THE DESIGN AND ANALYSIS OF SIMPLE SPAN PRESTRESSED CONCRETE BEAMS COMPUTER PROGRAM USER'S MANUAL

Version 2.50

Depressed Strand Design and Analysis

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TABLE OF CONTENTS

DISCLAIMER vi

ABSTRACT vii

ACKNOWLEDGEMENT viii

1. DESIGN CONSIDERATIONS 1
   - 1.1 Procedures and Specifications 1
   - 1.2 Concrete Strengths 2
   - 1.3 Modulus of Elasticity 3
   - 1.4 Effective Flange Width 4
   - 1.5 Diaphragm Locations 5
   - 1.6 Hold Down Locations 5
   - 1.7 Tensile Stresses 6
   - 1.8 Shear Design 8
   - 1.9 Ultimate Moments and Shears (Load Factors) 9
   - 1.10 Prestress Losses 10
   - 1.11 Number of Strands 13
   - 1.12 Location and Placement of Strands 15
   - 1.13 Strand Pattern 16
   - 1.14 End Eccentricity 16
   - 1.15 Straight Strand Design and Debonding (End Regions) 17
   - 1.16 Straight Strand Review 17
   - 1.17 Camber 18

2. METHODS AND SUBROUTINES 21

3. COMPUTER PROGRAM APPLICATIONS 33
   - 3.1 Input Data 33
   - 3.2 Output Report 104

4. EXAMPLES 107
   - 4.1 Straight Strand Design 107
   - 4.2 Straight Strand Review 116
   - 4.3 Depressed Strand Design 127
   - 4.4 Depressed Strand Review 135

APPENDIX 1 Non-Composite Standard Beam Properties 144
APPENDIX 2 Properties of Seven-Wire Uncoated Strands 145
APPENDIX 3 Default Values 146
APPENDIX 4 Variable Definitions 147
APPENDIX 5 Blank Input Coding Forms 152
INDEX 157

LIST OF FIGURES

FIGURE

Fig. 1-1 Typical Grid Systems. 15
Fig. 1-2 Camber-1 18
Fig. 1-3 Camber-2 19
Fig. 2-1 Debonding Sequence for Straight Strands 31
Fig. 3-1 Strand Clearance 34
Fig. 3-2 Typical Concentrated Loads and Required Distances 36
Fig. 3-3 Strand Position References for Input on cards Eight 40

LIST OF TABLES

TABLE

Table 1-1 Prestress Losses Constants C_1, C_2, C_3, C_4, C_5, C_6, C_7 11
Table 1-2 Camber Constants C_1, C_2 20
Table 3-1 Input Specifications for Simple Span Prestressed Beams 44

DISCLAIMER

No warranty, expressed or implied, is made by the Florida Department of Transportation as to the accuracy and functioning of the program text or the results it produces, nor shall the fact of distribution constitute any such warranty, and no responsibility is assumed by the Florida Department of Transportation in any connection therewith. The Engineer of Record assumes the entire responsibility for verifying the input data and interpreting the output results for each application.

ABSTRACT

The Simple Span Prestressed Concrete Beam Design Program is the Florida Department of Transportation's contribution to the Highway Engineering Exchange Program (HEEP) AREA II State's cooperation effort to upgrade bridge design software. The program presented here represents a major rewrite and modification of a program entitled "Prestressed Concrete Girder Design" previously obtained from the Texas Highway Department in April 1975. This is the second major update to the program initially prepared in October 1977.

The program language is FORTRAN 77 for IBM ES9000 Model 720 MVS/ESA series mainframe and IBM compatible microcomputers. It includes a main calling routine, nine (9) read functions, thirty-seven (37) subroutines and one (1) Block Data set. This program currently will design or review simply -supported I shaped beams which are similar in shape to AASHTO standard sections and Florida Bulb-Tee beams. For beams of other shapes, approximate solutions may be obtained subject to the limitations of the input data.

The program will function with absolute minimum input for 'standard' beams which are AASHTO Type II through VI girders and Florida 54, 63 and 72 bulb-tee beams as shown in Appendix 1. The program stores these standard beams' properties in corresponding arrays in accordance with the default design criteria shown in Appendix 3 or the bottom of Input Coding Sheet No. 2 of 2. Any design or review which varies from the above-stated criteria must have the user's input or overriding values. For the beams with top flange widths (Dimension "A") of 42 and 48 inches, the program tapers the flange overhang from a thickness of Dimension "H" to five (5) and two (2) inches, respectively, at the extreme edges of the overhang.

The output contains all of the input data, stranding and summaries of moments, shears, stresses, etc., tabulated at various points along the beam for the different stages of loading.

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1. DESIGN CONSIDERATIONS

1.1 Procedures and Specifications

This program complies with the following specifications:

1. AASHTO Specifications for Highway Bridges.
2. American Railway Engineering Association Specifications.
3. ACI Building Code Requirements for Reinforced Concrete.
4. Florida Department of Transportation Structures Design Guidelines.
5. Florida Department of Transportation Standard Specifications.

1.2 Concrete Strengths (AASHTO 9.15.2)

The required concrete release strength (f'_{ci}) is determined from the critical tensile or compressive stress condition occurring at the time of release.

The required concrete 28-day strength (f'_c) is determined from the critical tensile or compressive condition occurring under full working loads and after all prestress losses.

In a design mode, the 28-day concrete strength is limited to a maximum of 6,500 psi and the concrete release strength is limited to 80% of the 28-day strength.

The following options are available to the designer in specifying or controlling the concrete properties in the execution of the program:

1.2.1 Design Mode

1.2.1.1The designer may skip the beam concrete values (Card 2, cc 27-30 and 31-34) and the program will start with default values and iterate as required while maintaining the ratio: $f'_{ci} / f'_c = 0.8$.

1.2.1.2The designer may input either an f'_c or f'_{ci} value and the program will hold that value, set the other on the basis of the ratio: $f'_{ci} / f'_c = 0.8$ and provide results (if possible) based upon the assigned and calculated values.

1.2.1.3The designer may input both f'_c and f'_{ci} values forcing a solution (if possible) based on those fixed values.

1.2.2Review Mode

1.2.2.1The designer may skip the beam concrete values (Card 2, cc 27-30 and 31-34) and the program will provide results based upon the default values.

1.2.2.2The designer may input either an f'_c or f'_{ci} value and the program will hold that value, set the other on the basis of the ratio: $f'_{ci} / f'_c = 0.8$ and provide results based upon the assigned and calculated values.

1.2.2.3The designer may input both f'_c and f'_{ci} values and the program will provide results based upon those assigned values.

1.3 Modulus of Elasticity

The modulus of elasticity of prestressed reinforcement is assumed to be 28 x 10^6 psi; however, the value may be modified by the designer and input on Card 2, cc 43-46.

The modulus of elasticity of the concrete slab and the prestressed beam is computed by the program to be:

$$E_c = K_c \times 33 \times (W_c)^{\frac{3}{2}} \times \sqrt{f'_c}$$

Where:

W_c = Unit weight of plastic concrete which is assumed to be 8.0 pcf less than the design unit weight input on Card 2. W_c = 142.0 pcf for the normally assumed concrete dead load unit weight of 150 pcf.

f'_c = Strength of concrete under consideration, in psi.

K_c = Constant to adjust Ec for the aggregate being utilized.

(K_c = 0.90 for Florida aggregate)

The modulus of elasticity of the beam concrete typically is modified in the program with each iteration of concrete strength; however, the designer has the prerogative of inputting the value on Card 2 which holds the value constant regardless of modifications to the concrete strength. The modulus of elasticity of the concrete at release (E_{ci}) in the calculations for prestress loss is computed by the program in accordance with the formula shown above but without the user's control.

1.4 Effective Flange Width (AASHTO 8.10.1)

The effective flange width determination allows for an unsymmetrical slab configuration to be used as in the case of an exterior girder.

For symmetrical cases, the effective flange width is determined by the least of the following dimensions:

1. One-fourth of the span length of the beam.

2. The distance center-to-center of the beams.

3. Twelve (12) times the least thickness of the slab plus the width of the girder top flange.

To account for the unsymmetrical case or an effective flange width other than that determined above, the design engineer may input a total effective flange width thereby overriding the program method.

In all cases the effective flange width is transformed into an equivalent width of beam concrete on the basis of:

$$SLW = EFW \times \frac{E_{C_{SL}}}{E_C}$$

Where:

SLW = Transformed slab width.

EFW = Effective flange width.

$E_{C\,SL}$ = Modulus of elasticity for slab concrete.

E_C = Modulus of elasticity for beam concrete.

1.5 Diaphragm Locations

For 'standard' beams, the designer has the prerogative to input no (0) intermediate diaphragms, one (1) diaphragm located at the centerline of span or a diaphragm allowance of 5% of the live load. Default is no diaphragms nor allowance therefore.

For 'nonstandard' beams and/or for two (2) or more diaphragms, interior diaphragms may be input as concentrated static loads applied to the non-composite section.

Diaphragms are assumed to be D1-(CC + EE + 2") deep and eight (8) inches wide for slightly aggressive environment (IW $\geq$ 2) by definition. For moderately or extremely aggressive environment (IW = 1), diaphragms are nine (9) inches wide. The designer can override these assumptions by inputting zero (0) for diaphragms and the desired weight input as concentrated static loads applied to the non-composite section as described above for 'nonstandard' beams.

*** NOTES TO DESIGNERS ***

For Florida Bridge Designs Only:

(1) When the skew angle of the span exceeds 30°, no diaphragm is required up to a span length of 40 feet and one (1) diaphragm at the centerline of span is required for spans exceeding 40 feet. These requirements can be met by coding values in Last Blank Card, cc 59, of "0" and "1", respectively.

(2) When the skew angle is equal to or less than 30°, the beam shall be designed for a live load of 5% in excess of the AASHTO live load, and intermediate diaphragms omitted. This requirement can be met by coding a value of "5" in Last Blank Card, cc 59.

1.6 Hold Down Locations

Strand hold-down points are located at one-tenth of the span length rounded off to the nearest 0.25 foot on each side of midspan of the beam; or, optionally, may be input directly by the designer to override the program default by coding the appropriate value in Last Blank Card, cc 34-37.

1.7 Tensile Stresses

The following three (3) allowable tensile stress values, each related to a specific load condition at a specific location in the beam, are reconciled by the program:

1.7.1 Tensile stress in top fiber in end regions of the beam (from 0.75D to 0.15L from the end of the beam) at release is limited to the value $(-)12.0(f'_{ci})^{0.5}$ by default. The designer has the prerogative to modify this value by either of the following two (2) methods:

1.7.1.1 Input the constant C_7, less than "100.00", including the negative sign (-). and recognizing the decimal point location on the input Card 2, cc 67-71, such that:

$$(-)\ TTEN = (-)\ C_7\sqrt{f'_{ci}}$$

The value of "TTEN" is, then, automatically adjusted by the program for corresponding adjusted values of "f'_{ci}".

1.7.1.2 Input a constant value with the negative sign (-), equal to or greater than "100.00", such that :

(-)TTEN = (-)VALUE, regardless of value of "f'_{ci}".

1.7.2 Tensile stress in the top fiber of the beam at release other than within the end regions described above:

$$(-)\ Tensile\ Stress = (-)6.0\sqrt{f'_{ci}}$$

1.7.3 Tensile stress in the bottom fiber of the beam under working loads:

$$(-)\ FTP = (-)\ C_6\sqrt{f'_c}\ (Default)$$

Where:

C_6 = 3.0 for corrosive environment (IW = 1)
C_6 = 6.0 for non-corrosive environment (IW = 2)

Or, at the designer's option, the desired value of "FTP" maybe input directly on Card 2, cc 59-63, including the negative sign (-), and recognizing the decimal point location. In this event, the value of "FTP" is not altered by modification of "f'_c".

The following three input options for tensile stress under working loads in the bottom fiber of the beam in the precompressed tensile zone are, then, available to the designer:

1. The default values when no entry is made remains as described.

2. When a negative value from "(-)100.0" to "(-)999.9" is input in Card 2, cc 59-63, that allowable tensile stress is maintained during the solution of the program regardless of the value of the 28-day concrete strength (f'_c).

3. When a negative value from "(-)0.1" and "(-)99.9" is input, that value is assigned to the program constant "C6" which is used to calculate "FTP" for any and all concrete strengths (f'_c), even when "f'_c" is incremented by the program.

This value of "FTP" allows designs of beams for any combination of strand arrangement, cover and environmental class. For example, the single cover requirement for strands stipulated in the Structures Design Guidelines generally results in a strand pattern such that a vertical column of strands is located on the centerline, vertical axis of the beam ("IW = 1" or the default value of "1" when no value is entered for "IW"). The default value of "FTP" (" $FTP = (-)3.0\sqrt{f'_c}$ ") is proper for "extremely" corrosive environments. For "slightly" or "moderately" Aggressive environment, the designer should enter "(-)6.0" in Card 2, cc 61-63.

1.8 Shear Design (AASHTO 9.20)

Prestressed girders are analyzed for shear and stirrups sized and spaced in accordance with the provisions of AASHTO 9.20 with the following exception:

$$V_{ci} = (0.6\sqrt{f'_c} \times b' d) + V_d + V_{max} \times \frac{M_{cr}}{M_{max}}$$

Where:

$V_d = V_{DL} + V_{ncDL} + V_{cDL}$

$V_{max} = V_{ult} - V_d$

$M_{max} = M_{ult} - M_d$

$M_d = M_{DL} + M_{ncDL} + M_{cDL}$

The results are normally exact at all inspection points except the center of the span (where shear design is least critical), where the results are closely approximated for typical AASHTO loadings. Special live loads or unusual designs, however, many require an independent verification of the accuracy of the computed values. Stirrup spacings are reported as calculated at the inspection points; except that the spacing calculated and reported separately at 'h/2' from the face of the support is assigned to all inspection points up to that distance. Should the shear force to be resisted by the stirrups exceed the maximum value permitted by AASHTO, the design is completed for the designer's use and a warning note to that effect printed out.

1.9 Ultimate Moment (AASHTO 9.17)

$$\textit{Group I:} \qquad M_u = \frac{1.3}{\phi} \; x \; [D + \frac{5}{3}(L + I)]$$

$$\textit{Group IA:} \qquad M_u = \frac{1.3}{\phi} \; x \; [D + 2.2(L + I)]$$

Both the required ultimate moment and the ultimate moment capacity are determined in accordance with AASHTO Specifications. If the ultimate resisting moment is less than that required, additional prestressed strands are added until the required resistance is obtained.

1.10 Prestress Losses (AASHTO 9.16.2)

The predicted loss of prestress is computed as:

$$\Delta f_s = SH + ES + CR_c + CR_s$$

SH (SHRINKAGE):

$$SH = 17{,}000 - 150RH$$
$$RH = 75 \text{ (Florida)}$$

ES (ELASTIC SHORTENING):

$$ES = \frac{E_s}{E_{ci}} f_{cir}$$

$$E_{ci} = 0.9(33)(w_c)^{\frac{3}{2}} \sqrt{f'_{ci}} \qquad \textit{(Florida)}$$

$$W_c = [\textit{Unit weight of beam concrete} - 8.0] \ (\textit{Default} = 142.0 \ \textit{PCF})$$

$$f_{cir} = \frac{F}{A} + \frac{Fe^2}{I} - \frac{(M_{bmDL})e}{I}$$

CR_c (CREEP OF CONCRETE):

$$CR_c = 12f_{cir} - 7f_{cds}$$

$$f_{cds} = \frac{(M_{slDL})e}{I} + \frac{(M_{cDL})[e + (\overline{y'} - \bar{y})]}{I'}$$

Now, using the following constants:

Table 1-1 Prestress Losses Constants C_1, C_2, C_3, C_4, C_5, C_6, C_7

Constant	Stress-Relieved	Stabilized
C_1	0.70	0.75
C_2	0.85	0.90
C_3	20,000.00	5,000.00
C_4	0.40	0.10
C_5	0.20	0.05
C_7	10.00	45.00

$$CR_s = C3 - C4(ES) - C5(SH + CR_c)$$

$$CR = \frac{Log\ t}{10}\left[\left(\frac{f_{si}}{f_y} - 0.55\right)f_{si}\right]$$

Calculations - At release (assume 18 hours):

$$CR_{s18} = \frac{(Log\ 18)[C_1 \times f_s' - 0.55(C_2 \times f_s')](C_1 \times f_s')}{C_7(C_2 \times f_s')}$$

Stress at 18 hours = [Initial Pull] - [Creep of Steel (18 hrs)] - [Elastic Shortening]

$$f_{s18} = C_1 \times f_s' - CR_{s18} - ES$$

$$f_{s18} + ES = C_1 \times f_s' - CR_{s18}$$

$$f_{s18} + \frac{E_s}{E_{ci}} \times f_{cir} = C_1 \times f_s' - CR_{s18}$$

$$f_{s18} + n\left[\frac{(A_s)(f_{s18})}{A_c} + \frac{(A_s)(f_{s18})e^2}{I_c} - \frac{(M_{bmDL})e}{I_c}\right] = C_1 \times f_s' - CR_{s18}$$

$$f_{s18} = \frac{C_1 \times f_s' - CR_{s18} + \frac{n(M_{bmDL})e}{I_c}}{1.0 + n(A_s)\left[\frac{1}{A_c} + \frac{e^2}{I_c}\right]}$$

$$ES = C_1 \times f_s' - CR_{s18} - f_{s18}$$

$$f_{cir} = f_{s18}(A_s)\left[\frac{1}{A_c} + \frac{e^2}{I_c}\right] - \frac{e(M_{bmDL})}{I_c}$$

$$f_{cds} = \frac{e(M_{slDL})}{I_c} + \frac{(M_{cDL})[e + (\bar{y}' - \bar{y})]}{I'}$$

$$CR_c = 12f_{cir} - 7f_{cds}$$

$$CR_s = C_3 - C_4(ES) - C_5(SH + CR_c)$$

$$TOTAL\ LOSS = SH + ES + CR_c + CR_s$$

$$LOSS\ AT\ RELEASE = \frac{(C_1 \times f_s' - f_{s18})}{C_1 \times f_s'}$$

1.11 Number of Strands

The number of prestressing strands is dependent upon the algebraic sum of the allowable tension in the concrete and the bottom fiber stress at midspan due to all loads. A trial design is made assuming the midspan eccentricity equal to the distance from the centroid of the beam to the bottom fiber. The initial trial temporary prestressing force, which is subject to change later, and the corresponding number of strands are found from Equations 1.11.1 and 1.11.2, respectively.

$$PF = \frac{f_b}{\frac{1}{A} + \frac{e_{c.l.}}{Z_b}} \quad (Eq.\ 1.11.1)$$

$$NS = \frac{PF}{P} \quad (Eq.\ 1.11.2)$$

Where:

PF	= trial prestressing force
f_b	= stress in the bottom fiber due to all loads plus allowable tensile stress divided by 0.8 (20% prestress loss for initial trial only)
P	= prestressing force per strand
NS	= number of strands
$e_{c.l.}$	= eccentricity of strands at midspan
A	= gross cross-sectional area of the beam
Z_b	= section modulus at bottom of beam

The minimum number of strands is determined as follows:
(AASHTO 9.15.2.3 and 9.18.2.1)

$$M_u\ (Beam) = 1.2 \times f_{cr} \times \sqrt{f'_c} \times S_b$$

Where:

M_u	= ultimate moment capacity per AASHTO 9.17
S_b	= section modulus at bottom of composite beam
f'_c	= 28-day compressive strength of beam concrete
f_{cr}	= modulus of rupture factor for concrete per AASHTO 9.15.2.3
	= 7.5 for normal weight concrete
	= 6.3 for sand-lightweight concrete
	= 5.5 for all other lightweight concrete

The cracking moment is computed according to the following expression:

$$MCR = 1.2 \times [ZBBC \times (FCR \times \sqrt{FPC} + FB_P \times (1.0 - PLOSS)) - (ZBBC - ZBB) \times (FB_{DL} + FB_{NC\ DL})]$$

Where:

FB_P = Bottom fiber stress at centerline of span due to initial prestress (before losses), in psi.

FB_{DL} = Bottom fiber stress at centerline of span due to dead load of the beam and slab, in psi.

$FB_{NC\ DL}$ = Bottom fiber stress at centerline of span due to all other non-composite dead loads, in psi.

All other terms as defined in Appendix 4 Variable Definitions.

In the design mode, the number of strands are increased according to the following two criteria:

1. If the ultimate moment is greater than either the ultimate resisting moment for the beam or 1.2 times the cracking moment, the number of strands is increased in increments of two (2) until this condition is satisfied.

2. If the midspan bottom fiber stress resulting from prestressing plus the allowable tensile stress is less than that required under full service loading, the number of strands is again increased in increments of two (2) until the permitted stress condition is satisfied.

1.12 Location and Placement of Strands

Figure 1-1 shows typical grid systems for placement of the prestressing strands. The strands are placed as low as possible on this grid beginning in Row 1, then proceeding to Row 2, then to Row 3, etc., beginning each row in the "A" position and working outward until the required number of strands is obtained.

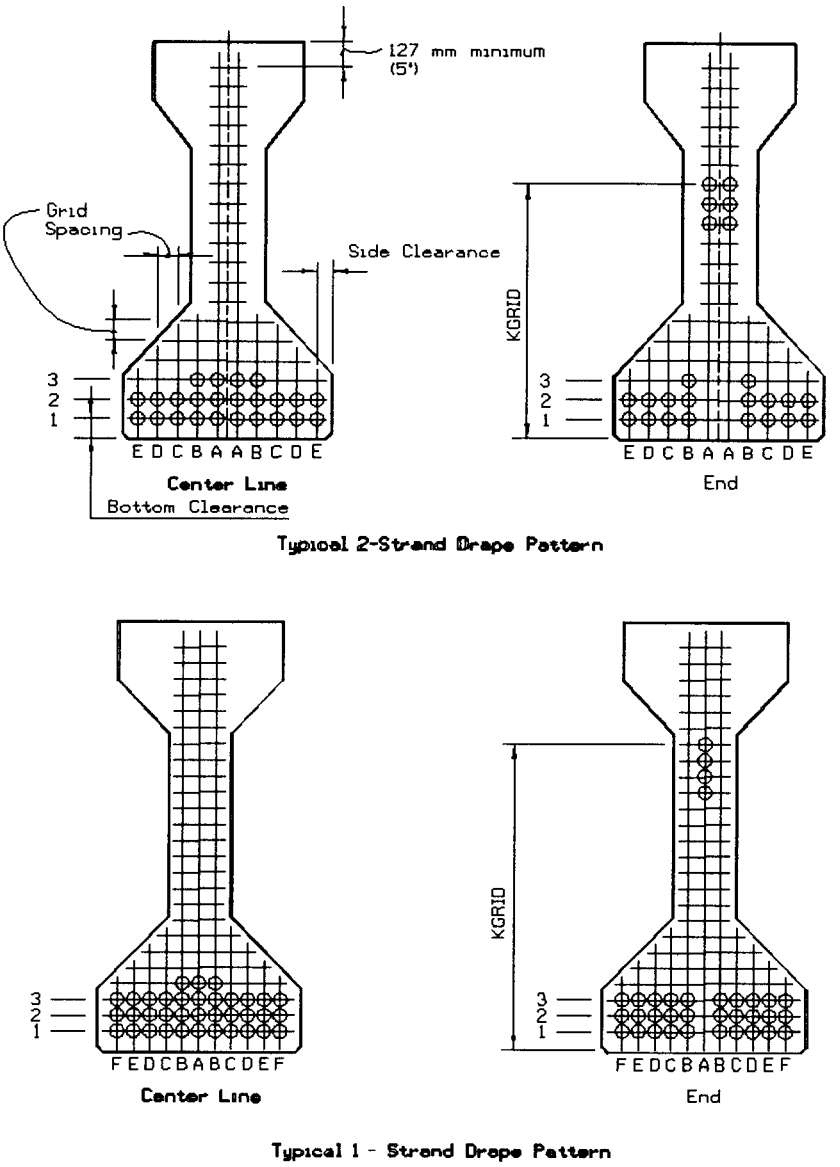


Fig. 1-1 Typical Grid Systems

1.13 Strand Pattern

Trial strand patterns are modified to meet the ultimate moment and stress requirements such as when the bottom fiber stress is satisfactory but the top fiber tension at midspan exceeds the allowable. The modification is made by moving strands from a lower row to a higher row, thus reducing the midspan eccentricity and top tensile stress.

By way of illustration, consider a beam with loading condition that requires ten (10) prestressing strands to satisfy the bottom fiber stress at midspan. The strand arrangement for this illustration uses six (6) strands to fill the bottom row, and the remaining four (4) strands are positioned in the next (second) row. The midspan eccentricity for this strand pattern may cause the midspan top fiber stress to exceed the allowable stress for concrete in tension. For this case, two (2) strands from the bottom row would be moved to form a third row since the number of strands in the bottom row is greater than the four (4) strands in the second row. The top fiber stress would be recomputed using the eccentricity of the revised pattern of strands to determine if that stress falls within the allowable limits. If the top fiber stress still exceeds the allowable stress, two (2) strands from the second row would be moved up to make a fourth row since it is the next row below the third row containing more strands than the third row. The strand pattern then would be four (4) strands in the first row and two (2) strands in each of the remaining three (3) rows. The top fiber stress would be recomputed using the revised pattern of strands to determine if that stress falls within the allowable limits.

1.14 End Eccentricity

1.14.1 Depressed Strands

The required end eccentricity is determined from the top and bottom fiber stress conditions in the end of the beam at the time of release. This eccentricity is obtained by depressing the strands in the central web columns to a position that will furnish the required end eccentricity. The topmost position to which these strands can be raised should have a minimum of five (5) inches of cover to the center of the topmost strands (see Figure 1-1).

If the end eccentricity required to accommodate the midspan release strength requires placement of the strands above the topmost position allowed, the program will place the strands at the topmost position and debond the required strands. In this event, the length of the debonding material to be applied to the debonded strand(s) is reported.

1.14.2 Straight Strands

The end eccentricity of the strand pattern is identical to that determined by the midspan design. For a straight strand profile, however, when end region stresses exceed the allowable values, strands are debonded in pairs in a prioritized sequence to satisfy stress requirements while not exceeding the specified percentage of strands that may be debonded. In this event, the strand pattern and prioritized debonding pattern is graphically reported along with the length of debonding material for each pair of debonded strands. If the maximum permitted percentage of debonded strands is exceeded and the stresses alsoexceedthe allowable limits, a "no solution" message is reported. Design values are reported for the designer's use in re-analyzing the problem.

1.15 Straight Strand Design and Debonding (End Regions)

Once the number and arrangement of the strands is determined from the midspan analysis, the strand pattern is passed to the ends of the member. If fully effective strands cannot be used within the allowable stress limitations, strands are debonded within the percentage of debonded strands limitations. If all limitations are reached without a design solution, the program prints a "no solution" message, but the final stresses are reported to assist the designer in re-analyzing the problem.

When a design solution is obtained, inspection point stresses are determined, the debonding priority determined and debonding lengths established. All this information is reported. Debonding lengths are the actual lengths of debond material to be applied to the strand measured from the end of the beam.

Strand transfer lengths are 50 diameters for bonded strands and 100 diameters for debonded strands past the reported length of debonding. Stresses at inspection points take into account partially developed strands in that eventuality.

1.16 Straight Strand Analysis (Review)

This option will perform an analysis of a beam with specified load, material and geometric criteria for virtually any strand and debonding pattern desired. Immediate identifiable uses and benefits of this option are:

1.16.1 Analyze and/or verify a beam designed performed by others; i.e., check a Contractor's proposed redesign.

1.16.2 As a design tool in combining two (2) or more independent beam designs into beams of uniform criteria, on a priority basis, as regards 28-day concrete strength, stranding, release strength and debonding.

1.17 Camber

Predicted maximum camber is computed by the conjugate beam method which is graphically shown in Fig. 1-2,

Where:

M_1 = Resisting moment from bonded strands at end of beam.

M_2 = Resisting moment from bonded strands at Center portion of beam between hold downs. For straight strands, M_2 is the resisting moment from bonded strands at the end of debonding.

M_3 = Resisting moment at end of beam if debonded strand (depressed strands only).

M_4 = Resisting moment at end of debonding all strands (depressed strands only).

M_5 = Resisting moment at end of debonding if debonded strands are being used (depressed strands only).

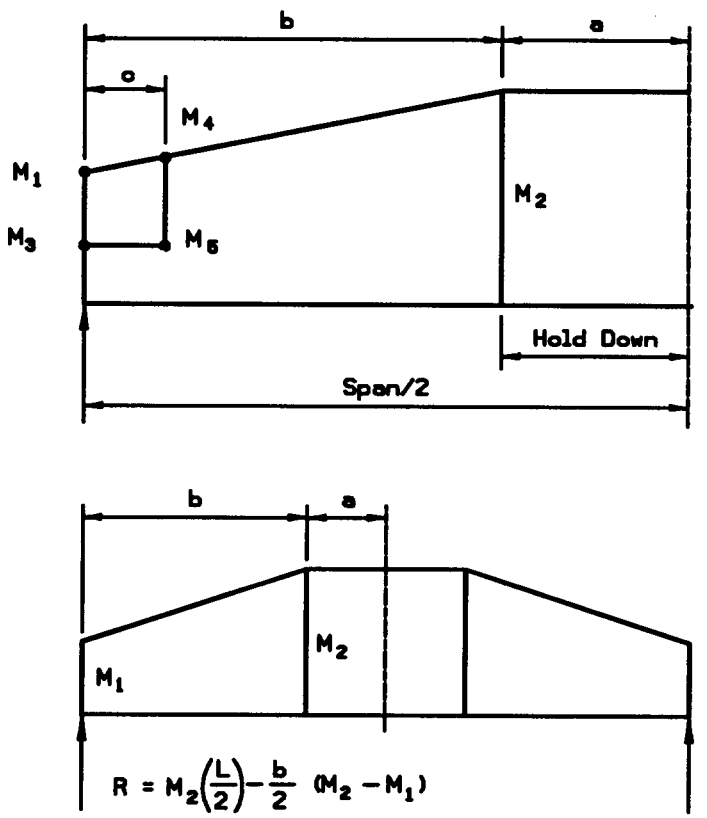


Fig. 1-2 Camber-1

$$\Delta P = \left[M_2\left(\frac{L}{2}\right)\left(\frac{L}{2}\right) - \frac{b}{2}(M_2 - M_1)\left(\frac{L}{2}\right) - M_2\left(\frac{L}{2}\right)\left(\frac{L}{4}\right) + \frac{b}{2}(M_2 - M_1)\left(a + \frac{2b}{3}\right)\right]\frac{1}{EI}$$

$$= \left[\frac{M_2L^2}{4} - \frac{M_2L^2}{8} + (M_2 - M_1)\left(a + \frac{2b}{3} - \frac{L}{2}\right)\left(\frac{b}{2}\right)\right]\frac{1}{EI}$$

$$= \left[\frac{M_2L^2}{8} + (M_2 - M_1)[6a + 4b - 3L]\frac{b}{12}\right]\frac{1}{EI}$$

$$= \left[\frac{M_2L^2}{8} + \frac{(M_2 - M_1)\left[6a + 4\left(\frac{L}{2} - a\right) - 3L\right]\left(\frac{L}{2} - a\right)}{12}\right]\frac{1}{EI}$$

$$= \left[\frac{M_2L^2}{8} - \frac{(M_2 - M_1)(L - 2a)\left(\frac{L}{2} - a\right)}{12}\right]\frac{1}{EI}$$

$$= \left[\frac{M_2L^2}{8} - \frac{(M_2 - M_1)[L^2 - 4aL + 4a^2]}{24}\right]\frac{1}{EI}$$

$$\Delta P = \left[\frac{M_2L^2}{8} - \frac{(M_2 - M_1)(L^2 - 4aL + 4a^2)}{24}\right]\frac{1}{EI}$$

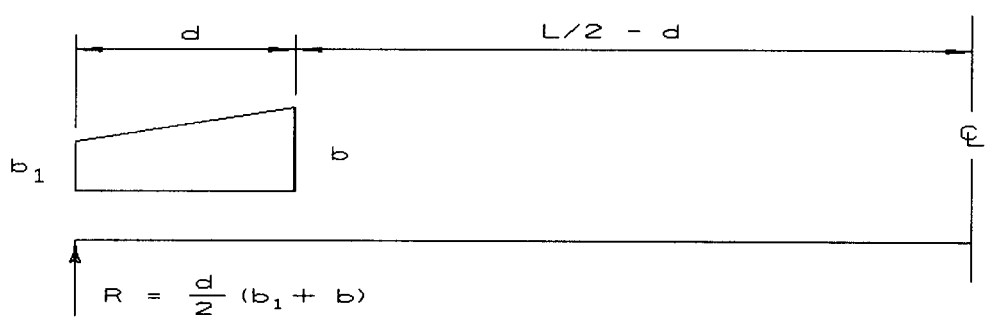


Fig.1-3 Camber-2

$$\Delta S = \left\{ \left(\frac{d}{2}\right)(b_1 + b)\left(\frac{L}{2}\right) - \left(\frac{d}{2}\right)(b_1 + b)\left[\frac{L}{2} - \frac{d(2b + b_1)}{3(b + b_1)}\right] \right\} \frac{1}{EI}$$

$$= \left[\frac{d^2}{6}(2b + b_1)\right] \frac{1}{EI}$$

$$= \frac{(Debond)^2[(M_1 - M_3) + 2(M_4 - M_5)]}{6EI}$$

$$\Delta S = \frac{(Debond)^2(M_1 - M_3 + 2M_4 - 2M_5)}{6EI}$$

$$\Delta B = \frac{5wl^4}{384EI}$$

By definition, the net camber at beam ages of release 30 days, 60 days, 120 days and 240 days is reported as:

$$C_{\max_t} = C_{1_t}(\Delta P - \Delta S) - C_{2_t}(\Delta B)$$

C_1 and C_2 are values at time "t" to account for the "aging" modulus of the beam concrete and the creep effect of Florida concrete materials as related to time. By definition, the values are:

Table 1-2 Camber Constants C_1, C_2

BEAM AGE IN DAYS	C_1	C_2
Release	1.35	1.22
30	2.09	2.07
60	2.26	2.27
120	2.43	2.47
240	2.60	2.64

2. METHODS AND SUBROUTINES

The methods of solution are described in the following subroutines, the subroutines are listed in alphabetical order:

Subroutine: **ALLOW**

A summary of steps for subroutine **ALLOW** is:

a. Define allowable stresses.

b. Calculate prestressing force before and after losses.

