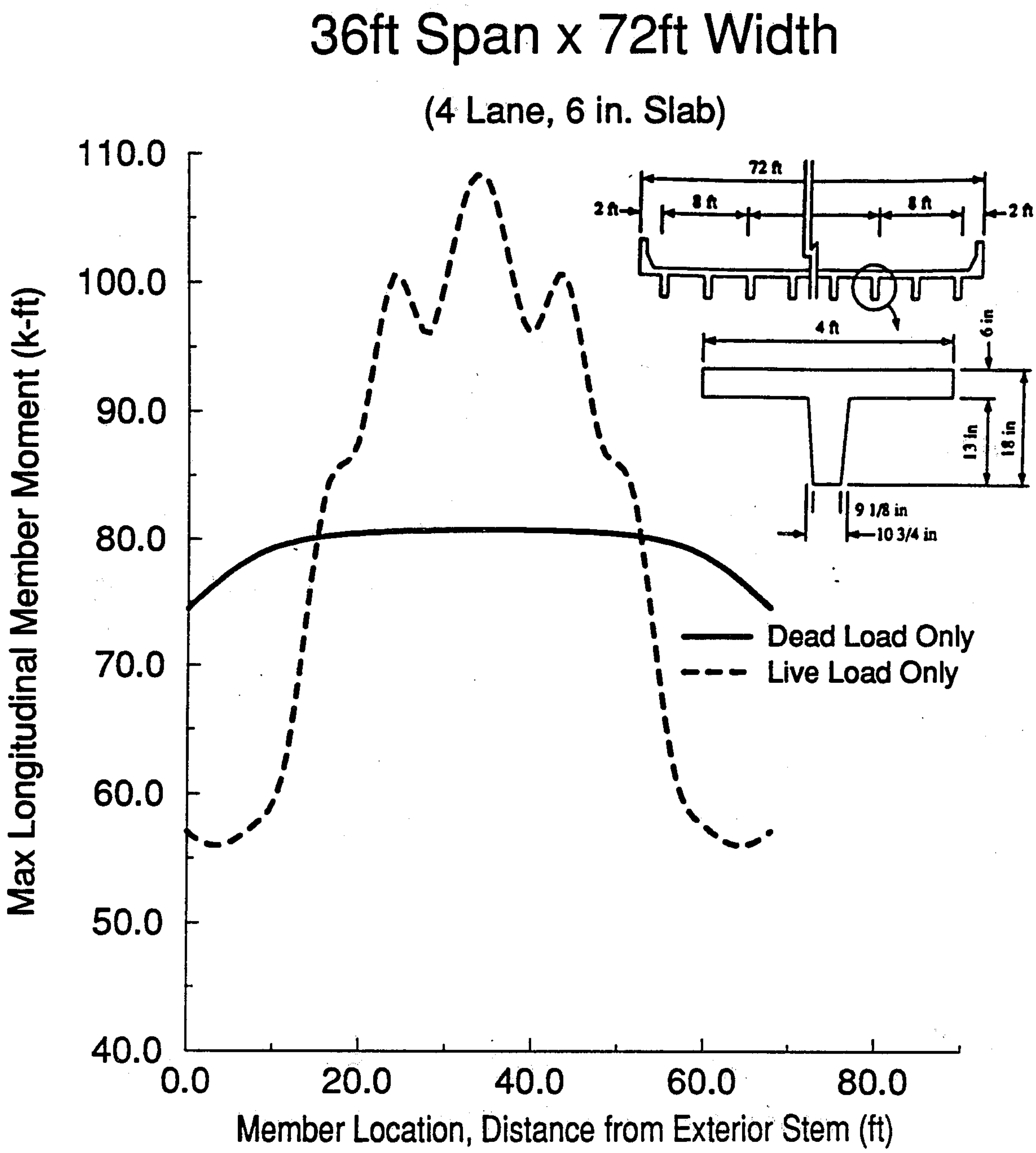


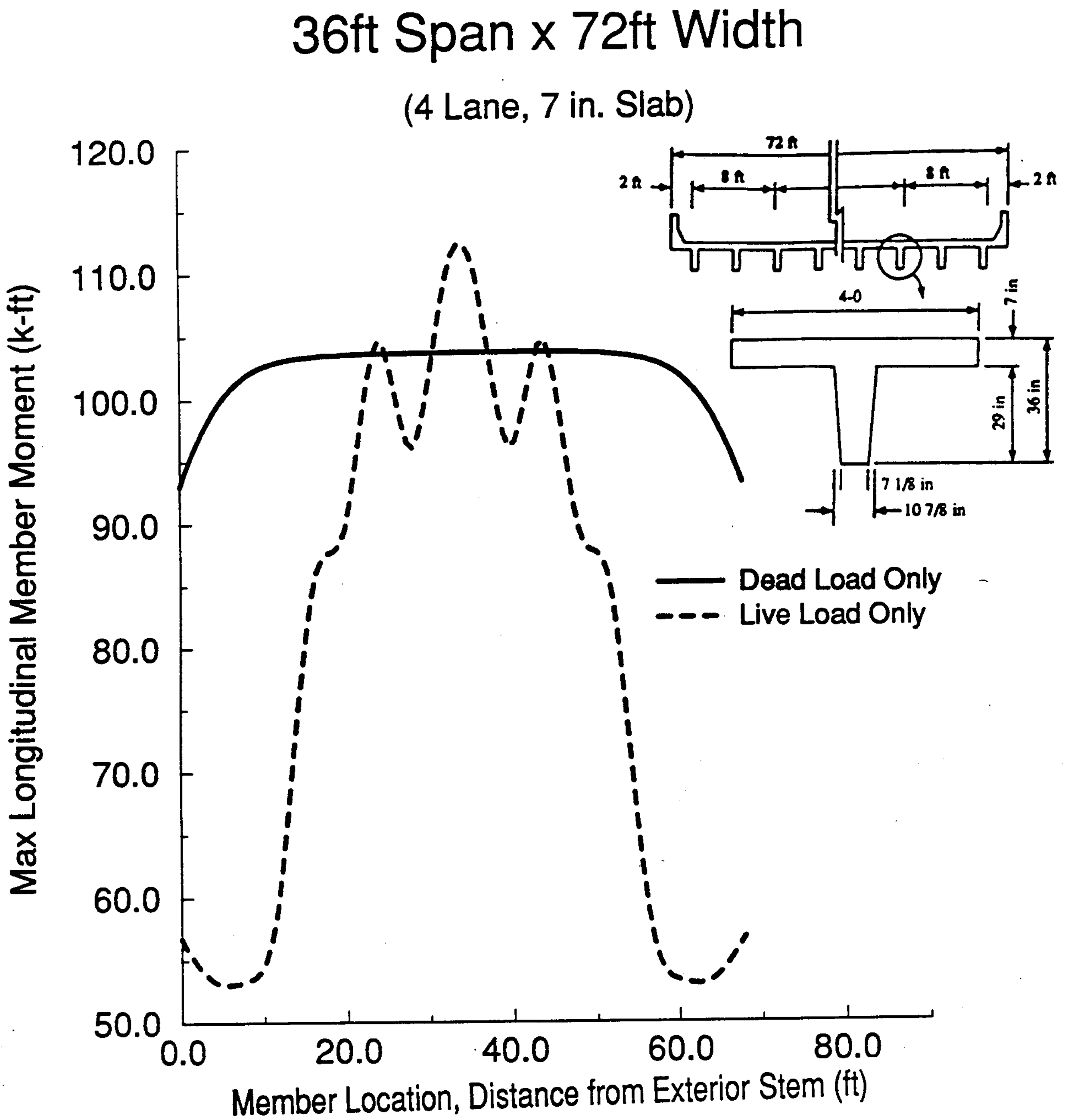

36ft Span x 56ft Width
(3 Lane, 5 in. Slab)
Max Longitudinal Member Moment (k-ft)
120.0
100.0
80.0
60.0
0.0
20.0
40.0
60.0
Member Location, Distance from Exterior Stem (ft)
56 ft
2 ft
8 ft
8 ft
2 ft
4 ft
5 in
13 in
18 in
9 1/8 in
10 3/4 in
Dead Load Only
Live Load Only


36ft Span x 56ft Width
(3 Lane, 6 in. Slab)
Max Longitudinal Member Moment (k-ft)
120.0
100.0
80.0
60.0
0.0
20.0
40.0
60.0
Member Location, Distance from Exterior Stem (ft)
Dead Load Only
Live Load Only
56 ft
8 ft
8 ft
2 ft
2 ft
4 ft
6 in
13 in
18 in
9 1/8 in
10 3/4 in

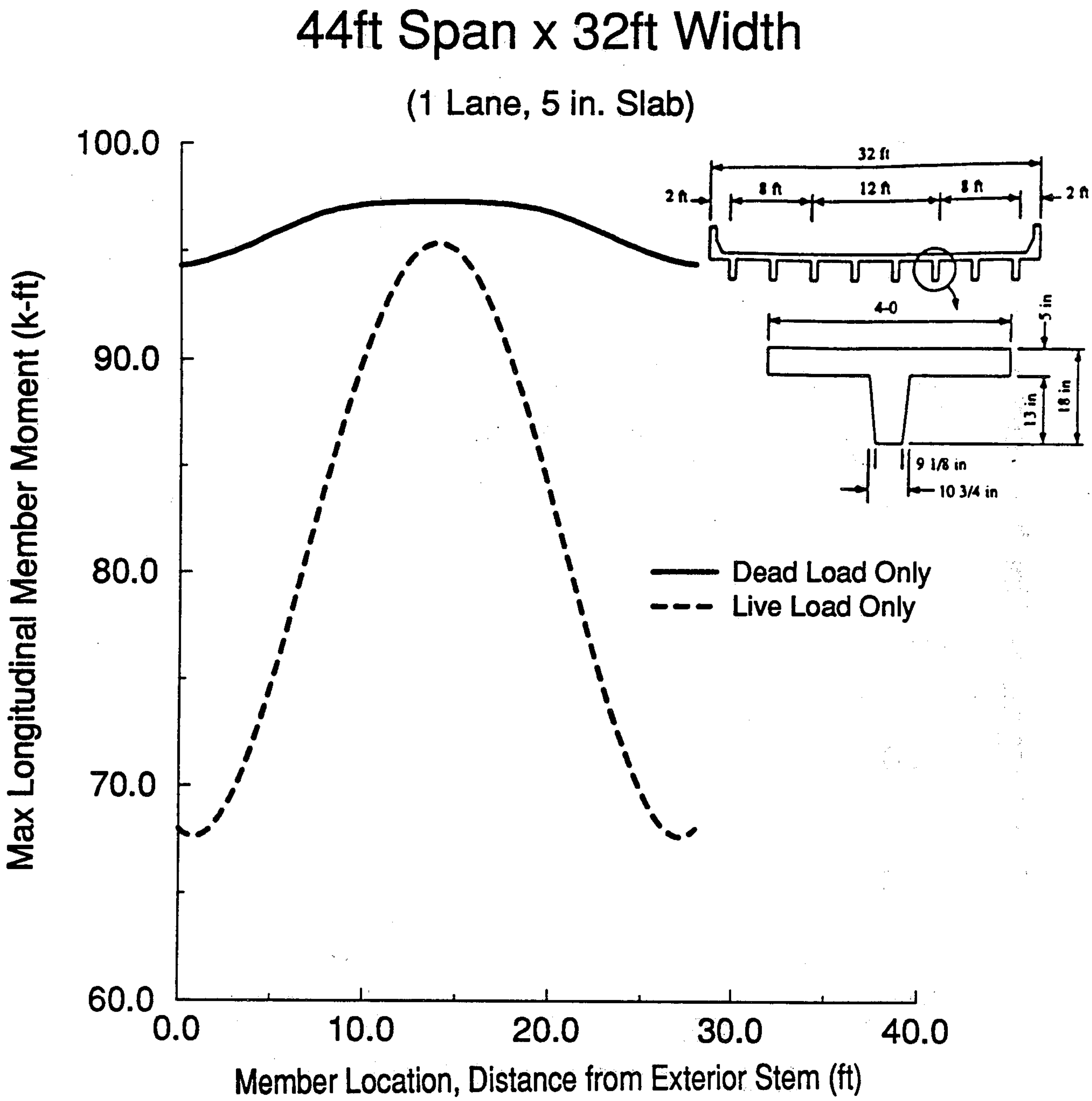

36ft Span x 56ft Width
(3 Lane, 7 in. Slab)
130.0
110.0
90.0
70.0
50.0
Max Longitudinal Member Moment (k-ft)
0.0
20.0
40.0
60.0
Member Location, Distance from Exterior Stem (ft)
Dead Load Only
Live Load Only
56 ft
2 ft
8 ft
8 ft
2 ft
4-0
7 in
29 in
36 in
7 1/8 in
10 7/8 in


36ft Span x 72ft Width
(4 Lane, 5 in. Slab)
Max Longitudinal Member Moment (k-ft)
Member Location, Distance from Exterior Stem (ft)
110.0
100.0
90.0
80.0
70.0
60.0
50.0
0.0
20.0
40.0
60.0
80.0
72 ft
8 ft
8 ft
2 ft
2 ft
4 ft
5 in
13 in
18 in
9 1/8 in
10 3/4 in
Dead Load Only
Live Load Only

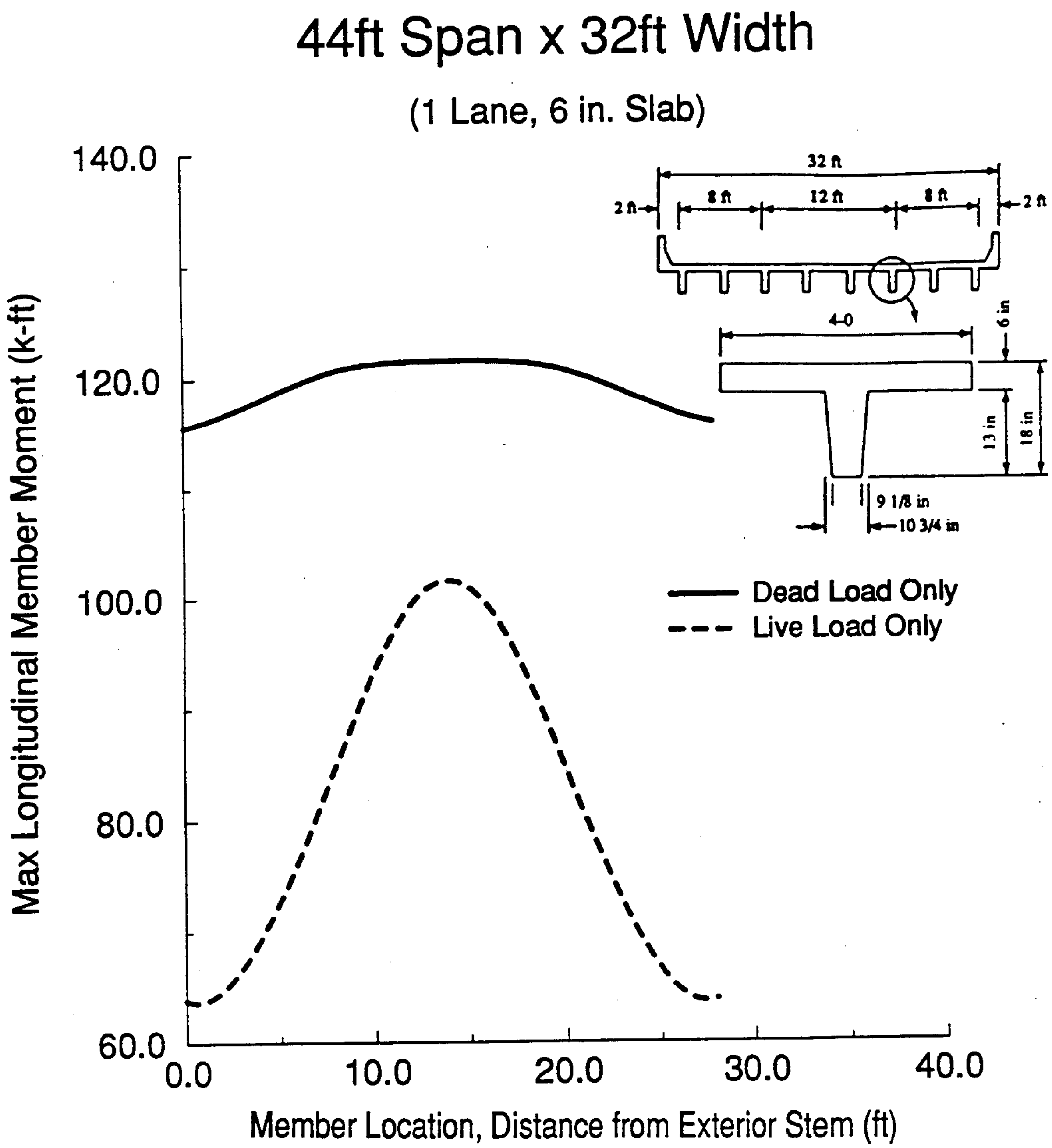

36ft Span x 72ft Width
(4 Lane, 6 in. Slab)
Max Longitudinal Member Moment (k-ft)
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
0.0
20.0
40.0
60.0
80.0
Member Location, Distance from Exterior Stem (ft)
72 ft
2 ft
8 ft
8 ft
2 ft
4 ft
6 in
13 in
18 in
9 1/8 in
10 3/4 in
Dead Load Only
Live Load Only