Subroutine: **BLOCK DATA**

Subroutine **BLOCK DATA** is used to initialize all variables and arrays.

Subroutine: **CAMBER**

A summary of steps for Subroutine **CAMBER** is:

a. Calculate the deflection due to debonding, if present.

b. Calculate the deflection due to prestressing.

c. Calculate the deflection due to the weight of the beam.

d. Calculate the predicted net camber for five (5) different ages of beam concrete.

Subroutine: **CONLD**

Subroutine **CONLD** calculates shears and moments at the inspection points due to concentrated live loads, CCP (I). In so doing, the loads are numbered from left to right while the load configuration is moved from right to left. A summary of steps for the Subroutine **CONLD** is:

a. Place first load in the configuration at an inspection point, inspection points being tenth, quarter, and hold-down positions.

b. Check the number of the last load to come into the beam. Determine the centroid of the load and the left end reaction.

c. Calculate moment and shear at the inspection point.

d. Place next load at the inspection point. Check the position of the first load to see if it remains on the beam.

e. Repeat Steps b, c and d until all loads have been positioned at the inspection point.

f. Repeat the above steps for each inspection point.

g. Determine maximum shears and moments by selecting larger values of the first and ninth, second and eighth, third and seventh, fourth and sixth, ...points.

Subroutine: **CONSTR**

Subroutine **CONSTR** is called from Subroutine **STSTND** when the final service load stress condition at any intermediate inspection point requires a modification in the 28-day concrete strength.

This subroutine is a condensed and modified version of Subroutine **PSTRES**. A summary of Subroutine **CONSTR** is:

a. Initialize all previously calculated values which include stress, strand pattern and debond length.

b. Utilize 28-day concrete strength from Subroutine **STSTND** and follow through Steps a through m of Subroutine **PSTRES**, except Step i.

Subroutine **ECCEND**

A summary of steps for Subroutine **ECCEND** is:

a. Determine the number of strands to remain straight and the number of strands to be depressed per row. For a straight strand design or analysis (STYPE = 1), 'DROW' is set to '0'.

b. Sum the product of the number of straight strands times the distance to the bottom of the beam for each row.

c. Sum the product of the number of depressed strands times the distance to the bottom of the beam for each row.

d. Determine the cgs of the strands with respect to the bottom of the beam.

e. Determine the minimum distance allowed from the bottom of the beam to the cgs.

f. Compare Steps d and e. If the value from Step d is less than the value from Step e, increment the value from Step d, by the spacing of strands.

g. For a depressed strand profile (STYPE = 2) only, determine the position of the topmost depressed strands. If that position is below five (5) inches from the top surface, repeat Steps d, e, f and g until the value from Step d is just greater than the value from Step e. If the position of the topmost depressed strands is five (5) inches below the top surface, set "IWCH" equal to two (2) and calculate the end eccentricity.

h. Calculate the end eccentricity.

Subroutine: **HELP**

A summary of steps for Subroutine **HELP** is:

Steps for "Standard" Beam

a. Define location of inspection points, tenth, quarter, and hold-down.

b. Calculate deflection at quarter-span and midspan due to slab weight and due to uniform load on the composite section.

c. Calculate deflections due to diaphragms.

d. Calculate shears and moments at the inspection points due to slab weight, beam weight, and uniform load on the composite section.

e. Call **TYPELD** to determine live load shears and moments.

f. Sum the dead plus live load shears and moments at the inspection points.

Steps for "Nonstandard" Beam

a. Define location of inspection points, tenth, quarter, and hold-down.

b. Calculate deflections at quarter-span and midspan due to slab weight and uniform load on the composite section.

c. Calculate deflections at quarter-span and midspan due to concentrated loads on the non-composite section.

d. Calculate shears and moments due to all concentrated loads, slab weight, and beam weight at the inspection points.

e. Call **TYPELD** to determine live load shears and moments.

f. Sum the dead plus live load shears and moments at the inspection points.

Subroutine: **JMLOAD**

Subroutine **JMLOAD** calculates shears and moments at the inspection points due to HS-20 live loading. For a summary of steps, see Subroutine **CONLD.**

Subroutine: **LANELD**

A summary of steps for subroutine **LANELD** is:

a. Calculate concentrated and uniformly distributed loads.

b. Calculate shears and moments at tenth points.

c. Select maximum shears and moments by choosing the larger of first and ninth tenth points, second and eighth tenth points, ...etc.

Subroutine: **MACKS**

Subroutine **MACKS** determines maximum shears and bending moments of **RRLOAD.**

Subroutine: **MAIN**

A summary of steps for Routine **MAIN** is:

a. Call **READRE** (or other user supplied routine allowing a card to be re-read).

b. Read input data and complete as necessary. (Cards '*' through 9.)

c. Read and edit a beam data card (Last Blank Card) for the minimum necessary input. If an error is encountered, print an error message and read another card.

d. Define STYPE.

e. Define LTYPE.

f. Define KODE.

g. Call **PROPTY**.

h. Call **HELP**.

i. Call **PSTRES**.

j. Call **OUTPUT**.

k. Call **ZERO**.

l. Repeat Steps c through j as necessary until all beam data cards have been processed.

Subroutine: **MILLER**

A summary of steps for Subroutine **MILLER** is:

a. Determine the number of strands that can be placed in the bottom row. Checks are provided to maintain proper edge clearance.

b. Place strands in the bottom row. If the number of strands is less than the maximum number of strands, control is transferred to the call **MILLER** position in **PSTRES**.

c. Check the next row to see if the same number of strands as the previous row can be placed. Place strands in the row until the row is filled unless the number of remaining strands is less than the number can be placed in the row, then transfer control to the call **MILLER** position in **PSTRES**.

d. Repeat Step c until all strands have been placed.

e. Determine the position of the cgs with reference to the bottom of the beam.

Subroutine: **MOMENT**

A summary of steps for Subroutine **MOMENT** is:

a. Calculate the required ultimate moment capacity.

b. Determine whether the section is rectangular or flanged.

c. Calculate the resisting moment capacity for the section using the appropriate equation.

d. Determine the actual steel percentage and compare that percentage with the maximum allowable percentage. If the allowable is exceeded, calculate the resisting moment capacity using the appropriate equation for flanged or rectangular section. A check for minimum steel percentage is made in Subroutine **PSTRES** in determining the number of strands for the initial trial.

The term **NSTATE** is defined as a number between 1 and 4 and is used as an indicator for printing messages along with the required and resisting moment capacities.

Subroutine: **OUTPUT**

A summary of steps for Subroutine **OUTPUT** is:

a. Call **DATIME** (or some other user supplied subroutine to obtain the DATE and TIME.

b. Round off concrete strengths to the nearest 10 pounds per square inch.

c. Convert the units to kips and feet for output by defining new variables.

d. Print out input data and results of computations. Based upon the type of output required the subroutine will output english units or if metric is required call MOUT to provide metric output.

Subroutine: **PROPTY**

A summary of steps for Subroutine **PROPTY** is:

a. Define beam section properties.

b. Determine the effective flange width.

c. Compute composite section properties.

d. Determine the hold-down position.

Subroutine: **PSTRES**

A summary of steps for Subroutine **PSTRES** is:

a. Establish constants depending on the type of stranding being used, stress relieved or stabilized.

b. Call **ALLOW** to calculate allowable stresses.

c. Compute stresses at inspection points.

d. Determine number of strands using stresses at midspan and assumed losses of 20%.

e. Call **MILLER** to place strands at midspan.

f. Determine prestress losses.

g. Check number of strands and stresses in extreme fiber at midspan due to prestress. If the stress requirements at midspan are not met, add two (2) strands repeat Steps e through g.

h. Calculate extreme fiber stresses at midspan before and after losses.

i. Determine concrete release strength required. If the required release is greater than 4,000 psi, call **ALLOW** to define allowable stresses and repeat g and h.

j. Compare the midspan release stress in the top fibers to the allowable stress. If allowable is exceeded, call **STRMOD** to modify the midspan strand pattern and repeat Steps e through j.

k. Compare the midspan top fiber stress after losses to the allowable. If the allowable is exceeded, redefine f. Call **ALLOW** to define allowable stresses, call **PROPTY** to recalculate the section properties and repeat Steps e through k.

l. Call **MOMENT** to determine the ultimate and resisting moments. If the resisting moment is less than the ultimate moment required, define MSTATE equal to two (2), increase the number of strands by two (2) and repeat Steps e through l.

m. Determine the maximum end eccentricity permitted.

n. If STYPE = 2, call **ECCEND** to determine the position of the topmost depressed strands and determine the end eccentricity. If IWCH is greater than one (1), the topmost strands are placed five (5) inches below the top surface.

o. If STYPE = 2 and if IWCH is greater than one (1), calculate the number of strands to be debonded and determine the length of debonding.

p. If STYPE = 1, call **STSTND** to determine the pattern of the strands to be debonded, if any, and the length of debonding of each pair of debonded strands.

q. Calculate stresses at inspection points and redefine release strength if allowable is exceeded.

r. Call **CAMBER**.

s. Call **SHEAR**.

t. Call **OUTPUT**. If stresses are met but not the ultimate moment, add two (2) strands and repeat Steps l through t.

Subroutine: **RRLOAD**

Subroutine **RRLOAD** calculates shears and moments at the inspection points due to Cooper's E - loading. For a summary of steps, see Subroutine **CONLD**.

Subroutine: **SHEAR**

A summary of steps for Subroutine **SHEAR** is:

a. Apply load factors by AASHTO Specifications to dead and live loads at the tenth points.

b. Define the distances from extreme compressive fiber to centroid of prestressing steel at the tenth points.

c. Define the cosine of the angle between the cgs and a horizontal plane through the end eccentricity position, ratio of distance between centroid of compression and centroid of tension to the depth "d", and shear carried by concrete.

d. Define the vertical component of prestressing force.

e. Calculate the spacing of web reinforcement at the tenth points.

f. Calculate values for design of horizontal shear connections at the tenth points.

g. Calculate the distance between the "cgc" and "cgs" at the tenth points.

h. Define distance from extreme compressive fiber to centroid of prestressing steel, compressive stress in concrete due to prestress only, after all losses, stress due to dead load net flexural cracking moment, and vertical component of prestress at the tenth points and at "h/2" from face of support (HX).

i. Define at the tenth points and at "h/2" from face of support the shear that corresponds to the minimum web reinforcement; shear at diagonal cracking due to all loads, when such cracking is the result of combined shear and moment; shear at diagonal cracking due to all loads, when such cracking is the result of excessive principal tension stresses in the web; and the minimum shear at diagonal cracking due to all loads, when such cracking is the result of combined shear and moment.

j. Calculate the spacing of web reinforcement at the tenth points. The spacing at any tenth point preceding (toward the support) HX is set equal to the spacing at HX.

Subroutine: **SORTD, SORTR**

These two subroutines are prepared for straight strand review option to create arrays, and perform sorting functions of the input strand pattern.

Subroutine: **SPCL**

Subroutine **SPCL** calculates shears and moments at the inspection points due to H-20 or H-15 live loading. For a summary of steps, see Subroutine **CONLD**.

Subroutine: **STANAL**

Subroutine **STANAL** is called from subroutine **PSTRES** to analyze the input of straight strand pattern, with or without debonded strands.

A summary of steps for subroutine **STANAL** is:

a. Determine the cracking moment per AASHTO Art. 9.18.2.

b. Determine ultimate moment per AASHTO Art. 9.17.1 and 9.18.1.

c. Determine maximum number of debonded strands.

d. Determine minimum spacing of strands per AASHTO Art. 9.25.2.1.

e. Determine maximum top tensile stress at release at end 15% of span.

f. Determine maximum top tensile stress at release at middle 70% of span.

g. Determine maximum bottom compressive stress at release.

h. Determine maximum top compressive stress at service load.

i. Determine maximum bottom tensile stress at service load.

Subroutine: **STSTND**

Subroutine **STSTND** is called from Subroutine **PSTRES** to calculate the number of straight strands to be debonded, the length of debonding and to compute the stresses at inspection points.

A summary of steps for Subroutine **STSTND** is:

a. Determine the number of strand pairs which may be debonded by the following criteria:

   1. Check stress at top and bottom of beam at release and determine number of strands to be debonded.

   2. Check percentage of debonded strands versus total number of strands against the default maximum value of 25 percent or against the value set by the user in Column 72, 73 of card number 2.

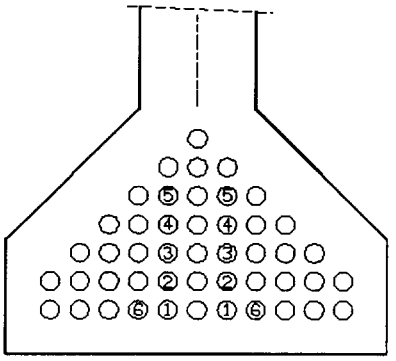
   3. Check ratio of debonded strands in each row versus number of strands in corresponding row against the preset ratio of 1.5 times the maximum percentage of debonded strands. (NOTE: Debonding of strands is prohibited in rows containing fewer than four (4) strands.)

b. Establish the priority of debonding sequence by debonding the strand pairs closest to the vertical centerline of the beam from the bottom row upward first then outward from the bottom row; and the length of debonding from longest to shortest calculated first at the strand pairs highest above the bottom of the beam and closest to the vertical centerline outward then downward to the bottom row. The length of debonding is then established in descending order toward the vertical centerline and bottom of the beam (see Figure 2-1).

c. Present graphic output which indicates the exact location of debonded strand pairs and the priority of debonding sequence by numbering strand pairs (see Figure 2-1).

d. Compute stresses at inspection points which include the development length of bonded strands at the end as 50 times the diameter of strand and the development length of debonded strands as 100 times the diameter of strand.

e. Increase concrete 28-day strength, if necessary, to ensure that allowable concrete stresses at any inspection point are not exceeded. Call CONSTR subroutine to adjust concrete strength, if necessary, and repeat steps a through d.

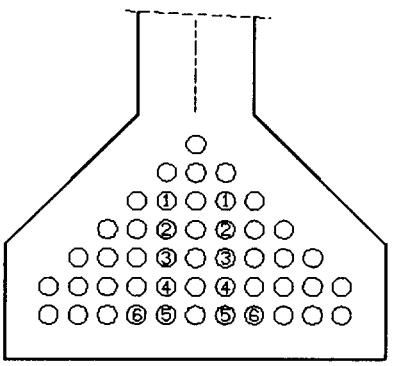


	NO. OF STRANDS PER ROW	% OF DEBONDED STRANDS	DEBONDED STRANDS PER ROW	ROW ROUNDOFF	TOTAL CHECK
	1	37.5%	0.4	0	0
	3	"	1.1	2	0
	5	"	1.9	2	2
	7	"	2.6	2	2
	9	"	3.8	4	2
	11	"	4.1	4	2
	11	"	4.1	4	4
TOTALS	47	25%	11.8	18	12

12

DETAIL "A"

(SHOWING PRIORITY FOR LOCATING STRANDS TO BE DEBONDED)



1 - LONGEST LENGTH OF DEBONDING

-TO-

6 - SHORTEST LENGTH OF DEBONDING

DETAIL "B"

(SHOWING PRIORITY FOR LENGTHS OF DEBONDING)

Fig. 2-1 Debonding Sequence for Straight Strands

Subroutine: **STRMOD**

A summary of steps for Subroutine **STRMOD** is:

a. Determine whether or not all rows have the same number of strands. If so, create another row with two (2) strands from the top row.

b. Should there be only two (2) rows and the bottom row has two (2) more strands than the top row, create a third row with two (2) strands from the bottom row. Should the number of strands in the bottom row exceed the number in the top row by more than two (2), move two (2) strands from the bottom row to the top row.

c. Should there be more than two (2) rows, determine the highest row from the bottom of the beam that has more strands than the top row and create a new row with two (2) strands from that row.

Subroutine: **TYPELD**

A summary of steps for Subroutine **TYPELD** is:

a. Calculate the live load impact factor.

b. Call the subroutine(s) to determine live load shears and moments.

c. Apply the impact and distribution factors.

Subroutine: **ZERO**

Subroutine **ZERO** zeroes out arrays for static dead loads, static live loads, shears, moments, and stranding. This operation is necessary when multiple beams are designed to one (1) execution of the program.

3. COMPUTER PROGRAM APPLICATIONS

3.1 Input Data

3.1.1 General Coding Information

The input forms on pages 153 and 154 include the program name (PSTDSN65), version number (VERSION 2.50), and the sheet numbers at the upper right corner. A typical beam section is shown on Sheet 1 and the default values are shown at the bottom of the Sheet 4.

This program was designed such that, by default options and previously defined 'standard' beam properties, the user need only supply a minimal amount of data for it to perform a complete design or review of a prestressed girder. The input form contains considerable instructional data so that the designer usually will not have to refer to this document after having become familiar with the program. All input data will be printed out as part of the formal output data. General coding considerations are as follows:

3.1.1.1 Three (3) comment cards must be the first three (3) cards of every run.

3.1.1.2 Card types one (1) through nine (9), if used, should immediately follow the three (3) comment cards sequentially. Only one (1) series of each can be used per run. Any data input on these cards remains in effect for the duration of the job.

3.1.1.3 As many beam cards (blank card type) as desired may be input in a single run. Each card input will generate corresponding output.

A complete listing of all input specifications by card type and program variable has been compiled and is included in Table 3-1. Additional coding instructions pertaining to each individual card type are as follows:

3.1.2.Header Cards

The first three (3) cards or lines in the input file (each line represents an input card) are comment cards except the third line may be a comment card or it can designate the units of the program input and output. These cards are printed, as coded, on top of each page of the output. All three cards must br provided one time only for each run of the program. The third header card (or line) is a comment card if a " * " is placed in the first column. Otherwise, the words metric and English are used in this line to designate the units of the input and output. The following four (4) cases can occur.

1) English input and English output.
   Place a " * " in column one as in previous versions of the program or write " ENGLISH ENGLISH " beginning in column one.
2) English input and metric output.
   Type "ENGLISH METRIC " beginning in column one.
3) Metric input and English output.
   Type "METRIC ENGLISH" beginning in column one.
4) Metric input and metric output.

3.1.3 Card One

The next card type is '1'. This card is only necessary if a design or review of a beam not previously defined to the program is desired. It contains all of the section properties of the beam under consideration necessary for the program to function properly. Each and every field on this card must be coded except for "Q" and "R". Note that a Beam Type of "NS" must be coded on 'Last Blank Card' as described in 3.1.9 in conjunction with the use of this card type.

3.1.4 Card Two

Card type '2' is prepared for the physical properties of the concrete, reinforcing steel and prestressing steel, as well as the strand profile type. Every field on this card has a program default as shown at the bottom of the second sheet of coding form. The user only inputs the necessary override values. In a review mode, input (or default) concrete properties are maintained throughout the run regardless of stress level encountered; whereas, in a design mode, the compressive concrete strengths are adjusted to satisfy stress requirements, the corresponding "E" values and composite section properties will be adjusted accordingly.

Unless otherwise specified on the input form, the program uses strand side and bottom clearance default values of 3.0 inches which is measured to the centerline of the strand. This value meets cover requirements on the confinement reinforcing as stipulated in the Structures Design Guidelines.

An input side clearance (Card 2, cc 51-54) value of as little as 2.50 inches could be specified and still provide 1-3/4 inch cover at reinforcing bend locations for strands up to 1/2-inch (special) diameter. While this value would not affect the number of strands in the bottom row of any standard beam, it could increase the number of strands allowed in upper rows. The positive benefit can be more effective prestressing to resist service loads by increasing the strand group eccentricity. The negative effect can be higher release stresses which may cause aborting the run when the maximum debonding limit is reached.

When strand clearance default values are used, it is suggested that if a design is aborted, if strand placement error messages occur in the review mode or if an alternate design solution is desired, the problem shall be re-run with the reduced strand side clearance value noted previously.

The strand clearance relationship to the concrete outline of the beam is shown in Figure 3.1 below.

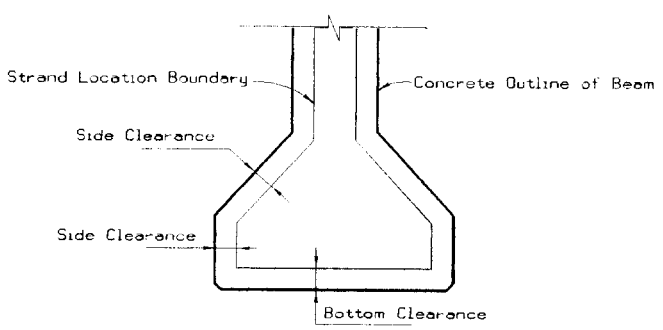


Fig. 3-1 Strand Clearence

AASHTO transfer and development lengths factor for fully bonded and partially debonded strands, respectively (cc 75-77 and 78-80) have the following format:

x.xx

and each has the default value of:

1.00

The strand transfer and/or development multiplier to be used for any given beam run **must** be in accordance with the appropriate edition of the Structures Design Guidelines and must be input on Card Two.

The program utilizes 50 diameters and 100 diameters as the transfer lengths of bonded and debonded strands, respectively, in accordance with AASHTO Articles 9.20.2.4 and 9.27.3. Total development lengths of bonded and debonded strands are calculated as AASHTO equation (9-32) and two (2) times equation (9-32), respectively, in accordance with Articles 9.27.1 and 9.27.3.

Example:

Given:

Strand diameter	= 0.5 in.
Bonded strand factor	= 1.60 (FHWA recommendation)
Debonded strand factor	= 1.00

Assume:

Equation (9-32)	= (156)D	
Bonded Strand Transfer Length	= (50)(0.5)(1.60)	= 40"
Debonded Strand Transfer Length	= (50)(2)(0.5)(1.00)	= 50"
Bonded Strand Development Length	= (156)(0.5)(1.60)	= 125"
Debonded Strand Development Length	= (156)(2)(0.5)(1.00)	= 156"

3.1.5 Card Three, Four, Five and Six

The next eight (8) cards are used to describe concentrated loads which can be applied to the beam being designed. Card type '3' is used to describe concentrated static loads applied to the non-composite section while Card type '4' serves the same purpose for the composite section. Card type '6' is merely a continuation of Card type '5' which is used to describe a concentrated live load pattern applied to a composite section which is moved across the beam to determine the maximum stress conditions at the inspection points. Whenever a load is input on a load card, it must be accompanied by a corresponding distance on the distance card of the same card type which immediately follows the load card. For static loads, the number of distances required is equal to the number of loads; however, for live loads, the number of distances required is one (1) less than the number of loads. This is illustrated in Figure 3-2. If there is an inconsistency between the number of loads and the number of distances input, execution of the problem will be stopped and an error message will be printed out.

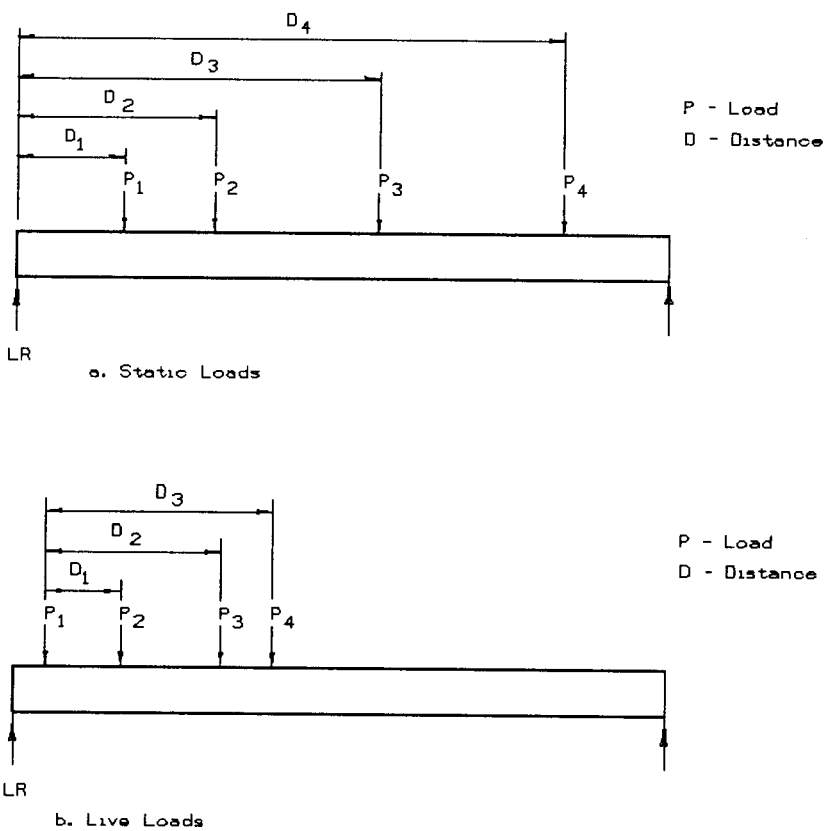


Fig. 3-2 Typical Concentrated Loads and Required Distances

3.1.6 Card Five and Six

3.1.6.1 If a concentrated live load is coded, the HS live loads on the Last Blank Card will be ignored; however, an HS live load must be coded on the Last Blank Card to obtain a satisfactory solution. This requirement was necessary to avoid the possibility of an accidental beam design without live load.

3.1.6.2 Military load check is checked under HS-20, refer to 3.1.9.

3.1.6.3 If the designer requires a beam run without any live load, special input data described for the Last Blank Card may be used.

3.1.6.4 Special Live Load, input any "AASHTO Live Load" in the last, blank card (cc 17-21) and the Special Live Load appropriately on Cards 5 and 6 as described in Table 3-1. The program will ignore the "AASHTO Live Load" and will report only the Special Live Load results. The Special Live Load must be an "axle" load (such as 32.0 kips for AASHTO HS-20) without impact, which is automatically included by the program.

3.1.7 Card Seven

The next three (3) lines are for card group '7'. These cards are prepared to review existing depressed strand beam stranding. The complete set of three cards must be included, with all blanks even if no data appears on the card. Up to eighteen (18) rows of strands may be coded on each card with the only difference being their vertical location. The first card is for the number of straight strands in each row at the end of the beam, followed by the distance to the top most depressed strand at the end of the beam. The next card is used to describe the number of bonded, straight strands in each row at the end of the beam, followed by the distance which the remaining strands are debonded from the end of the beam. The last card in this series is used to input the number of depressed strands at the end of the beam.

3.1.8 Cards Eight and Nine

Sheet No. 2 of 2 of the Input Form includes input cards 8 and 9 when a straight strand review is desired.

(RE: Table 3-1 and Figure 3-3): This option is activated by using input cards 8 and 9. Ten (10) pair of Cards 8 and 9 are required even if some cards require no input information. The resulting array allows up to 36 vertical and 20 horizontal strand positions (ten (10) input Cards 8 symmetrical about the vertical axis of the beam) and 80 characters (free format) for debonding lengths for each vertical column of strands (10 input Cards 9).

3.1.8.1 Card Eight

Half of the strands are input and the pattern is assumed symmetrical about the vertical axis of the beam. The strands input on the first Card 8 are designated to be located on the vertical axis of the beam when "IW" on the Last Blank Card(s), cc 22, is "1", "3" or is left blank (default = 1); and are designated to be located one-half strand grid space from the vertical axis of the beam when "IW" is "2". Entries on other Cards 8 designate vertical columns of strand locations at multiples of the strand grid spacing (Card 2, cc 55-58) from the first Card 8, progressively outward. Multiple entries on any Card 8 designate horizontal rows of strand locations at the strand grid spacing and are input in cc 3 for the row closest to the bottom of the beam and in every other cc (5, 7, 9, etc.) thereafter. When a strand is missing, that cc (or cc's) that signifies the horizontal row location is left blank. Strand positions where strands exist are input with "X" for fully bonded strands and "S" for partially bonded (debonded) strands.

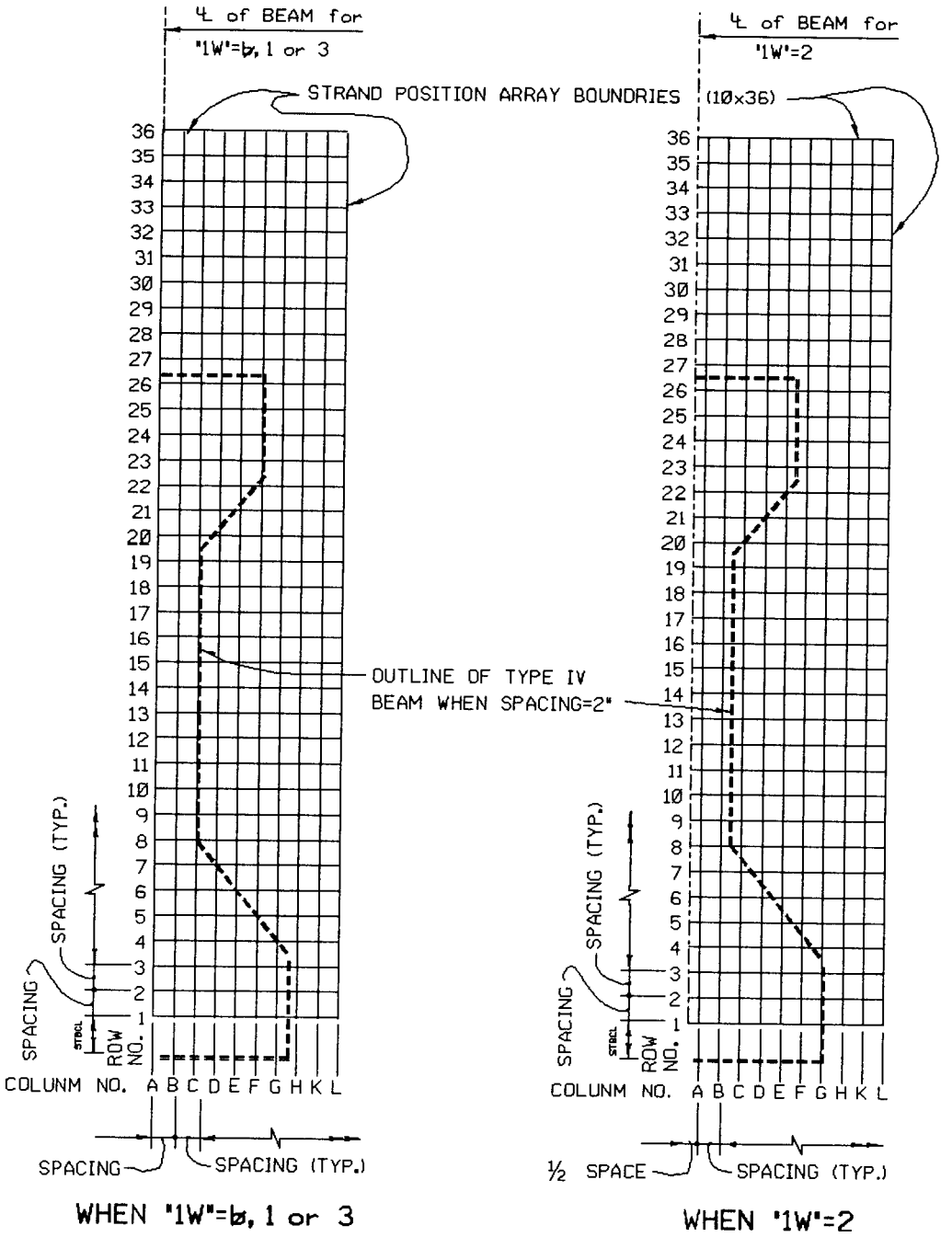


Fig. 3-3 Strand Position References for Input on cards Eight

3.1.8.2 Card Nine

Only half the strand debonding pattern is input. Each Card 9 is associated with Card 8 that precedes it and entries are required only when the preceding Card 8 contains an "S" entry (or entries) in any cc. The input required is the length of debonding material, in feet, from the centerline of bearing. The format is free form, with decimal points, and at least one (1) space between sequential debond lengths. Trailing zeroes are not required.