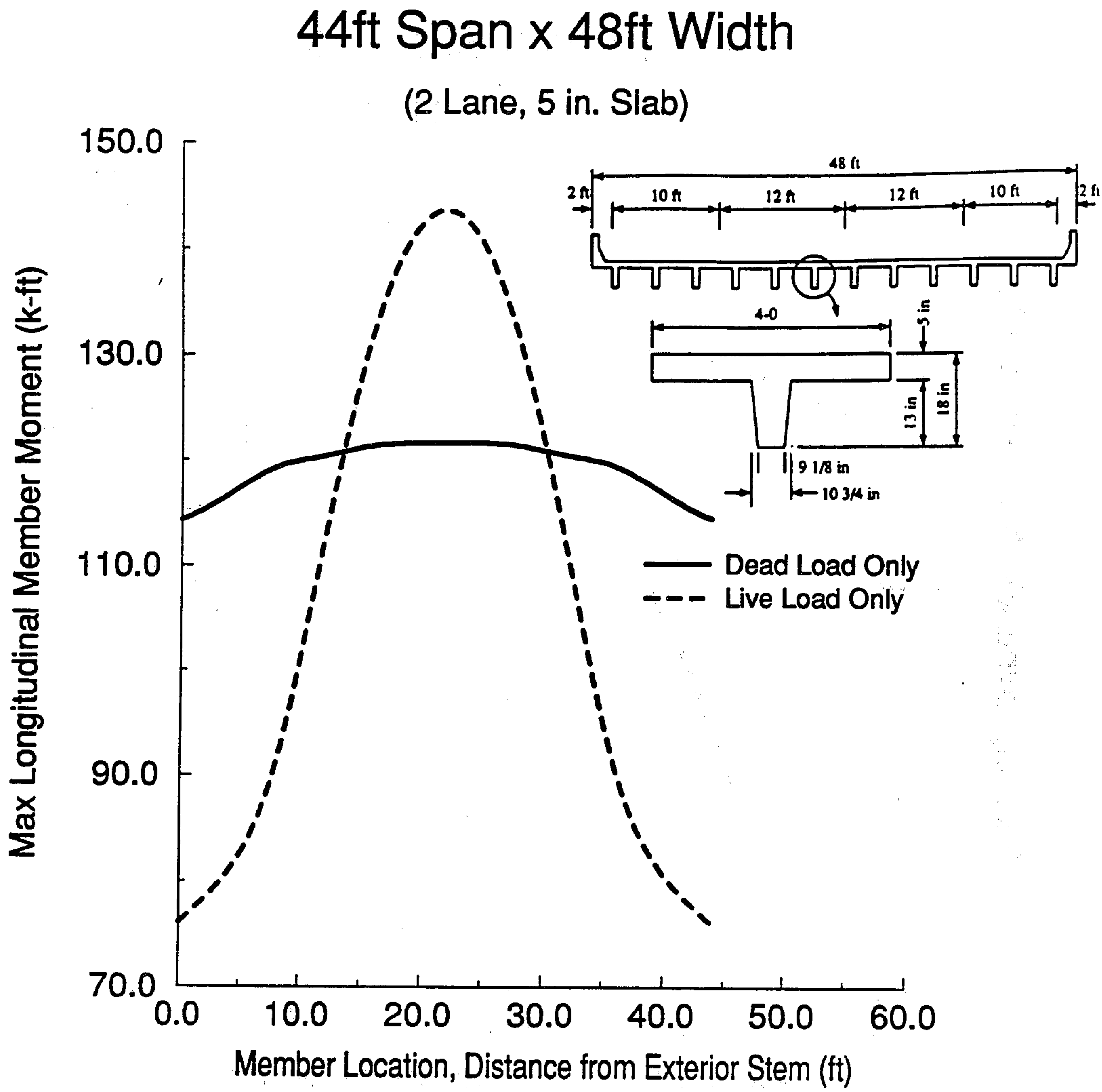


36ft Span x 72ft Width
(4 Lane, 7 in. Slab)
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
0.0
20.0
40.0
60.0
80.0
Max Longitudinal Member Moment (k-ft)
Member Location, Distance from Exterior Stem (ft)
Dead Load Only
Live Load Only
72 ft
2 ft
8 ft
8 ft
2 ft
4-0
7 in
29 in
36 in
7 1/8 in
10 7/8 in



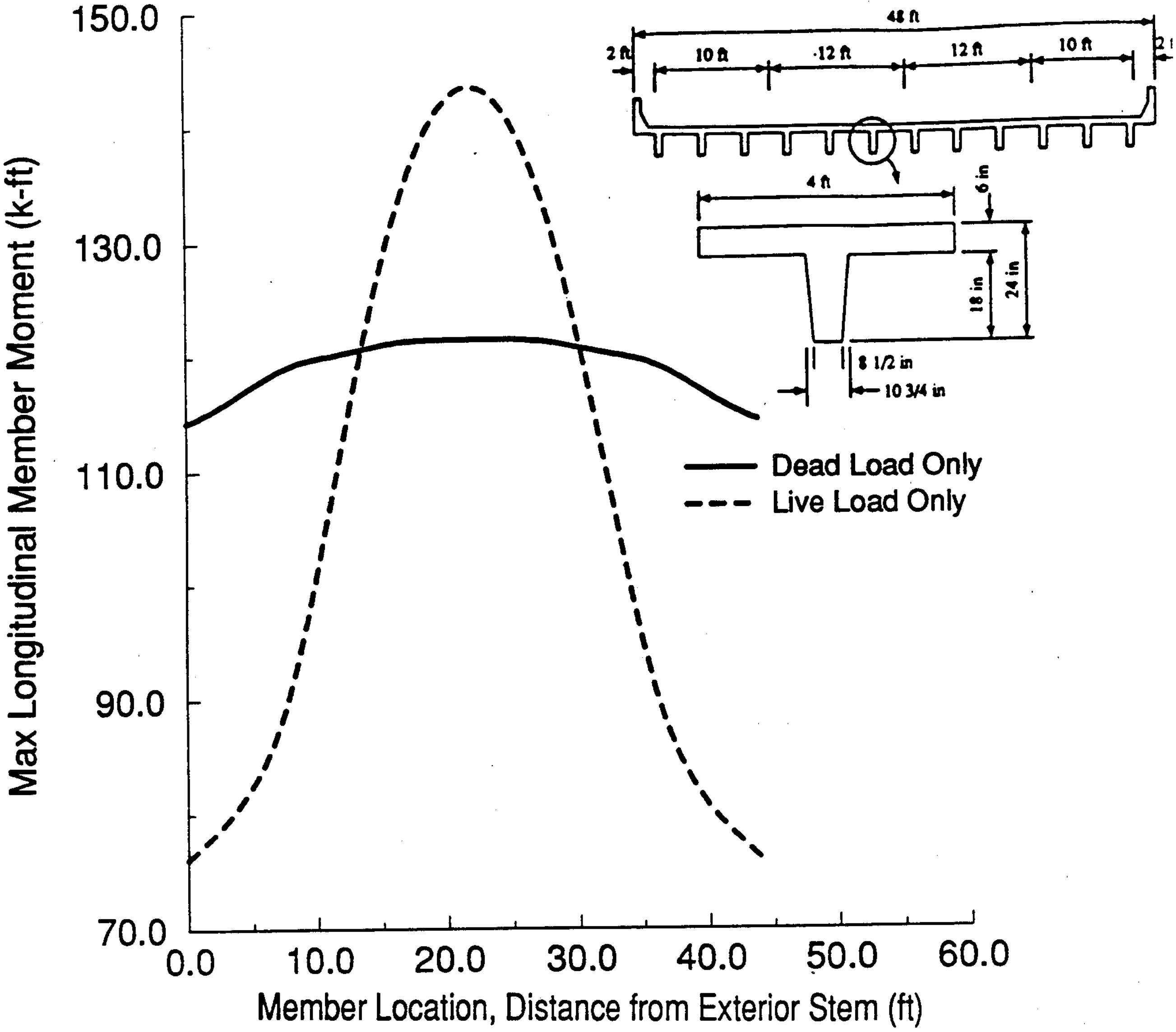
44ft Span x 32ft Width
(1 Lane, 5 in. Slab)
100.0
90.0
80.0
70.0
60.0
Max Longitudinal Member Moment (k-ft)
0.0
10.0
20.0
30.0
40.0
Member Location, Distance from Exterior Stem (ft)
Dead Load Only
Live Load Only
32 ft
2 ft
8 ft
12 ft
8 ft
2 ft
4-0
5 in
13 in
18 in
9 1/8 in
10 3/4 in

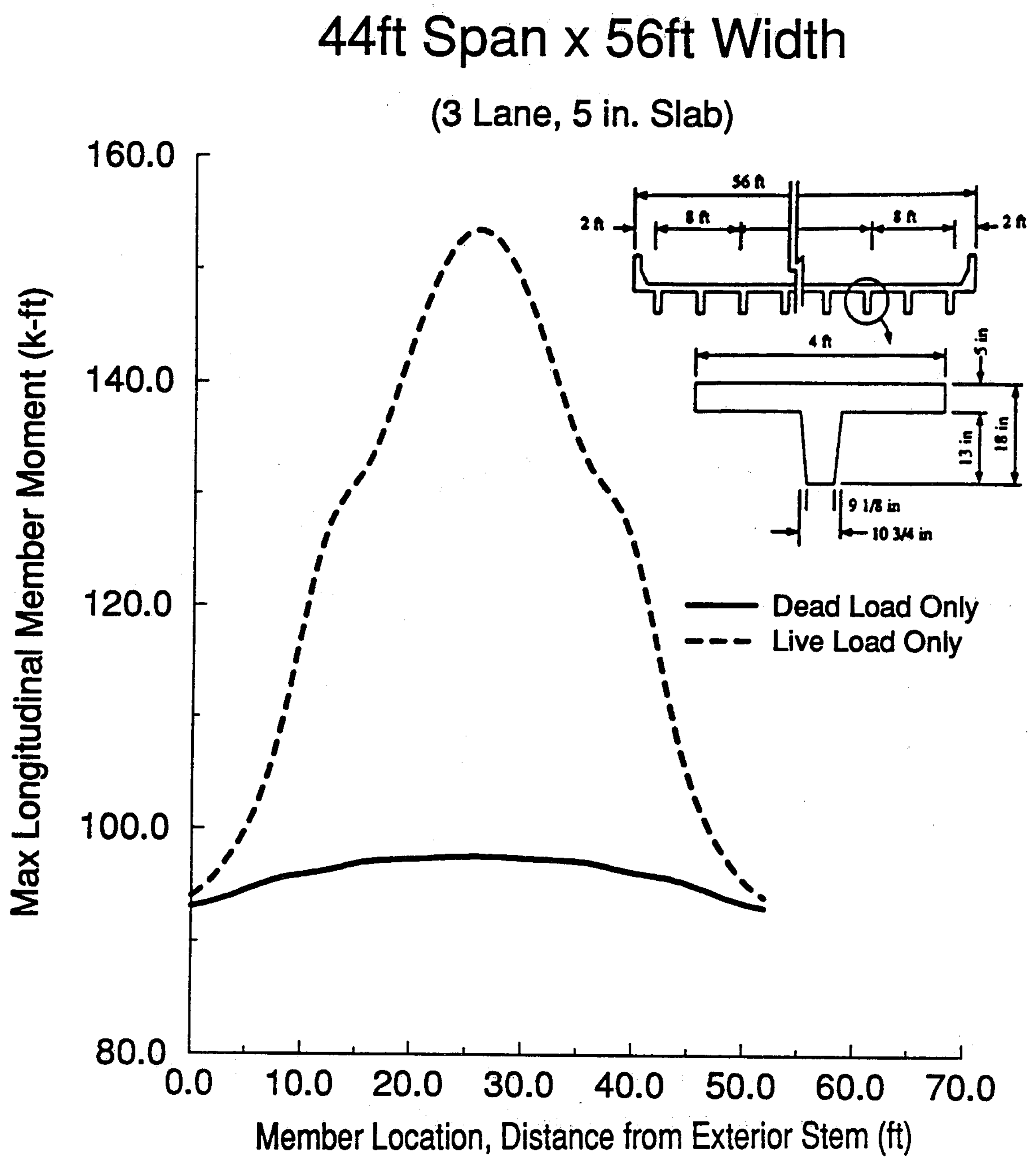

44ft Span x 32ft Width
(1 Lane, 6 in. Slab)
140.0
120.0
100.0
80.0
60.0
0.0
10.0
20.0
30.0
40.0
Max Longitudinal Member Moment (k-ft)
Member Location, Distance from Exterior Stem (ft)
32 ft
2 ft
8 ft
12 ft
8 ft
2 ft
4-0
6 in
13 in
18 in
9 1/8 in
10 3/4 in
Dead Load Only
Live Load Only


44ft Span x 48ft Width
(2 Lane, 5 in. Slab)
150.0
130.0
110.0
90.0
70.0
Max Longitudinal Member Moment (k-ft)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
Member Location, Distance from Exterior Stem (ft)
48 ft
2 ft
10 ft
12 ft
12 ft
10 ft
2 ft
4-0
5 in
13 in
18 in
9 1/8 in
10 3/4 in
Dead Load Only
Live Load Only

44ft Span x 48ft Width

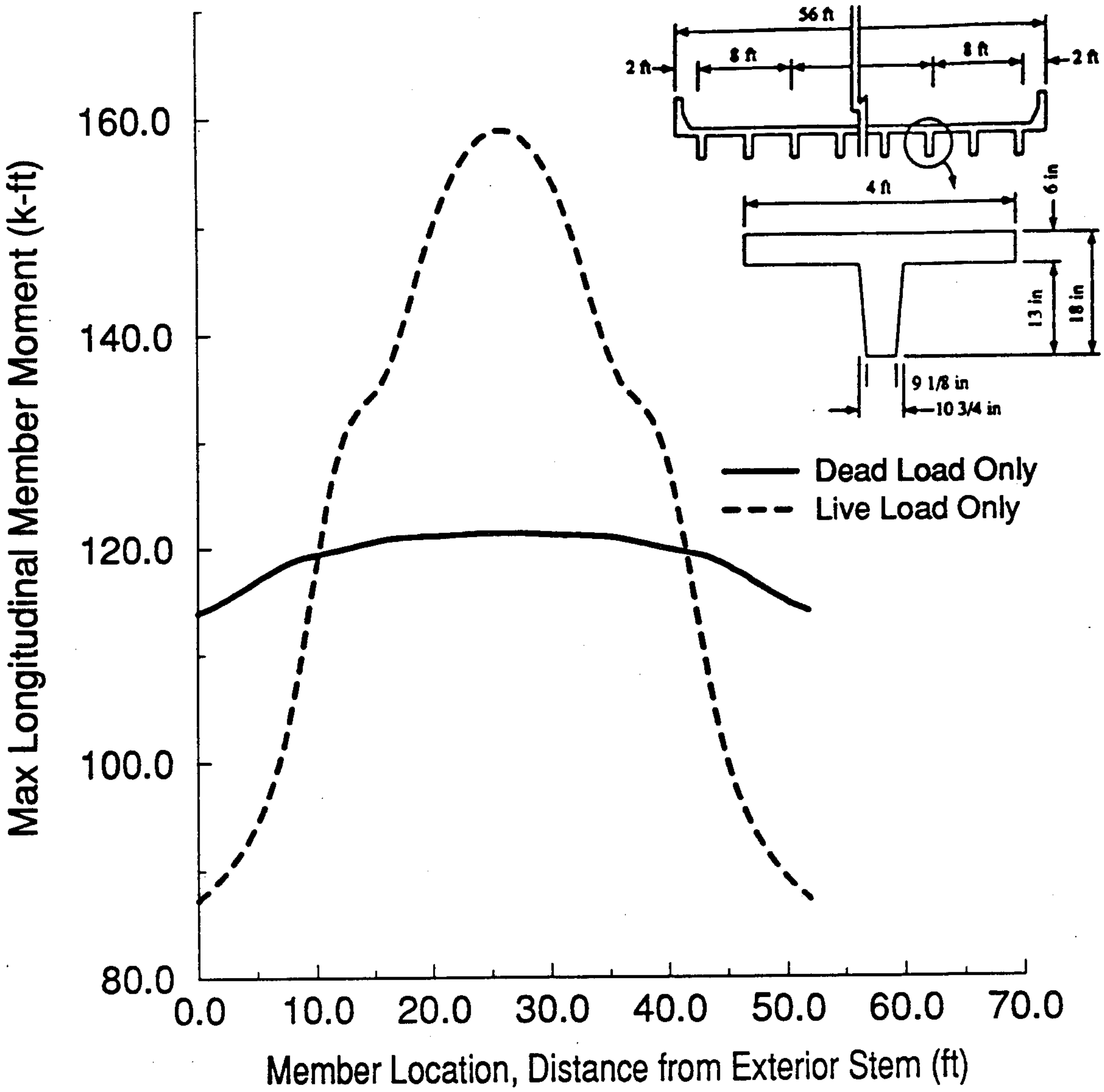
(2 Lane, 6 in. Slab)




44ft Span x 56ft Width
(3 Lane, 5 in. Slab)
Max Longitudinal Member Moment (k-ft)
160.0
140.0
120.0
100.0
80.0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
Member Location, Distance from Exterior Stem (ft)
Dead Load Only
Live Load Only
56 ft
2 ft
8 ft
8 ft
2 ft
4 ft
5 in
13 in
18 in
9 1/8 in
10 3/4 in

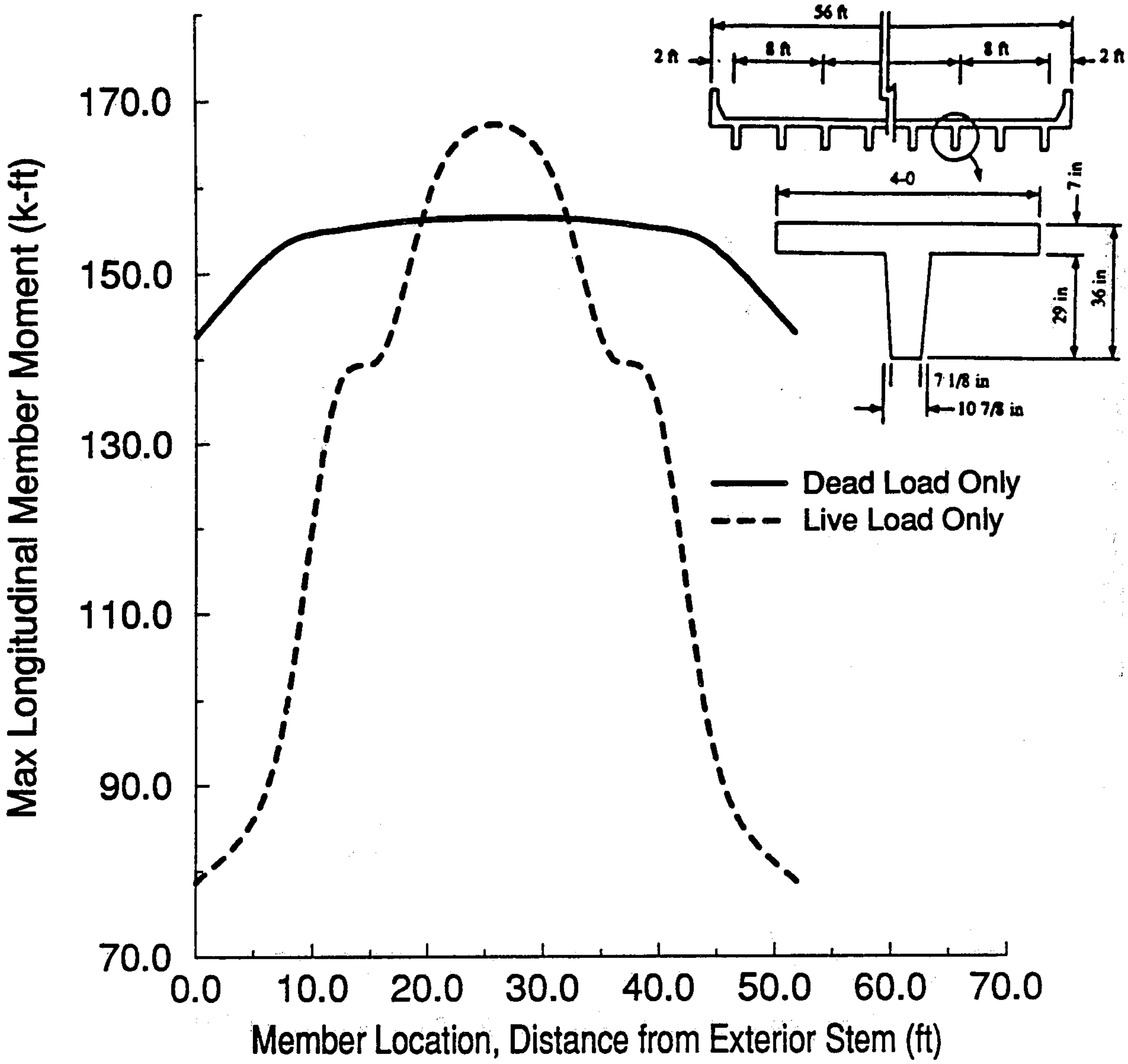
44ft Span x 56ft Width

(3 Lane, 6 in. Slab)



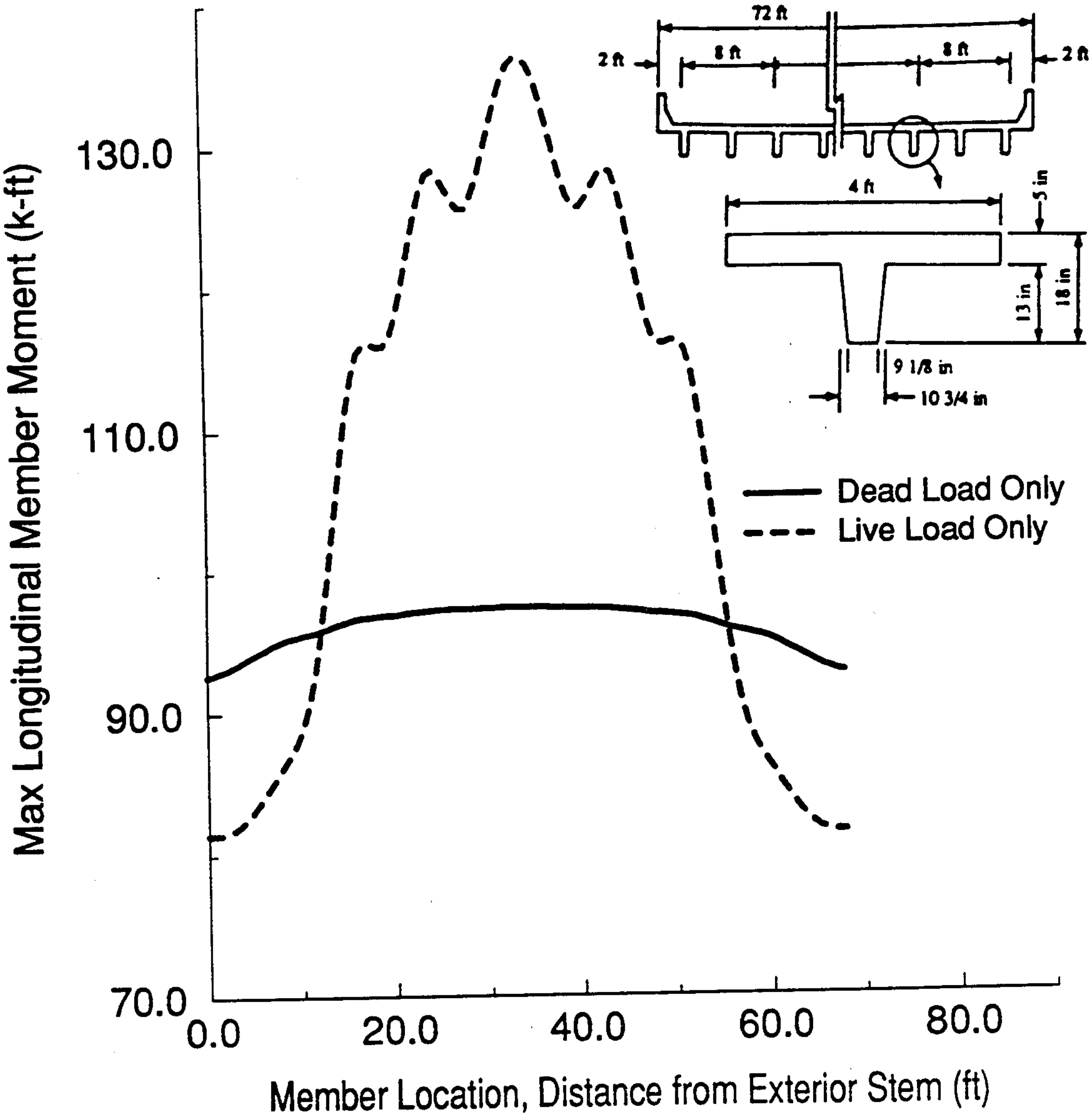
44ft Span x 56ft Width

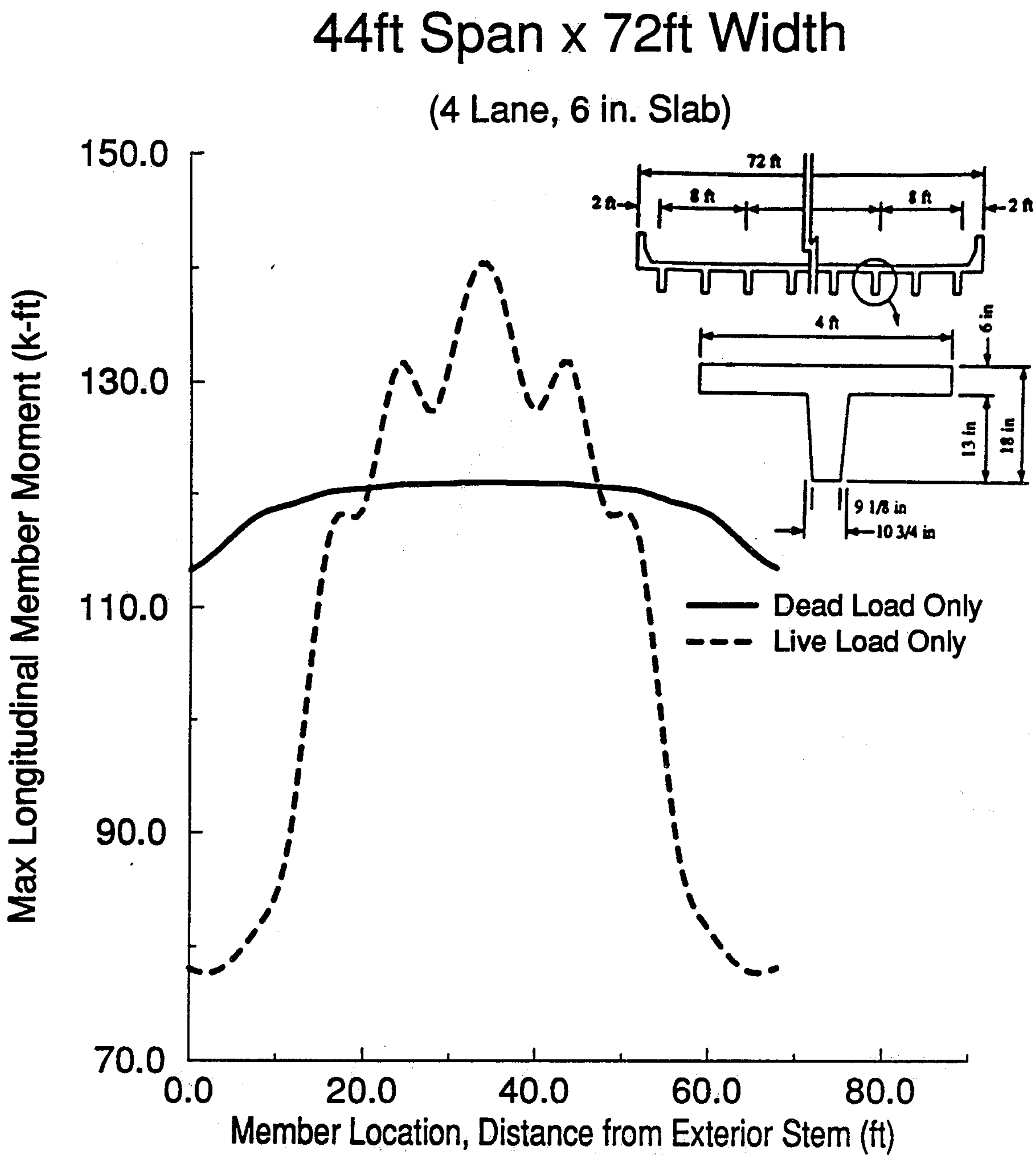
(3 Lane, 7 in. Slab)



44ft Span x 72ft Width

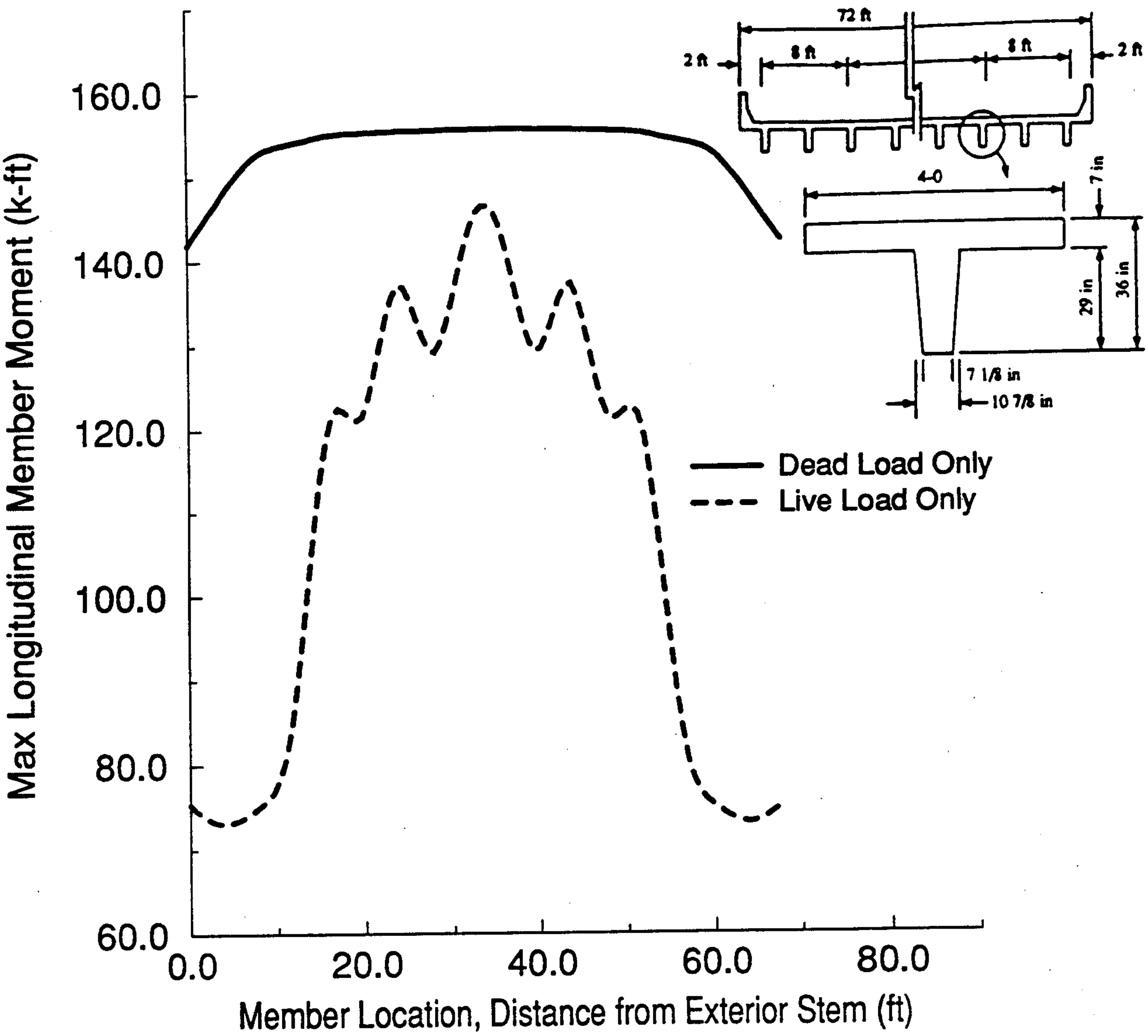
(4 Lane, 5 in. Slab)