An example of the input for one (1) vertical column of strands (one (1) pair of Cards 8 and 9) is:

```
8 X S X S X
9 6.33 12.1
```

3.1.9 Last Blank Card

The last card type is 'Blank Card'. At least one of these cards is required for each and every beam to be designed or reviewed. As many 'Blank Cards" as desired may be input per run. Required data fields on this card are: beam type, span length, beam spacing, slab thickness and type of live loading. Since these are the only required fields, the program will check on their validity and, if an error is found, issue the following error message: 'Error number X in input card (Card Data)'. In this case, X represents a number one (1) through four (4) standing for an error in the first through fourth data fields on the card. Note: If more than one error is detected, it will denote the last occurrence. Card data will just be a card image of the card in error.

AASHTO Live Load (cc 17-21), is required input for each and every run. The special Military Loading of 2-24,000 lb. axles, spaced 4'-0" apart automatically will be checked by the program and, on shorter spans, may control the design. Also, for a small range of span lengths under some live loads, the live load moment at 4/10 the span (0.4L) may be greater than at the centerline of span. In this event the moment at the centerline of span is set equal to that at 0.4L. If the beam design dictates either no live load or a special live load, the following options can be utilized:

No Live Load:

Input a **Concentrated Live Load on the Composite Section** value of 0.01 kips in the first Card 5 (cc 2-6) and include a second, blank Card 5. Enter any **AASHTO live Load** in the last, blank card (cc 17-21) and a **L.L. Distribution Factor** (cc 26-29) of 0.001. The results will show no live load moment or shear.

Special Live Load:

Input any **AASHTO Live Load** in the last, blank card (cc 17-21) and the Special Live Load appropriately on Cards 5 and 6 as described in 3.1.6. The program will ignore the **AASHTO Live Load** and will report only the Special Live Load results. The Special Live Load must be an "axle" load (such as 32.0 kips for AASHTO HS-20) without impact, which is automatically included by the program.

Uniform DL on the Non-Composite Section (CC 38-42), is to be used only for superimposed dead loads such as when an allowance for **Cope** and build-up are required. The self-weight of the slab and beam are automatically calculated and accounted for in the program by utilizing other input and/or default values such as beam type, beam spacing, slab thickness, unit weights of beam and slab concrete, etc. The effect of diaphragms on the non-composite section is described in 1.5.

Cope (cc 55-58), as shown on the input form in the beam section, is the vertical dimension, in inches, from the top of the beam to the underside of the slab; i.e., a continuous "build-up". When used, its weight, in kips per foot, must be included as a **Uniform Dead Load on the Non-Composite Section** (cc 38-42). Its effect is included in the composite beam/slab section properties as additional slab concrete.

The **Shear Distribution Factor, VFACT** (cc 30-33) distributes live load shears and moments according to the input value, on a per-axle basis, for all calculations within a distance of "OHT" from the centerline of bearing where:

$$OHT = D + TS + COPE$$

Distributions of shears and moments beyond this distance are in accordance with the input **Live Load Distribution Factor, DFACT**, on (cc 26-29), or as calculated by the program (S/5.5). In order to utilize **VFACT**, a value must be input by the designer.

An example of the use of **VFACT** for 56'-0" span interior Type II beams spaced at 7'0" centers for HS 20-44 loading is:

$$DF(AASHTO\ 3.23.1.2) = (1.0 + 7.0 + 3.0)/(2 \times 7.0) = 0.7857$$

$$DF(AASHTO\ Table\ 3.23.1) = 7.0/(2 \times 5.5) \qquad = 0.6364$$

At OHT = 3.25:

$$VFACT = \frac{(32)(0.7857)(52.75) + (32)(0.6364)(38.75) + (8)(0.6364)(24.75)}{(32)(52.75) + (32)(38.75) + (8)(24.75)}$$

$$VFACT = 0.7170$$

The designer may input the **Strand Losses** (cc 52-54) directly or use the value calculated by the program. One-half (50%) of the designer's input total loss of prestress is assigned to the prestress loss at release (RLOSS - 0.5 * PLOSS).

If cope is specified, its value is included in all calculations involving the composite section; i.e., shear, properties, ultimate moment, etc.

The designer has only three (3) choices for input for diaphragms: '0' for no diaphragms, '1' for one (1) diaphragm at the center of span or '5' for an allowance for diaphragms of 5% of the live load. If additional diaphragms are desired, their weights must be entered on Card '3' as static loads applied to the non-composite section.

A complete listing of all input specifications by card number and program variable has been compiled and is included as Table 3-1.

TABLE 3-1
Input Specifications for Simple Span Prestressed Beams
Note: Formats and card columns vary slightly for metric input.
See the metric data entry forms for specifics
HEADER CARDS AND CARD ONE

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
*	1-80		A80	HEADER CARD - 1 of 3,3 required	NA	Req'd
*	1-80		A80	HEADER CARD - 2 of 3,3 required	NA	Req'd
*	1-80		A80	HEADER CARD - 3 of 3,3 required	NA	Req'd
1	1	NTYPE	I1	CARD NO. 1 Valid code : 1 For standard AASHTO or Florida bulb tee beams skip this card	NA	
1	2- 9	IB	F8.2	MOMENT INERTIA OF BEAM Valid code xxxxxx.xx in.**4	NA	
1	10-15	AREA	F6.2	BEAM CROSS-SECTIONAL AREA Valid code xxxx.xx in.**2	NA	
1	16-20	D	F5.2	BEAM DEPTH Valid code xxx.xx in.	NA	
1	21-24	YB	F4.2	BEAM DIMENSION YB N.A. to Bottom Valid Code xx.xx in.	NA	
1	25-28	YT	F4.2	BEAM DIMENSION YT N.A. to Top Valid Code xx.xx in.	NA	
1	29-32	B	F4.2	BEAM DIMENSION B Bottom Width Valid Code xx.xx in.	NA	
1	33-36	W	F4.2	BEAM DIMENSION W Web Width Valid Code xx.xx in.	NA	
1	37-40	C	F4.2	BEAM DIMENSION C Bottom Flange Height Valid Code xx.xx in.	NA	

CARD ONE (CONTINUED)

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
1	41-44	E	F4.2	BEAM DIMENSION E Bottom Fillet Valid Code xx.xx in.	NA	
1	45-48	A	F4.2	BEAM DIMENSION A Top Width Valid Code xx.xx in.	NA	
1	49-52	H	F4.2	BEAM DIMENSION H Top Flange Height at Root Valid Code xx.xx in.	NA	
1	53-56	G	F4.2	BEAM DIMENSION G Top Fillet Valid Code Blank : No Strand xx.xx in.	NA	
1	57-60	Q	F4.2	BEAM DIMENSION Q Slope of Bottom of Top Flange Valid Code xx.xx	NA	Used for Wide -Top
1	61-64	R	F4.2	BEAM DIMENSION R Top Flange Height at Tip Valid Code xx.xx in.	NA	Used for Wide -Top

CARD TWO

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
2	1	NTYPE	I1	CARD NO. 2 Valid code : 2	NA	REQ'D
2	2- 5	DIA	A4	STRAND SIZE Valid code 1/2 3/8 7/16 9/16 6/10 in.	1/2	
2	6	SPEC	A1	REGULAR OR SPECIAL Valid code Blank : Regular S : Special	Regular	
2	7	LOLAX (SR/LL)	I1	STRAND TYPE Valid code Blank : Stress Relieved 0 : Stress Relieved 1 : Lolax		
2	8-12	FPS	F5.2	ULTIMATE STRENGTH OF STRAND Valid code : xxx.xx ksi	270	
2	13-17	UWB	F5.2	UNIT WEIGHT OF BEAM CONCRETE Valid code : xxx.xx lbs./cu.ft.	150	
2	18-22	UWS	F5.2	UNIT WEIGHT OF SLAB CONCRETE Valid code : xxx.xx lbs./cu.ft.	150	
2	23-26	SFPC	F4.0	SLAB CONCRETE 28-DAY STRENGTH Valid code : xxxx. psi	3400	
2	27-30	FPC	F4.0	BEAM CONCRETE 28-DAY STRENGTH Valid code : xxxx. psi	5000	
2	31-34	FPCI	F4.0	BEAM CONCRETE RELEASE STRENGTH Valid code : xxxx. psi	4000	
2	35-38	EC	F4.2	BEAM CONCRETE MODULUS OF ELASTICITY Valid code : xx.xx*1000000 psi	3.55	
2	39-42	ECSL	F4.2	SLAB CONCRETE MODULUS OF ELASTICITY Valid code : xx.xx*1000000 psi	2.93	
2	43-46	ES	F4.2	STEEL MODULUS OF ELASTICITY Valid code : xx.xx*1000000 psi	28.00	
2	47-50	STBCL	F4.3	STRAND POSITION FROM BOTTOM Valid code : x.xxx in.	3.0	
2	51-54	STSCL	F4.3	STRAND POSITION FROM SIDE Valid code : x.xxx in.	3.0	

CARD TWO (CONTINUED)

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
2	55-58	SPACE	F4.3	STRAND SPACING Valid Code : x.xxx in. Default to 2.00 in. if strand dia. less or equal to 0.516 in. Default to 2.25 in. if stranddia.greater than 0.516 in.	(2.00) or 2.25	
2	59-63	FTP	F5.1	SERVICE LOAD CONCRETE TENSILE STRESS Valid Code : -xxx.x psi (-100.0 to -999.9) or -xx.x(FDGI)$^{1/2}$ (-0.1 to -99.9) Default to 3(f'$_c$)$^{1/2}$ if no. of strands in web = 1 Default to -6(f'$_c$)$^{1/2}$ if no. strands in web = 2	-3(f'$_c$)$^{1/2}$ or -6(f'$_c$)$^{1/2}$	
2	64	SMBOL3	A1	STRAND PROFILE Valid Code Blank:Stra.Strand D : Depressed Str. S : Stra. Strand	S	
2	65-66	FPY	F2.0	REINFORCEING STEEL GRADE Valid Code : xx.(ksi)	60.	
2	67-71	TTEN	F5.1	INITIAL TENSION AT BEAM END Valid Code : -xxx.x psi) (-100.0 to -999.9] or -xx.x (f'$_c$)$^{1/2}$] (-0.1 to -99.9)		
2	72-74	DBDPCT	F3.3	FRACTION OF DEBOND Valid code : x.xx	0.250	
2	75-77	DVN	F3.3	AASHTO TRANSFER LENGTH FACTOR Valid code : x.xx	1.00	
2	78-80	DVS	F3.2	AASHTO DEVELOPMENT LENGTH FACTOR Valid code : x.xx	1.00	

FIRST CARD THREE

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
3	1	NTYPE	I1	CARD NO. 3 Valid code : 3	NA	IN PAIRS
3	2- 6	CNCP(1)	F5.2	CONCENTRATED STATIC LOAD APPLIED TO NON-COMPOSITE SECTION Valid code : xxx.xx kips	NA	
3	7-11	CNCP(2)	F5.2	CONCENTRATED STATIC LOAD APPLIED TO NON-COMPOSITE SECTION Valid code : xxx.xx kips	NA	
3	12-16	CNCP(3)	F5.2	CONCENTRATED STATIC LOAD APPLIED TO NON-COMPOSITE SECTION Valid code : xxx.xx kips	NA	
3	17-21	CNCP(4)	F5.2	CONCENTRATED STATIC LOAD APPLIED TO NON-COMPOSITE SECTION Valid code : xxx.xx kips	NA	
3	22-26	CNCP(5)	F5.2	CONCENTRATED STATIC LOAD APPLIED TO NON-COMPOSITE SECTION Valid code : xxx.xx kips	NA	
3	27-31	CNCP(6)	F5.2	CONCENTRATED STATIC LOAD APPLIED TO NON-COMPOSITE SECTION Valid code : xxx.xx kips	NA	
3	32-36	CNCP(7)	F5.2	CONCENTRATED STATIC LOAD APPLIED TO NON-COMPOSITE SECTION Valid code : xxx.xx kips	NA	
3	37-41	CNCP(8)	F5.2	CONCENTRATED STATIC LOAD APPLIED TO NON-COMPOSITE SECTION Valid code : xxx.xx kips	NA	
3	42-46	CNCP(9)	F5.2	CONCENTRATED STATIC LOAD APPLIED TO NON-COMPOSITE SECTION Valid code : xxx.xx kips	NA	
3	47-51	CNCP(10)	F5.2	CONCENTRATED STATIC LOAD APPLIED TO NON-COMPOSITE SECTION Valid code : xxx.xx kips	NA	

SECOND CARD THREE

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
3	1	NTYPE	I1	CARD NO. 3 Valid code : 3	NA	IN PAIRS
3	2- 6	CNCD(1)	F5.2	DISTANCE FROM LEFT SUPPORT OF NON-COMPOSITE LOAD Valid code : xxx.xx ft.	NA	
3	7-11	CNCD(2)	F5.2	DISTANCE FROM LEFT SUPPORT OF NON-COMPOSITE LOAD Valid code : xxx.xx ft.	NA	
3	12-16	CNCD(3)	F5.2	DISTANCE FROM LEFT SUPPORT OF NON-COMPOSITE LOAD Valid code : xxx.xx ft.	NA	
3	17-21	CNCD(4)	F5.2	DISTANCE FROM LEFT SUPPORT OF NON-COMPOSITE LOAD Valid code : xxx.xx ft.	NA	
3	22-26	CNCD(5)	F5.2	DISTANCE FROM LEFT SUPPORT OF NON-COMPOSITE LOAD Valid code : xxx.xx ft.	NA	
3	27-31	CNCD(6)	F5.2	DISTANCE FROM LEFT SUPPORT OF NON-COMPOSITE LOAD Valid code : xxx.xx ft.	NA	
3	32-36	CNCD(7)	F5.2	DISTANCE FROM LEFT SUPPORT OF NON-COMPOSITE LOAD Valid code : xxx.xx ft.	NA	
3	37-41	CNCD(8)	F5.2	DISTANCE FROM LEFT SUPPORT OF NON-COMPOSITE LOAD Valid code : xxx.xx ft.	NA	
3	42-46	CNCD(9)	F5.2	DISTANCE FROM LEFT SUPPORT OF NON-COMPOSITE LOAD Valid code : xxx.xx ft.	NA	
3	47-51	CNCD(10)	F5.2	DISTANCE FROM LEFT SUPPORT OF NON-COMPOSITE LOAD Valid code : xxx.xx ft.	NA	

FIRST CARD FOUR

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
4	1	NTYPE	I1	CARD NO. 4 Valid code : 4	NA	IN PAIRS
4	2- 6	SCNCP(1)	F5.2	CONCENTRATED STATIC LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	
4	7-11	SCNCP(2)	F5.2	CONCENTRATED STATIC LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	
4	12-16	SCNCP(3)	F5.2	CONCENTRATED STATIC LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	
4	17-21	SCNCP(4)	F5.2	CONCENTRATED STATIC LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	
4	22-26	SCNCP(5)	F5.2	CONCENTRATED STATIC LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	
4	27-31	SCNCP(6)	F5.2	CONCENTRATED STATIC LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	
4	32-36	SCNCP(7)	F5.2	CONCENTRATED STATIC LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	
4	37-41	SCNCP(8)	F5.2	CONCENTRATED STATIC LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	
4	42-46	SCNCP(9)	F5.2	CONCENTRATED STATIC LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	
4	47-51	SCNCP (10)	F5.2	CONCENTRATED STATIC LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	

SECOND CARD FOUR

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
4	1	NTYPE	I1	CARD NO. 4 Valid code : 4	NA	IN PAIRS
4	2- 6	SCNCD(1)	F5.2	DISTANCE FROM LEFT SUPPORT Valid code : xxx.xx ft.	NA	
4	7-11	SCNCD(2)	F5.2	DISTANCE FROM LEFT SUPPORT Valid code : xxx.xx ft.	NA	
4	12-16	SCNCD(3)	F5.2	DISTANCE FROM LEFT SUPPORT Valid code : xxx.xx ft.	NA	
4	17-21	SCNCD(4)	F5.2	DISTANCE FROM LEFT SUPPORT Valid code : xxx.xx ft.	NA	
4	22-26	SCNCD(5)	F5.2	DISTANCE FROM LEFT SUPPORT Valid code : xxx.xx ft.	NA	
4	27-31	SCNCD(6)	F5.2	DISTANCE FROM LEFT SUPPORT Valid code : xxx.xx ft.	NA	
4	32-36	SCNCD(7)	F5.2	DISTANCE FROM LEFT SUPPORT Valid code : xxx.xx ft.	NA	
4	37-41	SCNCD(8)	F5.2	DISTANCE FROM LEFT SUPPORT Valid code : xxx.xx ft.	NA	
4	42-46	SCNCD(9)	F5.2	DISTANCE FROM LEFT SUPPORT Valid code : xxx.xx ft.	NA	
4	47-51	SCNCD (10)	F5.2	DISTANCE FROM LEFT SUPPORT Valid code : xxx.xx ft.	NA	

FIRST CARD FIVE

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
5	1	NTYPE	I1	CARD NO. 5 Valid code : 5	NA	IN PAIRS
5	2- 6	CCP(1)	F5.2	CONCENTRATED LIVE LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	
5	7-11	CCP(2)	F5.2	CONCENTRATED LIVE LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	
5	12-16	CCP(3)	F5.2	CONCENTRATED LIVE LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	
5	17-21	CCP(4)	F5.2	CONCENTRATED LIVE LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	
5	22-26	CCP(5)	F5.2	CONCENTRATED LIVE LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	
5	27-31	CCP(6)	F5.2	CONCENTRATED LIVE LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	
5	32-36	CCP(7)	F5.2	CONCENTRATED LIVE LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	
5	37-41	CCP(8)	F5.2	CONCENTRATED LIVE LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	
5	42-46	CCP(9)	F5.2	CONCENTRATED LIVE LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	
5	47-51	CCP(10)	F5.2	CONCENTRATED LIVE LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	

SECOND CARD FIVE

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
5	1	NTYPE	I1	CARD NO. 5 Valid code : 5	NA	IN PAIRS
5	2- 6	CCD(1)	F5.2	DISTANCE FROM LEFT LOAD Valid code : xxx.xx ft.	NA	
5	7-11	CCD(2)	F5.2	DISTANCE FROM LEFT LOAD Valid code : xxx.xx ft.	NA	
5	12-16	CCD(3)	F5.2	DISTANCE FROM LEFT LOAD Valid code : xxx.xx ft.	NA	
5	17-21	CCD(4)	F5.2	DISTANCE FROM LEFT LOAD Valid code : xxx.xx ft.	NA	
5	22-26	CCD(5)	F5.2	DISTANCE FROM LEFT LOAD Valid code : xxx.xx ft.	NA	
5	27-31	CCD(6)	F5.2	DISTANCE FROM LEFT LOAD Valid code : xxx.xx ft.	NA	
5	32-36	CCD(7)	F5.2	DISTANCE FROM LEFT LOAD Valid code : xxx.xx ft.	NA	
5	37-41	CCD(8)	F5.2	DISTANCE FROM LEFT LOAD Valid code : xxx.xx ft.	NA	
5	42-46	CCD(9)	F5.2	DISTANCE FROM LEFT LOAD Valid code : xxx.xx ft.	NA	
5	47-51	CCD(10)	F5.2	DISTANCE FROM LEFT LOAD Valid code : xxx.xx ft.	NA	

FIRST CARD SIX

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
6	1	NTYPE	I1	CARD NO. 6 Valid code : 6	NA	IN PAIRS
6	2- 6	CCP(1)	F5.2	CONCENTRATED LIVE LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	
6	7-11	CCP(2)	F5.2	CONCENTRATED LIVE LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	
6	12-16	CCP(3)	F5.2	CONCENTRATED LIVE LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	
6	17-21	CCP(4)	F5.2	CONCENTRATED LIVE LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	
6	22-26	CCP(5)	F5.2	CONCENTRATED LIVE LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	
6	27-31	CCP(6)	F5.2	CONCENTRATED LIVE LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	
6	32-36	CCP(7)	F5.2	CONCENTRATED LIVE LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	
6	37-41	CCP(8)	F5.2	CONCENTRATED LIVE LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	
6	42-46	CCP(9)	F5.2	CONCENTRATED LIVE LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	
6	47-51	CCP(10)	F5.2	CONCENTRATED LIVE LOAD APPLIED TO COMPOSITE SECTION Valid code : xxx.xx kips	NA	

SECOND CARD SIX

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
6	1	NTYPE	I1	CARD NO. 6 Valid code : 6	NA	IN PAIRS
6	2- 6	CCD(1)	F5.2	DISTANCE FROM LEFT LOAD Valid code : xxx.xx ft.	NA	
6	7-11	CCD(2)	F5.2	DISTANCE FROM LEFT LOAD Valid code : xxx.xx ft.	NA	
6	12-16	CCD(3)	F5.2	DISTANCE FROM LEFT LOAD Valid code : xxx.xx ft.	NA	
6	17-21	CCD(4)	F5.2	DISTANCE FROM LEFT LOAD Valid code : xxx.xx ft.	NA	
6	22-26	CCD(5)	F5.2	DISTANCE FROM LEFT LOAD Valid code : xxx.xx ft.	NA	
6	27-31	CCD(6)	F5.2	DISTANCE FROM LEFT LOAD Valid code : xxx.xx ft.	NA	
6	32-36	CCD(7)	F5.2	DISTANCE FROM LEFT LOAD Valid code : xxx.xx ft.	NA	
6	37-41	CCD(8)	F5.2	DISTANCE FROM LEFT LOAD Valid code : xxx.xx ft.	NA	
6	42-46	CCD(9)	F5.2	DISTANCE FROM LEFT LOAD Valid code : xxx.xx ft.	NA	
6	47-51	CCD(10)	F5.2	DISTANCE FROM LEFT LOAD Valid code : xxx.xx ft.	NA	

FIRST CARD SEVEN

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
7	1	NTYPE	I1	CARD NO. 7 Valid code : 7	NA	1 of 3
7	2- 3	SROW(1)	I2	NUMBER OF STRAIGHT STRANDS IN ROW 1 AT BEAM END Valid code : xx	NA	
7	4- 5	SROW(2)	I2	NUMBER OF STRAIGHT STRANDS IN ROW 2 AT BEAM END Valid code : xx	NA	
7	6- 7	SROW(3)	I2	NUMBER OF STRAIGHT STRANDS IN ROW 3 AT BEAM END Valid code : xx	NA	
7	8- 9	SROW(4)	I2	NUMBER OF STRAIGHT STRANDS IN ROW 4 AT BEAM END Valid code : xx	NA	
7	10-11	SROW(5)	I2	NUMBER OF STRAIGHT STRANDS IN ROW 5 AT BEAM END Valid code : xx	NA	
7	12-13	SROW(6)	I2	NUMBER OF STRAIGHT STRANDS IN ROW 6 AT BEAM END Valid code : xx	NA	
7	14-15	SROW(7)	I2	NUMBER OF STRAIGHT STRANDS IN ROW 7 AT BEAM END Valid code : xx	NA	
7	16-17	SROW(8)	I2	NUMBER OF STRAIGHT STRANDS IN ROW 8 AT BEAM END Valid code : xx	NA	
7	18-19	SROW(9)	I2	NUMBER OF STRAIGHT STRANDS IN ROW 9 AT BEAM END Valid code : xx	NA	
7	20-21	SROW(10)	I2	NUMBER OF STRAIGHT STRANDS IN ROW 10 AT BEAM END Valid code : xx	NA	
7	20-21	SROW(11)	I2	NUMBER OF STRAIGHT STRANDS IN ROW 11 AT BEAM END Valid code : xx	NA	
7	24-25	SROW(12)	I2	NUMBER OF STRAIGHT STRANDS IN ROW 12 AT BEAM END Valid code : xx	NA	
7	26-27	SROW(13)	I2	NUMBER OF STRAIGHT STRANDS IN ROW 13 AT BEAM END Valid code : xx	NA	

FIRST CARD SEVEN (CONTINUED)

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
7	28-29	SROW(14)	I2	NUMBER OF STRAIGHT STRANDS IN ROW 14 AT BEAM END Valid code : xx	NA	
7	30-31	SROW(15)	I2	NUMBER OF STRAIGHT STRANDS IN ROW 15 AT BEAM END Valid code : xx	NA	
7	32-33	SROW(16)	I2	NUMBER OF STRAIGHT STRANDS IN ROW 16 AT BEAM END Valid code : xx	NA	
7	34-35	SROW(17)	I2	NUMBER OF STRAIGHT STRANDS IN ROW 17 AT BEAM END Valid code : xx	NA	
7	36-37	SROW(18)	I2	NUMBER OF STRAIGHT STRANDS IN ROW 18 AT BEAM END Valid code : xx	NA	
7	38-41	KGRID	F4.2	DISTANCE TO UPPERMOST DEPRESSED STRANDS AT END OF BEAM Valid code : xx.xx	NA	

SECOND CARD SEVEN

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
7	1	NTYPE	I1	CARD NO. 7 Valid code : 7	NA	2 of 3
7	2- 3	NSROW(1)	I2	NUMBER OF STRAIGHT, BONDED STRANDS IN ROW 1 AT BEAM END Valid code : xx	NA	
7	4- 5	NSROW(2)	I2	NUMBER OF STRAIGHT, BONDED STRANDS IN ROW 2 AT BEAM END Valid code : xx	NA	
7	6- 7	NSROW(3)	I2	NUMBER OF STRAIGHT, BONDED STRANDS IN ROW 3 AT BEAM END Valid code : xx	NA	
7	8- 9	NSROW(4)	I2	NUMBER OF STRAIGHT, BONDED STRANDS IN ROW 4 AT BEAM END Valid code : xx	NA	
7	10-11	NSROW(5)	I2	NUMBER OF STRAIGHT, BONDED STRANDS IN ROW 5 AT BEAM END Valid code : xx	NA	
7	12-13	NSROW(6)	I2	NUMBER OF STRAIGHT, BONDED STRANDS IN ROW 6 AT BEAM END Valid code : xx	NA	
7	14-15	NSROW(7)	I2	NUMBER OF STRAIGHT, BONDED STRANDS IN ROW 7 AT BEAM END Valid code : xx	NA	
7	16-17	NSROW(8)	I2	NUMBER OF STRAIGHT, BONDED STRANDS IN ROW 8 AT BEAM END Valid code : xx	NA	
7	18-19	NSROW(9)	I2	NUMBER OF STRAIGHT, BONDED STRANDS IN ROW 9 AT BEAM END Valid code : xx	NA	
7	20-21	NSROW (10)	I2	NUMBER OF STRAIGHT, BONDED STRANDS IN ROW 10 AT BEAM END Valid code : xx	NA	
7	22-23	NSROW (11)	I2	NUMBER OF STRAIGHT, BONDED STRANDS IN ROW 11 AT BEAM END Valid code : xx	NA	
7	24-25	NSROW (12)	I2	NUMBER OF STRAIGHT, BONDED STRANDS IN ROW 12 AT BEAM END Valid code : xx	NA	

SECOND CARD SEVEN (CONTINUED)

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
7	26-27	NSROW (13)	I2	NUMBER OF STRAIGHT, BONDED STRANDS IN ROW 13 AT BEAM END Valid code : xx	NA	
7	28-29	NSROW (14)	I2	NUMBER OF STRAIGHT, BONDED STRANDS IN ROW 14 AT BEAM END Valid code : xx	NA	
7	30-31	NSROW (15)	I2	NUMBER OF STRAIGHT, BONDED STRANDS IN ROW 15 AT BEAM END Valid code : xx	NA	
7	32-33	NSROW (16)	I2	NUMBER OF STRAIGHT, BONDED STRANDS IN ROW 16 AT BEAM END Valid code : xx	NA	
7	34-35	NSROW (17)	I2	NUMBER OF STRAIGHT, BONDED STRANDS IN ROW 17 AT BEAM END Valid code : xx	NA	
7	36-37	NSROW (18)	I2	NUMBER OF STRAIGHT, BONDED STRANDS IN ROW 18 AT BEAM END Valid code : xx	NA	
7	38-41	SHIELD	F4.2	DEBOND LENGTH Valid code : xx.xx ft.	NA	

THIRD CARD SEVEN

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
7	1	NTYPE	I1	CARD NO. 7 Valid code : 7	NA	3 of 3
7	2- 3	DROW(1)	I2	NUMBER OF DEPRESSED STRAND IN LOWEST ROW AT BEAM END Valid code : xx	NA	
7	4- 5	DROW(2)	I2	NUMBER OF DEPRESSED STRAND IN NEXT LOWEST ROW AT BEAM END Valid code : xx	NA	
7	6- 7	DROW(3)	I2	NUMBER OF DEPRESSED STRAND IN NEXT LOWEST ROW AT BEAM END Valid code : xx	NA	
7	8- 9	DROW(4)	I2	NUMBER OF DEPRESSED STRAND IN NEXT LOWEST ROW AT BEAM END Valid code : xx	NA	
7	10-11	DROW(5)	I2	NUMBER OF DEPRESSED STRAND IN NEXT LOWEST ROW AT BEAM END Valid code : xx	NA	
7	12-13	DROW(6)	I2	NUMBER OF DEPRESSED STRAND IN NEXT LOWEST ROW AT BEAM END Valid code : xx	NA	
7	14-15	DROW(7)	I2	NUMBER OF DEPRESSED STRAND IN NEXT LOWEST ROW AT BEAM END Valid code : xx	NA	
7	16-17	DROW(8)	I2	NUMBER OF DEPRESSED STRAND IN NEXT LOWEST ROW AT BEAM END Valid code : xx	NA	
7	18-19	DROW(9)	I2	NUMBER OF DEPRESSED STRAND IN NEXT LOWEST ROW AT BEAM END Valid code : xx	NA	
7	20-21	DROW(10)	I2	NUMBER OF DEPRESSED STRAND IN NEXT LOWEST ROW AT BEAM END Valid code : xx	NA	
7	22-23	DROW(11)	I2	NUMBER OF DEPRESSED STRAND IN NEXT LOWEST ROW AT BEAM END Valid code : xx	NA	
7	24-25	DROW(12)	I2	NUMBER OF DEPRESSED STRAND IN NEXT LOWEST ROW AT BEAM END Valid code : xx	NA	

THIRD CARD SEVEN (CONTINUED)

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
7	26-27	DROW(13)	I2	NUMBER OF DEPRESSED STRAND IN NEXT LOWEST ROW AT BEAM END Valid code : xx	NA	
7	28-29	DROW(14)	I2	NUMBER OF DEPRESSED STRAND IN NEXT LOWEST ROW AT BEAM END Valid code : xx	NA	
7	30-31	DROW(15)	I2	NUMBER OF DEPRESSED STRAND IN NEXT LOWEST ROW AT BEAM END Valid code : xx	NA	
7	32-33	DROW(16)	I2	NUMBER OF DEPRESSED STRAND IN NEXT LOWEST ROW AT BEAM END Valid code : xx	NA	
7	34-35	DROW(17)	I2	NUMBER OF DEPRESSED STRAND IN NEXT LOWEST ROW AT BEAM END Valid code : xx	NA	
7	36-37	DROW(18)	I2	NUMBER OF DEPRESSED STRAND IN NEXT LOWEST ROW AT BEAM END Valid code : xx	NA	