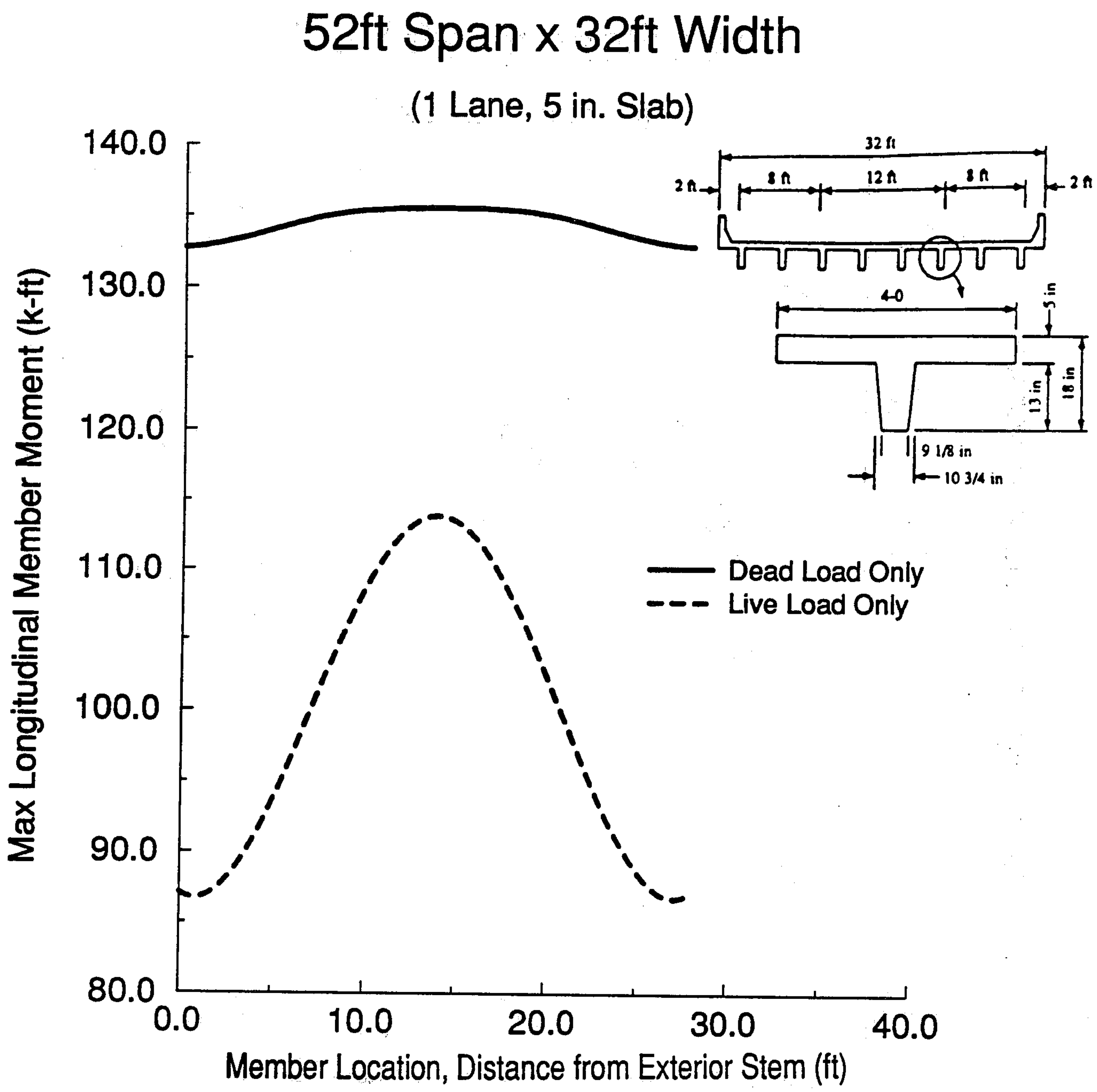



44ft Span x 72ft Width
(4 Lane, 6 in. Slab)
Max Longitudinal Member Moment (k-ft)
150.0
130.0
110.0
90.0
70.0
0.0
20.0
40.0
60.0
80.0
Member Location, Distance from Exterior Stem (ft)
72 ft
2 ft
8 ft
8 ft
2 ft
4 ft
6 in
13 in
18 in
9 1/8 in
10 3/4 in
Dead Load Only
Live Load Only

44ft Span x 72ft Width

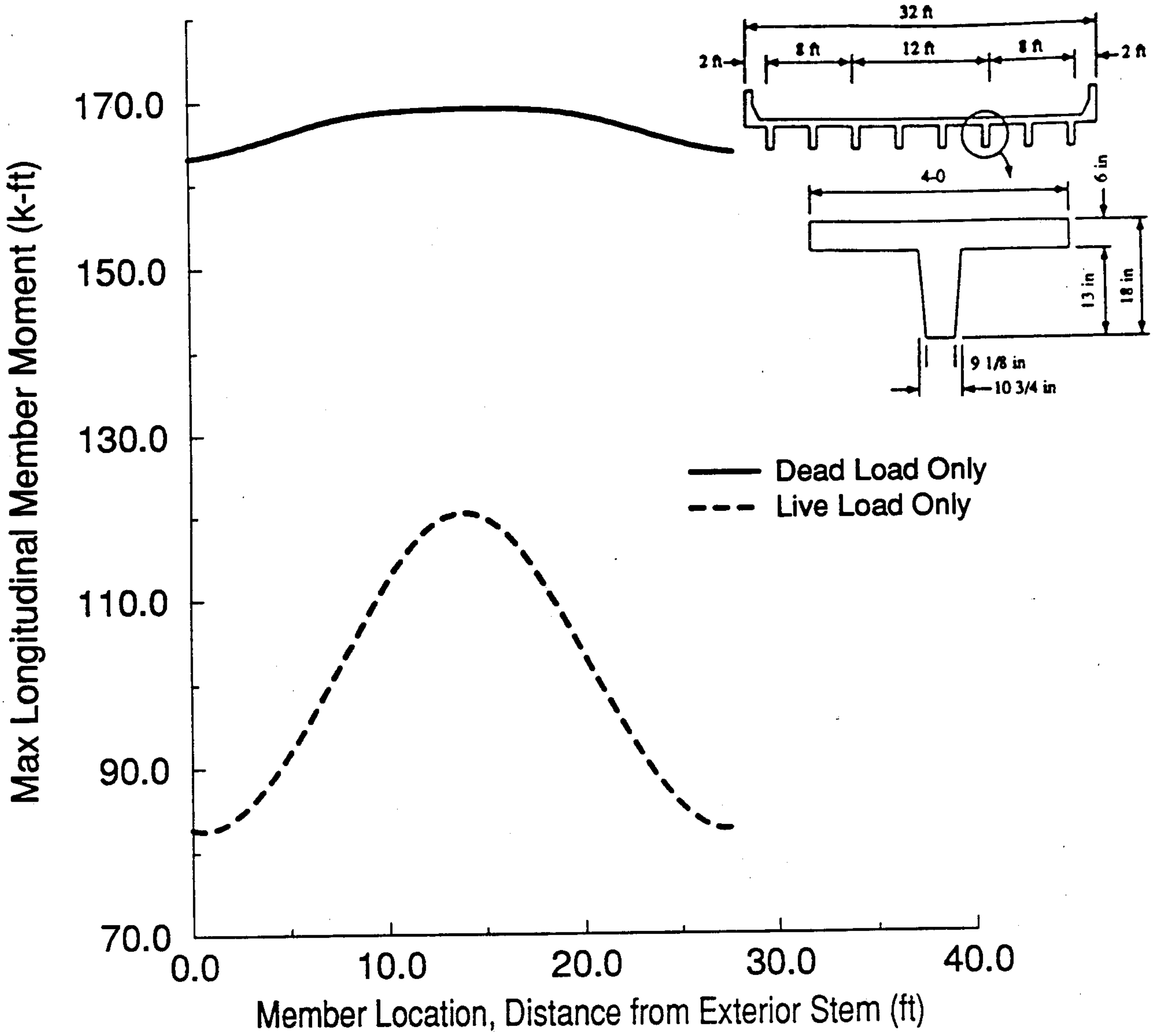
(4 Lane, 7 in. Slab)




52ft Span x 32ft Width
(1 Lane, 5 in. Slab)
Max Longitudinal Member Moment (k-ft)
140.0
130.0
120.0
110.0
100.0
90.0
80.0
0.0
10.0
20.0
30.0
40.0
Member Location, Distance from Exterior Stem (ft)
Dead Load Only
Live Load Only
32 ft
2 ft
8 ft
12 ft
8 ft
2 ft
4-0
5 in
13 in
18 in
9 1/8 in
10 3/4 in

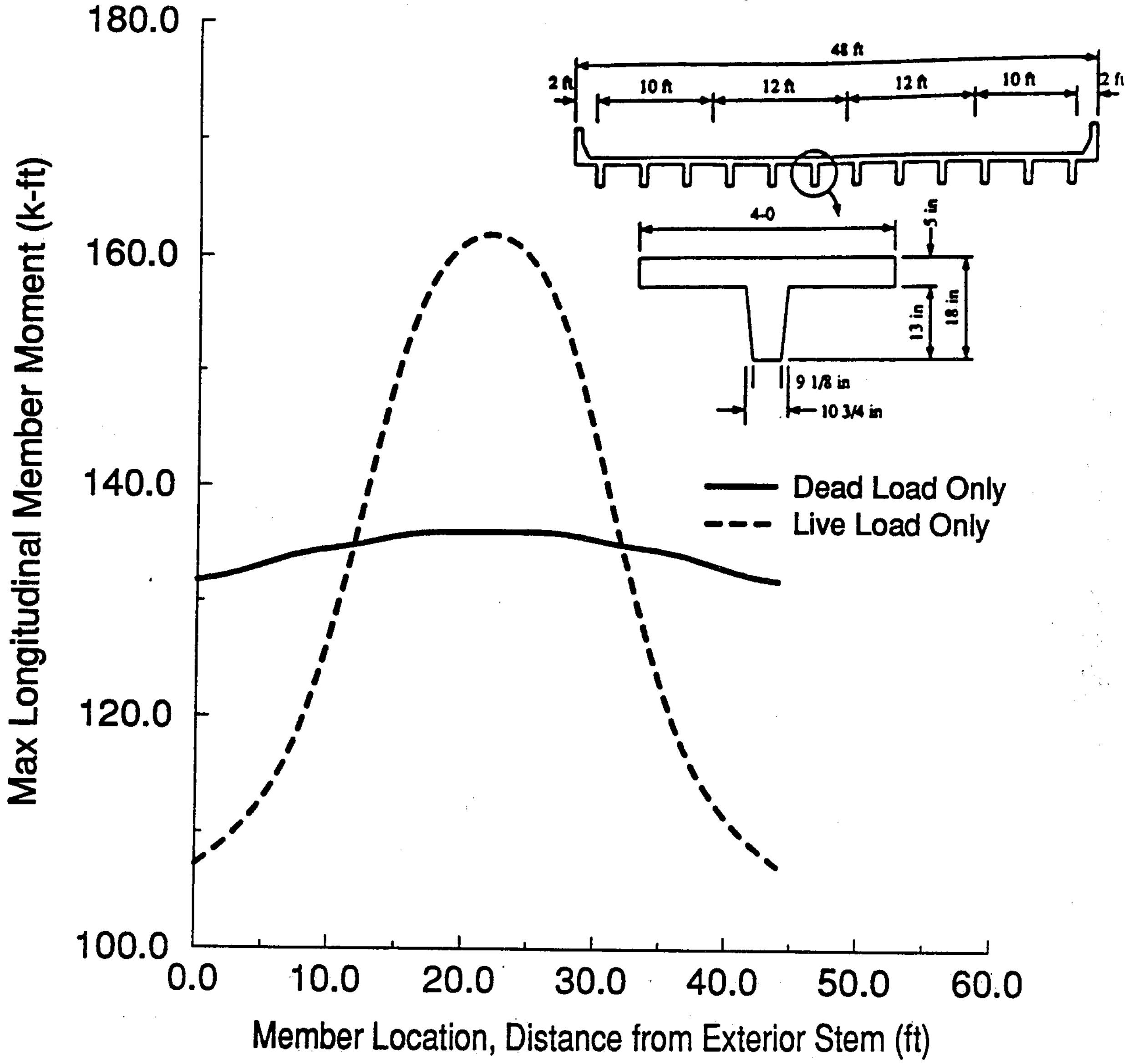
52ft Span x 32ft Width

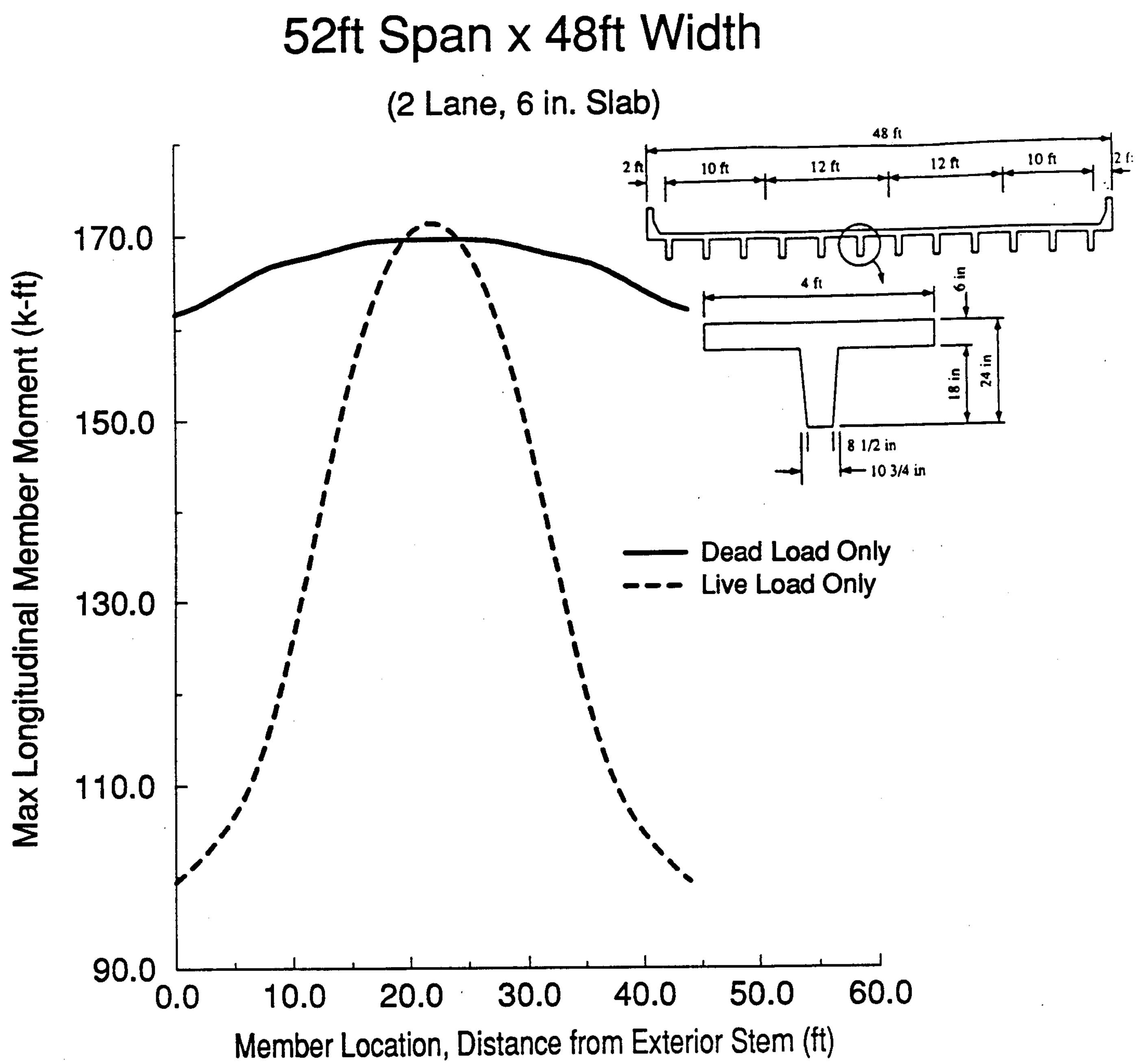
(1 Lane, 6 in. Slab)

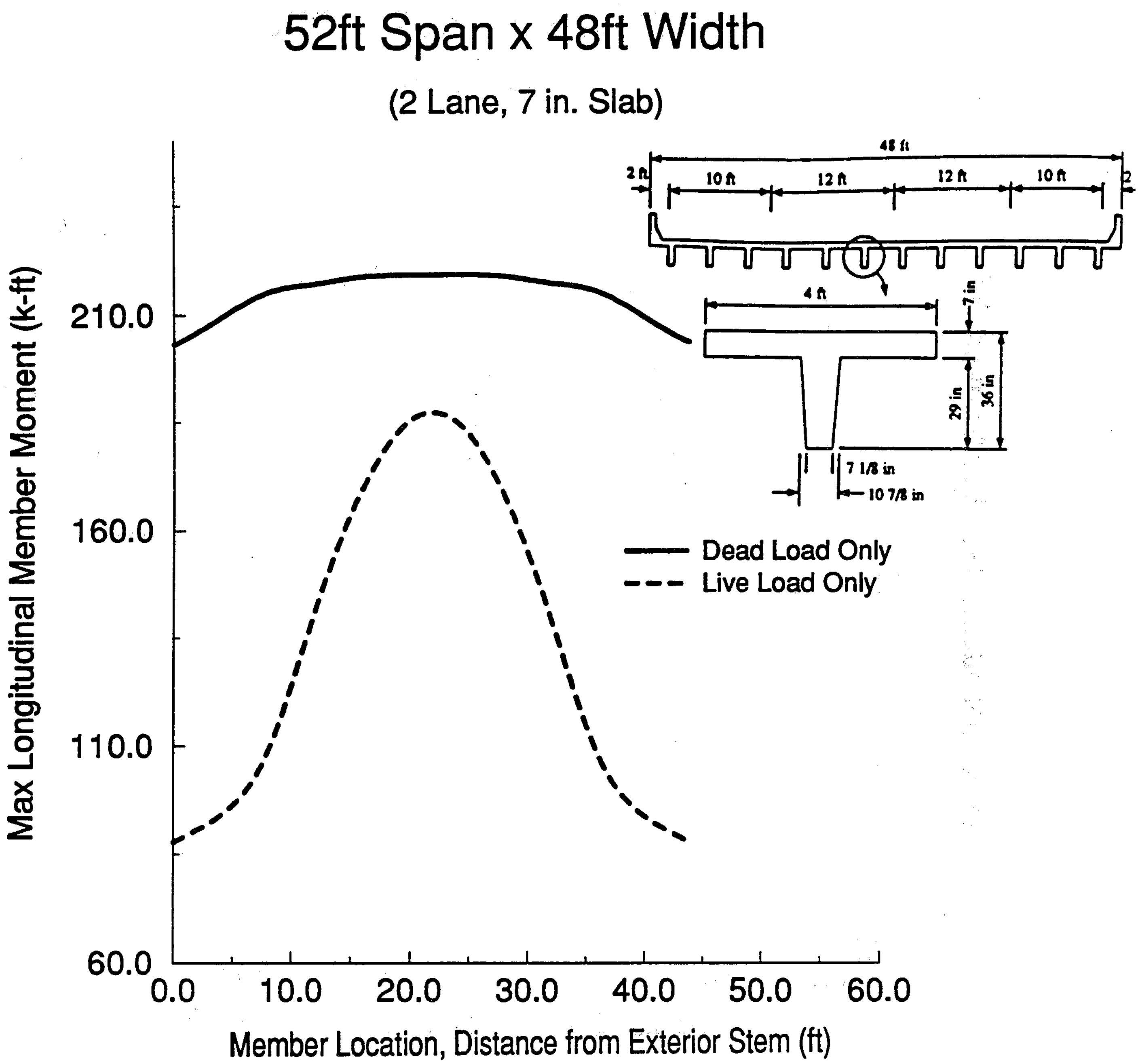


52ft Span x 48ft Width

(2 Lane, 5 in. Slab)

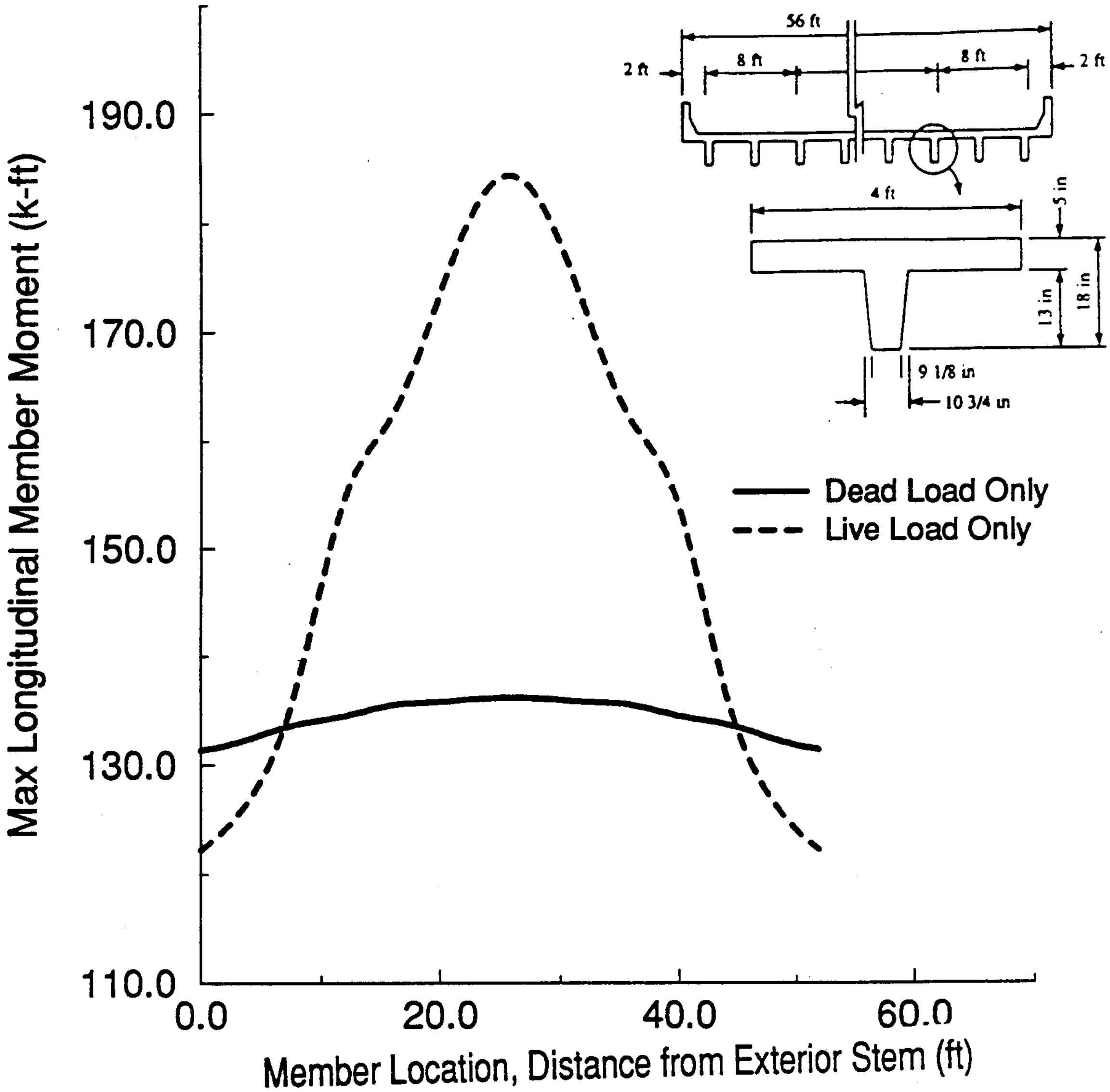



52ft Span x 48ft Width
(2 Lane, 6 in. Slab)
48 ft
2 ft
10 ft
12 ft
12 ft
10 ft
4 ft
6 in
18 in
24 in
8 1/2 in
10 3/4 in
Dead Load Only
Live Load Only
Max Longitudinal Member Moment (k-ft)
170.0
150.0
130.0
110.0
90.0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
Member Location, Distance from Exterior Stem (ft)


52ft Span x 48ft Width
(2 Lane, 7 in. Slab)
Max Longitudinal Member Moment (k-ft)
210.0
160.0
110.0
60.0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
Member Location, Distance from Exterior Stem (ft)
Dead Load Only
Live Load Only
48 ft
2 ft
10 ft
12 ft
12 ft
10 ft
4 ft
7 in
29 in
36 in
7 1/8 in
10 7/8 in

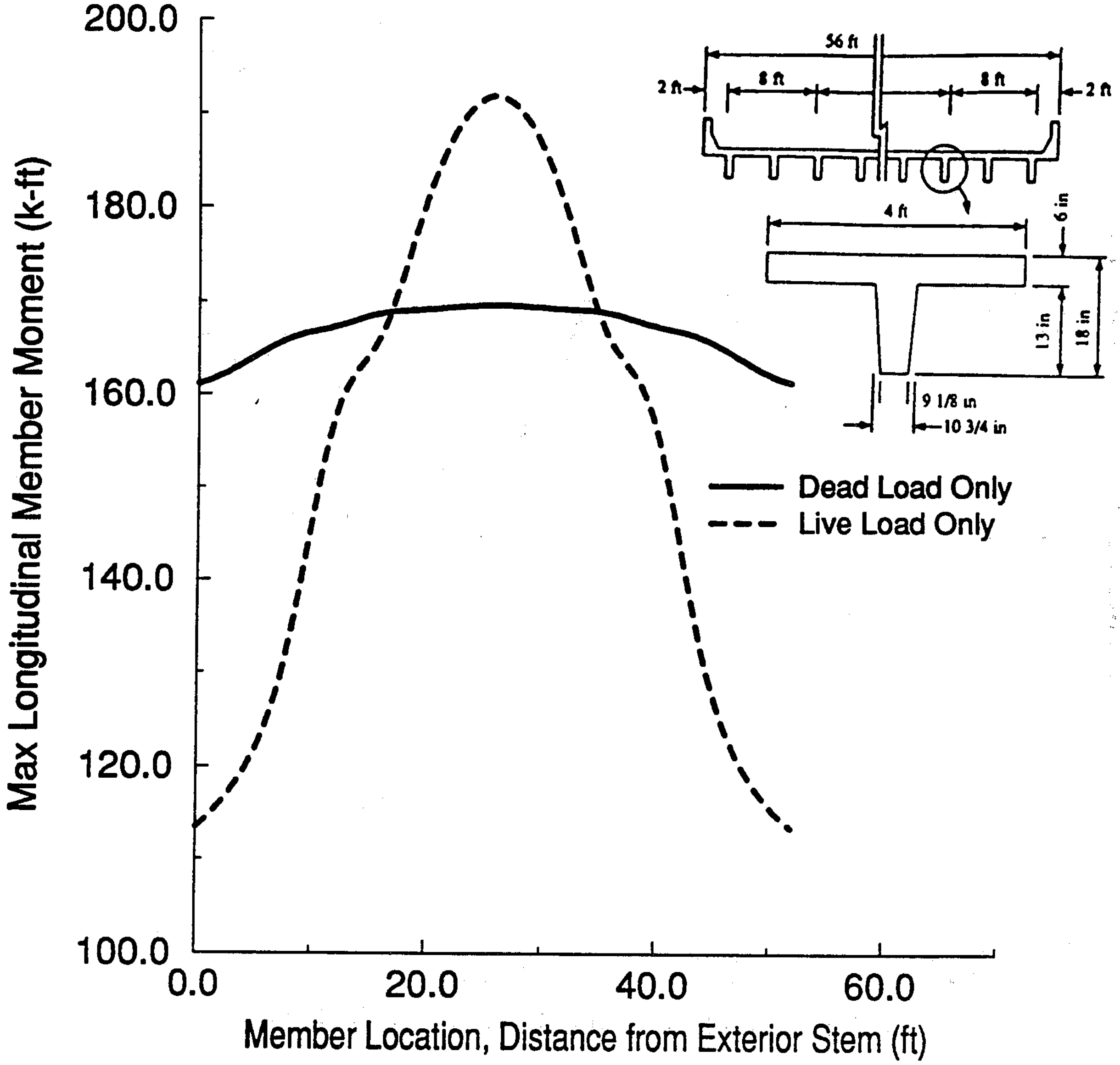
52ft Span x 56ft Width

(3 Lane, 5 in. Slab)



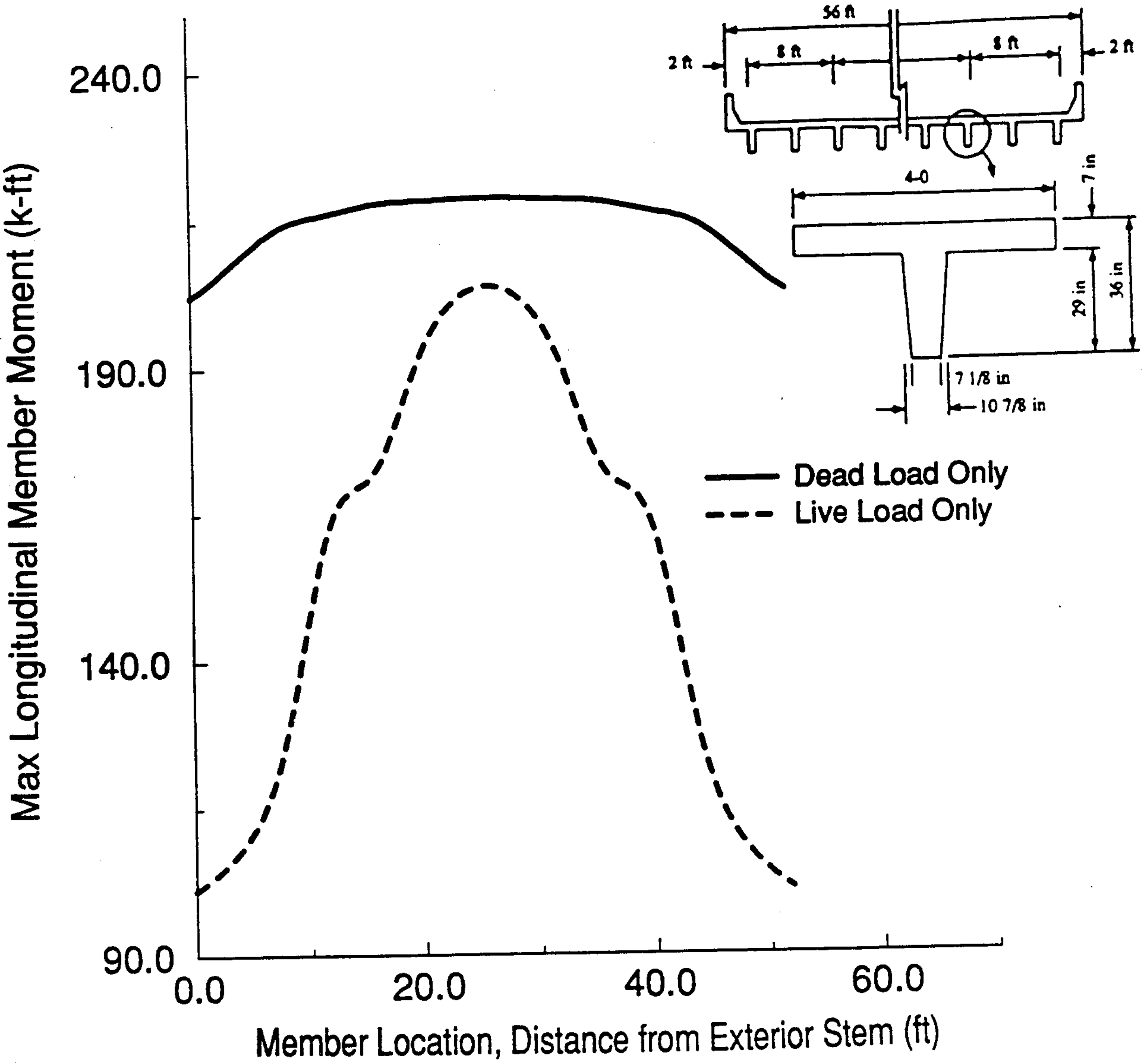
52ft Span x 56ft Width

(3 Lane, 6 in. Slab)



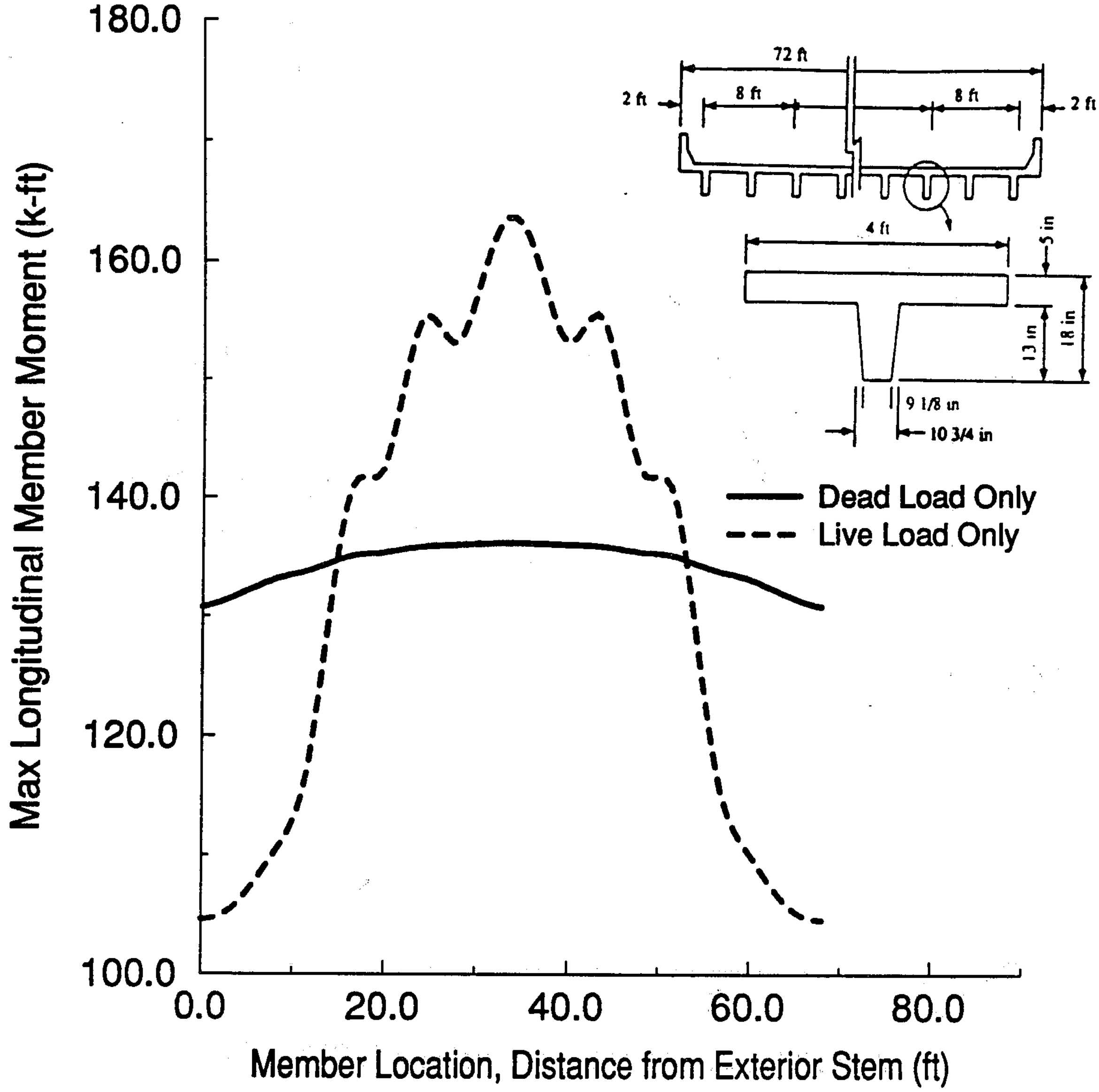
52ft Span x 56ft Width

(3 Lane, 7 in. Slab)