FIRST CARD EIGHT

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	1	NTYPE	I1	CARD NO. 8 Valid code : 8	NA	
8	3	STDPOS (1,1)	A1	STRAIGHT STRAND AT COL.A, ROW 1 Valid code Blank : No Strand X : Bonded Strand S : Debonded Strand	NA	(1)
8	5	STDPOS (1,2)	A1	STRAIGHT STRAND AT COL.A, ROW 2 Valid code : (See CC. 3)	NA	(1)
8	7	STDPOS (1,3)	A1	STRAIGHT STRAND AT COL.A, ROW 3 Valid code : (See CC. 3)	NA	(1)
8	9	STDPOS (1,4)	A1	STRAIGHT STRAND AT COL.A, ROW 4 Valid code : (See CC. 3)	NA	(1)
8	11	STDPOS (1,5)	A1	STRAIGHT STRAND AT COL.A, ROW 5 Valid code : (See CC. 3)	NA	(1)
8	13	STDPOS (1,6)	A1	STRAIGHT STRAND AT COL.A, ROW 6 Valid code : (See CC. 3)	NA	(1)
8	15	STDPOS (1,7)	A1	STRAIGHT STRAND AT COL.A, ROW 7 Valid code : (See CC. 3)	NA	(1)
8	17	STDPOS (1,8)	A1	STRAIGHT STRAND AT COL.A, ROW 8 Valid code : (See CC. 3)	NA	(1)
8	19	STDPOS (1,9)	A1	STRAIGHT STRAND AT COL.A, ROW 9 Valid code : (See CC. 3)	NA	(1)
8	21	STDPOS (1,10)	A1	STRAIGHT STRAND AT COL.A,ROW 10 Valid code : (See CC. 3)	NA	(1)
8	23	STDPOS (1,11)	A1	STRAIGHT STRAND AT COL.A,ROW 11 Valid code : (See CC. 3)	NA	(1)
8	25	STDPOS (1,12)	A1	STRAIGHT STRAND AT COL.A,ROW 12 Valid code : (See CC. 3)	NA	(1)
8	27	STDPOS (1,13)	A1	STRAIGHT STRAND AT COL.A,ROW 13 Valid code : (See CC. 3)	NA	(1)
8	29	STDPOS (1,14)	A1	STRAIGHT STRAND AT COL.A,ROW 14 Valid code : (See CC. 3)	NA	(1)
8	31	STDPOS (1,15)	A1	STRAIGHT STRAND AT COL.A,ROW 15 Valid code : (See CC. 3)	NA	(1)

FIRST CARD EIGHT (CONTINUED)

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	33	STDPOS (1,16)	A1	STRAIGHT STRAND AT COL.A,ROW 16 Valid code : (See CC. 3)	NA	(1)
8	35	STDPOS (1,17)	A1	STRAIGHT STRAND AT COL.A,ROW 17 Valid code : (See CC. 3)	NA	(1)
8	37	STDPOS (1,18)	A1	STRAIGHT STRAND AT COL.A,ROW 18 Valid code : (See CC. 3)	NA	(1)
8	39	STDPOS (1,19)	A1	STRAIGHT STRAND AT COL.A,ROW 19 Valid code : (See CC. 3)	NA	(1)
8	41	STDPOS (1,20)	A1	STRAIGHT STRAND AT COL.A,ROW 20 Valid code : (See CC. 3)	NA	(1)
8	43	STDPOS (1,21)	A1	STRAIGHT STRAND AT COL.A,ROW 21 Valid code : (See CC. 3)	NA	(1)
8	45	STDPOS (1,22)	A1	STRAIGHT STRAND AT COL.A,ROW 22 Valid code : (See CC. 3)	NA	(1)
8	47	STDPOS (1,23)	A1	STRAIGHT STRAND AT COL.A,ROW 23 Valid code : (See CC. 3)	NA	(1)
8	49	STDPOS (1,24)	A1	STRAIGHT STRAND AT COL.A,ROW 24 Valid code : (See CC. 3)	NA	(1)
8	51	STDPOS (1,25)	A1	STRAIGHT STRAND AT COL.A,ROW 25 Valid code : (See CC. 3)	NA	(1)
8	53	STDPOS (1,26)	A1	STRAIGHT STRAND AT COL.A,ROW 26 Valid code : (See CC. 3)	NA	(1)
8	55	STDPOS (1,27)	A1	STRAIGHT STRAND AT COL.A,ROW 27 Valid code : (See CC. 3)	NA	(1)
8	57	STDPOS (1,28)	A1	STRAIGHT STRAND AT COL.A,ROW 28 Valid code : (See CC. 3)	NA	(1)
8	59	STDPOS (1,29)	A1	STRAIGHT STRAND AT COL.A,ROW 29 Valid code : (See CC. 3)	NA	(1)
8	61	STDPOS (1,30)	A1	STRAIGHT STRAND AT COL.A,ROW 30 Valid code : (See CC. 3)	NA	(1)
8	63	STDPOS (1,31)	A1	STRAIGHT STRAND AT COL.A,ROW 31 Valid code : (See CC. 3)	NA	(1)
8	65	STDPOS (1,32)	A1	STRAIGHT STRAND AT COL.A,ROW 32 Valid code : (See CC. 3)	NA	(1)

FIRST CARD EIGHT (CONTINUED)

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	67	STDPOS (1,33)	A1	STRAIGHT STRAND AT COL.A,ROW 33 Valid code : (See CC. 3)	NA	(1)
8	69	STDPOS (1,34)	A1	STRAIGHT STRAND AT COL.A,ROW 34 Valid code : (See CC. 3)	NA	(1)
8	71	STDPOS (1,35)	A1	STRAIGHT STRAND AT COL.A,ROW 35 Valid code : (See CC. 3)	NA	(1)
8	73	STDPOS (1,36)	A1	STRAIGHT STRAND AT COL.A,ROW 36 Valid code : (See CC. 3)	NA	(1)

Note :

(1) Strand locations from bottom to top of beam are input from left to right (every other card column) on each CARD EIGHT; and from the centerline (vertical axis) of the beam outward on each successive CARD EIGHT. If no strand exists at a possible strand location, that card column is left blank. Only one-half the strand pattern, symmetrical about the centerline of the beam, is input. Refer to Figure 3-3, for strand column and row references for conditions when the centermost strand column is coincidental with the centerline of the beam (IW = 0, 1 or 3 on the LAST BLANK CARD, cc. 22) and when the centermost strand column is one-half strand grid spacing from the centerline (IW = 2 on the LAST BLANK CARD, cc. 22).

FIRST CARD NINE

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
9	1	NTYPE	I1	CARD NO. 9 Valid code : 9	NA	
9	2 thru 80	STDSHD (1,J)	FREE	STRAIGHT STRAND DEBOND LENGTH AT COL.A, ROW (J) Valid Code : See Note (1)	NA	(1)

NOTE :

(1) Length of strand debonding material, in feet, with decimal points, from the centerline of bearing are input sequentially with at least one (1) blank space (cc.) between adjacent entries. Only the same number of entries as input values of "S" on the preceeding CARD EIGHT are permitted. Trailing zeroes are not required. The row number, (J), is assigned according to the corresponding sequential order of input "S" values from the preceeding CARD EIGHT.

EXAMPLE :

```
9  2.15  6.7  11.  15.3958
```

SECOND CARD EIGHT

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	1	NTYPE	I1	CARD NO. 8 Valid code : 8	NA	
8	3	STDPOS (2,1)	A1	STRAIGHT STRAND AT COL.B, ROW 1 Valid code Blank : No Strand X : Bonded Strand S : Debonded Strand	NA	(1)
8	5	STDPOS (2,2)	A1	STRAIGHT STRAND AT COL.B, ROW 2 Valid code : (See CC. 3)	NA	(1)
8	7	STDPOS (2,3)	A1	STRAIGHT STRAND AT COL.B, ROW 3 Valid code : (See CC. 3)	NA	(1)
8	9	STDPOS (2,4)	A1	STRAIGHT STRAND AT COL.B, ROW 4 Valid code : (See CC. 3)	NA	(1)
8	11	STDPOS (2,5)	A1	STRAIGHT STRAND AT COL.B, ROW 5 Valid code : (See CC. 3)	NA	(1)
8	13	STDPOS (2,6)	A1	STRAIGHT STRAND AT COL.B, ROW 6 Valid code : (See CC. 3)	NA	(1)
8	15	STDPOS (2,7)	A1	STRAIGHT STRAND AT COL.B, ROW 7 Valid code : (See CC. 3)	NA	(1)
8	17	STDPOS (2,8)	A1	STRAIGHT STRAND AT COL.B, ROW 8 Valid code : (See CC. 3)	NA	(1)
8	19	STDPOS (2,9)	A1	STRAIGHT STRAND AT COL.B, ROW 9 Valid code : (See CC. 3)	NA	(1)
8	21	STDPOS (2,10)	A1	STRAIGHT STRAND AT COL.B,ROW 10 Valid code : (See CC. 3)	NA	(1)
8	23	STDPOS (2,11)	A1	STRAIGHT STRAND AT COL.B,ROW 11 Valid code : (See CC. 3)	NA	(1)
8	25	STDPOS (2,12)	A1	STRAIGHT STRAND AT COL.B,ROW 12 Valid code : (See CC. 3)	NA	(1)
8	27	STDPOS (2,13)	A1	STRAIGHT STRAND AT COL.B,ROW 13 Valid code : (See CC. 3)	NA	(1)
8	29	STDPOS (2,14)	A1	STRAIGHT STRAND AT COL.B,ROW 14 Valid code : (See CC. 3)	NA	(1)
8	31	STDPOS (2,15)	A1	STRAIGHT STRAND AT COL.B,ROW 15 Valid code : (See CC. 3)	NA	(1)

SECOND CARD EIGHT (CONTINUED)

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	33	STDPOS (2,16)	A1	STRAIGHT STRAND AT COL.B,ROW 16 Valid code : (See CC. 3)	NA	(1)
8	35	STDPOS (2,17)	A1	STRAIGHT STRAND AT COL.B,ROW 17 Valid code : (See CC. 3)	NA	(1)
8	37	STDPOS (2,18)	A1	STRAIGHT STRAND AT COL.B,ROW 18 Valid code : (See CC. 3)	NA	(1)
8	39	STDPOS (2,19)	A1	STRAIGHT STRAND AT COL.B,ROW 19 Valid code : (See CC. 3)	NA	(1)
8	41	STDPOS (2,20)	A1	STRAIGHT STRAND AT COL.B,ROW 20 Valid code : (See CC. 3)	NA	(1)
8	43	STDPOS (2,21)	A1	STRAIGHT STRAND AT COL.B,ROW 21 Valid code : (See CC. 3)	NA	(1)
8	45	STDPOS (2,22)	A1	STRAIGHT STRAND AT COL.B,ROW 22 Valid code : (See CC. 3)	NA	(1)
8	47	STDPOS (2,23)	A1	STRAIGHT STRAND AT COL.B,ROW 23 Valid code : (See CC. 3)	NA	(1)
8	49	STDPOS (2,24)	A1	STRAIGHT STRAND AT COL.B,ROW 24 Valid code : (See CC. 3)	NA	(1)
8	51	STDPOS (2,25)	A1	STRAIGHT STRAND AT COL.B,ROW 25 Valid code : (See CC. 3)	NA	(1)
8	53	STDPOS (2,26)	A1	STRAIGHT STRAND AT COL.B,ROW 26 Valid code : (See CC. 3)	NA	(1)
8	55	STDPOS (2,27)	A1	STRAIGHT STRAND AT COL.B,ROW 27 Valid code : (See CC. 3)	NA	(1)
8	57	STDPOS (2,28)	A1	STRAIGHT STRAND AT COL.B,ROW 28 Valid code : (See CC. 3)	NA	(1)
8	59	STDPOS (2,29)	A1	STRAIGHT STRAND AT COL.B,ROW 29 Valid code : (See CC. 3)	NA	(1)
8	61	STDPOS (2,30)	A1	STRAIGHT STRAND AT COL.B,ROW 30 Valid code : (See CC. 3)	NA	(1)
8	63	STDPOS (2,31)	A1	STRAIGHT STRAND AT COL.B,ROW 31 Valid code : (See CC. 3)	NA	(1)
8	65	STDPOS (2,32)	A1	STRAIGHT STRAND AT COL.B,ROW 32 Valid code : (See CC. 3)	NA	(1)

SECOND CARD EIGHT (CONTINUED)

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	67	STDPOS (2,33)	A1	STRAIGHT STRAND AT COL.B,ROW 33 Valid code : (See CC. 3)	NA	(1)
8	69	STDPOS (2,34)	A1	STRAIGHT STRAND AT COL.B,ROW 34 Valid code : (See CC. 3)	NA	(1)
8	71	STDPOS (2,35)	A1	STRAIGHT STRAND AT COL.B,ROW 35 Valid code : (See CC. 3)	NA	(1)
8	73	STDPOS (2,36)	A1	STRAIGHT STRAND AT COL.B,ROW 36 Valid code : (See CC. 3)	NA	(1)

Note :

(1) Strand locations from bottom to top of beam are input from left to right (every other card column) on each CARD EIGHT; and from the centerline (vertical axis) of the beam outward on each successive CARD EIGHT. If no strand exists at a possible strand location, that card column is left blank. Only one-half the strand pattern, symmetrical about the centerline of the beam, is input. Refer to Figure 3-3, for strand column and row references for conditions when the centermost strand column is coincidental with the centerline of the beam (IW = 0, 1 or 3 on the LAST BLANK CARD, cc. 22) and when the centermost strand column is one-half strand grid spacing from the centerline (IW = 2 on the LAST BLANK CARD, cc. 22).

SECOND CARD NINE

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
9	1	NTYPE	I1	CARD NO. 9 Valid code : 9	NA	
9	2 thru 80	STDSHD (2,J)	FREE	STRAIGHT STRAND DEBOND LENGTH AT COL.B, ROW (J) Valid Code : See Note (1)	NA	(1)

NOTE :

(1) Length of strand debonding material, in feet, with decimal points, from the centerline of bearing are input sequentially with at least one (1) blank space (cc.) between adjacent entries. Only the same number of entries as input values of "S" on the preceeding CARD EIGHT are permitted. Trailing zeroes are not required. The row number, (J), is assigned according to the corresponding sequential order of input "S" values from the preceeding CARD EIGHT.

EXAMPLE :

```
9  2.15  6.7  11.  15.3958
```

THIRD CARD EIGHT

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	1	NTYPE	I1	CARD NO. 8 Valid code : 8	NA	
8	3	STDPOS (3,1)	A1	STRAIGHT STRAND AT COL.C, ROW 1 Valid code Blank : No Strand X : Bonded Strand S : Debonded Strand	NA	(1)
8	5	STDPOS (3,2)	A1	STRAIGHT STRAND AT COL.C, ROW 2 Valid code : (See CC. 3)	NA	(1)
8	7	STDPOS (3,3)	A1	STRAIGHT STRAND AT COL.C, ROW 3 Valid code : (See CC. 3)	NA	(1)
8	9	STDPOS (3,4)	A1	STRAIGHT STRAND AT COL.C, ROW 4 Valid code : (See CC. 3)	NA	(1)
8	11	STDPOS (3,5)	A1	STRAIGHT STRAND AT COL.C, ROW 5 Valid code : (See CC. 3)	NA	(1)
8	13	STDPOS (3,6)	A1	STRAIGHT STRAND AT COL.C, ROW 6 Valid code : (See CC. 3)	NA	(1)
8	15	STDPOS (3,7)	A1	STRAIGHT STRAND AT COL.C, ROW 7 Valid code : (See CC. 3)	NA	(1)
8	17	STDPOS (3,8)	A1	STRAIGHT STRAND AT COL.C, ROW 8 Valid code : (See CC. 3)	NA	(1)
8	19	STDPOS (3,9)	A1	STRAIGHT STRAND AT COL.C, ROW 9 Valid code : (See CC. 3)	NA	(1)
8	21	STDPOS (3,10)	A1	STRAIGHT STRAND AT COL.C,ROW 10 Valid code : (See CC. 3)	NA	(1)
8	23	STDPOS (3,11)	A1	STRAIGHT STRAND AT COL.C,ROW 11 Valid code : (See CC. 3)	NA	(1)
8	25	STDPOS (3,12)	A1	STRAIGHT STRAND AT COL.C,ROW 12 Valid code : (See CC. 3)	NA	(1)
8	27	STDPOS (3,13)	A1	STRAIGHT STRAND AT COL.C,ROW 13 Valid code : (See CC. 3)	NA	(1)
8	29	STDPOS (3,14)	A1	STRAIGHT STRAND AT COL.C,ROW 14 Valid code : (See CC. 3)	NA	(1)
8	31	STDPOS (3,15)	A1	STRAIGHT STRAND AT COL.C,ROW 15 Valid code : (See CC. 3)	NA	(1)

THIRD CARD EIGHT (CONTINUED)

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	33	STDPOS (3,16)	A1	STRAIGHT STRAND AT COL.C,ROW 16 Valid code : (See CC. 3)	NA	(1)
8	35	STDPOS (3,17)	A1	STRAIGHT STRAND AT COL.C,ROW 17 Valid code : (See CC. 3)	NA	(1)
8	37	STDPOS (3,18)	A1	STRAIGHT STRAND AT COL.C,ROW 18 Valid code : (See CC. 3)	NA	(1)
8	39	STDPOS (3,19)	A1	STRAIGHT STRAND AT COL.C,ROW 19 Valid code : (See CC. 3)	NA	(1)
8	41	STDPOS (3,20)	A1	STRAIGHT STRAND AT COL.C,ROW 20 Valid code : (See CC. 3)	NA	(1)
8	43	STDPOS (3,21)	A1	STRAIGHT STRAND AT COL.C,ROW 21 Valid code : (See CC. 3)	NA	(1)
8	45	STDPOS (3,22)	A1	STRAIGHT STRAND AT COL.C,ROW 22 Valid code : (See CC. 3)	NA	(1)
8	47	STDPOS (3,23)	A1	STRAIGHT STRAND AT COL.C,ROW 23 Valid code : (See CC. 3)	NA	(1)
8	49	STDPOS (3,24)	A1	STRAIGHT STRAND AT COL.C,ROW 24 Valid code : (See CC. 3)	NA	(1)
8	51	STDPOS (3,25)	A1	STRAIGHT STRAND AT COL.C,ROW 25 Valid code : (See CC. 3)	NA	(1)
8	53	STDPOS (3,26)	A1	STRAIGHT STRAND AT COL.C,ROW 26 Valid code : (See CC. 3)	NA	(1)
8	55	STDPOS (3,27)	A1	STRAIGHT STRAND AT COL.C,ROW 27 Valid code : (See CC. 3)	NA	(1)
8	57	STDPOS (3,28)	A1	STRAIGHT STRAND AT COL.C,ROW 28 Valid code : (See CC. 3)	NA	(1)
8	59	STDPOS (3,29)	A1	STRAIGHT STRAND AT COL.C,ROW 29 Valid code : (See CC. 3)	NA	(1)
8	61	STDPOS (3,30)	A1	STRAIGHT STRAND AT COL.C,ROW 30 Valid code : (See CC. 3)	NA	(1)
8	63	STDPOS (3,31)	A1	STRAIGHT STRAND AT COL.C,ROW 31 Valid code : (See CC. 3)	NA	(1)
8	65	STDPOS (3,32)	A1	STRAIGHT STRAND AT COL.C,ROW 32 Valid code : (See CC. 3)	NA	(1)

THIRD CARD EIGHT (CONTINUED)

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	67	STDPOS (3,33)	A1	STRAIGHT STRAND AT COL.C,ROW 33 Valid code : (See CC. 3)	NA	(1)
8	69	STDPOS (3,34)	A1	STRAIGHT STRAND AT COL.C,ROW 34 Valid code : (See CC. 3)	NA	(1)
8	71	STDPOS (3,35)	A1	STRAIGHT STRAND AT COL.C,ROW 35 Valid code : (See CC. 3)	NA	(1)
8	73	STDPOS (3,36)	A1	STRAIGHT STRAND AT COL.C,ROW 36 Valid code : (See CC. 3)	NA	(1)

Note :

(1) Strand locations from bottom to top of beam are input from left to right (every other card column) on each CARD EIGHT; and from the centerline (vertical axis) of the beam outward on each successive CARD EIGHT. If no strand exists at a possible strand location, that card column is left blank. Only one-half the strand pattern, symmetrical about the centerline of the beam, is input. Refer to Figure 3-3, for strand column and row references for conditions when the centermost strand column is coincidental with the centerline of the beam (IW = 0, 1 or 3 on the LAST BLANK CARD, cc. 22) and when the centermost strand column is one-half strand grid spacing from the centerline (IW = 2 on the LAST BLANK CARD, cc. 22).

THIRD CARD NINE

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
9	1	NTYPE	I1	CARD NO. 9 Valid code : 9	NA	
9	2 thru 80	STDSHD (3,J)	FREE	STRAIGHT STRAND DEBOND LENGTH AT COL.C, ROW (J) Valid Code : See Note (1)	NA	(1)

NOTE :

(1) Length of strand debonding material, in feet, with decimal points, from the centerline of bearing are input sequentially with at least one (1) blank space (cc.) between adjacent entries. Only the same number of entries as input values of "S" on the preceeding CARD EIGHT are permitted. Trailing zeroes are not required. The row number, (J), is assigned according to the corresponding sequential order of input "S" values from the preceeding CARD EIGHT.

EXAMPLE :

```
9  2.15  6.7  11.  15.3958
```

FOURTH CARD EIGHT

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	1	NTYPE	I1	CARD NO. 8 Valid code : 8	NA	
8	3	STDPOS (4,1)	A1	STRAIGHT STRAND AT COL.D, ROW 1 Valid code Blank : No Strand X : Bonded Strand S : Debonded Strand	NA	(1)
8	5	STDPOS (4,2)	A1	STRAIGHT STRAND AT COL.D, ROW 2 Valid code : (See CC. 3)	NA	(1)
8	7	STDPOS (4,3)	A1	STRAIGHT STRAND AT COL.D, ROW 3 Valid code : (See CC. 3)	NA	(1)
8	9	STDPOS (4,4)	A1	STRAIGHT STRAND AT COL.D, ROW 4 Valid code : (See CC. 3)	NA	(1)
8	11	STDPOS (4,5)	A1	STRAIGHT STRAND AT COL.D, ROW 5 Valid code : (See CC. 3)	NA	(1)
8	13	STDPOS (4,6)	A1	STRAIGHT STRAND AT COL.D, ROW 6 Valid code : (See CC. 3)	NA	(1)
8	15	STDPOS (4,7)	A1	STRAIGHT STRAND AT COL.D, ROW 7 Valid code : (See CC. 3)	NA	(1)
8	17	STDPOS (1,8)	A1	STRAIGHT STRAND AT COL.D, ROW 8 Valid code : (See CC. 3)	NA	(1)
8	19	STDPOS (4,9)	A1	STRAIGHT STRAND AT COL.D, ROW 9 Valid code : (See CC. 3)	NA	(1)
8	21	STDPOS (4,10)	A1	STRAIGHT STRAND AT COL.D,ROW 10 Valid code : (See CC. 3)	NA	(1)
8	23	STDPOS (4,11)	A1	STRAIGHT STRAND AT COL.D,ROW 11 Valid code : (See CC. 3)	NA	(1)
8	25	STDPOS (4,12)	A1	STRAIGHT STRAND AT COL.D,ROW 12 Valid code : (See CC. 3)	NA	(1)
8	27	STDPOS (4,13)	A1	STRAIGHT STRAND AT COL.D,ROW 13 Valid code : (See CC. 3)	NA	(1)
8	29	STDPOS (4,14)	A1	STRAIGHT STRAND AT COL.D,ROW 14 Valid code : (See CC. 3)	NA	(1)
8	31	STDPOS (4,15)	A1	STRAIGHT STRAND AT COL.D,ROW 15 Valid code : (See CC. 3)	NA	(1)

FOURTH CARD EIGHT (CONTINUED)

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	33	STDPOS (4,16)	A1	STRAIGHT STRAND AT COL.D,ROW 16 Valid code : (See CC. 3)	NA	(1)
8	35	STDPOS (4,17)	A1	STRAIGHT STRAND AT COL.D,ROW 17 Valid code : (See CC. 3)	NA	(1)
8	37	STDPOS (4,18)	A1	STRAIGHT STRAND AT COL.D,ROW 18 Valid code : (See CC. 3)	NA	(1)
8	39	STDPOS (4,19)	A1	STRAIGHT STRAND AT COL.D,ROW 19 Valid code : (See CC. 3)	NA	(1)
8	41	STDPOS (4,20)	A1	STRAIGHT STRAND AT COL.D,ROW 20 Valid code : (See CC. 3)	NA	(1)
8	43	STDPOS (4,21)	A1	STRAIGHT STRAND AT COL.D,ROW 21 Valid code : (See CC. 3)	NA	(1)
8	45	STDPOS (4,22)	A1	STRAIGHT STRAND AT COL.D,ROW 22 Valid code : (See CC. 3)	NA	(1)
8	47	STDPOS (4,23)	A1	STRAIGHT STRAND AT COL.D,ROW 23 Valid code : (See CC. 3)	NA	(1)
8	49	STDPOS (4,24)	A1	STRAIGHT STRAND AT COL.D,ROW 24 Valid code : (See CC. 3)	NA	(1)
8	51	STDPOS (4,25)	A1	STRAIGHT STRAND AT COL.D,ROW 25 Valid code : (See CC. 3)	NA	(1)
8	53	STDPOS (4,26)	A1	STRAIGHT STRAND AT COL.D,ROW 26 Valid code : (See CC. 3)	NA	(1)
8	55	STDPOS (4,27)	A1	STRAIGHT STRAND AT COL.A,ROW 27 Valid code : (See CC. 3)	NA	(1)
8	57	STDPOS (4,28)	A1	STRAIGHT STRAND AT COL.D,ROW 28 Valid code : (See CC. 3)	NA	(1)
8	59	STDPOS (4,29)	A1	STRAIGHT STRAND AT COL.D,ROW 29 Valid code : (See CC. 3)	NA	(1)
8	61	STDPOS (4,30)	A1	STRAIGHT STRAND AT COL.D,ROW 30 Valid code : (See CC. 3)	NA	(1)
8	63	STDPOS (4,31)	A1	STRAIGHT STRAND AT COL.D,ROW 31 Valid code : (See CC. 3)	NA	(1)
8	65	STDPOS (4,32)	A1	STRAIGHT STRAND AT COL.D,ROW 32 Valid code : (See CC. 3)	NA	(1)

FOURTH CARD EIGHT (CONTINUED)

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	67	STDPOS (4,33)	A1	STRAIGHT STRAND AT COL.D,ROW 33 Valid code : (See CC. 3)	NA	(1)
8	69	STDPOS (4,34)	A1	STRAIGHT STRAND AT COL.D,ROW 34 Valid code : (See CC. 3)	NA	(1)
8	71	STDPOS (4,35)	A1	STRAIGHT STRAND AT COL.D,ROW 35 Valid code : (See CC. 3)	NA	(1)
8	73	STDPOS (4,36)	A1	STRAIGHT STRAND AT COL.D,ROW 36 Valid code : (See CC. 3)	NA	(1)

Note :

(1) Strand locations from bottom to top of beam are input from left to right (every other card column) on each CARD EIGHT; and from the centerline (vertical axis) of the beam outward on each successive CARD EIGHT. If no strand exists at a possible strand location, that card column is left blank. Only one-half the strand pattern, symmetrical about the centerline of the beam, is input. Refer to Figure 3-3 for strand column and row references for conditions when the centermost strand column is coincidental with the centerline of the beam (IW = 0, 1 or 3 on the LAST BLANK CARD, cc. 22) and when the centermost strand column is one-half strand grid spacing from the centerline (IW = 2 on the LAST BLANK CARD, cc. 22).

FOURTH CARD NINE

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
9	1	NTYPE	I1	CARD NO. 9 Valid code : 9	NA	
9	2 thru 80	STDSHD (4,J)	FREE	STRAIGHT STRAND DEBOND LENGTH AT COL.D, ROW (J) Valid Code : See Note (1)	NA	(1)

NOTE :

(1) Length of strand debonding material, in feet, with decimal points, from the centerline of bearing are input sequentially with at least one (1) blank space (cc.) between adjacent entries. Only the same number of entries as input values of "S" on the preceeding CARD EIGHT are permitted. Trailing zeroes are not required. The row number, (J), is assigned according to the corresponding sequential order of input "S" values from the preceeding CARD EIGHT.

EXAMPLE :

9 2.15 6.7 11. 15.3958

FIFTH CARD EIGHT

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	1	NTYPE	I1	CARD NO. 8 Valid code : 8	NA	
8	3	STDPOS (5,1)	A1	STRAIGHT STRAND AT COL.E, ROW 1 Valid code Blank : No Strand X : Bonded Strand S : Debonded Strand	NA	(1)
8	5	STDPOS (5,2)	A1	STRAIGHT STRAND AT COL.E, ROW 2 Valid code : (See CC. 3)	NA	(1)
8	7	STDPOS (5,3)	A1	STRAIGHT STRAND AT COL.E, ROW 3 Valid code : (See CC. 3)	NA	(1)
8	9	STDPOS (5,4)	A1	STRAIGHT STRAND AT COL.E, ROW 4 Valid code : (See CC. 3)	NA	(1)
8	11	STDPOS (5,5)	A1	STRAIGHT STRAND AT COL.E, ROW 5 Valid code : (See CC. 3)	NA	(1)
8	13	STDPOS (5,6)	A1	STRAIGHT STRAND AT COL.E, ROW 6 Valid code : (See CC. 3)	NA	(1)
8	15	STDPOS (5,7)	A1	STRAIGHT STRAND AT COL.E, ROW 7 Valid code : (See CC. 3)	NA	(1)
8	17	STDPOS (5,8)	A1	STRAIGHT STRAND AT COL.E, ROW 8 Valid code : (See CC. 3)	NA	(1)
8	19	STDPOS (5,9)	A1	STRAIGHT STRAND AT COL.E, ROW 9 Valid code : (See CC. 3)	NA	(1)
8	21	STDPOS (5,10)	A1	STRAIGHT STRAND AT COL.E,ROW 10 Valid code : (See CC. 3)	NA	(1)
8	23	STDPOS (1,11)	A1	STRAIGHT STRAND AT COL.E,ROW 11 Valid code : (See CC. 3)	NA	(1)
8	25	STDPOS (5,12)	A1	STRAIGHT STRAND AT COL.E,ROW 12 Valid code : (See CC. 3)	NA	(1)
8	27	STDPOS (5,13)	A1	STRAIGHT STRAND AT COL.E,ROW 13 Valid code : (See CC. 3)	NA	(1)
8	29	STDPOS (5,14)	A1	STRAIGHT STRAND AT COL.E,ROW 14 Valid code : (See CC. 3)	NA	(1)
8	31	STDPOS (5,15)	A1	STRAIGHT STRAND AT COL.E,ROW 15 Valid code : (See CC. 3)	NA	(1)

FIFTH CARD EIGHT (CONTINUED)

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	33	STDPOS (5,16)	A1	STRAIGHT STRAND AT COL.E,ROW 16 Valid code : (See CC. 3)	NA	(1)
8	35	STDPOS (5,17)	A1	STRAIGHT STRAND AT COL.E,ROW 17 Valid code : (See CC. 3)	NA	(1)
8	37	STDPOS (5,18)	A1	STRAIGHT STRAND AT COL.E,ROW 18 Valid code : (See CC. 3)	NA	(1)
8	39	STDPOS (5,19)	A1	STRAIGHT STRAND AT COL.E,ROW 19 Valid code : (See CC. 3)	NA	(1)
8	41	STDPOS (5,20)	A1	STRAIGHT STRAND AT COL.E,ROW 20 Valid code : (See CC. 3)	NA	(1)
8	43	STDPOS (5,21)	A1	STRAIGHT STRAND AT COL.E,ROW 21 Valid code : (See CC. 3)	NA	(1)
8	45	STDPOS (5,22)	A1	STRAIGHT STRAND AT COL.E,ROW 22 Valid code : (See CC. 3)	NA	(1)
8	47	STDPOS (5,23)	A1	STRAIGHT STRAND AT COL.E,ROW 23 Valid code : (See CC. 3)	NA	(1)
8	49	STDPOS (5,24)	A1	STRAIGHT STRAND AT COL.E,ROW 24 Valid code : (See CC. 3)	NA	(1)
8	51	STDPOS (5,25)	A1	STRAIGHT STRAND AT COL.E,ROW 25 Valid code : (See CC. 3)	NA	(1)
8	53	STDPOS (5,26)	A1	STRAIGHT STRAND AT COL.E,ROW 26 Valid code : (See CC. 3)	NA	(1)
8	55	STDPOS (5,27)	A1	STRAIGHT STRAND AT COL.E,ROW 27 Valid code : (See CC. 3)	NA	(1)
8	57	STDPOS (5,28)	A1	STRAIGHT STRAND AT COL.E,ROW 28 Valid code : (See CC. 3)	NA	(1)
8	59	STDPOS (5,29)	A1	STRAIGHT STRAND AT COL.E,ROW 29 Valid code : (See CC. 3)	NA	(1)
8	61	STDPOS (5,30)	A1	STRAIGHT STRAND AT COL.E,ROW 30 Valid code : (See CC. 3)	NA	(1)
8	63	STDPOS (5,31)	A1	STRAIGHT STRAND AT COL.E,ROW 31 Valid code : (See CC. 3)	NA	(1)
8	65	STDPOS (5,32)	A1	STRAIGHT STRAND AT COL.E,ROW 32 Valid code : (See CC. 3)	NA	(1)

FIFTH CARD EIGHT (CONTINUED)

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	67	STDPOS (5,33)	A1	STRAIGHT STRAND AT COL.E,ROW 33 Valid code : (See CC. 3)	NA	(1)
8	69	STDPOS (5,34)	A1	STRAIGHT STRAND AT COL.E,ROW 34 Valid code : (See CC. 3)	NA	(1)
8	71	STDPOS (5,35)	A1	STRAIGHT STRAND AT COL.E,ROW 35 Valid code : (See CC. 3)	NA	(1)
8	73	STDPOS (5,36)	A1	STRAIGHT STRAND AT COL.E,ROW 36 Valid code : (See CC. 3)	NA	(1)

Note :

(1) Strand locations from bottom to top of beam are input from left to right (every other card column) on each CARD EIGHT; and from the centerline (vertical axis) of the beam outward on each successive CARD EIGHT. If no strand exists at a possible strand location, that card column is left blank. Only one-half the strand pattern, symmetrical about the centerline of the beam, is input. Refer to Figure 3-3 for strand column and row references for conditions when the centermost strand column is coincidental with the centerline of the beam (IW = 0, 1 or 3 on the LAST BLANK CARD, cc. 22) and when the centermost strand column is one-half strand grid spacing from the centerline (IW = 2 on the LAST BLANK CARD, cc. 22).

FIFTH CARD NINE

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
9	1	NTYPE	I1	CARD NO. 9 Valid code : 9	NA	
9	2 thru 80	STDSHD (5,J)	FREE	STRAIGHT STRAND DEBOND LENGTH AT COL.E, ROW (J) Valid Code : See Note (1)	NA	(1)

NOTE :

(1) Length of strand debonding material, in feet, with decimal points, from the centerline of bearing are input sequentially with at least one (1) blank space (cc.) between adjacent entries. Only the same number of entries as input values of "S" on the preceeding CARD EIGHT are permitted. Trailing zeroes are not required. The row number, (J), is assigned according to the corresponding sequential order of input "S" values from the preceeding CARD EIGHT.

EXAMPLE :

```
9  2.15  6.7  11.  15.3958
```

SIXTH CARD EIGHT

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	1	NTYPE	I1	CARD NO. 8 Valid code : 8	NA	
8	3	STDPOS (6,1)	A1	STRAIGHT STRAND AT COL.F, ROW 1 Valid code Blank : No Strand X : Bonded Strand S : Debonded Strand	NA	(1)
8	5	STDPOS (6,2)	A1	STRAIGHT STRAND AT COL.F, ROW 2 Valid code : (See CC. 3)	NA	(1)
8	7	STDPOS (6,3)	A1	STRAIGHT STRAND AT COL.F, ROW 3 Valid code : (See CC. 3)	NA	(1)
8	9	STDPOS (6,4)	A1	STRAIGHT STRAND AT COL.F, ROW 4 Valid code : (See CC. 3)	NA	(1)
8	11	STDPOS (6,5)	A1	STRAIGHT STRAND AT COL.F, ROW 5 Valid code : (See CC. 3)	NA	(1)
8	13	STDPOS (6,6)	A1	STRAIGHT STRAND AT COL.F, ROW 6 Valid code : (See CC. 3)	NA	(1)
8	15	STDPOS (6,7)	A1	STRAIGHT STRAND AT COL.F, ROW 7 Valid code : (See CC. 3)	NA	(1)
8	17	STDPOS (6,8)	A1	STRAIGHT STRAND AT COL.F, ROW 8 Valid code : (See CC. 3)	NA	(1)
8	19	STDPOS (6,9)	A1	STRAIGHT STRAND AT COL.F, ROW 9 Valid code : (See CC. 3)	NA	(1)
8	21	STDPOS (6,10)	A1	STRAIGHT STRAND AT COL.F,ROW 10 Valid code : (See CC. 3)	NA	(1)
8	23	STDPOS (6,11)	A1	STRAIGHT STRAND AT COL.F,ROW 11 Valid code : (See CC. 3)	NA	(1)
8	25	STDPOS (6,12)	A1	STRAIGHT STRAND AT COL.F,ROW 12 Valid code : (See CC. 3)	NA	(1)
8	27	STDPOS (6,13)	A1	STRAIGHT STRAND AT COL.F,ROW 13 Valid code : (See CC. 3)	NA	(1)
8	29	STDPOS (6,14)	A1	STRAIGHT STRAND AT COL.F,ROW 14 Valid code : (See CC. 3)	NA	(1)
8	31	STDPOS (6,15)	A1	STRAIGHT STRAND AT COL.F,ROW 15 Valid code : (See CC. 3)	NA	(1)

SIXTH CARD EIGHT (CONTINUED)

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	33	STDPOS (6,16)	A1	STRAIGHT STRAND AT COL.F,ROW 16 Valid code : (See CC. 3)	NA	(1)
8	35	STDPOS (6,17)	A1	STRAIGHT STRAND AT COL.F,ROW 17 Valid code : (See CC. 3)	NA	(1)
8	37	STDPOS (6,18)	A1	STRAIGHT STRAND AT COL.F,ROW 18 Valid code : (See CC. 3)	NA	(1)
8	39	STDPOS (6,19)	A1	STRAIGHT STRAND AT COL.F,ROW 19 Valid code : (See CC. 3)	NA	(1)
8	41	STDPOS (6,20)	A1	STRAIGHT STRAND AT COL.F,ROW 20 Valid code : (See CC. 3)	NA	(1)
8	43	STDPOS (6,21)	A1	STRAIGHT STRAND AT COL.F,ROW 21 Valid code : (See CC. 3)	NA	(1)
8	45	STDPOS (6,22)	A1	STRAIGHT STRAND AT COL.F,ROW 22 Valid code : (See CC. 3)	NA	(1)
8	47	STDPOS (6,23)	A1	STRAIGHT STRAND AT COL.F,ROW 23 Valid code : (See CC. 3)	NA	(1)
8	49	STDPOS (6,24)	A1	STRAIGHT STRAND AT COL.F,ROW 24 Valid code : (See CC. 3)	NA	(1)
8	51	STDPOS (6,25)	A1	STRAIGHT STRAND AT COL.F,ROW 25 Valid code : (See CC. 3)	NA	(1)
8	53	STDPOS (6,26)	A1	STRAIGHT STRAND AT COL.F,ROW 26 Valid code : (See CC. 3)	NA	(1)
8	55	STDPOS (6,27)	A1	STRAIGHT STRAND AT COL.F,ROW 27 Valid code : (See CC. 3)	NA	(1)
8	57	STDPOS (6,28)	A1	STRAIGHT STRAND AT COL.F,ROW 28 Valid code : (See CC. 3)	NA	(1)
8	59	STDPOS (6,29)	A1	STRAIGHT STRAND AT COL.F,ROW 29 Valid code : (See CC. 3)	NA	(1)
8	61	STDPOS (6,30)	A1	STRAIGHT STRAND AT COL.F,ROW 30 Valid code : (See CC. 3)	NA	(1)
8	63	STDPOS (6,31)	A1	STRAIGHT STRAND AT COL.F,ROW 31 Valid code : (See CC. 3)	NA	(1)
8	65	STDPOS (6,32)	A1	STRAIGHT STRAND AT COL.F,ROW 32 Valid code : (See CC. 3)	NA	(1)

SIXTH CARD EIGHT (CONTINUED)

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	67	STDPOS (6,33)	A1	STRAIGHT STRAND AT COL.F,ROW 33 Valid code : (See CC. 3)	NA	(1)
8	69	STDPOS (6,34)	A1	STRAIGHT STRAND AT COL.F,ROW 34 Valid code : (See CC. 3)	NA	(1)
8	71	STDPOS (6,35)	A1	STRAIGHT STRAND AT COL.F,ROW 35 Valid code : (See CC. 3)	NA	(1)
8	73	STDPOS (6,36)	A1	STRAIGHT STRAND AT COL.F,ROW 36 Valid code : (See CC. 3)	NA	(1)

Note :

(1) Strand locations from bottom to top of beam are input from left to right (every other card column) on each CARD EIGHT; and from the centerline (vertical axis) of the beam outward on each successive CARD EIGHT. If no strand exists at a possible strand location, that card column is left blank. Only one-half the strand pattern, symmetrical about the centerline of the beam, is input. Refer to Figure 3-3, for strand column and row references for conditions when the centermost strand column is coincidental with the centerline of the beam (IW = 0, 1 or 3 on the LAST BLANK CARD, cc. 22) and when the centermost strand column is one-half strand grid spacing from the centerline (IW = 2 on the LAST BLANK CARD, cc. 22).

SIXTH CARD NINE

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
9	1	NTYPE	I1	CARD NO. 9 Valid code : 9	NA	
9	2 thru 80	STDSHD (6,J)	FREE	STRAIGHT STRAND DEBOND LENGTH AT COL.F, ROW (J) Valid Code : See Note (1)	NA	(1)

NOTE :

(1) Length of strand debonding material, in feet, with decimal points, from the centerline of bearing are input sequentially with at least one (1) blank space (cc.) between adjacent entries. Only the same number of entries as input values of "S" on the preceeding CARD EIGHT are permitted. Trailing zeroes are not required. The row number, (J), is assigned according to the corresponding sequential order of input "S" values from the preceeding CARD EIGHT.

EXAMPLE :

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9  2.15  6.7  11.  15.3958
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SEVENTH CARD EIGHT

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	1	NTYPE	I1	CARD NO. 8 Valid code : 8	NA	
8	3	STDPOS (7,1)	A1	STRAIGHT STRAND AT COL.G, ROW 1 Valid code Blank : No Strand X : Bonded Strand S : Debonded Strand	NA	(1)
8	5	STDPOS (7,2)	A1	STRAIGHT STRAND AT COL.G, ROW 2 Valid code : (See CC. 3)	NA	(1)
8	7	STDPOS (7,3)	A1	STRAIGHT STRAND AT COL.G, ROW 3 Valid code : (See CC. 3)	NA	(1)
8	9	STDPOS (7,4)	A1	STRAIGHT STRAND AT COL.G, ROW 4 Valid code : (See CC. 3)	NA	(1)
8	11	STDPOS (7,5)	A1	STRAIGHT STRAND AT COL.G, ROW 5 Valid code : (See CC. 3)	NA	(1)
8	13	STDPOS (1,6)	A1	STRAIGHT STRAND AT COL.G, ROW 6 Valid code : (See CC. 3)	NA	(1)
8	15	STDPOS (7,7)	A1	STRAIGHT STRAND AT COL.G, ROW 7 Valid code : (See CC. 3)	NA	(1)
8	17	STDPOS (7,8)	A1	STRAIGHT STRAND AT COL.G, ROW 8 Valid code : (See CC. 3)	NA	(1)
8	19	STDPOS (7,9)	A1	STRAIGHT STRAND AT COL.G, ROW 9 Valid code : (See CC. 3)	NA	(1)
8	21	STDPOS (7,10)	A1	STRAIGHT STRAND AT COL.G,ROW 10 Valid code : (See CC. 3)	NA	(1)
8	23	STDPOS (7,11)	A1	STRAIGHT STRAND AT COL.G,ROW 11 Valid code : (See CC. 3)	NA	(1)
8	25	STDPOS (7,12)	A1	STRAIGHT STRAND AT COL.G,ROW 12 Valid code : (See CC. 3)	NA	(1)
8	27	STDPOS (7,13)	A1	STRAIGHT STRAND AT COL.G,ROW 13 Valid code : (See CC. 3)	NA	(1)
8	29	STDPOS (7,14)	A1	STRAIGHT STRAND AT COL.G,ROW 14 Valid code : (See CC. 3)	NA	(1)
8	31	STDPOS (7,15)	A1	STRAIGHT STRAND AT COL.G,ROW 15 Valid code : (See CC. 3)	NA	(1)

SEVENTH CARD EIGHT (CONTINUED)

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	33	STDPOS (7,16)	A1	STRAIGHT STRAND AT COL.G,ROW 16 Valid code : (See CC. 3)	NA	(1)
8	35	STDPOS (7,17)	A1	STRAIGHT STRAND AT COL.G,ROW 17 Valid code : (See CC. 3)	NA	(1)
8	37	STDPOS (7,18)	A1	STRAIGHT STRAND AT COL.G,ROW 18 Valid code : (See CC. 3)	NA	(1)
8	39	STDPOS (7,19)	A1	STRAIGHT STRAND AT COL.G,ROW 19 Valid code : (See CC. 3)	NA	(1)
8	41	STDPOS (7,20)	A1	STRAIGHT STRAND AT COL.G,ROW 20 Valid code : (See CC. 3)	NA	(1)
8	43	STDPOS (7,21)	A1	STRAIGHT STRAND AT COL.G,ROW 21 Valid code : (See CC. 3)	NA	(1)
8	45	STDPOS (7,22)	A1	STRAIGHT STRAND AT COL.G,ROW 22 Valid code : (See CC. 3)	NA	(1)
8	47	STDPOS (7,23)	A1	STRAIGHT STRAND AT COL.G,ROW 23 Valid code : (See CC. 3)	NA	(1)
8	49	STDPOS (7,24)	A1	STRAIGHT STRAND AT COL.G,ROW 24 Valid code : (See CC. 3)	NA	(1)
8	51	STDPOS (7,25)	A1	STRAIGHT STRAND AT COL.G,ROW 25 Valid code : (See CC. 3)	NA	(1)
8	53	STDPOS (7,26)	A1	STRAIGHT STRAND AT COL.G,ROW 26 Valid code : (See CC. 3)	NA	(1)
8	55	STDPOS (7,27)	A1	STRAIGHT STRAND AT COL.G,ROW 27 Valid code : (See CC. 3)	NA	(1)
8	57	STDPOS (7,28)	A1	STRAIGHT STRAND AT COL.G,ROW 28 Valid code : (See CC. 3)	NA	(1)
8	59	STDPOS (7,29)	A1	STRAIGHT STRAND AT COL.G,ROW 29 Valid code : (See CC. 3)	NA	(1)
8	61	STDPOS (7,30)	A1	STRAIGHT STRAND AT COL.G,ROW 30 Valid code : (See CC. 3)	NA	(1)
8	63	STDPOS (7,31)	A1	STRAIGHT STRAND AT COL.G,ROW 31 Valid code : (See CC. 3)	NA	(1)
8	65	STDPOS (7,32)	A1	STRAIGHT STRAND AT COL.G,ROW 32 Valid code : (See CC. 3)	NA	(1)

SEVENTH CARD EIGHT (CONTINUED)

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	67	STDPOS (7,33)	A1	STRAIGHT STRAND AT COL.G,ROW 33 Valid code : (See CC. 3)	NA	(1)
8	69	STDPOS (7,34)	A1	STRAIGHT STRAND AT COL.G,ROW 34 Valid code : (See CC. 3)	NA	(1)
8	71	STDPOS (7,35)	A1	STRAIGHT STRAND AT COL.G,ROW 35 Valid code : (See CC. 3)	NA	(1)
8	73	STDPOS (7,36)	A1	STRAIGHT STRAND AT COL.G,ROW 36 Valid code : (See CC. 3)	NA	(1)

Note :

(1) Strand locations from bottom to top of beam are input from left to right (every other card column) on each CARD EIGHT; and from the centerline (vertical axis) of the beam outward on each successive CARD EIGHT. If no strand exists at a possible strand location, that card column is left blank. Only one-half the strand pattern, symmetrical about the centerline of the beam, is input. Refer to Figure 3-3, for strand column and row references for conditions when the centermost strand column is coincidental with the centerline of the beam (IW = 0, 1 or 3 on the LAST BLANK CARD, cc. 22) and when the centermost strand column is one-half strand grid spacing from the centerline (IW = 2 on the LAST BLANK CARD, cc. 22).

SEVENTH CARD NINE

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
9	1	NTYPE	I1	CARD NO. 9 Valid code : 9	NA	
9	2 thru 80	STDSHD (7,J)	FREE	STRAIGHT STRAND DEBOND LENGTH AT COL.G, ROW (J) Valid Code : See Note (1)	NA	(1)

NOTE :

(1) Length of strand debonding material, in feet, with decimal points, from the centerline of bearing are input sequentially with at least one (1) blank space (cc.) between adjacent entries. Only the same number of entries as input values of "S" on the preceeding CARD EIGHT are permitted. Trailing zeroes are not required. The row number, (J), is assigned according to the corresponding sequential order of input "S" values from the preceeding CARD EIGHT.

EXAMPLE :

9 2.15 6.7 11. 15.3958

EIGHTH CARD EIGHT

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	1	NTYPE	I1	CARD NO. 8 Valid code : 8	NA	
8	3	STDPOS (8,1)	A1	STRAIGHT STRAND AT COL.H, ROW 1 Valid code Blank : No Strand X : Bonded Strand S : Debonded Strand	NA	(1)
8	5	STDPOS (8,2)	A1	STRAIGHT STRAND AT COL.H, ROW 2 Valid code : (See CC. 3)	NA	(1)
8	7	STDPOS (8,3)	A1	STRAIGHT STRAND AT COL.H, ROW 3 Valid code : (See CC. 3)	NA	(1)
8	9	STDPOS (8,4)	A1	STRAIGHT STRAND AT COL.H, ROW 4 Valid code : (See CC. 3)	NA	(1)
8	11	STDPOS (8,5)	A1	STRAIGHT STRAND AT COL.H, ROW 5 Valid code : (See CC. 3)	NA	(1)
8	13	STDPOS (8,6)	A1	STRAIGHT STRAND AT COL.H, ROW 6 Valid code : (See CC. 3)	NA	(1)
8	15	STDPOS (8,7)	A1	STRAIGHT STRAND AT COL.H, ROW 7 Valid code : (See CC. 3)	NA	(1)
8	17	STDPOS (8,8)	A1	STRAIGHT STRAND AT COL.H, ROW 8 Valid code : (See CC. 3)	NA	(1)
8	19	STDPOS (8,9)	A1	STRAIGHT STRAND AT COL.H, ROW 9 Valid code : (See CC. 3)	NA	(1)
8	21	STDPOS (8,10)	A1	STRAIGHT STRAND AT COL.H,ROW 10 Valid code : (See CC. 3)	NA	(1)
8	23	STDPOS (8,11)	A1	STRAIGHT STRAND AT COL.H,ROW 11 Valid code : (See CC. 3)	NA	(1)
8	25	STDPOS (8,12)	A1	STRAIGHT STRAND AT COL.H,ROW 12 Valid code : (See CC. 3)	NA	(1)
8	27	STDPOS (8,13)	A1	STRAIGHT STRAND AT COL.H,ROW 13 Valid code : (See CC. 3)	NA	(1)
8	29	STDPOS (8,14)	A1	STRAIGHT STRAND AT COL.H,ROW 14 Valid code : (See CC. 3)	NA	(1)
8	31	STDPOS (8,15)	A1	STRAIGHT STRAND AT COL.H,ROW 15 Valid code : (See CC. 3)	NA	(1)

EIGHTH CARD EIGHT (CONTINUED)

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	33	STDPOS (8,16)	A1	STRAIGHT STRAND AT COL.H,ROW 16 Valid code : (See CC. 3)	NA	(1)
8	35	STDPOS (8,17)	A1	STRAIGHT STRAND AT COL.H,ROW 17 Valid code : (See CC. 3)	NA	(1)
8	37	STDPOS (8,18)	A1	STRAIGHT STRAND AT COL.H,ROW 18 Valid code : (See CC. 3)	NA	(1)
8	39	STDPOS (8,19)	A1	STRAIGHT STRAND AT COL.H,ROW 19 Valid code : (See CC. 3)	NA	(1)
8	41	STDPOS (8,20)	A1	STRAIGHT STRAND AT COL.H,ROW 20 Valid code : (See CC. 3)	NA	(1)
8	43	STDPOS (8,21)	A1	STRAIGHT STRAND AT COL.H,ROW 21 Valid code : (See CC. 3)	NA	(1)
8	45	STDPOS (8,22)	A1	STRAIGHT STRAND AT COL.H,ROW 22 Valid code : (See CC. 3)	NA	(1)
8	47	STDPOS (8,23)	A1	STRAIGHT STRAND AT COL.H,ROW 23 Valid code : (See CC. 3)	NA	(1)
8	49	STDPOS (8,24)	A1	STRAIGHT STRAND AT COL.H,ROW 24 Valid code : (See CC. 3)	NA	(1)
8	51	STDPOS (8,25)	A1	STRAIGHT STRAND AT COL.H,ROW 25 Valid code : (See CC. 3)	NA	(1)
8	53	STDPOS (8,26)	A1	STRAIGHT STRAND AT COL.H,ROW 26 Valid code : (See CC. 3)	NA	(1)
8	55	STDPOS (8,27)	A1	STRAIGHT STRAND AT COL.H,ROW 27 Valid code : (See CC. 3)	NA	(1)
8	57	STDPOS (8,28)	A1	STRAIGHT STRAND AT COL.H,ROW 28 Valid code : (See CC. 3)	NA	(1)
8	59	STDPOS (8,29)	A1	STRAIGHT STRAND AT COL.H,ROW 29 Valid code : (See CC. 3)	NA	(1)
8	61	STDPOS (8,30)	A1	STRAIGHT STRAND AT COL.H,ROW 30 Valid code : (See CC. 3)	NA	(1)
8	63	STDPOS (8,31)	A1	STRAIGHT STRAND AT COL.H,ROW 31 Valid code : (See CC. 3)	NA	(1)
8	65	STDPOS (8,32)	A1	STRAIGHT STRAND AT COL.H,ROW 32 Valid code : (See CC. 3)	NA	(1)

EIGHTH CARD EIGHT (CONTINUED)

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	67	STDPOS (8,33)	A1	STRAIGHT STRAND AT COL.H,ROW 33 Valid code : (See CC. 3)	NA	(1)
8	69	STDPOS (8,34)	A1	STRAIGHT STRAND AT COL.H,ROW 34 Valid code : (See CC. 3)	NA	(1)
8	71	STDPOS (8,35)	A1	STRAIGHT STRAND AT COL.H,ROW 35 Valid code : (See CC. 3)	NA	(1)
8	73	STDPOS (8,36)	A1	STRAIGHT STRAND AT COL.H,ROW 36 Valid code : (See CC. 3)	NA	(1)

Note :

(1) Strand locations from bottom to top of beam are input from left to right (every other card column) on each CARD EIGHT; and from the centerline (vertical axis) of the beam outward on each successive CARD EIGHT. If no strand exists at a possible strand location, that card column is left blank. Only one-half the strand pattern, symmetrical about the centerline of the beam, is input. Refer to Figure 3-3, for strand column and row references for conditions when the centermost strand column is coincidental with the centerline of the beam (IW = 0, 1 or 3 on the LAST BLANK CARD, cc. 22) and when the centermost strand column is one-half strand grid spacing from the centerline (IW = 2 on the LAST BLANK CARD, cc. 22).

EIGHTH CARD NINE

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
9	1	NTYPE	I1	CARD NO. 9 Valid code : 9	NA	
9	2 thru 80	STDSHD (8,J)	FREE	STRAIGHT STRAND DEBOND LENGTH AT COL.H, ROW (J) Valid Code : See Note (1)	NA	(1)

NOTE :

(1) Length of strand debonding material, in feet, with decimal points, from the centerline of bearing are input sequentially with at least one (1) blank space (cc.) between adjacent entries. Only the same number of entries as input values of "S" on the preceeding CARD EIGHT are permitted. Trailing zeroes are not required. The row number, (J), is assigned according to the corresponding sequential order of input "S" values from the preceeding CARD EIGHT.