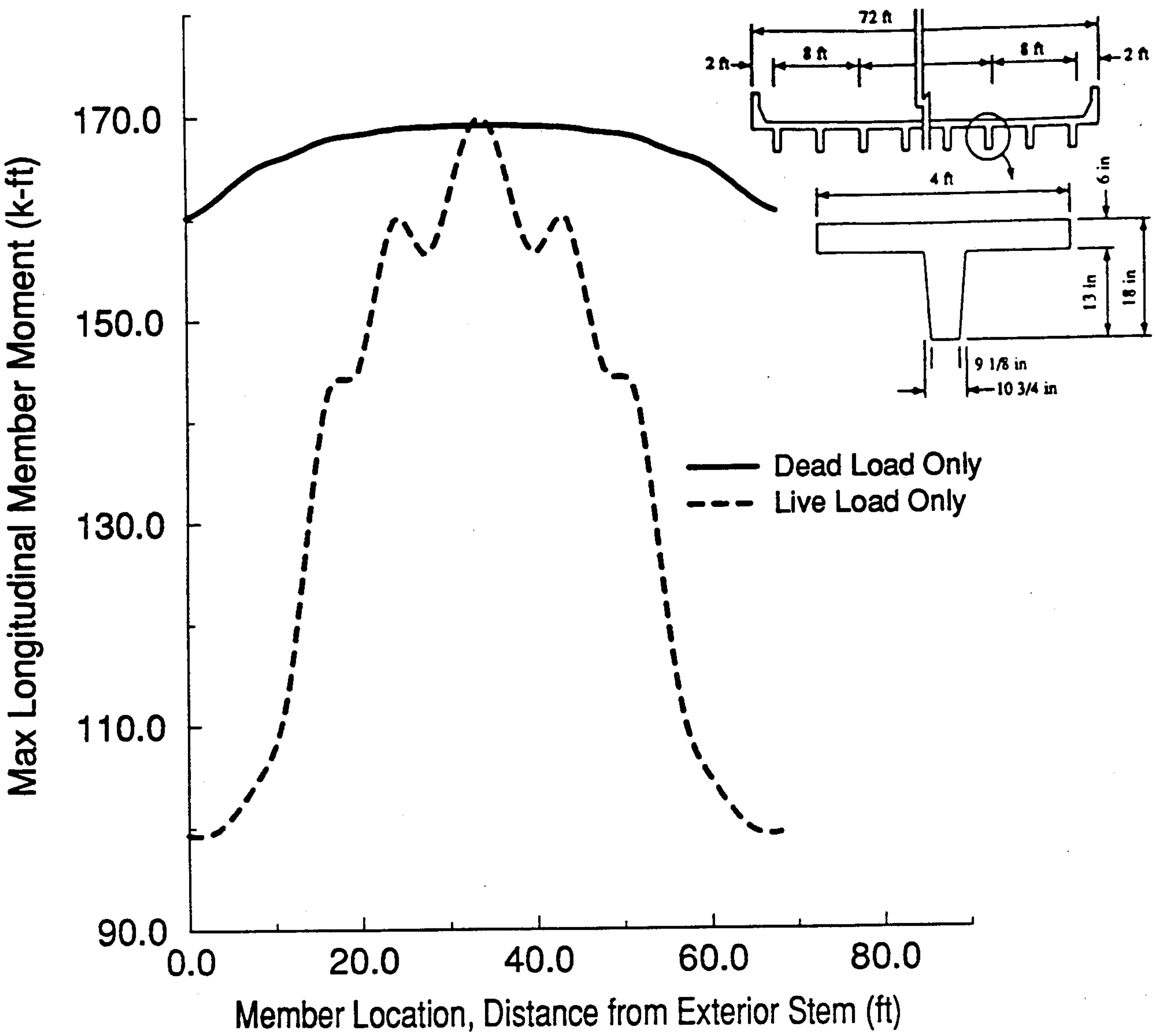
52ft Span x 72ft Width

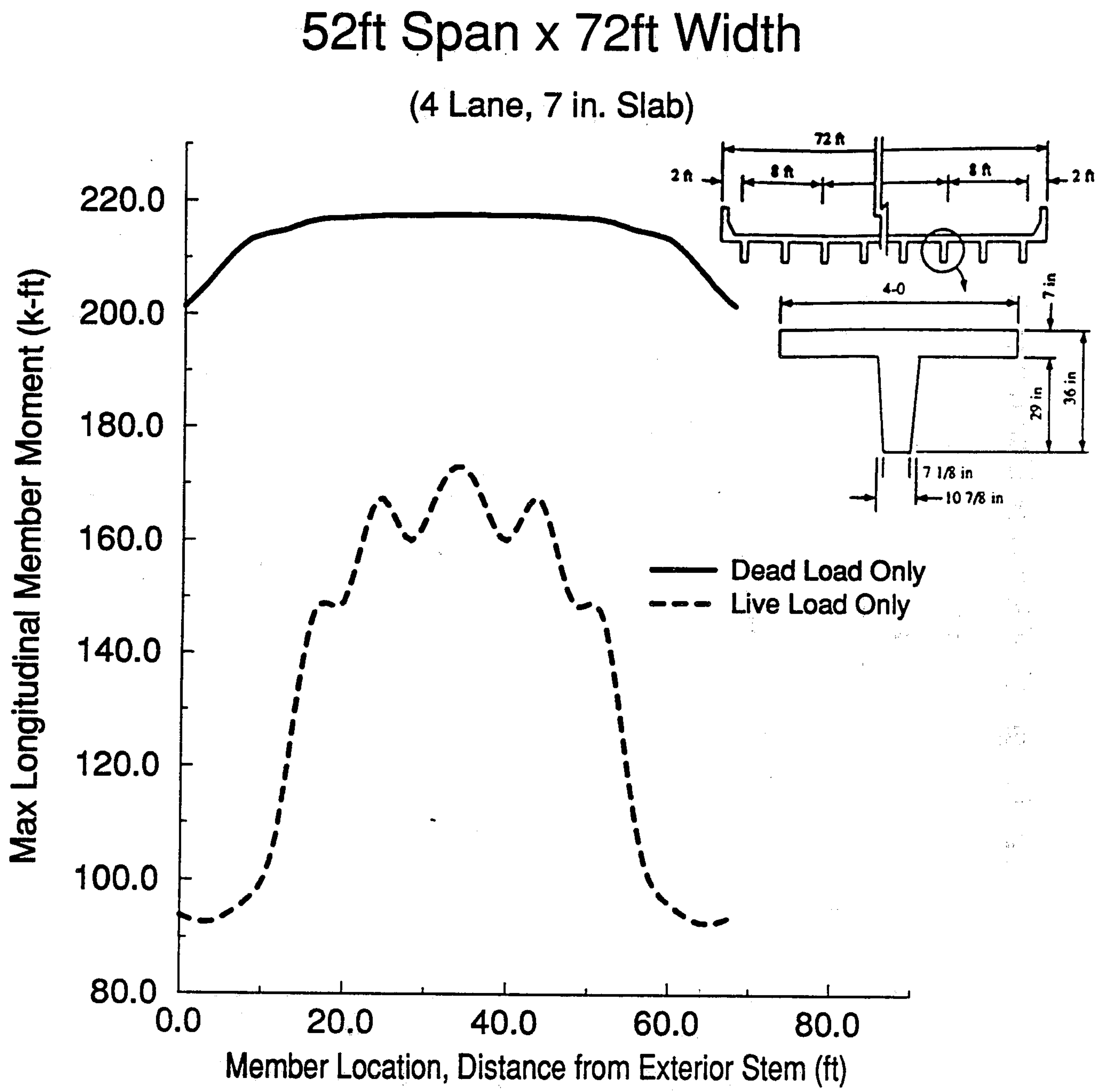
(4 Lane, 5 in. Slab)



52ft Span x 72ft Width

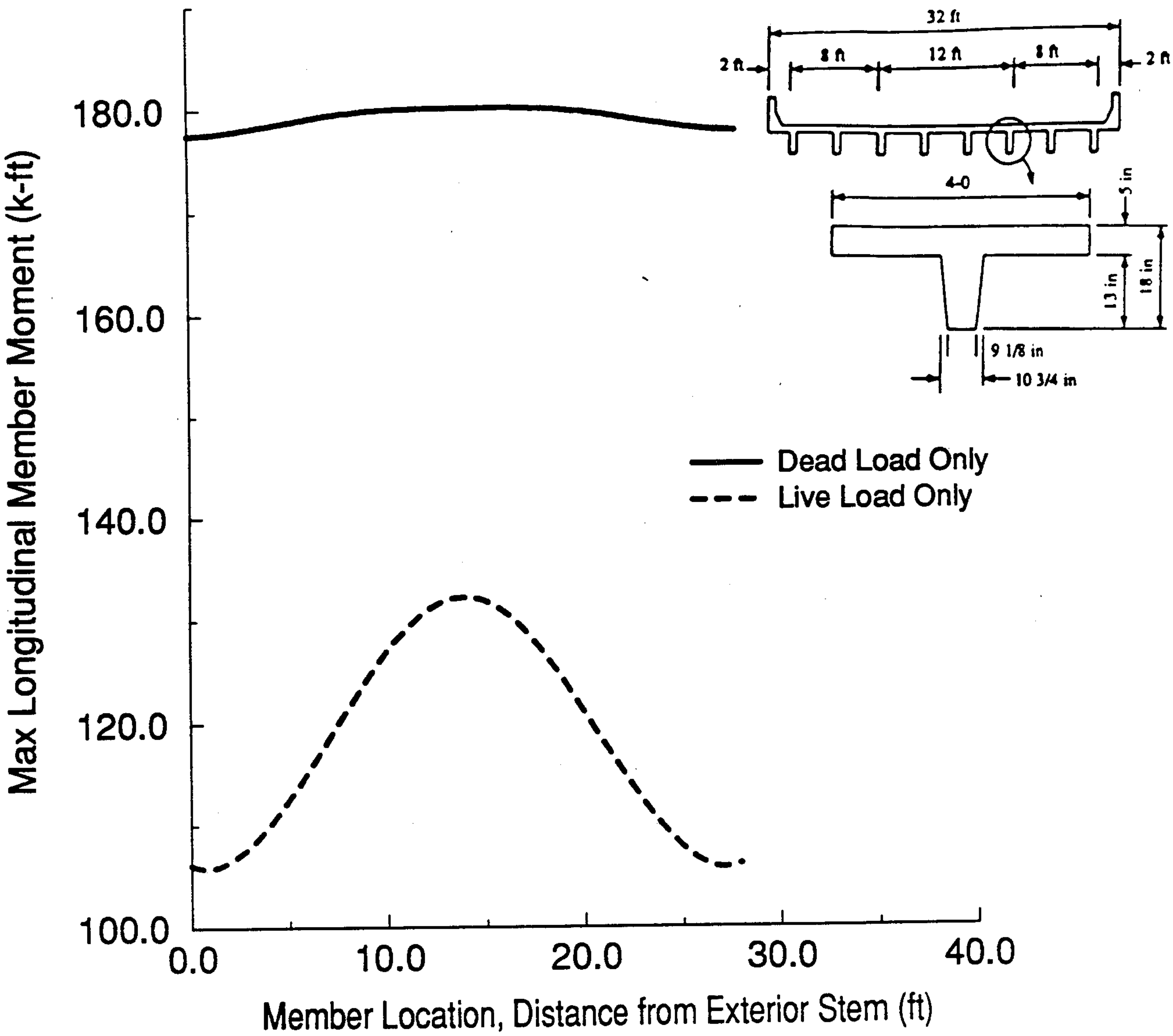
(4 Lane, 6 in. Slab)




52ft Span x 72ft Width
(4 Lane, 7 in. Slab)
Max Longitudinal Member Moment (k-ft)
220.0
200.0
180.0
160.0
140.0
120.0
100.0
80.0
0.0
20.0
40.0
60.0
80.0
Member Location, Distance from Exterior Stem (ft)
Dead Load Only
Live Load Only
72 ft
2 ft
8 ft
8 ft
2 ft
4-0
7 in
29 in
36 in
7 1/8 in
10 7/8 in

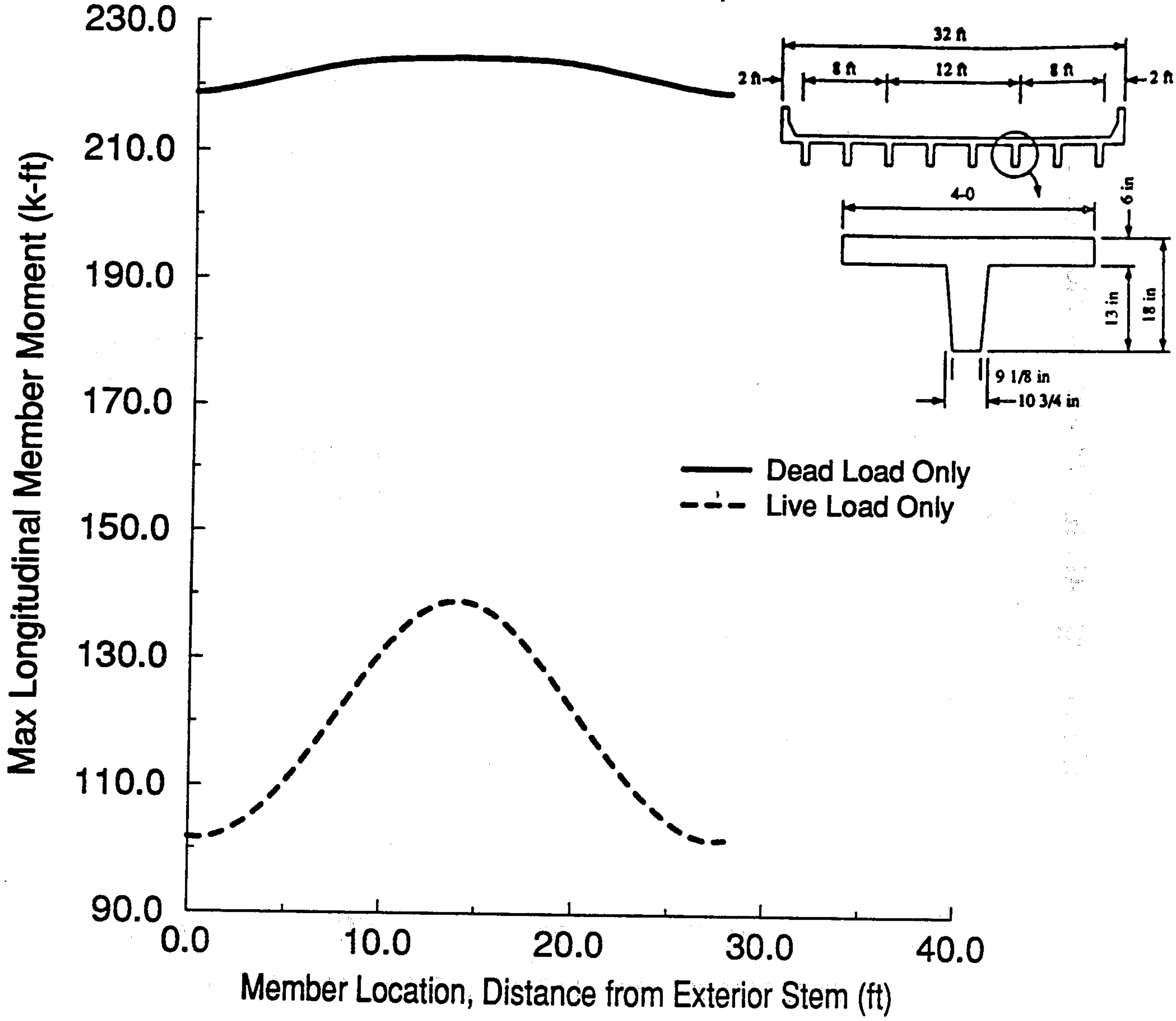
60ft Span x 32ft Width

(1 Lane, 5 in. Slab)