EXAMPLE :

```
9  2.15  6.7  11.  15.3958
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NINTH CARD EIGHT

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	1	NTYPE	I1	CARD NO. 8 Valid code : 8	NA	
8	3	STDPOS (9,1)	A1	STRAIGHT STRAND AT COL.K, ROW 1 Valid code Blank : No Strand X : Bonded Strand S : Debonded Strand	NA	(1)
8	5	STDPOS (9,2)	A1	STRAIGHT STRAND AT COL.K, ROW 2 Valid code : (See CC. 3)	NA	(1)
8	7	STDPOS (9,3)	A1	STRAIGHT STRAND AT COL.K, ROW 3 Valid code : (See CC. 3)	NA	(1)
8	9	STDPOS (9,4)	A1	STRAIGHT STRAND AT COL.K, ROW 4 Valid code : (See CC. 3)	NA	(1)
8	11	STDPOS (9,5)	A1	STRAIGHT STRAND AT COL.K, ROW 5 Valid code : (See CC. 3)	NA	(1)
8	13	STDPOS (9,6)	A1	STRAIGHT STRAND AT COL.K, ROW 6 Valid code : (See CC. 3)	NA	(1)
8	15	STDPOS (9,7)	A1	STRAIGHT STRAND AT COL.K, ROW 7 Valid code : (See CC. 3)	NA	(1)
8	17	STDPOS (9,8)	A1	STRAIGHT STRAND AT COL.K, ROW 8 Valid code : (See CC. 3)	NA	(1)
8	19	STDPOS (9,9)	A1	STRAIGHT STRAND AT COL.K, ROW 9 Valid code : (See CC. 3)	NA	(1)
8	21	STDPOS (9,10)	A1	STRAIGHT STRAND AT COL.K,ROW 10 Valid code : (See CC. 3)	NA	(1)
8	23	STDPOS (9,11)	A1	STRAIGHT STRAND AT COL.K,ROW 11 Valid code : (See CC. 3)	NA	(1)
8	25	STDPOS (9,12)	A1	STRAIGHT STRAND AT COL.K,ROW 12 Valid code : (See CC. 3)	NA	(1)
8	27	STDPOS (9,13)	A1	STRAIGHT STRAND AT COL.K,ROW 13 Valid code : (See CC. 3)	NA	(1)
8	29	STDPOS (9,14)	A1	STRAIGHT STRAND AT COL.K,ROW 14 Valid code : (See CC. 3)	NA	(1)
8	31	STDPOS (9,15)	A1	STRAIGHT STRAND AT COL.K,ROW 15 Valid code : (See CC. 3)	NA	(1)

NINTH CARD EIGHT (CONTINUED)

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	33	STDPOS (9,16)	A1	STRAIGHT STRAND AT COL.K,ROW 16 Valid code : (See CC. 3)	NA	(1)
8	35	STDPOS (9,17)	A1	STRAIGHT STRAND AT COL.K,ROW 17 Valid code : (See CC. 3)	NA	(1)
8	37	STDPOS (9,18)	A1	STRAIGHT STRAND AT COL.K,ROW 18 Valid code : (See CC. 3)	NA	(1)
8	39	STDPOS (9,19)	A1	STRAIGHT STRAND AT COL.K,ROW 19 Valid code : (See CC. 3)	NA	(1)
8	41	STDPOS (9,20)	A1	STRAIGHT STRAND AT COL.K,ROW 20 Valid code : (See CC. 3)	NA	(1)
8	43	STDPOS (9,21)	A1	STRAIGHT STRAND AT COL.K,ROW 21 Valid code : (See CC. 3)	NA	(1)
8	45	STDPOS (9,22)	A1	STRAIGHT STRAND AT COL.K,ROW 22 Valid code : (See CC. 3)	NA	(1)
8	47	STDPOS (9,23)	A1	STRAIGHT STRAND AT COL.K,ROW 23 Valid code : (See CC. 3)	NA	(1)
8	49	STDPOS (9,24)	A1	STRAIGHT STRAND AT COL.K,ROW 24 Valid code : (See CC. 3)	NA	(1)
8	51	STDPOS (9,25)	A1	STRAIGHT STRAND AT COL.K,ROW 25 Valid code : (See CC. 3)	NA	(1)
8	53	STDPOS (9,26)	A1	STRAIGHT STRAND AT COL.K,ROW 26 Valid code : (See CC. 3)	NA	(1)
8	55	STDPOS (9,27)	A1	STRAIGHT STRAND AT COL.K,ROW 27 Valid code : (See CC. 3)	NA	(1)
8	57	STDPOS (9,28)	A1	STRAIGHT STRAND AT COL.K,ROW 28 Valid code : (See CC. 3)	NA	(1)
8	59	STDPOS (9,29)	A1	STRAIGHT STRAND AT COL.K,ROW 29 Valid code : (See CC. 3)	NA	(1)
8	61	STDPOS (9,30)	A1	STRAIGHT STRAND AT COL.K,ROW 30 Valid code : (See CC. 3)	NA	(1)
8	63	STDPOS (9,31)	A1	STRAIGHT STRAND AT COL.K,ROW 31 Valid code : (See CC. 3)	NA	(1)
8	65	STDPOS (9,32)	A1	STRAIGHT STRAND AT COL.K,ROW 32 Valid code : (See CC. 3)	NA	(1)

NINTH CARD EIGHT (CONTINUED)

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	67	STDPOS (9,33)	A1	STRAIGHT STRAND AT COL.K,ROW 33 Valid code : (See CC. 3)	NA	(1)
8	69	STDPOS (9,34)	A1	STRAIGHT STRAND AT COL.K,ROW 34 Valid code : (See CC. 3)	NA	(1)
8	71	STDPOS (9,35)	A1	STRAIGHT STRAND AT COL.K,ROW 35 Valid code : (See CC. 3)	NA	(1)
8	73	STDPOS (9,36)	A1	STRAIGHT STRAND AT COL.K,ROW 36 Valid code : (See CC. 3)	NA	(1)

Note :

(1) Strand locations from bottom to top of beam are input from left to right (every other card column) on each CARD EIGHT; and from the centerline (vertical axis) of the beam outward on each successive CARD EIGHT. If no strand exists at a possible strand location, that card column is left blank. Only one-half the strand pattern, symmetrical about the centerline of the beam, is input. Refer to Figure 3-3, for strand column and row references for conditions when the centermost strand column is coincidental with the centerline of the beam (IW = 0, 1 or 3 on the LAST BLANK CARD, cc. 22) and when the centermost strand column is one-half strand grid spacing from the centerline (IW = 2 on the LAST BLANK CARD, cc. 22).

NINTH CARD NINE

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
9	1	NTYPE	I1	CARD NO. 9 Valid code : 9	NA	
9	2 thru 80	STDSHD (9,J)	FREE	STRAIGHT STRAND DEBOND LENGTH AT COL.K, ROW (J) Valid Code : See Note (1)	NA	(1)

NOTE :

(1) Length of strand debonding material, in feet, with decimal points, from the centerline of bearing are input sequentially with at least one (1) blank space (cc.) between adjacent entries. Only the same number of entries as input values of "S" on the preceeding CARD EIGHT are permitted. Trailing zeroes are not required. The row number, (J), is assigned according to the corresponding sequential 2 order of input "S" values from the preceeding CARD EIGHT.

EXAMPLE :

9 2.15 6.7 11. 15.3958

TENTH CARD EIGHT

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	1	NTYPE	I1	CARD NO. 8 Valid code : 8	NA	
8	3	STDPOS (10,1)	A1	STRAIGHT STRAND AT COL.L, ROW 1 Valid code Blank : No Strand X : Bonded Strand S : Debonded Strand	NA	(1)
8	5	STDPOS (10,2)	A1	STRAIGHT STRAND AT COL.L, ROW 2 Valid code : (See CC. 3)	NA	(1)
8	7	STDPOS (10,3)	A1	STRAIGHT STRAND AT COL.L, ROW 3 Valid code : (See CC. 3)	NA	(1)
8	9	STDPOS (10,4)	A1	STRAIGHT STRAND AT COL.L, ROW 4 Valid code : (See CC. 3)	NA	(1)
8	11	STDPOS (10,5)	A1	STRAIGHT STRAND AT COL.L, ROW 5 Valid code : (See CC. 3)	NA	(1)
8	13	STDPOS (10,6)	A1	STRAIGHT STRAND AT COL.L, ROW 6 Valid code : (See CC. 3)	NA	(1)
8	15	STDPOS (10,7)	A1	STRAIGHT STRAND AT COL.L, ROW 7 Valid code : (See CC. 3)	NA	(1)
8	17	STDPOS (10,8)	A1	STRAIGHT STRAND AT COL.L, ROW 8 Valid code : (See CC. 3)	NA	(1)
8	19	STDPOS (10,9)	A1	STRAIGHT STRAND AT COL.L, ROW 9 Valid code : (See CC. 3)	NA	(1)
8	21	STDPOS (10,10)	A1	STRAIGHT STRAND AT COL.L,ROW 10 Valid code : (See CC. 3)	NA	(1)
8	23	STDPOS (10,11)	A1	STRAIGHT STRAND AT COL.L,ROW 11 Valid code : (See CC. 3)	NA	(1)
8	25	STDPOS (10,12)	A1	STRAIGHT STRAND AT COL.L,ROW 12 Valid code : (See CC. 3)	NA	(1)
8	27	STDPOS (10,13)	A1	STRAIGHT STRAND AT COL.L,ROW 13 Valid code : (See CC. 3)	NA	(1)
8	29	STDPOS (10,14)	A1	STRAIGHT STRAND AT COL.L,ROW 14 Valid code : (See CC. 3)	NA	(1)
8	31	STDPOS (10,15)	A1	STRAIGHT STRAND AT COL.L,ROW 15 Valid code : (See CC. 3)	NA	(1)

TENTH CARD EIGHT (CONTINUED)

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	33	STDPOS (10,16)	A1	STRAIGHT STRAND AT COL.L,ROW 16 Valid code : (See CC. 3)	NA	(1)
8	35	STDPOS (10,17)	A1	STRAIGHT STRAND AT COL.L,ROW 17 Valid code : (See CC. 3)	NA	(1)
8	37	STDPOS (10,18)	A1	STRAIGHT STRAND AT COL.L,ROW 18 Valid code : (See CC. 3)	NA	(1)
8	39	STDPOS (10,19)	A1	STRAIGHT STRAND AT COL.L,ROW 19 Valid code : (See CC. 3)	NA	(1)
8	41	STDPOS (10,20)	A1	STRAIGHT STRAND AT COL.L,ROW 20 Valid code : (See CC. 3)	NA	(1)
8	43	STDPOS (10,21)	A1	STRAIGHT STRAND AT COL.L,ROW 21 Valid code : (See CC. 3)	NA	(1)
8	45	STDPOS (10,22)	A1	STRAIGHT STRAND AT COL.L,ROW 22 Valid code : (See CC. 3)	NA	(1)
8	47	STDPOS (10,23)	A1	STRAIGHT STRAND AT COL.L,ROW 23 Valid code : (See CC. 3)	NA	(1)
8	49	STDPOS (10,24)	A1	STRAIGHT STRAND AT COL.L,ROW 24 Valid code : (See CC. 3)	NA	(1)
8	51	STDPOS (10,25)	A1	STRAIGHT STRAND AT COL.L,ROW 25 Valid code : (See CC. 3)	NA	(1)
8	53	STDPOS (10,26)	A1	STRAIGHT STRAND AT COL.L,ROW 26 Valid code : (See CC. 3)	NA	(1)
8	55	STDPOS (10,27)	A1	STRAIGHT STRAND AT COL.L,ROW 27 Valid code : (See CC. 3)	NA	(1)
8	57	STDPOS (10,28)	A1	STRAIGHT STRAND AT COL.L,ROW 28 Valid code : (See CC. 3)	NA	(1)
8	59	STDPOS (10,29)	A1	STRAIGHT STRAND AT COL.L,ROW 29 Valid code : (See CC. 3)	NA	(1)
8	61	STDPOS (10,30)	A1	STRAIGHT STRAND AT COL.L,ROW 30 Valid code : (See CC. 3)	NA	(1)
8	63	STDPOS (10,31)	A1	STRAIGHT STRAND AT COL.L,ROW 31 Valid code : (See CC. 3)	NA	(1)
8	65	STDPOS (10,32)	A1	STRAIGHT STRAND AT COL.L,ROW 32 Valid code : (See CC. 3)	NA	(1)

TENTH CARD EIGHT (CONTINUED)

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
8	67	STDPOS (10,33)	A1	STRAIGHT STRAND AT COL.L,ROW 33 Valid code : (See CC. 3)	NA	(1)
8	69	STDPOS (10,34)	A1	STRAIGHT STRAND AT COL.L,ROW 34 Valid code : (See CC. 3)	NA	(1)
8	71	STDPOS (10,35)	A1	STRAIGHT STRAND AT COL.L,ROW 35 Valid code : (See CC. 3)	NA	(1)
8	73	STDPOS (10,36)	A1	STRAIGHT STRAND AT COL.L,ROW 36 Valid code : (See CC. 3)	NA	(1)

Note :

(1) Strand locations from bottom to top of beam are input from left to right (every other card column) on each CARD EIGHT; and from the centerline (vertical axis) of the beam outward on each successive CARD EIGHT. If no strand exists at a possible strand location, that card column is left blank. Only one-half the strand pattern, symmetrical about the centerline of the beam, is input. Refer to Figure 3-3, for strand column and row references for conditions when the centermost strand column is coincidental with the centerline of the beam (IW = 0, 1 or 3 on the LAST BLANK CARD, cc. 22) and when the centermost strand column is one-half strand grid spacing from the centerline (IW = 2 on the LAST BLANK CARD, cc. 22).

TENTH CARD NINE

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
9	1	NTYPE	I1	CARD NO. 9 Valid code : 9	NA	
9	2 thru 80	STDSHD (10,J)	FREE	STRAIGHT STRAND DEBOND LENGTH AT COL.L, ROW (J) Valid Code : See Note (1)	NA	(1)

NOTE :

(1) Length of strand debonding material, in feet, with decimal points, from the centerline of bearing are input sequentially with at least one (1) blank space (cc.) between adjacent entries. Only the same number of entries as input values of "S" on the preceeding CARD EIGHT are permitted. Trailing zeroes are not required. The row number, (J), is assigned according to the corresponding sequential order of input "S" values from the preceeding CARD EIGHT.

EXAMPLE :

9 2.15 6.7 11. 15.3958

LAST BLANK CARD

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
BLANK	1	NTYPE	1X	CARD NO. Valid code : Blank	NA	REQ'D
BLANK	2- 3	BTYPE	A2	BEAM TYPE Valid code 2 : AASHTO TYPE II BEAM 3 : AASHTO TYPE III BEAM 4 : AASHTO TYPE IV BEAM 5 : AASHTO TYPE V BEAM 6 : AASHTO TYPE VI BEAM 54 : FLORIDA BULB TEE 54 in. 63 : FLORIDA BULB TEE 63 in. 72 : FLORIDA BULB TEE 72 in. NS : NON STANDARD BEAM	NA	REQ'D
BLANK	4- 8	SPANL	F5.2	SPAN LENGTH - BETWEEN CENTER-LINES OF BEARINGS Valid code : xxx.xx ft.	NA	REQ'D
BLANK	9-12	BSPAC	F4.2	BEAM SPACING Valid code : xx.xx ft.	NA	REQ'D
BLANK	13-16	TS	F4.2	SLAB THICKNESS Valid code : xx.xx in.	NA	REQ'D
BLANK	17-21	SMBOL1 SMBOL2	A4 A1	AASHTO LIVE LOAD Valid code H-15 H -15 HS-15 H-20 H -20 HS-20	NA	REQ'D
BLANK	22	IW	I1	NUMBER OF STRANDS IN WEB Valid code : x	1	
BLANK	23-25	RROAD	F3.0	RAILROAD LIVE LOAD Valid code : xxx.	NA	
BLANK	26-29	DFACT	F4.3	LIVE LOAD DISTRIBUTION FACTOR Valid code : x.xxx	NA	OVER-RIDE
BLANK	30-33	VFACT	F4.3	SHEAR DISTRIBUTION FACTOR Valid code : x.xxx	NA	OVER-RIDE
BLANK	34-37	HDPT	F4.2	DISTANCE FROM HOLD-DOWN DEVICE TO BEAM CENTER LINE Valid code : xx.xx ft.	NA	OVER-RIDE
BLANK	38-42	NCDL	F5.3	UNIFORM DEAD LOAD ON NON-COMPOSITE SECTION Valid code : xx.xxx kips/ft.	NA	DON'T INCL. SLAB

LAST BLANK CARD (CONTINUED)

CARD NUMBER	CARD COLUMN	VARIABLE NAME	FORMAT	DESCRIPTION	DEFAULT VALUE	NOTES
BLANK	43-47	CDL	F5.3	UNIFORM DEAD LOAD ON COMPOSITE SECTION Valid code : xx.xxx kip./ft.	NA	
BLANK	48-51	EFW	F4.2	WIDTH OF COMPOSITE SLAB Valid code : xx.xx ft.	NA	OVER-RIDE
BLANK	52-54	PLOSS	F3.1	STRAND LOSS Valid code : xx.x %	NA	OVER-RIDE
BLANK	55-58	COPE	F4.3	COPE DISTANCE BETWEEN BEAM TOP AND SLAB BOTTOM Valid code : x.xxx in.	NA	(1)
BLANK	59	ID	I1	DIAPHRAGM Valid code 0 : No diaphragm 1 : One diaphgagm 5 : 5% of live load	0	
BLANK	60-63	ENDIST	F4.2	DISTANCE FROM BEAM END TO CENTER LINE OF BEARING Valid code : xx.xx in.	6.5	(2)

NOTES :

(1) COPE will be utilized in computing the composite beam/slab section properties but its weight of concrete must be input as a uniform dead load on the non-composite section. An example of its use is in conjunction with stay-in-place slab forms that are supported on the beam top flange.

(2) Input ENDIST accurately if other than 6.5 inches as this dimension affects strand development lengths and resultant stresses in the beam's end region. For skewed beams, the dimension from beam end to center line of of bearing measured along the centerline of beam should be used.

3.2 Output Report

For English output the program output consist of the following:
(Metric output is similar)

3.2.1 General Information

The title on each page of output now contains the program version number; i.e., Version 2.50. The last line of the title on each page of output describes the strand type as either "LOW-RELAXATION" or "STRESS-RELIEVED".

3.2.2 Output Page One - Input Data Reflection

The input data verification on the first page of output contains:

1. All input data, default value and / or user input section properties.

2. The values for "Q" and "R", if any, is listed under "*** BEAM DIMENSIONS (INCHES) ***".

3. The Diaphragm Design Option, described as "NONE", "ONE", or "5% L.L.", is located at the bottom of the left most data block and the Cope Dimension, in inches, is located at the bottom of the right most data block.

4. The WEIGHT of the PRECAST and COMPOSITE sections in pounds per linear foot (PLF) is listed under "*** SECTION PROPERTIES ***". The composite weight shown does <u>not</u> include the weight of the cope, if any.

3.2.3 Output Page Two

Dead load deflection at midspan and quarter points due to slab and diaphragms.

ULTIMATE MOMENT REQUIRED for design loads and provided by the design section.

ULTIMATE MOMENT PROVIDED has been printed, also 1.2 TIMES THE CRACKING MOMENT "MCR", is printed.

Stirrup spacing, based on AASHTO Specifications, at 'h/2' from face of support. Predicted loss of prestress, both ultimate and at release.

Predicted net camber of beam ages at release, 30, 60, 120 and 240 days.

Required number, size, pull and eccentricities of prestressing strands.

Required concrete strengths. (At 28 days)

"ELASTIC AND TIME-DEPENDENT SHORTENING EFFECTS (EST.) IN." are tabled below the camber and build-up values and for the same ages of beam concrete. The values are computed as:

$$Ls_t = \frac{C_1 \times P \times L}{A \times E_c}$$

Where:

Ls_t = Elastic and time-dependent shorting effects of beam at time "t", in inches.

C_1 = Age and creep factor as described in the manual for "camber", Table 1-2.

P = Total initial pull of <u>all</u> strands, pounds.

L = Beam span length, inches.

A = Area of beam, square inches.

E_C = 28-day modulus of elasticity of the beam concrete, psi

The input (or default) factors, transfer lengths and development lengths of bonded and debonded strands are printed out at the bottom of this page.

All stresses and shear steel calculations include the effects of the transfer and development factors as applicable.

Maximum permitted tension in the beam at release.

3.2.4 In the table of the "STRESSES IN EXTREME FIBERS DUE TO EXTERNAL LOADS (LBS. PER SQ. IN.)", tensile stresses include a negative sign (-) to be consistent with other tables of stresses.

3.2.5 Shear values and stirrup spacing, based on AASHTO Specifications, at the tenth points. Maximum ultimate horizontal shear between slab and girders at the tenth points.

The stirrup spacings shown on the second and last pages of the output indicate whether the spacing is for "(ONE BAR)" or "(IN PAIRS)". If "IW" on the last blank card, cc 22, is either "0" (default = 1) or "1", the stirrup spacings are shown for one (1) No. 4 Bar of the specified grade of steel. All other values of "IW" will result in spacings of No. 4 Bars in pairs.

Additional informative messages are printed in conjunction with situations which are encountered in the design or review. These messages are:

(1) Whether or not the beam design is based on stress requirements or ultimate moment requirements.

(2) Whether or not strands were depressed to the topmost position and the possible necessity of debonding. (Length will be printed later).

(3) Whether or not the maximum reinforceable shear value permitted by AASHTO has been exceeded.

(4) Whether or not the straight strand design pattern can be satisfactorily debonded to meet release stress requirements.

(5) A message showing INPUT ERROR NO. 6 OR 7 ON CARD NO. 2 informs the designer that the mandatory minus sign (-) for either the input tension value of "FTP" (or "C6") (cc 59-63) or "TTEN" (or "C7") (cc 67-71), respectively, has been omitted causing the program run to be aborted.

4. EXAMPLES

4.1 Straight Strand Design

4.1.1 Input Criteria:

Beam	AASHTO Type IV
Span	104.50 ft.
Spacing	6.5 ft.
Slab Thickness	7.5 in.
Loading	HS20-44

4.1.2 Output Report:

The third page of output describes the strand pattern and debond lengths and displays a graphic output of the strand pattern.

The maximum length of debonding is calculated as half the span length minus the strand embedment length as determined by AASHTO 9.27 but not less than 100D.

The calculated transfer length of a pair of debonded strands is not permitted to overlap that of other pairs of debonded strands. Rather, in this event, the length of debonding is duplicated to that of the longer debond length.

PSTDSN65 (Version 2.40)

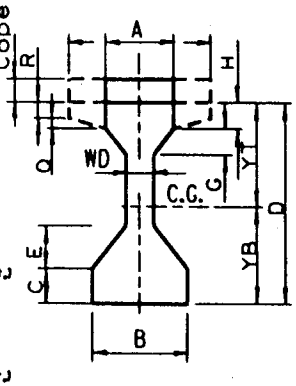
5-12-93

PRESTRESSED CONCRETE BEAM DESIGN PROGRAM


```
* THIS IS A SAMPLE PROBLEM FOR A STANDARD BEAM WITH STRAIGHT STRANDS.
* THREE COMMENT CARDS ARE REQUIRED FOR EVERY RUN.
* FOR A STANDARD BEAM, ONLY A BLANK CARD 2 AND A CARD 'BLANK' ARE REQUIRED.
```

Card 1 (1–80): INERTIA (IN^4) 2–9; AREA (IN^2) 10–15; D (IN) 16–20; YB (IN) 21–24; YT (IN) 25–28; B (IN) 29–32; WD (IN) 33–36; C (IN) 37–40; E (IN) 41–44; A (IN) 45–48; H (IN) 49–52; G (IN) 50–56; Q(IN) 57–60; R(IN) 61–64

Card 2 (1–80): Strand Size (1/8, 1/16, 1/2, 5/16, 3/8) 2–5; Special 6; Sk. Jt. 7; Ult. Strgth of Strand (ksi) 8–12; Unit Wt. (lbs./cu. ft.) Beam 13–17, Slab 18–22; Slab Conc. 28 Day St. (psi) 23–26; Beam Conc. 28 Day St. (psi) 27–30; Beam Conc. Rel. St. (psi) 31–34; Modulus of Elasticity (10^6 psi) Beam Conc. 35–38, Slab Conc. 39–42, Steel 43–46; Strand Clearance Bott. 47–50, Side 51–54, Spacing 55–58; Work Load Conc. Tens.(-) 59–63; Str. Pft. 64; Cr. of Reinf. 65; Initial Conc. Tens.(-) 67–71; Fr. of Debond 72–74; Strand Trans. & Dev. Factors Bonded 75–77, Shielded 78–80



Card 3 (1–80): Concentrated Static Loads Applied to Non-Composite Section — Loads (kips); Distance from Left Support (Ft.)

Card 4 (1–80): Concentrated Static Loads Applied to Composite Section — Loads (kips); Distance from Left Support (Ft.)

Card 5 (1–80): Concentrated Live Loads Applied to Composite Section — Loads (kips); Distance from Left Load (Ft.)

Card 6 (1–80): Concentrated Live Loads Applied to Composite Section — Loads (kips); Distance from Left Load (Ft.)

NOTE: THE FOLLOWING 3 CARDS (7) ARE REQUIRED FOR A DEPRESSED STRAND REVIEW (ANALYSIS) ONLY!

Card 7 (1–80): ROW 1–18 — ℄ Straight Strands; End Straight Strands; Depressed Strands

Distance to Top Draped Strands (In.) 38–41; Shield Length (Ft.)

NOTE: SEE SHEET NO. 2 OF 2 FOR THE LAST BLANK CARDS REQUIRED FOR ALL PROGRAM OPTIONS AND CARDS 8 AND 9 REQUIRED FOR STRAIGHT STRAND REVIEW (ANALYSIS) ONLY.

PSTDSN65 (Version 2.40)

NOTE: THE FOLLOWING 10 PAIR OF CARDS 8 AND 9 ARE REQUIRED FOR STRAIGHT STRAND REVIEW (ANALYSIS) ONLY!

Beam Type	Span (C-C Brg.) (Ft.)	Beam Spacing (Ft.)	Slab Thickness (In.)	AASHTO L.L.	Strands in Web	R R L.L.	L.L. Distribution Factor	Shear Distribution Factor	Hold Down From ℄ (Ft.)	Unif. DL on Non-Composite (kips/ft.)	Unif. DL on Composite Sec. (kips/ft.)	Width of Composite Slab (Ft.)	Strand Losses (%)	Cope (In.)	Diaphragm 0= None 1= One 5= 5% LL	End (In.) Distance
4	104.5	6.5	7.5	HS-20												
				-												
				-												
2 3	4 8	9 12	13 16	17 21	22	23 25	26 29	30 33	34 37	38 42	43 47	48 51	52 54	55 58	59	60 63

DEFAULT VALUES: 1/2" 270 ksi S.R. Strands
1-Strand in Web
.25 Debond
Grade of Reinf. = 60 ksi

2" Spacing of Strand ≤ 1/2" ø
2 1/4" Spacing of Strand > 1/2" ø
f'c Beam = 5000 psi
Strand Profile = S

Stress Relieved Strand
End Dist. = 6.5"
Cope = 0.0"
Strand Trans. Factor = LO x AASHTO
Strand Dev. Factor = LO x AASHTO

3" Clear. Side & Bott.
f'ci = 4000 psi
Initial Ten. = $-12\sqrt{f'ci}$

Work. Ten. = $-3\sqrt{f'c}$ (1 Strand in Web)
Work. Ten. = $-6\sqrt{f'c}$ (2 Strands in Web)
No Diaphragm Load

150 #/cu. ft. Unit Wt. of Conc.
$E_c = 2.93 \times 10^6$ psi
$E_{slab} = 3.55 \times 10^6$ psi
$E_{stee} = 28 \times 10^6$ psi

1/2 SPACE
℄ BEAM WHEN TW=B, OR 3
℄ BEAM WHEN TW=2

Sample 1. Straight Strands Design Input

```
* THIS IS A SAMPLE PROBLEM FOR A STANDARD BEAM WITH STRAIGHT STRANDS.
* THREE COMMENT CARDS ARE REQUIRED FOR EVERY RUN.
* FOR A STANDARD BEAM, ONLY A BLANK CARD 2 AND A CARD 'BLANK' ARE REQUIRED.
2
 4 1045  65  75 HS-20
```

Sample 1. Straight Strands Design Output
(Next 5 Pages)

5/12/93 FLORIDA DEPARTMENT OF TRANSPORTATION 08:45:56

PRESTRESSED CONCRETE BRIDGE GIRDER DESIGN PROGRAM - VERSION 2.40

```
* THIS IS A SAMPLE PROBLEM FOR A STANDARD BEAM WITH STRAIGHT STRANDS.
* THREE COMMENT CARDS ARE REQUIRED FOR EVERY RUN.
* FOR A STANDARD BEAM, ONLY A BLANK CARD 2 AND A CARD 'BLANK' ARE REQUIRED.
```

SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS S T R A I G H T S T R A N D S SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS

***** S T R E S S - R E L I E V E D *****

*** INPUT DATA ***

BEAM TYPE	= 4	UNIT WT. BEAM CONC.	= 150. PCF	STRAND SIZE	= 1/2 IN
SPAN LENGTH	= 104.50 FT	UNIT WT. SLAB CONC.	= 150. PCF	STRAND ULT STRENGTH	= 270 K
BEAM SPACING	= 6.50 FT	28-DAY ST.(SLAB CONC.)	= 3400. PSI	NO. OF WEB STRANDS	= 1
SLAB THICKNESS	= 7.50 IN	E(BM.CONC.)	= 3.82 E(06)PSI	GRID SIZE	= 2.00 IN
L.L. DIST. FACTOR	= 0.59	E(SLAB CONC.)	= 2.93 E(06)PSI	STRAND CL. BOTT. BEAM	= 3.00 IN
TRANS. SLAB WIDTH	= 59.89 IN	E(PRESTRESS STEEL)	= 28.00 E(06)PSI	STRAND CL. SIDE BEAM	= 3.00 IN
UNIF. D.L. N-COMP	= 0.000 KLF	AASHTO L.L.	= HS-20	MAX COMP BM. CONC(ALLOW)	= 2307. PSI
UNIF. D.L. COMP	= 0.000 KLF	RAILROAD L.L.	= E- 0.	MAX. TENSION AT DES. LOAD	= -228. PSI
DIAPHRAGM	= NONE			COPE DIMENSION	= 0.00 IN

*** SECTION PROPERTIES ***

		PRECAST	COMPOSITE	
AREA	=	789.00	1238.19	IN2
WEIGHT	=	821.87	1431.25	PLF
MOMENT OF INERTIA	=	260741.00	574931.00	IN4
YB BEAM	=	24.73	36.71	IN
SECTION MODULUS BOTTOM	=	10543.51	15661.89	IN3
YT BEAM	=	29.27	17.29	IN
SECTION MODULUS TOP	=	8908.13	33250.15	IN3
YTS SLAB	=		24.79	IN
SECTION MODULUS SLAB	=		23191.04	IN3
HEIGHT	=	54.00	61.50	IN

*** BEAM DIMENSIONS (INCHES) ***

B= 26.00 W= 8.00 C= 8.00 E= 9.00 A= 20.00 H= 8.00 G= 6.00 Q= 0.00 R= 0.00

*** CONCENTRATED LOADS APPLIED TO NON-COMPOSITE SECTION ***

LOAD (KIPS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DIST. FROM LT. REACT. (FT)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

*** CONCENTRATED STATIC LOADS APPLIED TO COMPOSITE SECTION ***

LOAD (KIPS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DIST. FROM LT. REACT. (FT)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

*** CONCENTRATED LIVE LOADS APPLIED TO COMPOSITE SECTION ***

LOAD (KIPS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DIST. FROM LT. LOAD (FT)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LOAD (KIPS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DIST. FROM LT. LOAD (FT)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PRESTRESSED CONCRETE BRIDGE GIRDER DESIGN PROGRAM - VERSION 2.40

```
* THIS IS A SAMPLE PROBLEM FOR A STANDARD BEAM WITH STRAIGHT STRANDS.
* THREE COMMENT CARDS ARE REQUIRED FOR EVERY RUN.
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```

SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS S T R A I G H T S T R A N D S SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS

***** S T R E S S - R E L I E V E D *****

*** BEAM DESIGN ***

```
TYPE OF BEAM                =   4
NO. OF STRANDS              =   46.
SIZE OF STRANDS & PULL      =   1/2   IN AT 28920. LB
TYPE OF STRANDS             =   270K
ECCENTRICITY AT C.L.        =   18.03 IN
ECCENTRICITY AT SUP.        =   18.12 IN

CONCRETE RELEASE STRENGTH =   4610.   PSI
CONCRETE 28-DAY STRENGTH  =   5770.   PSI

BEAM END TO CTR BEARING   =    6.50 IN

MAX. END TENSION AT REL.  =  -815. PSI
MAX. CTR TENSION AT REL.  =  -407. PSI
```

```
D.L. DEFLECTION AT MID-SPAN =  1.643 IN (SLAB)      0.000 IN (DIAF)
D.L. DEFLECTION AT 1/4 PT.  =  1.171 IN (SLAB)      0.000 IN (DIAF)

ULTIMATE MOMENT REQUIRED  =  5036. FT-KIPS
ULTIMATE MOMENT PROVIDED  =  7526. FT-KIPS  UNDER REINF. FLGD. SECT.
1.2 TIMES CRACKING MOMENT =  4320. FT-KIPS

STIRRUP SPACING AT  30.75  INCHES
FROM FACE OF SUPPORT  =  NO. 4 (GR. 60) AT 11.43 IN. (ONE BAR)

TOP FIBER DESIGN STRESS (C.L.)     = 3048. PSI
BOTTOM FIBER DESIGN STRESS (C.L.) = 3106. PSI

PRESTRESS LOSS  = 26.40 PERCENT
LOSS AT RELEASE = 12.15 PERCENT
```

AGE OF BEAM CONCRETE	RELEASE	30 DAYS	60 DAYS	120 DAYS	240 DAYS
NET CAMBER (PSTRES-BEAM) IN.	2.92	4.11	4.38	4.64	4.98
BUILD-UP REQD (CAMBER-SL-DF) IN.	----	2.47	2.74	3.00	3.33
ELASTIC AND TIME-DEPENDENT SHORTENING EFFECTS (EST.) IN.	0.66	1.02	1.10	1.18	1.27

L.L. STRESS IN TOP FIBER OF SLAB AT MIDSPAN = 458. PSI

*** STRAND TRANSFER AND DEVELOPMENT LENGTHS ***

TYPE OF STRAND	AASHTO MULT	TRANSFER LENGTH	DEVELOPMENT LENGTH
FULLY BONDED.....	1.00	2.08 FT	6.65 FT
PATRIALLY DEBONDED... (SHIELDED)	1.00	4.17 FT	13.30 FT

5/12/93 FLORIDA DEPARTMENT OF TRANSPORTATION 08:45:56

PRESTRESSED CONCRETE BRIDGE GIRDER DESIGN PROGRAM - VERSION 2.40

```
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```

SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS S T R A I G H T S T R A N D S SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS

***** S T R E S S - R E L I E V E D *****

*** DEBOND SEQUENCE OF STRAIGHT STRANDS ***

```
STRAND PAIR NUMBER  1 DEBONDED   13.33 FT. FROM CENTERLINE OF BEARING
STRAND PAIR NUMBER  2 DEBONDED   13.33 FT. FROM CENTERLINE OF BEARING
STRAND PAIR NUMBER  3 DEBONDED    5.81 FT. FROM CENTERLINE OF BEARING
STRAND PAIR NUMBER  4 DEBONDED    5.81 FT. FROM CENTERLINE OF BEARING
STRAND PAIR NUMBER  5 DEBONDED    1.54 FT. FROM CENTERLINE OF BEARING
```

*** STRAND PATTERN ***

```
ROW  6 HAS  3. STRANDS                    0  0  0
ROW  5 HAS  5. STRANDS                 0  1  0  1  0
ROW  4 HAS  7. STRANDS              0  0  2  0  2  0  0
ROW  3 HAS  9. STRANDS           0  0  0  3  0  3  0  0  0
ROW  2 HAS 11. STRANDS        0  0  0  0  4  0  4  0  0  0  0
ROW  1 HAS 11. STRANDS        0  0  0  0  5  0  5  0  0  0  0
```

0 : BONDED STRANDS
: DEBONDED STRAND PAIRS

```
NUMBER OF DEBONDED STRANDS BASED ON ALLOWABLE STRESS LIMITS ARE      10
NUMBER OF DEBONDED STRANDS BASED ON PERCENTAGE LIMITATIONS ARE       12
PERCENTAGE LIMITATIONS OR CONCRETE STRENGTH MAY BE ADJUSTED TO MEET STRESS REQUIREMENTS
```

5/12/93 FLORIDA DEPARTMENT OF TRANSPORTATION 08:45:56

PRESTRESSED CONCRETE BRIDGE GIRDER DESIGN PROGRAM - VERSION 2.40

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SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS S T R A I G H T S T R A N D S SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS

***** S T R E S S - R E L I E V E D *****

*** MOMENT SUMMARY (FT-KIPS) ***

SECTION	DEAD LD.	NCOMP DL	COMP DL	L.L.+I	TOTAL
0	0.000	0.000	0.000	0.000	0.000
1	703.332	0.000	0.000	438.956	1142.288
2	1250.368	0.000	0.000	769.619	2019.987
3	1641.108	0.000	0.000	991.989	2633.096
4	1875.552	0.000	0.000	1122.187	2997.739
5	1953.700	0.000	0.000	1152.154	3105.853
6	1875.552	0.000	0.000	1122.187	2997.739
7	1641.108	0.000	0.000	991.989	2633.096
8	1250.368	0.000	0.000	769.619	2019.987
9	703.332	0.000	0.000	438.956	1142.288
10	0.000	0.000	0.000	0.000	0.000
3/4 DEPTH	244.240	0.000	0.000	153.613	397.853

*** SHEAR SUMMARY (KIPS) ***

DEAD LD.	NCOMP DL	COMP DL	L.L.+I	TOTAL
74.783	0.000	0.000	47.188	121.971
59.826	0.000	0.000	42.007	101.833
44.870	0.000	0.000	36.826	81.695
29.913	0.000	0.000	31.644	61.557
14.957	0.000	0.000	26.463	41.419
0.000	0.000	0.000	21.281	21.281
14.957	0.000	0.000	26.463	41.419
29.913	0.000	0.000	31.644	61.557
44.870	0.000	0.000	36.826	81.695
59.826	0.000	0.000	42.007	101.833
74.783	0.000	0.000	47.188	121.971
69.952	0.000	0.000	45.515	115.467

**** STRESSES IN EXTREME FIBERS DUE TO EXTERNAL LOADS (LBS PER SQ. IN.) ****

SECTION	BEAM		SLAB		TOTAL D.L. NON-COMP SEC.		TOTAL D.L. NON-COMP SEC.		COMP SECT.		L.L. + IMPACT COMP SEC.		TOTAL	
	TOP	BOT	TOP	BOT	TOP	BOT	TOP	BOT	TOP	BOT	TOP	BOT	TOP	BOT
0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1	544.	-460.	403.	-341.	0.	0.	947.	-800.	0.	0.	158.	-336.	1106.	-1137.
2	967.	-817.	717.	-606.	0.	0.	1684.	-1423.	0.	0.	278.	-590.	1962.	-2013.
3	1269.	-1073.	941.	-795.	0.	0.	2211.	-1868.	0.	0.	358.	-760.	2569.	-2628.
4	1451.	-1226.	1076.	-909.	0.	0.	2527.	-2135.	0.	0.	405.	-860.	2932.	-2994.
5	1511.	-1277.	1121.	-947.	0.	0.	2632.	-2224.	0.	0.	416.	-883.	3048.	-3106.
6	1451.	-1226.	1076.	-909.	0.	0.	2527.	-2135.	0.	0.	405.	-860.	2932.	-2994.
7	1269.	-1073.	941.	-795.	0.	0.	2211.	-1868.	0.	0.	358.	-760.	2569.	-2628.
8	967.	-817.	717.	-606.	0.	0.	1684.	-1423.	0.	0.	278.	-590.	1962.	-2013.
9	544.	-460.	403.	-341.	0.	0.	947.	-800.	0.	0.	158.	-336.	1106.	-1137.
10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3/4 DEPTH	189.	-160.	140.	-118.	0.	0.	329.	-278.	0.	0.	55.	-118.	384.	-396.

5/12/93 FLORIDA DEPARTMENT OF TRANSPORTATION 08:45:56

PRESTRESSED CONCRETE BRIDGE GIRDER DESIGN PROGRAM - VERSION 2.40

* THIS IS A SAMPLE PROBLEM FOR A STANDARD BEAM WITH STRAIGHT STRANDS.
* THREE COMMENT CARDS ARE REQUIRED FOR EVERY RUN.
* FOR A STANDARD BEAM, ONLY A BLANK CARD 2 AND A CARD 'BLANK' ARE REQUIRED.

SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS S T R A I G H T S T R A N D S SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS

***** S T R E S S - R E L I E V E D *****

**** STRESSES DUE TO EXTERNAL LOADS PLUS PRESTRESS (LBS PER SQ. IN.) ****

	INITIAL PREST.		BEAM PLUS INITIAL PREST. - LOSSES @ REL.		FINAL PREST. PLUS TOT. D.L.(N/C SEC.)		ALL LOADS PLUS FINAL PREST.	
	TOP	BOT	TOP	BOT	TOP	BOT	TOP	BOT
0	-207.	808.	-182.	710.	-153.	595.	-153.	595.
1	-962.	3653.	-301.	2750.	239.	1888.	398.	1552.
2	-1007.	3961.	83.	2663.	943.	1492.	1221.	903.
3	-1007.	3961.	385.	2407.	1470.	1048.	1828.	288.
4	-1007.	3961.	566.	2254.	1785.	781.	2190.	-79.
5	-1007.	3961.	627.	2203.	1891.	692.	2306.	-191.
6	-1007.	3961.	566.	2254.	1785.	781.	2190.	-79.
7	-1007.	3961.	385.	2407.	1470.	1048.	1828.	288.
8	-1007.	3961.	83.	2663.	943.	1492.	1221.	903.
9	-962.	3653.	-301.	2750.	239.	1888.	398.	1552.
10	-207.	808.	-182.	710.	-153.	595.	-153.	595.
3/4 DEPTH	-828.	3193.	-538.	2646.	-280.	2072.	-225.	1955.

**** SHEAR VALUES AND STIRRUP SPACING (ONE BAR) ****
(AASHTO 1983 SPECS.)

SECTION	VCI	VCW	VS	SIZE GRADE SPACING
0	0.000	128.127	93.496	NO. 4 (GR. 60) AT 11.43 IN
1	366.758	218.685	-31.140	NO. 4 (GR. 60) AT 12.00 IN
2	182.539	263.407	-29.072	NO. 4 (GR. 60) AT 12.00 IN
3	108.559	291.883	10.831	NO. 4 (GR. 60) AT 12.00 IN
4	69.045	308.968	16.266	NO. 4 (GR. 60) AT 12.00 IN
5	56.884	314.663	-5.651	NO. 4 (GR. 60) AT 12.00 IN
6	69.045	308.968	16.266	NO. 4 (GR. 60) AT 12.00 IN
7	108.559	291.883	10.831	NO. 4 (GR. 60) AT 12.00 IN
8	182.539	263.407	-29.072	NO. 4 (GR. 60) AT 12.00 IN
9	366.758	218.685	-31.140	NO. 4 (GR. 60) AT 12.00 IN
10	0.000	128.127	93.496	NO. 4 (GR. 60) AT 11.43 IN

**** MAX. ULT. HORIZ. SHEAR (VQ/IB) ****
(BETWEEN SL. AND GIR. FLANGE)

SECTION	
0	84.0 PSI
1	74.8 PSI
2	65.6 PSI
3	56.4 PSI
4	47.1 PSI
5	37.9 PSI
6	47.1 PSI
7	56.4 PSI
8	65.6 PSI
9	74.8 PSI
10	84.0 PSI

4.2 Straight Strand Review

4.2.1 Input Criteria:

Span . . . . . 82.00 ft.

Design Span . . . . . 79.88 ft.

Skew Angle . . . . . 30°

End Distance . . . . . 6.50 in.
(perpend. to joint)
. . . . . 7.51 in.
(along beam)

Beam . . . . . AASHTO Type III

Spacing . . . . . 6.83 ft.

Slab Thickness . . . . . 7.50 in.

Loading HS20-44

Uniform Non-Comp. DL:
. . . . . 0.010 k/ft.

Uniform Composite DL: 0.213 k/ft

Cope. . . . . 0.320 in.

Diaphragm. . . . . 5% LL

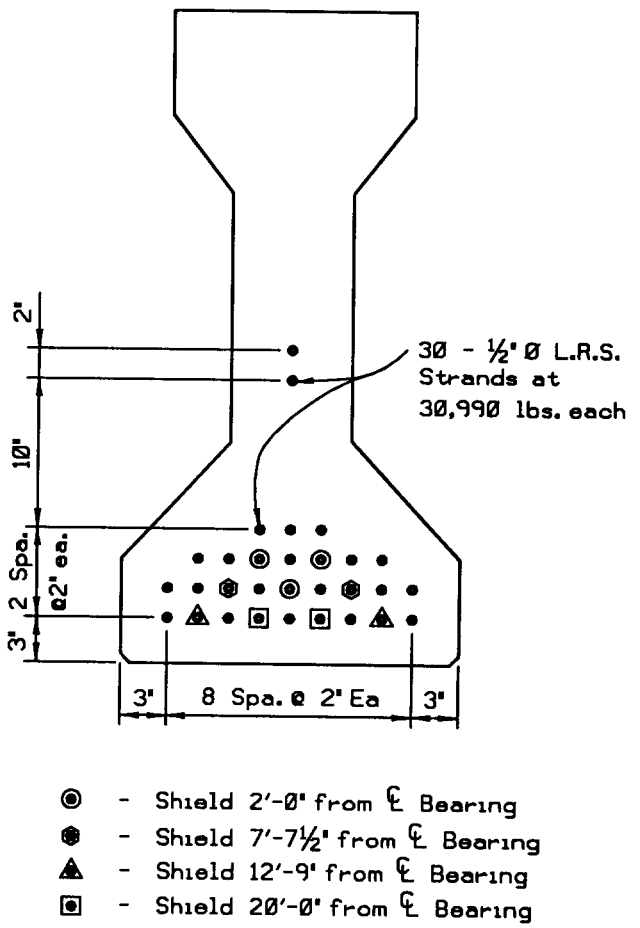
Environment . . . Slightly Aggressive

Strands. . . . . 1/2 in. dia., 270k,
Low-Relaxation

Release Strength . . . . . 4,200 psi

28-Day Strength . . . . . 5,500 psi

Reinforcing Steel . . . . . Grade 60



TYPE III BEAM

4.2.2 Output Report:

This option will analyze a beam with specified load, material and geometric criteria for virtually any strand and debonding pattern. Immediate identifiable uses and benefits of this option are:

1. Analyze and/or verify a beam designed performed by others; i.e., check a Contractor's proposed redesign.

2. As a design tool in combining two (2) or more independent beam designs into beams of uniform criteria, on a priority basis, as regards 28-day concrete strength, stranding, release strength and debonding.

The output format for this option is identical to that for a straight strand design, except a nine-point table is produced that checks specific code and/or specification requirements. For each item the specified and maximum (or minimum, when critical) analysis values are reported along with a "YES/NO" statement of compliance. Stresses at release are analyzed at each predesignated inspection point, at the point of strand transfer length for fully bonded strands and each different length of partially bonded strand. When any maximum release stress occurs at the end of a debonded strand transfer length, the value of the input debond length for that condition is printed out to the right of the analysis value itself for the designer's information and use; otherwise, the maximum release stress occurs at a predesignated inspection point.

The table was formulated to assist the designer in a quick overview of the analysis and is not intended to be all-conclusive. Specific concerns, stresses at points other than those checked by the program and verification of input are still the responsibility of the designer. Except for input syntax problems or erroneous values too large for the program, results under this option will be obtained.

PSTDSN65 (Version 2.40)

5-12-93

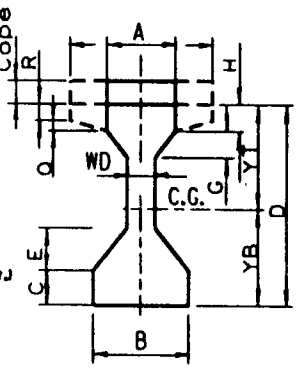
PRESTRESSED CONCRETE BEAM DESIGN PROGRAM


```
* THIS IS A SAMPLE PROBLEM FOR REVIEWING A STANDARD BEAM WITH STRAIGHT STRANDS.
* THREE COMMENT CARDS ARE REQUIRED FOR EVERY RUN.
* TEN (10) PAIR OF CARDS 8 AND 9 ARE REQUIRED.
```

Card	Cols 1–9	10–15	16–20	21–24	25–28	29–32	33–36	37–40	41–44	45–48	49–52	53–56	57–60	61–64
1	INERTIA (IN^4)	AREA (IN^2)	D (IN)	YB (IN)	YT (IN)	B (IN)	WD (IN)	C (IN)	E (IN)	A (IN)	H (IN)	G (IN)	Q(IN)	R(IN)

Card 2	Cols 2–5	6	7	8–12	13–17	18–22	23–26	27–30	31–34	35–38	39–42	43–46	47–50	51–54	55–58
	Strand Size 1/16	Special	Str. Pfl.	Ult. Strgth of Strand (ksi)	Unit Wt. (lbs./cu. ft.) Beam	Slab	Slab Conc. 28 Day St. (psi)	Beam Conc. 28 Day St. (psi)	Beam Conc. Rel. St. (psi)	Modulus of Elasticity (10^6 psi) Beam Conc.	Slab Conc.	Steel	Bott.	Strand Clearance Side	Spacing
			1					5500	4200						

Card 2	Cols 59–63	64	65	67–71	72–74	75–77	78–80
	Work Load Conc. Ten.(-)	Str. Pfl.	Cr. of Reinf.	Initial Conc. Ten.(-)	Fr. of Debond	Strand Trans. & Bonded	Dev. Factors Shielded
	-60		60				



Card	Cols 1–2	3–6	7–11	12–16	17–21	22–26	27–31	32–36	37–41	42–46	47–51	
3	Concentrated Static Loads Applied to Non-Composite Section											Loads (kips)
3												Distance from Left Support (Ft.)
4	Concentrated Static Loads Applied to Composite Section											Loads (kips)
4												Distance from Left Support (Ft.)
5	Concentrated Live Loads Applied to Composite Section											Loads (kips)
5												Distance from Left Load (Ft.)
6	Concentrated Live Loads Applied to Composite Section											Loads (kips)
6												Distance from Left Load (Ft.)

NOTE: THE FOLLOWING 3 CARDS (7) ARE REQUIRED FOR A DEPRESSED STRAND REVIEW (ANALYSIS) ONLY!

Card	Cols 1–2	3–4	5–6	7–8	9–10	11–12	13–14	15–16	17–18	19–20	21–22	23–24	25–26	27–28	29–30	31–32	33–34	35–36
7	ROW 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
7	℄ Straight Strands																	
7	End Straight Strands																	
7	Depressed Strands																	

Card 7	Cols 37–38	39–41
	Distance to Top Draped Strands (in.)	Shield Length (Ft.)

NOTE: SEE SHEET NO. 2 OF 2 FOR THE LAST BLANK CARDS REQUIRED FOR ALL PROGRAM OPTIONS AND CARDS 8 AND 9 REQUIRED FOR STRAIGHT STRAND REVIEW (ANALYSIS) ONLY.

PSTDSN65 (Version 2.40)

NOTE: THE FOLLOWING 10 PAIR OF CARDS 8 AND 9 ARE REQUIRED FOR STRAIGHT STRAND REVIEW (ANALYSIS) ONLY!

ROW	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
8	X	S	X	X					X	X																										
9	2.																																			

1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	77	80
8	S	X	S	X																																			
9	20.	2.																																					

8	X S X
9	7.625
8	S X X
9	12.75
8	X X
9	
8	
9	
8	
9	
8	
9	
8	
9	
8	
9	

½ SPACE

℄ BEAM WHEN "WEB" OR 3

℄ BEAM WHEN "WEB"=2

Beam Type	Span (C-C Brg.) (Ft.)	Beam Spacing (Ft.)	Slab Thickness (In.)	AASHTO L.L.	Strands In Web	R R L.L.	L.L. Distribution Factor	Shear Distribution Factor	Hold Down From ℄ (Ft.)	Unif. DL on Non-Composite (kips/ft.)	Unif. DL on Composite Sec. (kips/ft.)	Width of Composite Slab (Ft.)	Strand Losses (%)	Cope (In.)	Diaphragm 0= None 1= One 5= 5% LL	End (In.) Distance
3	80 75	6 8 3	7 5	HS-20						0 1 0	2 1 3			3 2	5	7 5 1
				-												
				-												
2 3	4 8	9 12	13 16	17 21	22	23 25	26 29	30 33	34 37	38 42	43 47	48 51	52 54	55 58	59	60 63

DEFAULT VALUES:
- 1/2" 270 ksi S.R. Strands
- 1-Strand In Web
- .25 Debond
- Grade of Reinf. = 60 ksi
- 2" Spacing of Strand ≤ 1/2" ø
- 2 1/4" Spacing of Strand > 1/2" ø
- f'c Beam = 5000 psi
- Strand Profile = S
- Stress Relieved Strand
- End Dist. = 6.5"
- Cope = 0.0"
- Strand Trans. Factor = 1.0 x AASHTO
- Strand Dev. Factor = 1.0 x AASHTO
- 3" Clear. Side & Bott.
- f'ci = 4000 psi
- Initial Ten. = $-12\sqrt{f'ci}$
- Work. Ten. = $-3\sqrt{f'c}$ (1 Strand In Web)
- Work. Ten. = $-6\sqrt{f'c}$ (2 Strands In Web)
- No Diaphragm Load
- 150 #/cu. ft. Unit Wt. of Conc.
- $E_c = 2.93 \times 10^6$ psi
- $E_{max} = 3.55 \times 10^6$ psi
- $E_{min} = 28 \times 10^6$ psi

Sample 2. Straight Strands Review Input

```
* THIS IS A SAMPLE PROBLEM FOR REVIEWING A STANDARD BEAM WITH STRAIGHT STRANDS.
* THREE COMMENT CARDS ARE REQUIRED FOR EVERY RUN.
* TEN (10) PAIR OF CARDS 8 AND 9 ARE REQUIRED
2     1                  55004200                        -60 60
8 X S X X         X X
9 2.
8 S X S X
9 20. 2.
8 X S X
9 7.625
8 S X X
9 12.75
8 X X
9
8
9
8
9
8
9
8
9
8
9
 3  8075 683 75 HS-20                 010  213       32 5 751
```

Sample 2. Straight Strands Review Output
(Next 6 Pages)

PRESTRESSED CONCRETE BRIDGE GIRDER DESIGN PROGRAM - VERSION 2.40

```
* THIS IS A SAMPLE PROBLEM FOR REVIEWING A STANDARD BEAM WITH STRAIGHT STRANDS.
* THREE COMMENT CARDS ARE REQUIRED FOR EVERY RUN.
* TEN (10) PAIR OF CARDS 8 AND 9 ARE REQUIRED
```

***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY *****

SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS S T R A I G H T S T R A N D S SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS

****** L O W - R E L A X A T I O N ******

*** INPUT DATA ***

BEAM TYPE	= 3	UNIT WT. BEAM CONC.	= 150. PCF	STRAND SIZE	= 1/2 IN
SPAN LENGTH	= 80.75 FT	UNIT WT. SLAB CONC.	= 150. PCF	STRAND ULT STRENGTH	= 270 K
BEAM SPACING	= 6.83 FT	28-DAY ST.(SLAB CONC.)	= 3400. PSI	NO. OF WEB STRANDS	= 1
SLAB THICKNESS	= 7.50 IN	E(BM.CONC.)	= 3.73 E(06)PSI	GRID SIZE	= 2.00 IN
L.L. DIST. FACTOR	= 0.62	E(SLAB CONC.)	= 2.93 E(06)PSI	STRAND CL. BOTT. BEAM	= 3.00 IN
TRANS. SLAB WIDTH	= 64.44 IN	E(PRESTRESS STEEL)	= 28.00 E(06)PSI	STRAND CL. SIDE BEAM	= 3.00 IN
UNIF. D.L. N-COMP	= 0.010 KLF	AASHTO L.L. + DIAF. WT.	= HS-20 (+5%)	MAX COMP BM. CONC(ALLOW)	= 2200. PSI
UNIF. D.L. COMP	= 0.213 KLF	RAILROAD L.L.	= E- 0.	MAX. TENSION AT DES. LOAD	= -445. PSI
DIAPHRAGM	= 5% L.L.			COPE DIMENSION	= 0.32 IN

*** SECTION PROPERTIES ***

		PRECAST	COMPOSITE	
AREA	=	559.50	1047.92	IN2
WEIGHT	=	582.81	1228.46	PLF
MOMENT OF INERTIA	=	125390.00	343270.00	IN4
YB BEAM	=	20.27	33.66	IN
SECTION MODULUS BOTTOM	=	6185.98	10197.49	IN3
YT BEAM	=	24.73	11.34	IN
SECTION MODULUS TOP	=	5070.36	30276.60	IN3
YTS SLAB	=		19.16	IN
SECTION MODULUS SLAB	=		17918.04	IN3
HEIGHT	=	45.00	52.82	IN

*** BEAM DIMENSIONS (INCHES) ***

B= 22.00 W= 7.00 C= 7.00 E= 7.50 A= 16.00 H= 7.00 G= 4.50 Q= 0.00 R= 0.00

*** CONCENTRATED LOADS APPLIED TO NON-COMPOSITE SECTION ***

LOAD (KIPS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DIST. FROM LT. REACT. (FT)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

*** CONCENTRATED STATIC LOADS APPLIED TO COMPOSITE SECTION ***

LOAD (KIPS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DIST. FROM LT. REACT. (FT)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

*** CONCENTRATED LIVE LOADS APPLIED TO COMPOSITE SECTION ***

LOAD (KIPS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DIST. FROM LT. LOAD (FT)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LOAD (KIPS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DIST. FROM LT. LOAD (FT)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PRESTRESSED CONCRETE BRIDGE GIRDER DESIGN PROGRAM - VERSION 2.40

* THIS IS A SAMPLE PROBLEM FOR REVIEWING A STANDARD BEAM WITH STRAIGHT STRANDS.
* THREE COMMENT CARDS ARE REQUIRED FOR EVERY RUN.
* TEN (10) PAIR OF CARDS 8 AND 9 ARE REQUIRED

***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY *****

SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS S T R A I G H T S T R A N D S SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS

****** L O W - R E L A X A T I O N ******

*** BEAM DESIGN ***

TYPE OF BEAM = 3
NO. OF STRANDS = 30.
SIZE OF STRANDS & PULL = 1/2 IN AT 30990. LB
TYPE OF STRANDS = 270K
ECCENTRICITY AT C.L. = 14.00 IN
ECCENTRICITY AT SUP. = 13.27 IN

CONCRETE RELEASE STRENGTH = 4200. PSI
CONCRETE 28-DAY STRENGTH = 5500. PSI

BEAM END TO CTR BEARING = 7.51 IN

MAX. END TENSION AT REL. = -778. PSI
MAX. CTR TENSION AT REL. = -389. PSI

D.L. DEFLECTION AT MID-SPAN = 1.311 IN (SLAB) 0.000 IN (DIAF)
D.L. DEFLECTION AT 1/4 PT. = 0.934 IN (SLAB) 0.000 IN (DIAF)

ULTIMATE MOMENT REQUIRED = 3593. FT-KIPS
ULTIMATE MOMENT PROVIDED = 4328. FT-KIPS UNDER REINF. RECT. SECT.
1.2 TIMES CRACKING MOMENT = 2751. FT-KIPS

STIRRUP SPACING AT 26.41 INCHES
FROM FACE OF SUPPORT = NO. 4 (GR. 60) AT 6.09 IN. (ONE BAR)

TOP FIBER DESIGN STRESS (C.L.) = 2824. PSI
BOTTOM FIBER DESIGN STRESS (C.L.) = 3273. PSI

PRESTRESS LOSS = 22.77 PERCENT
LOSS AT RELEASE = 9.99 PERCENT

AGE OF BEAM CONCRETE	RELEASE	30 DAYS	60 DAYS	120 DAYS	240 DAYS
NET CAMBER (PSTRES-BEAM) IN.	2.49	3.64	3.90	4.16	4.45
BUILD-UP REQD (CAMBER-SL-DF)IN.	----	2.33	2.59	2.85	3.14
ELASTIC AND TIME-DEPENDENT SHORTENING EFFECTS (EST.) IN.	0.52	0.81	0.88	0.94	1.01

L.L. STRESS IN TOP FIBER OF SLAB AT MIDSPAN = 501. PSI

*** STRAND TRANSFER AND DEVELOPMENT LENGTHS ***

TYPE OF STRAND	AASHTO MULT	TRANSFER LENGTH	DEVELOPMENT LENGTH
FULLY BONDED.....	1.00	2.08 FT	6.37 FT
PATRIALLY DEBONDED... (SHIELDED)	1.00	4.17 FT	12.74 FT

PRESTRESSED CONCRETE BRIDGE GIRDER DESIGN PROGRAM - VERSION 2.40

```
* THIS IS A SAMPLE PROBLEM FOR REVIEWING A STANDARD BEAM WITH STRAIGHT STRANDS.
* THREE COMMENT CARDS ARE REQUIRED FOR EVERY RUN.
* TEN (10) PAIR OF CARDS 8 AND 9 ARE REQUIRED
```

***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY *****

SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS S T R A I G H T S T R A N D S SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS

****** L O W - R E L A X A T I O N ******

*** DEBOND SEQUENCE OF STRAIGHT STRANDS ***

```
STRAND NUMBER  1 DEBONDED   20.00 FT. FROM CENTERLINE OF BEARING
STRAND NUMBER  2 DEBONDED   12.75 FT. FROM CENTERLINE OF BEARING
STRAND NUMBER  3 DEBONDED    7.62 FT. FROM CENTERLINE OF BEARING
STRAND NUMBER  4 DEBONDED    2.00 FT. FROM CENTERLINE OF BEARING
```

*** STRAND PATTERN ***

```
ROW 10 HAS  1. STRAND(S)                 0

ROW  9 HAS  1. STRAND(S)                 0

ROW  8 HAS  0. STRAND(S)

ROW  7 HAS  0. STRAND(S)

ROW  6 HAS  0. STRAND(S)

ROW  5 HAS  0. STRAND(S)

ROW  4 HAS  3. STRAND(S)               0 0 0

ROW  3 HAS  7. STRAND(S)             0 0 4 0 4 0 0

ROW  2 HAS  9. STRAND(S)           0 0 3 0 4 0 3 0 0

ROW  1 HAS  9. STRAND(S)           0 2 0 1 0 1 0 2 0
```

0 : BONDED STRANDS
: DEBONDED STRAND(S)

PRESTRESSED CONCRETE BRIDGE GIRDER DESIGN PROGRAM - VERSION 2.40

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* THREE COMMENT CARDS ARE REQUIRED FOR EVERY RUN.
* TEN (10) PAIR OF CARDS 8 AND 9 ARE REQUIRED

***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY *****

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****** L O W - R E L A X A T I O N ******

***** SUMMARY OF RESULTS OF SPECIFICATION COMPARISON *****

A SURVEY OF THE STRAIGHT STRAND ANALYSIS HAS BEEN CONDUCTED TO COMPARE THE REPORTED RESULTS WITH THE DESIGNER'S INPUT OR PROGRAM-DEFAULT SPECIFICATIONS. THE DESIGNER IS CAUTIONED TO VERIFY THAT THE INPUT SPECIFICATIONS ARE PROPER AND IN ACCORDANCE WITH AASHTO AND-OR FDOT ESTABLISHED DESIGN POLICIES PROCEDURES AND REQUIREMENTS. FINAL RESULTS OF THE ANALYSIS ARE REPORTED FOR THE DESIGNER'S REVIEW REGARDLESS OF THE OUTCOME OF THE SPECIFICATION COMPARISON. THE FOLLOWING TABLE OUTLINES THE RESULTS OF THE SPECIFICATION COMPARISON TO ASSIST THE DESIGNER IN HIS REVIEW OF THE ANALYSIS-

DESCRIPTION OF SPECIFICATION COMPARISON	COMPLIES (YES-NO)	SPECIFIED VALUE	ANALYSIS VALUE	
1. CRACKING MOMENT (AASHTO ART. 9.18.2).....	YES	2750.5	4328.3	
2. ULTIMATE MOMENT (AASHTO ART. 9.17.1 AND 9.18.1).....	YES	3592.8	4328.3	
3. MAXIMUM NUMBER OF SHIELDED (DEBONDED) STRANDS.....	*NO*	8	9	
4. MINIMUM SPACING OF STRANDS (AASHTO ART. 9.25.2.1).....	YES	2.000	2.000	
5. MAXIMUM TENSILE STRESS (TOP) AT RELEASE (END 15% OF SPAN)..	YES	-778.0	-350.5	
6. MAXIMUM TENSILE STRESS (TOP) AT RELEASE (MID 70% OF SPAN)..	YES	-388.8	-61.3	
7. MAXIMUM COMPRESSIVE STRESS (BOTTOM) AT RELEASE.....	*NO*	2520.0	2616.2	20.00 #
8. MAXIMUM COMPRESSIVE STRESS (TOP) AT SERVICE LOAD.....	YES	2200.0	2124.9	
9. MAXIMUM TENSILE STRESS (BOTTOM) AT SERVICE LOAD.....	YES	-445.0	-365.1	

- LENGTH SHOWN, IN FEET, IS THE INPUT SHIELD LENGTH OF STRAND AT THE DEVELOPMENT LENGTH OF WHICH THE MAXIMUM INDICATED ANALYSIS VALUE OCCURRED.

5/12/93 FLORIDA DEPARTMENT OF TRANSPORTATION 08:49:22

PRESTRESSED CONCRETE BRIDGE GIRDER DESIGN PROGRAM - VERSION 2.40

* THIS IS A SAMPLE PROBLEM FOR REVIEWING A STANDARD BEAM WITH STRAIGHT STRANDS.
* THREE COMMENT CARDS ARE REQUIRED FOR EVERY RUN.
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***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY *****

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****** L O W - R E L A X A T I O N ******

*** MOMENT SUMMARY (FT-KIPS) ***

SECTION	DEAD LD.	NCOMP DL	COMP DL	L.L.+I	TOTAL
0	0.000	0.000	0.000	0.000	0.000
1	358.896	2.934	62.500	369.585	793.915
2	638.036	5.216	111.110	644.939	1399.301
3	837.423	6.847	145.832	826.061	1816.160
4	957.055	7.825	166.665	931.101	2062.645
5	996.932	8.151	173.610	950.990	2129.681
6	957.055	7.825	166.665	931.101	2062.645
7	837.423	6.847	145.832	826.061	1816.160
8	638.036	5.216	111.110	644.939	1399.301
9	358.896	2.934	62.500	369.585	793.915
10	0.000	0.000	0.000	0.000	0.000
3/4 DEPTH	134.054	1.096	23.345	139.427	297.921

*** SHEAR SUMMARY (KIPS) ***

DEAD LD.	NCOMP DL	COMP DL	L.L.+I	TOTAL
49.384	0.404	8.600	51.606	109.993
39.507	0.323	6.880	45.771	92.481
29.630	0.242	5.160	39.937	74.969
19.753	0.162	3.440	34.102	57.457
9.877	0.081	1.720	28.267	39.945
0.000	0.000	0.000	22.432	22.432
9.877	0.081	1.720	28.267	39.945
19.753	0.162	3.440	34.102	57.457
29.630	0.242	5.160	39.937	74.969
39.507	0.323	6.880	45.771	92.481
49.384	0.404	8.600	51.606	109.993
45.944	0.376	8.001	49.574	103.894

**** STRESSES IN EXTREME FIBERS DUE TO EXTERNAL LOADS (LBS PER SQ. IN.) ****

SECTION	BEAM		SLAB		TOTAL D.L. NON-COMP SEC.		TOTAL D.L. NON-COMP SEC.		L.L. + IMPACT COMP SECT.		L.L. + IMPACT COMP SEC.		TOTAL	
	TOP	BOT	TOP	BOT	TOP	BOT	TOP	BOT	TOP	BOT	TOP	BOT	TOP	BOT
0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1	405.	-332.	445.	-364.	7.	-6.	856.	-702.	25.	-74.	146.	-435.	1028.	-1210.
2	720.	-590.	791.	-648.	12.	-10.	1522.	-1248.	44.	-131.	256.	-759.	1822.	-2138.
3	944.	-774.	1038.	-850.	16.	-13.	1998.	-1638.	58.	-172.	327.	-972.	2383.	-2781.
4	1079.	-885.	1186.	-972.	19.	-15.	2284.	-1872.	66.	-196.	369.	-1096.	2719.	-3164.
5	1124.	-922.	1235.	-1012.	19.	-16.	2379.	-1950.	69.	-204.	377.	-1119.	2824.	-3273.
6	1079.	-885.	1186.	-972.	19.	-15.	2284.	-1872.	66.	-196.	369.	-1096.	2719.	-3164.
7	944.	-774.	1038.	-850.	16.	-13.	1998.	-1638.	58.	-172.	327.	-972.	2383.	-2781.
8	720.	-590.	791.	-648.	12.	-10.	1522.	-1248.	44.	-131.	256.	-759.	1822.	-2138.
9	405.	-332.	445.	-364.	7.	-6.	856.	-702.	25.	-74.	146.	-435.	1028.	-1210.
10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3/4 DEPTH	151.	-124.	166.	-136.	3.	-2.	320.	-262.	9.	-27.	55.	-164.	384.	-454.

PRESTRESSED CONCRETE BRIDGE GIRDER DESIGN PROGRAM - VERSION 2.40

* THIS IS A SAMPLE PROBLEM FOR REVIEWING A STANDARD BEAM WITH STRAIGHT STRANDS.
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* TEN (10) PAIR OF CARDS 8 AND 9 ARE REQUIRED

***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY *****

SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS S T R A I G H T S T R A N D S SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS

****** L O W - R E L A X A T I O N ******

**** STRESSES DUE TO EXTERNAL LOADS PLUS PRESTRESS (LBS PER SQ. IN.) ****

	INITIAL PREST.		BEAM PLUS INITIAL PREST. - LOSSES @ REL.		FINAL PREST. PLUS TOT. D.L.(N/C SEC.)		ALL LOADS PLUS FINAL PREST.	
	TOP	BOT	TOP	BOT	TOP	BOT	TOP	BOT
0	-162.	769.	-146.	692.	-125.	594.	-125.	594.
1	-637.	2963.	-169.	2335.	364.	1586.	535.	1078.
2	-787.	3429.	11.	2497.	915.	1401.	1214.	511.
3	-906.	3765.	129.	2615.	1299.	1270.	1684.	127.
4	-906.	3765.	264.	2505.	1584.	1036.	2019.	-255.
5	-906.	3765.	309.	2468.	1679.	958.	2125.	-365.
6	-906.	3765.	264.	2505.	1584.	1036.	2019.	-255.
7	-906.	3765.	129.	2615.	1299.	1270.	1684.	127.
8	-787.	3429.	11.	2497.	915.	1401.	1214.	511.
9	-637.	2963.	-169.	2335.	364.	1586.	535.	1078.
10	-162.	769.	-146.	692.	-125.	594.	-125.	594.
3/4 DEPTH	-557.	2632.	-351.	2245.	-111.	1770.	-46.	1579.

**** SHEAR VALUES AND STIRRUP SPACING (ONE BAR) ****
(AASHTO 1983 SPECS.)

SECTION	VCI	VCW	VS	SIZE	GRADE	SPACING
0	0.000	88.628	119.949	NO. 4	(GR. 60)	AT 6.09 IN
1	263.896	148.232	29.430	NO. 4	(GR. 60)	AT 12.00 IN
2	136.546	184.853	10.202	NO. 4	(GR. 60)	AT 12.00 IN
3	88.705	210.841	27.128	NO. 4	(GR. 60)	AT 12.00 IN
4	56.181	225.953	28.738	NO. 4	(GR. 60)	AT 12.00 IN
5	41.085	230.990	12.920	NO. 4	(GR. 60)	AT 12.00 IN
6	56.181	225.953	28.738	NO. 4	(GR. 60)	AT 12.00 IN
7	88.705	210.841	27.128	NO. 4	(GR. 60)	AT 12.00 IN
8	136.546	184.853	10.202	NO. 4	(GR. 60)	AT 12.00 IN
9	263.896	148.232	29.430	NO. 4	(GR. 60)	AT 12.00 IN
10	0.000	88.628	119.949	NO. 4	(GR. 60)	AT 6.09 IN

**** MAX. ULT. HORIZ. SHEAR (VQ/IB) ****
(BETWEEN SL. AND GIR. FLANGE)

SECTION	
0	163.3 PSI
1	143.5 PSI
2	123.8 PSI
3	104.0 PSI
4	84.3 PSI
5	64.5 PSI
6	84.3 PSI
7	104.0 PSI
8	123.8 PSI
9	143.5 PSI
10	163.3 PSI

4.3 Depressed Strand Design

4.3.1 Input Criteria:

Strands ..... 1/2 in. Dia., Special, Low-Relaxation

Reinforcing Steel ..... Grade 60

Concentrated Static Loads on Non-Composite Section
..... 0.56 kip at 40.00 ft. from left support

Concentrated Static Loads on Composite Section ... 0.25 kip at 26.67 ft. from left support
..... 0.25 kip at 26.67 ft. from left support

Concentrated Live Loads on Composite Section
..... 15 ft. between 16.30 kip and 6.10 kip loads

Span ..... 7.50 ft.

Beam ..... AASHTO Type III

Spacing ..... 5.50 ft.

Slab Thickness ..... 7.00 in.

Loading HS20-44

Uniform Non-Comp. DL ..... 0.140 k/ft.

Uniform Composite DL ..... 0.275 k/ft.

Diaphragm ..... One

End Distance ..... 8.50 in.

4.3.2 Output Report:

Page Two: Debonding length, if required.
Arrangement of prestressing strands at ends and centerline of beam.

Page Three: Vertical shears, moments and stresses at tenth points and hold-downpoints (depressed strands) or "3/4D" (straight strands).

PSTDSN65 (Version 2.40)

5-12-93

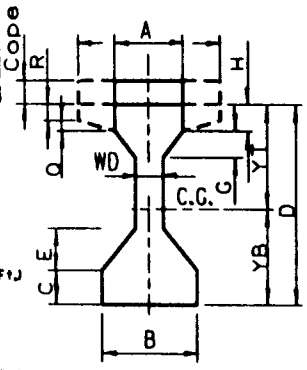
PRESTRESSED CONCRETE BEAM DESIGN PROGRAM