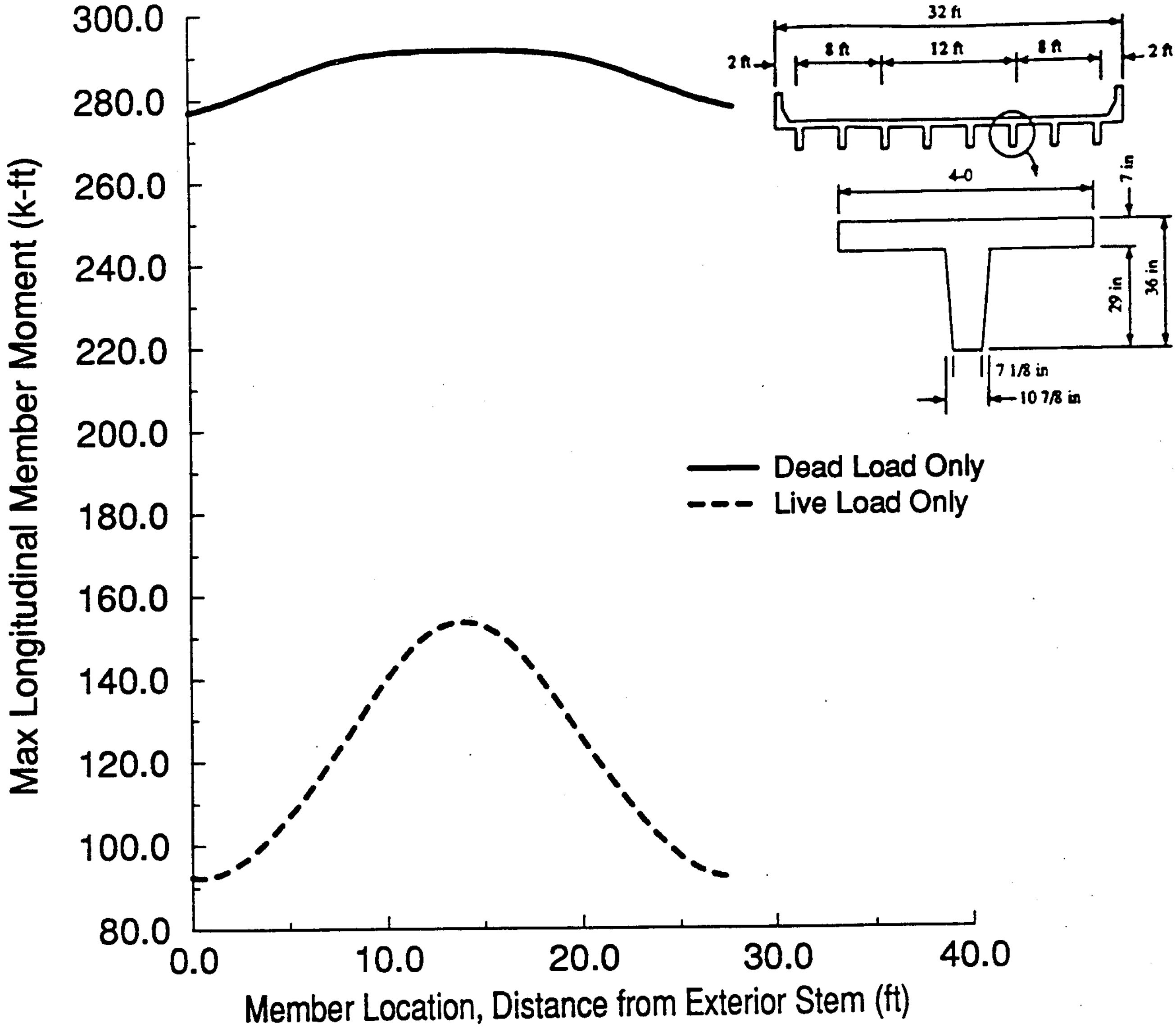
60ft Span x 32ft Width

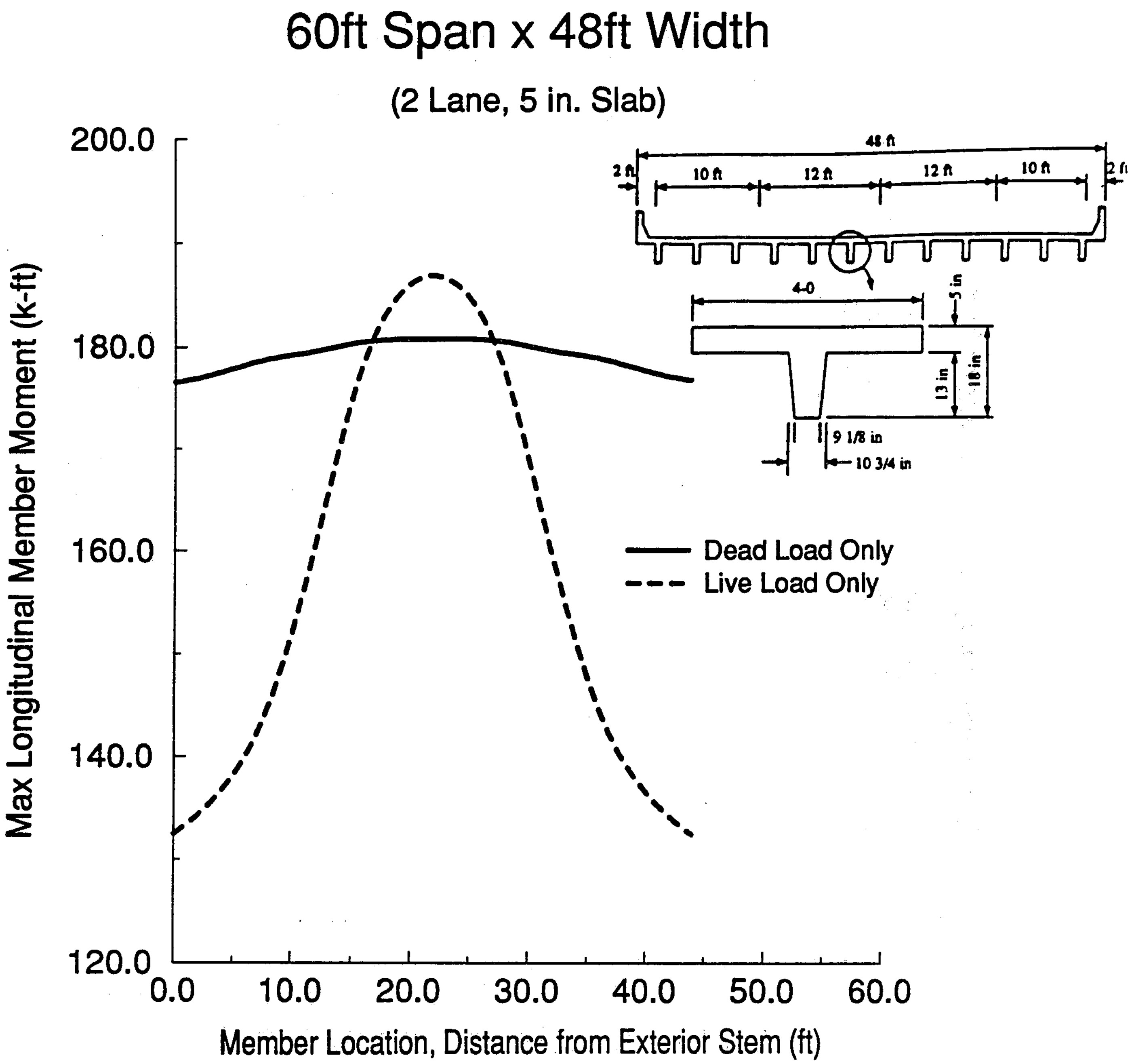
(1 Lane, 6 in. Slab)



60ft Span x 32ft Width

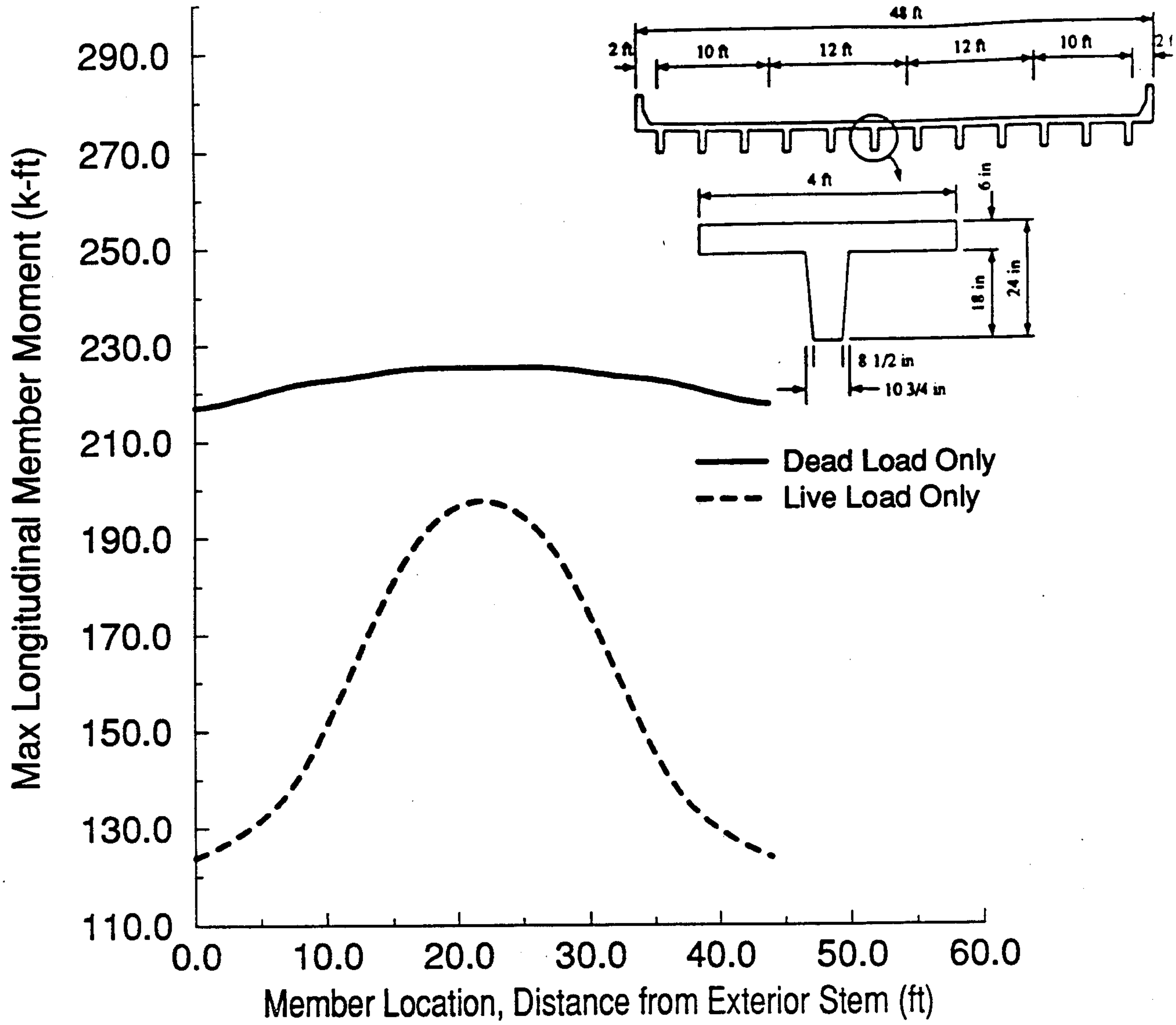
(1 Lane, 7 in. Slab)




60ft Span x 48ft Width
(2 Lane, 5 in. Slab)
Max Longitudinal Member Moment (k-ft)
200.0
180.0
160.0
140.0
120.0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
Member Location, Distance from Exterior Stem (ft)
Dead Load Only
Live Load Only
48 ft
2 ft
10 ft
12 ft
12 ft
10 ft
2 ft
4-0
5 in
13 in
18 in
9 1/8 in
10 3/4 in

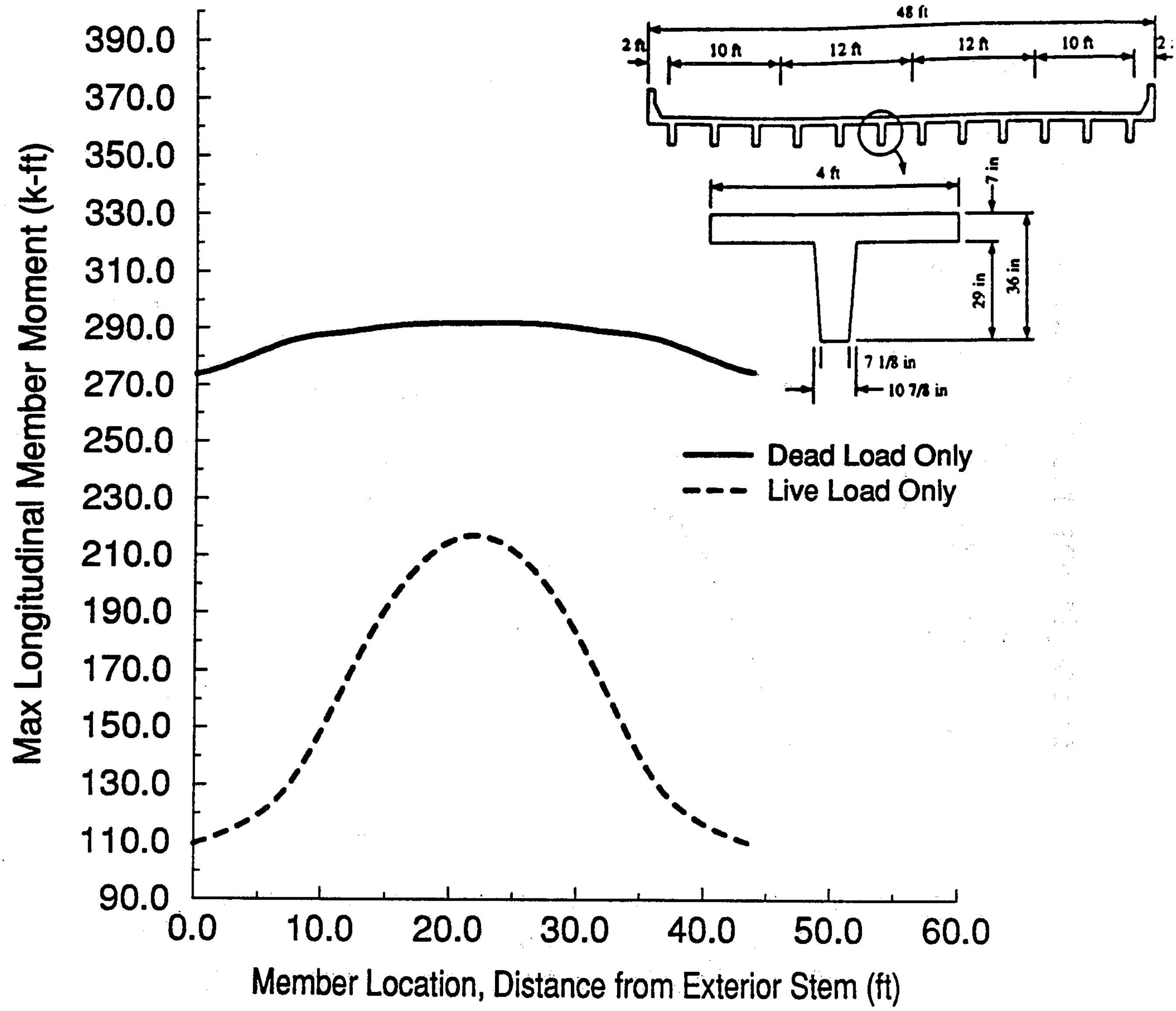
60ft Span x 48ft Width

(2 Lane, 6 in. Slab)



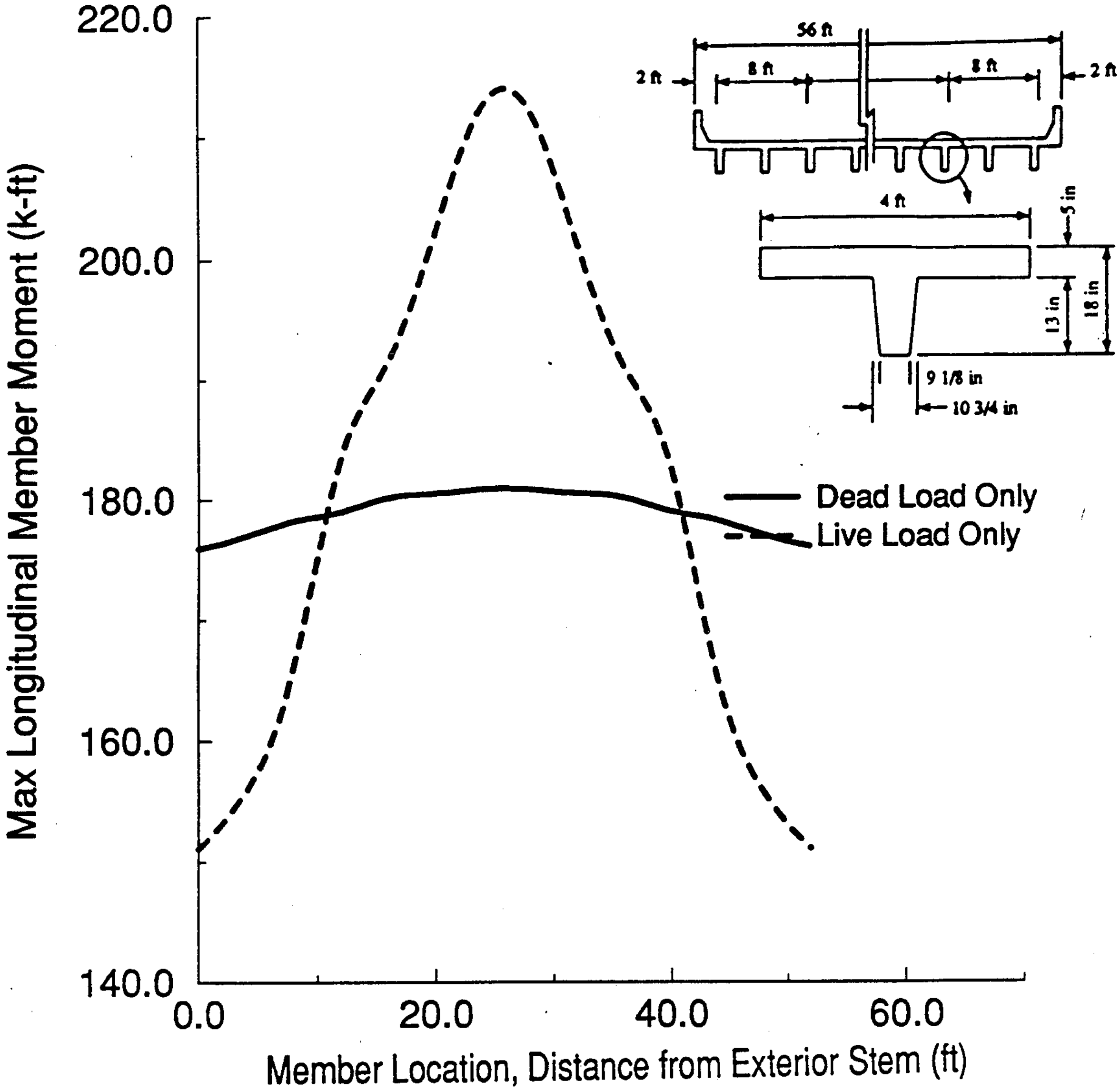
60ft Span x 48ft Width

(2 Lane, 7 in. Slab)



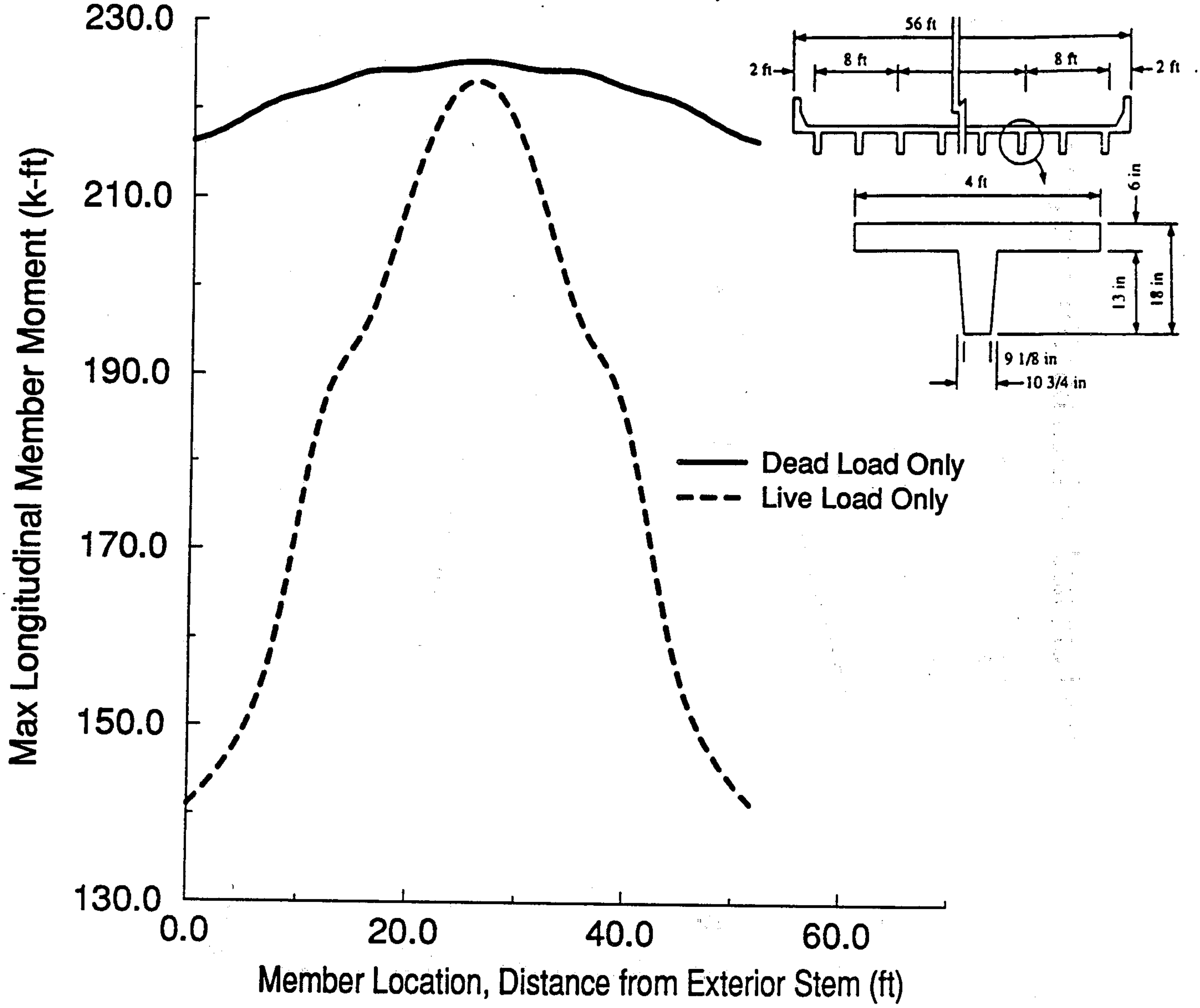
60ft Span x 56ft Width

(3 Lane, 5 in. Slab)



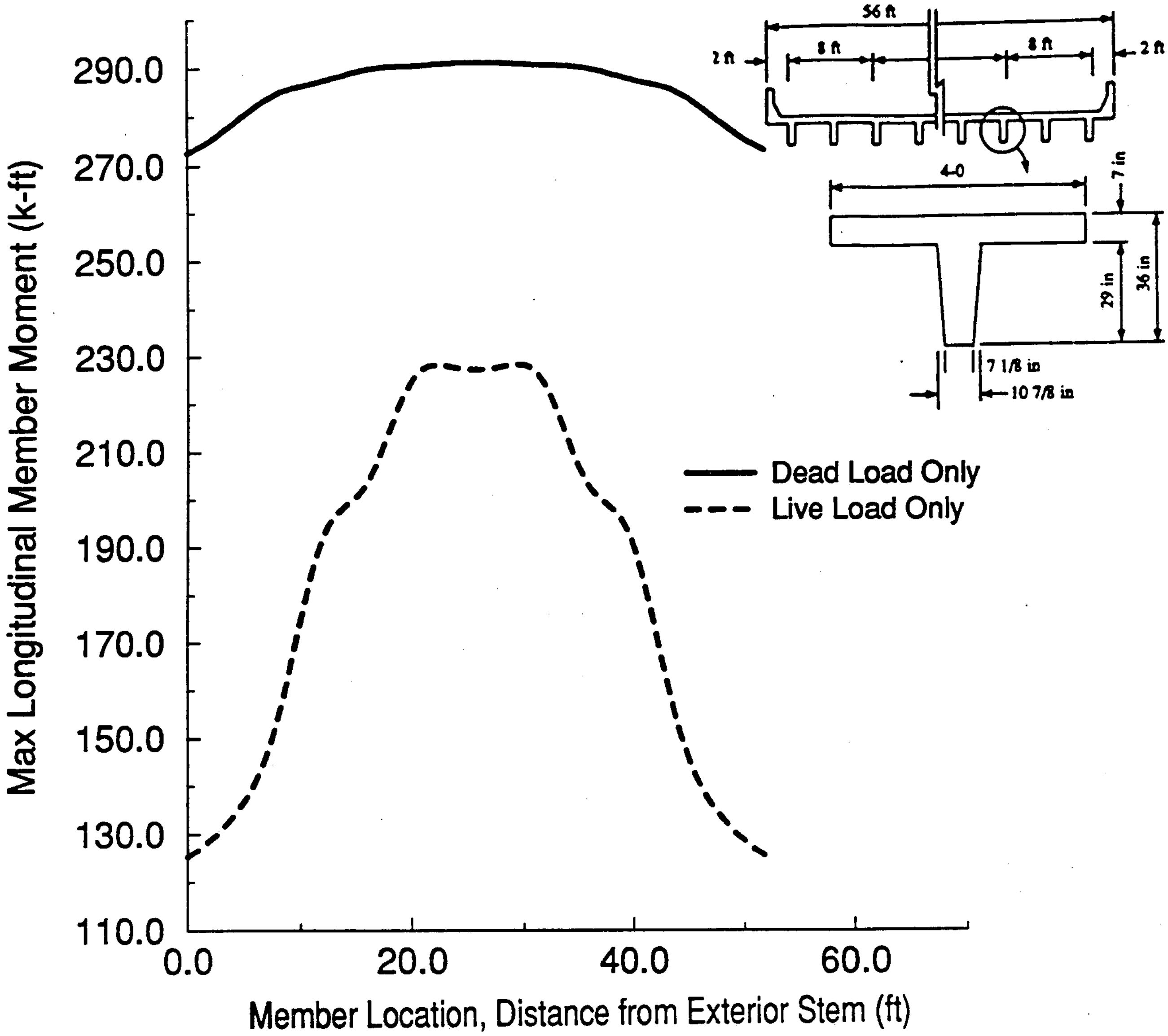
60ft Span x 56ft Width

(3 Lane, 6 in. Slab)



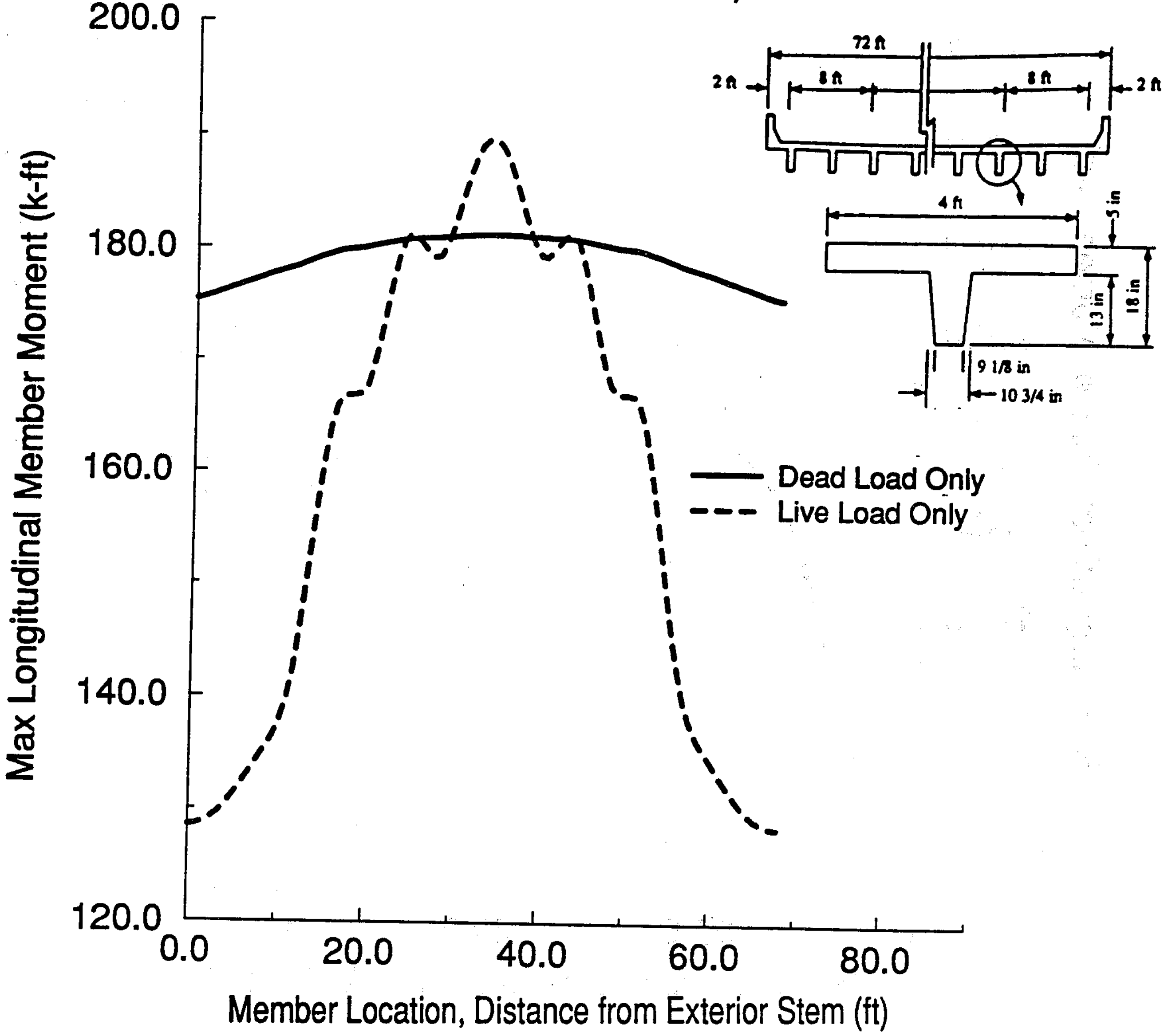
60ft Span x 56ft Width

(3 Lane, 7 in. Slab)



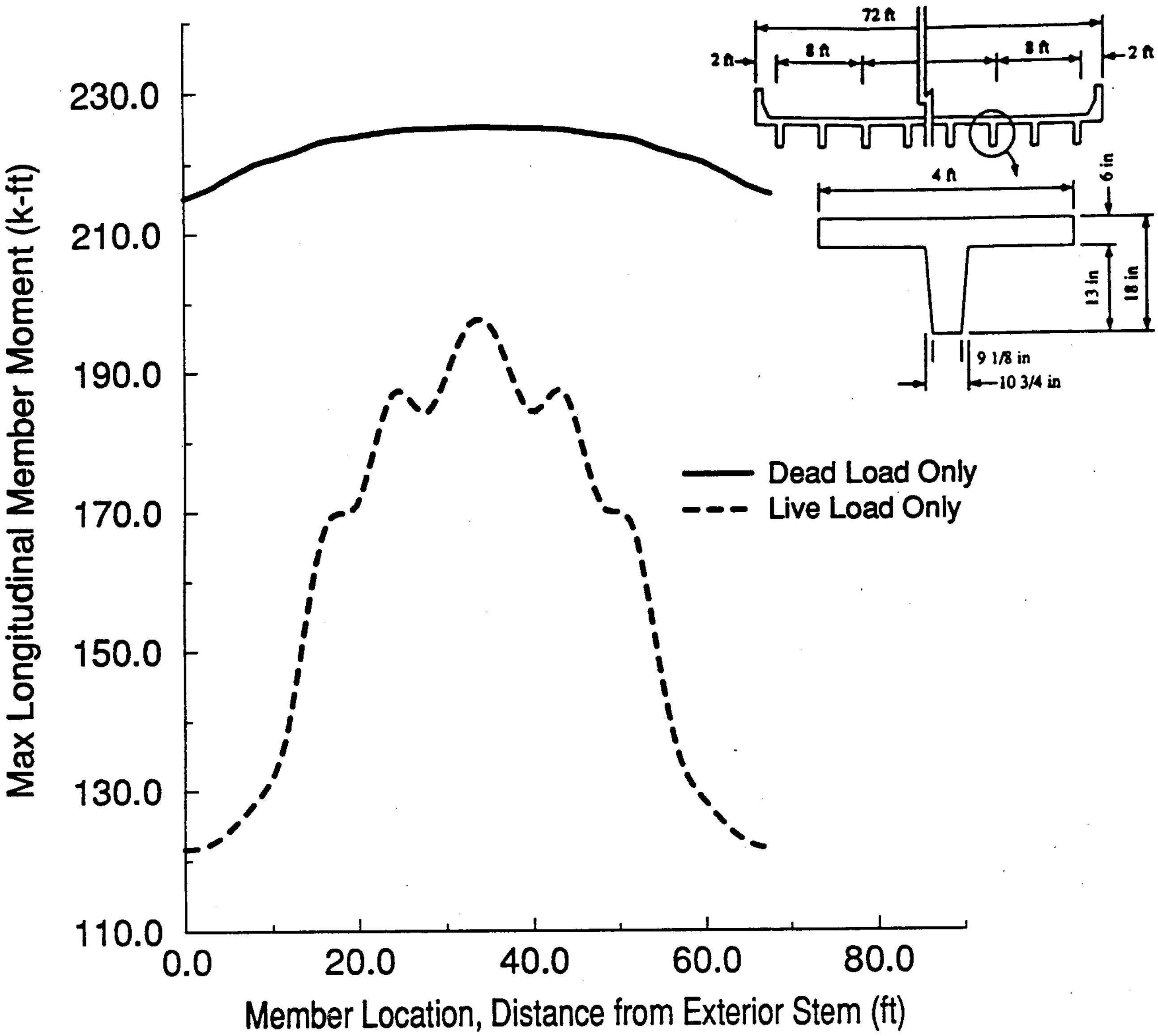
60ft Span x 72ft Width

(4 Lane, 5 in. Slab)



60ft Span x 72ft Width

(4 Lane, 6 in. Slab)



60ft Span x 72ft Width

(4 Lane, 7 in. Slab)