```
* THIS IS A SAMPLE PROBLEM FOR A STANDARD BEAM WITH DEPRESSED STRANDS.
* THIS SAMPLE UTILIZES SPECIAL LOADINGS AND LOW-RELAXATION STRANDS.
* AGAIN, THREE COMMENT CARDS ARE REQUIRED.
```

Card	Cols 1–9	Cols 10–15	Cols 16–20	Cols 21–24	Cols 25–28	Cols 29–32	Cols 33–36	Cols 37–40	Cols 41–44	Cols 45–48	Cols 49–52	Cols 53–56	Cols 57–60	Cols 61–64
1	INERTIA (IN^4)	AREA (IN^2)	D (IN)	YB (IN)	YT (IN)	B (IN)	WD (IN)	C (IN)	E (IN)	A (IN)	H (IN)	G (IN)	Q(IN)	R(IN)

Card	Cols 1–5	Col 6	Cols 7–8	Cols 8–12	Cols 13–17	Cols 18–22	Cols 23–26	Cols 27–30	Cols 31–34	Cols 35–38	Cols 39–42	Cols 43–46	Cols 47–50	Cols 51–54	Cols 55–58
2	Strand Size (1/8, 1/16, 1/2, 9/16, 5/8, 7/8)	Special	Lt. Strgth of Strand (ksi)	Unit Wt. (lbs./cu. ft.) Beam	Unit Wt. (lbs./cu. ft.) Slab	Slab Conc. 28 Day St. (psi)	Beam Conc. 28 Day St. (psi)	Beam Conc. Rel. St. (psi)	Modulus of Elasticity (10^6 psi) Beam Conc.	Modulus of Elasticity (10^6 psi) Slab Conc.	Modulus of Elasticity (10^6 psi) Steel	Strand Clearance Bott.	Strand Clearance Side	Strand Clearance Spacing	Cop ⊕
	1/2	S	1										3		

Card	Cols 59–63	Col 64	Cols 65–66	Cols 67–71	Cols 72–74	Cols 75–77	Cols 78–80
2	Work Load Conc. Ten.(-)	Str. Pfl.	Gr. of Reinf.	Initial Conc. Ten.(-)	Fr. of Debond	Strand Trans. & Bonded	Dev. Factors Shielded
		D	60				



Concentrated Static Loads Applied to Non-Composite Section

Card	Cols 1–6	Cols 7–11	Cols 12–16	Cols 17–21	Cols 22–26	Cols 27–31	Cols 32–36	Cols 37–41	Cols 42–46	Cols 47–51	
3	56										Loads (kips)
3	40										Distance from Left Support (Ft.)

Concentrated Static Loads Applied to Composite Section

Card	Cols 1–6	Cols 7–11	Cols 12–16	Cols 17–21	Cols 22–26	Cols 27–31	Cols 32–36	Cols 37–41	Cols 42–46	Cols 47–51	
4	25	25									Loads (kips)
4	2667	2667									Distance from Left Support (Ft.)

Concentrated Live Loads Applied to Composite Section

Card	Cols 1–6	Cols 7–11	Cols 12–16	Cols 17–21	Cols 22–26	Cols 27–31	Cols 32–36	Cols 37–41	Cols 42–46	Cols 47–51	
5	163	61									Loads (kips)
5	15										Distance from Left Load (Ft.)

Concentrated Live Loads Applied to Composite Section

Card	Cols 1–6	Cols 7–11	Cols 12–16	Cols 17–21	Cols 22–26	Cols 27–31	Cols 32–36	Cols 37–41	Cols 42–46	Cols 47–51	
6											Loads (kips)
6											Distance from Left Load (Ft.)

NOTE: THE FOLLOWING 3 CARDS (7) ARE REQUIRED FOR A DEPRESSED STRAND REVIEW (ANALYSIS) ONLY!

Card	Cols 1–2	Cols 3–4	Cols 5–6	Cols 7–8	Cols 9–10	Cols 11–12	Cols 13–14	Cols 15–16	Cols 17–18	Cols 19–20	Cols 21–22	Cols 23–24	Cols 25–26	Cols 27–28	Cols 29–30	Cols 31–32	Cols 33–34	Cols 35–36	Cols 37–38	Cols 39–41	
7																					℄ Straight Strands
7																					End Straight Strands
7																					Depressed Strands

Cols 38–41	
	Distance to Top Draped Strands (In.)
	Shield Length (Ft.)

NOTE: SEE SHEET NO. 2 OF 2 FOR THE LAST BLANK CARDS REQUIRED FOR ALL PROGRAM OPTIONS AND CARDS 8 AND 9 REQUIRED FOR STRAIGHT STRAND REVIEW (ANALYSIS) ONLY.

PSTDSN65 (Version 2.40)

NOTE: THE FOLLOWING 10 PAIR OF CARDS 8 AND 9 ARE REQUIRED FOR STRAIGHT STRAND REVIEW (ANALYSIS) ONLY!

ROW 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36

1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49 51 53 55 57 59 61 63 65 67 69 71 73 75 77 80

8
9

½ SPACE

℄ BEAM WHEN "IW"=B, IOR 3

℄ BEAM WHEN "IW"=2

Beam Type	Span (C-C Brg.) (Ft.)	Beam Spacing (Ft.)	Slab Thickness (In.)	AASHTO L.L.	Strands In Web	R R L.L.	L.L. Distribution Factor	Shear Distribution Factor	Hold Down From ℄ (Ft.)	Unif. DL on Non-Composite (Kips/ft.)	Unif. DL on Composite Sec. (Kips/ft.)	Width of Composite Slab (Ft.)	Strand Losses (%)	Cope (In.)	Diaphragm 0= None 1= One 5= 5% LL	End (In.) Distance
3	77.5	5.5	7	HS-20						1.40	2.75				1	8
				-												
				-												
2 3	4 8	9 12	13 16	17 21	22	23 25	26 29	30 33	34 37	38 42	43 47	48 51	52 54	55 58	59	60 63

DEFAULT VALUES: 1/2" 270 ksi S.R. Strands
1-Strand In Web
.25 Deband
Grade of Reinf. = 60 ksi

2" Spacing of Strand ≤ 1/2" ø
2 1/4" Spacing of Strand > 1/2" ø
f'c Beam = 5000 psi
Strand Profile = S

Stress Relieved Strand
End Dist. = 6.5'
Cope = 0.0"
Strand Trans. Factor = 1.0 x AASHTO
Strand Dev. Factor = 1.0 x AASHTO

3" Clear. Side & Bott.
f'ci = 4000 psi
Initial Ten. = $-12\sqrt{f'ci}$

Work. Ten. = $-3\sqrt{f'c}$ (1 Strand In Web)
Work. Ten. = $-6\sqrt{f'c}$ (2 Strands In Web)
No Diaphragm Load

150 #/cu. ft. Unit Wt. of Conc.
$E_c = 2.93 \times 10^6$ psi
$E_{slab} = 3.55 \times 10^6$ psi
$E_{steel} = 28 \times 10^6$ psi

Sample 3. Depressed Strands Design Input

```
* THIS IS A SAMPLE PROBLEM FOR A STANDARD BEAM WITH DEPRESSED STRANDS.
* THIS SAMPLE UTILIZES SPECIAL LOADINGS AND LOW-RELAXATION STRANDS.
* AGAIN, THREE COMMENT CARDS ARE REQUIRED.
21/2 S1                                          3          D60
3   56
3 40
4   25   25
4 2667 2667
5 163   61
5 15
  3 775  55  7  HS-20                140  275          1 8
```

Sample 3. Depressed Strands Design Output
(Next 4 Pages)

PRESTRESSED CONCRETE BRIDGE GIRDER DESIGN PROGRAM - VERSION 2.40

```
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```

DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD D E P R E S S E D S T R A N D S DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD

****** L O W - R E L A X A T I O N ******

*** INPUT DATA ***

BEAM TYPE	= 3	UNIT WT. BEAM CONC.	= 150.	PCF	STRAND SIZE (SPECIAL)	= 1/2	IN
SPAN LENGTH	= 77.50 FT	UNIT WT. SLAB CONC.	= 150.	PCF	STRAND ULT STRENGTH	= 270	K
BEAM SPACING	= 5.50 FT	28-DAY ST.(SLAB CONC.)	= 3400.	PSI	NO. OF WEB STRANDS	= 1	
SLAB THICKNESS	= 7.00 IN	E(BM.CONC.)	= 3.55	E(06)PSI	GRID SIZE	= 2.00	IN
L.L. DIST. FACTOR	= 0.50	E(SLAB CONC.)	= 2.93	E(06)PSI	STRAND CL. BOTT. BEAM	= 3.00	IN
TRANS. SLAB WIDTH	= 54.42 IN	E(PRESTRESS STEEL)	= 28.00	E(06)PSI	STRAND CL. SIDE BEAM	= 3.00	IN
UNIF. D.L. N-COMP	= 0.140 KLF	AASHTO L.L.	= HS-20		MAX COMP BM. CONC(ALLOW)	= 2000.	PSI
UNIF. D.L. COMP	= 0.275 KLF	RAILROAD L.L.	= E- 0.		MAX. TENSION AT DES. LOAD	= -212.	PSI
DIAPHRAGM	= ONE				COPE DIMENSION	= 0.00	IN

*** SECTION PROPERTIES ***

		PRECAST	COMPOSITE	
AREA	=	559.50	940.47	IN2
WEIGHT	=	582.81	1064.06	PLF
MOMENT OF INERTIA	=	125390.00	307567.81	IN4
YB BEAM	=	20.27	31.71	IN
SECTION MODULUS BOTTOM	=	6185.98	9700.73	IN3
YT BEAM	=	24.73	13.29	IN
SECTION MODULUS TOP	=	5070.36	23135.16	IN3
YTS SLAB	=		20.29	IN
SECTION MODULUS SLAB	=		15155.31	IN3
HEIGHT	=	45.00	52.00	IN

*** BEAM DIMENSIONS (INCHES) ***

B= 22.00 W= 7.00 C= 7.00 E= 7.50 A= 16.00 H= 7.00 G= 4.50 Q= 0.00 R= 0.00

*** CONCENTRATED LOADS APPLIED TO NON-COMPOSITE SECTION ***

LOAD (KIPS)	0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DIST. FROM LT. REACT. (FT)	40.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

*** CONCENTRATED STATIC LOADS APPLIED TO COMPOSITE SECTION ***

LOAD (KIPS)	0.25	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DIST. FROM LT. REACT. (FT)	26.67	26.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

*** CONCENTRATED LIVE LOADS APPLIED TO COMPOSITE SECTION ***

LOAD (KIPS)	16.30	6.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DIST. FROM LT. LOAD (FT)	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LOAD (KIPS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DIST. FROM LT. LOAD (FT)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PRESTRESSED CONCRETE BRIDGE GIRDER DESIGN PROGRAM - VERSION 2.40

```
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```

DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD D E P R E S S E D S T R A N D S DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD

****** L O W - R E L A X A T I O N ******

*** BEAM DESIGN ***

```
TYPE OF BEAM              =   3
NO. OF STRANDS            =   18.
SIZE OF STRANDS & PULL    =   1/2 S IN AT 33820. LB
TYPE OF STRANDS           =   270K
ECCENTRICITY AT C.L.      =   16.27 IN
ECCENTRICITY AT SUP.      =   13.22 IN
ECCENTRICITY AT END       =   13.16 IN
NO. OF DEPRESSED STRANDS  =    2
DEPRESS TOP 1 STRANDS TO POSITION @ 33.00 IN
CONCRETE RELEASE STRENGTH =   4000.   PSI
CONCRETE 28-DAY STRENGTH  =   5000.   PSI
HOLD DOWN FROM C. L.      =    7.75 FT

BEAM END TO CTR BEARING   =    8.00 IN

SHIELD LENGTH FROM CTR BRG=    0.00 FT

MAX. END TENSION AT REL.  =  -759. PSI
MAX. CTR TENSION AT REL.  =  -379. PSI
```

```
D.L. DEFLECTION AT MID-SPAN =  0.877 IN (SLAB)      0.047 IN (DIAF)
D.L. DEFLECTION AT 1/4 PT.  =  0.625 IN (SLAB)      0.032 IN (DIAF)

ULTIMATE MOMENT REQUIRED  =  2022. FT-KIPS
ULTIMATE MOMENT PROVIDED  =  2988. FT-KIPS  UNDER REINF. RECT. SECT.
1.2 TIMES CRACKING MOMENT =  2052. FT-KIPS

STIRRUP SPACING AT  26.00  INCHES
FROM FACE OF SUPPORT  =  NO. 4 (GR. 60) AT 12.00 IN. (ONE BAR)

TOP FIBER DESIGN STRESS (C.L.)    = 2458. PSI
BOTTOM FIBER DESIGN STRESS (C.L.) = 2384. PSI

PRESTRESS LOSS  = 16.52 PERCENT
LOSS AT RELEASE =  7.39 PERCENT
```

AGE OF BEAM CONCRETE	RELEASE	30 DAYS	60 DAYS	120 DAYS	240 DAYS
NET CAMBER (PSTRES-BEAM) IN.	1.59	2.27	2.42	2.57	2.75
BUILD-UP REQD (CAMBER-SL-DF)IN.	----	1.34	1.50	1.65	1.83
ELASTIC AND TIME-DEPENDENT SHORTENING EFFECTS (EST.) IN.	0.36	0.55	0.60	0.64	0.69

L.L. STRESS IN TOP FIBER OF SLAB AT MIDSPAN = 158. PSI

*** STRAND TRANSFER AND DEVELOPMENT LENGTHS ***

TYPE OF STRAND	AASHTO MULT	TRANSFER LENGTH	DEVELOPMENT LENGTH
FULLY BONDED.....	1.00	2.15 FT	6.33 FT
PATRIALLY DEBONDED... (SHIELDED)	1.00	4.30 FT	12.65 FT

*** STRAND PATTERN ***

```
   (C.L. OF BEAM)            (END OF BEAM)
ROW  1 HAS  9. STRANDS    ROW  1 HAS  8. STRANDS WITH  0. STRANDS SHIELDED    ROW 31.000 INCHES FROM BOTTOM HAS  1. STRANDS
ROW  2 HAS  9. STRANDS    ROW  2 HAS  8. STRANDS WITH  0. STRANDS SHIELDED    ROW 33.000 INCHES FROM BOTTOM HAS  1. STRANDS
```

PRESTRESSED CONCRETE BRIDGE GIRDER DESIGN PROGRAM - VERSION 2.40

* THIS IS A SAMPLE PROBLEM FOR A STANDARD BEAM WITH DEPRESSED STRANDS.
* THIS SAMPLE UTILIZES SPECIAL LOADINGS AND LOW-RELAXATION STRANDS.
* AGAIN, THREE COMMENT CARDS ARE REQUIRED.

DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD D E P R E S S E D S T R A N D S DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD

****** L O W - R E L A X A T I O N ******

*** MOMENT SUMMARY (FT-KIPS) ***

SECTION	DEAD LD.	NCOMP DL	COMP DL	L.L.+I	TOTAL
0	0.000	0.000	0.000	0.000	0.000
1	292.435	40.079	76.869	91.704	501.087
2	520.959	71.750	137.220	161.762	891.691
3	685.573	95.012	181.055	210.173	1171.813
4	786.277	109.865	206.207	236.938	1339.287
5	823.071	115.609	213.132	242.057	1393.869
6	786.277	109.865	206.207	236.938	1339.287
7	685.573	95.012	181.055	210.173	1171.813
8	520.959	71.750	137.220	161.762	891.691
9	292.435	40.079	76.869	91.704	501.087
10	0.000	0.000	0.000	0.000	0.000
HOLD-DOWN	786.277	109.305	206.207	236.938	1338.727

*** SHEAR SUMMARY (KIPS) ***

DEAD LD.	NCOMP DL	COMP DL	L.L.+I	TOTAL
41.857	5.696	10.984	13.229	71.766
33.610	4.611	8.853	11.833	58.907
25.364	3.526	6.722	10.436	46.048
17.117	2.441	4.590	9.040	33.188
8.871	1.356	1.959	7.643	19.829
0.624	0.271	-0.172	6.247	6.970
8.871	1.356	1.959	7.643	19.829
17.117	2.441	4.590	9.040	33.188
25.364	3.526	6.722	10.436	46.048
33.610	4.611	8.853	11.833	58.907
41.857	5.696	10.984	13.229	71.766
8.871	1.356	2.131	13.229	25.587

**** STRESSES IN EXTREME FIBERS DUE TO EXTERNAL LOADS (LBS PER SQ. IN.) ****

SECTION	BEAM		SLAB		TOTAL D.L. NON-COMP SEC.		TOTAL D.L. NON-COMP SEC.		L.L. + IMPACT COMP SECT.		L.L. + IMPACT COMP SEC.		TOTAL	
	TOP	BOT	TOP	BOT	TOP	BOT	TOP	BOT	TOP	BOT	TOP	BOT	TOP	BOT
0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1	373.	-306.	319.	-262.	95.	-78.	787.	-645.	40.	-95.	48.	-113.	874.	-854.
2	663.	-543.	570.	-467.	170.	-139.	1403.	-1150.	71.	-170.	84.	-200.	1558.	-1520.
3	870.	-713.	753.	-617.	225.	-184.	1847.	-1514.	94.	-224.	109.	-260.	2050.	-1998.
4	994.	-815.	867.	-710.	260.	-213.	2121.	-1738.	107.	-255.	123.	-293.	2351.	-2287.
5	1036.	-849.	912.	-748.	274.	-224.	2222.	-1821.	111.	-264.	126.	-299.	2458.	-2384.
6	994.	-815.	867.	-710.	260.	-213.	2121.	-1738.	107.	-255.	123.	-293.	2351.	-2287.
7	870.	-713.	753.	-617.	225.	-184.	1847.	-1514.	94.	-224.	109.	-260.	2050.	-1998.
8	663.	-543.	570.	-467.	170.	-139.	1403.	-1150.	71.	-170.	84.	-200.	1558.	-1520.
9	373.	-306.	319.	-262.	95.	-78.	787.	-645.	40.	-95.	48.	-113.	874.	-854.
10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
HOLD-DOWN	994.	-815.	867.	-710.	259.	-212.	2120.	-1737.	107.	-255.	123.	-293.	2349.	-2285.

PRESTRESSED CONCRETE BRIDGE GIRDER DESIGN PROGRAM - VERSION 2.40

* THIS IS A SAMPLE PROBLEM FOR A STANDARD BEAM WITH DEPRESSED STRANDS.
* THIS SAMPLE UTILIZES SPECIAL LOADINGS AND LOW-RELAXATION STRANDS.
* AGAIN, THREE COMMENT CARDS ARE REQUIRED.

DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD D E P R E S S E D S T R A N D S DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD

****** L O W - R E L A X A T I O N ******

**** STRESSES DUE TO EXTERNAL LOADS PLUS PRESTRESS (LBS PER SQ. IN.) ****

	INITIAL PREST.		BEAM PLUS INITIAL PREST. - LOSSES @ REL.		FINAL PREST. PLUS TOT. D.L.(N/C SEC.)		ALL LOADS PLUS FINAL PREST.	
	TOP	BOT	TOP	BOT	TOP	BOT	TOP	BOT
0	-155.	741.	-143.	686.	-129.	618.	-129.	618.
1	-591.	2464.	-175.	1977.	294.	1412.	381.	1203.
2	-682.	2539.	31.	1808.	833.	970.	988.	600.
3	-774.	2614.	153.	1708.	1201.	668.	1404.	184.
4	-865.	2689.	193.	1675.	1399.	506.	1628.	-42.
5	-865.	2689.	234.	1642.	1499.	424.	1735.	-139.
6	-865.	2689.	193.	1675.	1399.	506.	1628.	-42.
7	-774.	2614.	153.	1708.	1201.	668.	1404.	184.
8	-682.	2539.	31.	1808.	833.	970.	988.	600.
9	-591.	2464.	-175.	1977.	294.	1412.	381.	1203.
10	-155.	741.	-143.	686.	-129.	618.	-129.	618.
HOLD-DOWN	-865.	2689.	193.	1675.	1397.	507.	1627.	-41.

**** SHEAR VALUES AND STIRRUP SPACING (ONE BAR) ****
(AASHTO 1983 SPECS.)

SECTION	VCI	VCW	VS	SIZE GRADE SPACING
0	0.000	109.924	6.478	NO. 4 (GR. 60) AT 12.00 IN
1	234.721	143.264	-46.782	NO. 4 (GR. 60) AT 12.00 IN
2	107.282	169.930	-30.719	NO. 4 (GR. 60) AT 12.00 IN
3	63.493	189.542	-6.849	NO. 4 (GR. 60) AT 12.00 IN
4	40.390	201.721	-4.387	NO. 4 (GR. 60) AT 12.00 IN
5	40.390	206.414	-24.307	NO. 4 (GR. 60) AT 12.00 IN
6	40.390	201.721	-4.387	NO. 4 (GR. 60) AT 12.00 IN
7	63.493	189.542	-6.849	NO. 4 (GR. 60) AT 12.00 IN
8	107.282	169.930	-30.719	NO. 4 (GR. 60) AT 12.00 IN
9	234.721	143.264	-46.782	NO. 4 (GR. 60) AT 12.00 IN
10	0.000	109.924	6.478	NO. 4 (GR. 60) AT 12.00 IN

**** MAX. ULT. HORIZ. SHEAR (VQ/IB) ****
(BETWEEN SL. AND GIR. FLANGE)

SECTION	
0	55.8 PSI
1	48.3 PSI
2	40.8 PSI
3	33.2 PSI
4	24.8 PSI
5	17.3 PSI
6	24.8 PSI
7	33.2 PSI
8	40.8 PSI
9	48.3 PSI
10	55.8 PSI

4.4 Depressed Strand Review (Analysis)

4.4.1 Input Criteria:

Non-Standard Beam Moment of Inertia . . . . . 733,320.00 in4.

Beam Cross-Sectional Area . . . . . 1085 in2.

Beam Depth D . . . . . 72.00 in.

Beam Dimension YB . . . . . 36.38 in.

Beam Dimension YT . . . . . 35.62 in.

Beam Dimension B . . . . . 28.00 in.

Beam Dimension W . . . . . 8.00 in.

Beam Dimension C . . . . . 8.00 in.

Beam Dimension E . . . . . 10.00 in.

Beam Dimension A . . . . . 42.00 in.

Beam Dimension H . . . . . 8.00 in.

Beam Dimension G . . . . . 4.00 in.

Beam Dimension Q . . . . . in.

Beam Dimension R . . . . . in.

Strands . . . . . 9/16 in. Dia., Stress-Relieved

Concentrated Static Loads on Non-Composite Section

. . . . . 3.23 kip at 31.73 ft. from left support
. . . . . 3.23 kip at 63.46 ft. from left support
. . . . . 3.23 kip at 95.19 ft. from left support

Strand Pattern

Distance from beam bottom to the topmost depressed strand . . . . . 67.00 in.
Debond length . . . . . 24.23 ft.

Row	C.L. of Beam	End of Beam
1	11 strands	10 strands with 6 strands debonded 1 strand at 55.75 in. from bottom
2	11 strands	10 strands with 6 strands debonded 1 strand at 58.00 in. from bottom
3	9 strands	8 strands with 0 strands debonded 1 strand at 60.25 in. from bottom
4	9 strands	8 strands with 0 strands debonded 1 strand at 62.50 in. from bottom
5	7 strands	6 strands with 0 strands debonded 1 strand at 64.75 in. from bottom
6	3 strands	2 strands with 0 strands debonded 1 strand at 67.00 in. from bottom

Beam . . . . . Non-Standard

Span . . . . . 126.93 ft.

Spacing . . . . . 7.69 ft.

Slab Thickness . . . . . 7.50 in.

Loading HS20-44

No. of Strands in the Web 1

Uniform Composite DL . . . . . 0.347 k/ft.

PSTDSN65 (Version 2.40)

5-12-93

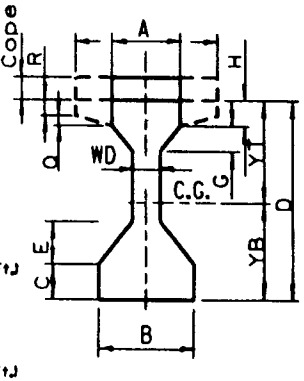
PRESTRESSED CONCRETE BEAM DESIGN PROGRAM

* THIS IS A NON-STANDARD BEAM WITH DEPRESSED STRANDS REVIEW SAMPLE.

* USING CARD TYPE 1 AND CARD 'BLANK' TO SPECIFY SECTION PROPERTIES.

* AGAIN, THREE COMMENT CARDS ARE REQUIRED.

Card	Field	Value
1	INERTIA (IN^4)	733320
	AREA (IN^2)	1085
	D (IN)	72
	YB (IN)	3638
	YT (IN)	3562
	B (IN)	28
	WD (IN)	8
	C (IN)	8
	E (IN)	10
	A (IN)	42
	H (IN)	8
	G (IN)	4
	Q (IN)	
	R (IN)	
2	Strand Size (1/8, 1/4, 3/8, 1/2, 0.6)	9/16
	Special	
	Ult. Strgth of Strand (ksi)	
	Unit Wt. lbs./cu. ft. Beam	
	Unit Wt. lbs./cu. ft. Slab	
	Slab Conc. 28 Day St. (psi)	
	Beam Conc. 28 Day St. (psi)	
	Beam Conc. Rel. St. (psi)	
	Modulus of Elasticity (10^6 psi) Beam Conc.	
	Modulus of Elasticity (10^6 psi) Slab Conc.	
	Modulus of Elasticity (10^6 psi) Steel	
	Strand Clearance Bott.	
	Strand Clearance Side	
	Strand Clearance Spacing	
	Work Load Conc. Tens.(-)	
	Str. Pft.	D
	Gr. of Reinf.	
	Initial Conc. Tens.(-)	
	Fr. of Debond	
	Strand Trans. & Bonded	
	Dev. Factors Shielded	
3	Concentrated Static Loads Applied to Non-Composite Section: Loads (kips)	323, 323, 323
3	Distance from Left Support (Ft.)	3173, 6346, 9519
4	Concentrated Static Loads Applied to Composite Section: Loads (kips)	
4	Distance from Left Support (Ft.)	
5	Concentrated Live Loads Applied to Composite Section: Loads (kips)	
5	Distance from Left Load (Ft.)	
6	Concentrated Live Loads Applied to Composite Section: Loads (kips)	
6	Distance from Left Load (Ft.)	



NOTE: THE FOLLOWING 3 CARDS (7) ARE REQUIRED FOR A DEPRESSED STRAND REVIEW (ANALYSIS) ONLY!

Card	Field	Value
7	℄ Straight Strands	10 10 8 8 6 2
7	End Straight Strands	4 4 8 8 6 2
7	Depressed Strands	1 1 1 1 1 1
	Distance to Top Draped Strands (In.)	67
	Shield Length (Ft.)	2423

NOTE: SEE SHEET NO. 2 OF 2 FOR THE LAST BLANK CARDS REQUIRED FOR ALL PROGRAM OPTIONS AND CARDS 8 AND 9 REQUIRED FOR STRAIGHT STRAND REVIEW (ANALYSIS) ONLY.

PSTDSN65 (Version 2.40)

NOTE: THE FOLLOWING 10 PAIR OF CARDS 8 AND 9 ARE REQUIRED FOR STRAIGHT STRAND REVIEW (ANALYSIS) ONLY!

ROW 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36

1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49 51 53 55 57 59 61 63 65 67 69 71 73 75 77 80

8
9

½ SPACE

℄ BEAM WHEN "W"=B, LOR 3

℄ BEAM WHEN "W"=2

Beam Type	Span (C-C Brg.) (ft.)	Beam Spacing (ft.)	Slab Thickness (in.)	AASHTO L.L.	Strands in Web	R R L.L.	L.L. Distribution Factor	Shear Distribution Factor	Hold Down From ℄ ~ (ft.)	Unif. DL on Non-Composite (kips/ft.)	Unif. DL on Composite Sec. (kips/ft.)	Width of Composite Slab (ft.)	Strand Losses (%)	Cope (in.)	Diaphragm 0= None 1= One 5= 5% LL	End (in.) Distance
NS	126.92	7.69	7.5	HS-20	1						3.47					
				-												
				-												
2 3	4 8	9 12	13 16	17 21	22	23 25	26 29	30 33	34 37	38 42	43 47	48 51	52 54	55 58	59	60 63

DEFAULT VALUES: 1/2" 270 ksi S.R. Strands
1-Strand in Web
.25 Debond
Grade of Reinf. = 60 ksi

2" Spacing of Strand ≤ 1/2" ø
2 1/4" Spacing of Strand > 1/2" ø
f'c Beam = 5000 psi
Strand Profile = S

Stress Relieved Strand
End Dist. = 6.5'
Cope = 0.0'
Strand Trans. Factor = 1.0 x AASHTO
Strand Dev. Factor = 1.0 x AASHTO

3" Clear, Side & Bott.
f'ci = 4000 psi
Initial Ten. = $-12\sqrt{f'ci}$

Work. Ten. = $-3\sqrt{f'c}$ (1 Strand in Web)
Work. Ten. = $-6\sqrt{f'c}$ (2 Strands in Web)
No Diaphragm Load

150 #/cu. ft. Unit Wt. of Conc.
$E_c = 2.93 \times 10^6$ psi
$E_{slab} = 3.55 \times 10^6$ psi
$E_{steel} = 28 \times 10^6$ psi

Sample 4. Depressed Strands Review Input

```
* THIS IS A NON-STANDARD BEAM WITH DEPRESSED STRANDS REVIEW SAMPLE.
* USING CARD TYPE 1 AND CARD 'BLANK' TO SPECIFY SECTION PROPERTIES.
* AGAIN, THREE COMMENTS CARDS ARE REQUIRED.
1733320  1085   72  3638356228   8   8  10  42   8   4
29/16                                                          D
3  323  323  323
3 3173 6346 9519
71010 8 8 6 2                     67
7 4 4 8 8 6 2                     2423
7 1 1 1 1 1 1
 NS12692 769 75 HS-201                  347
```

Sample 4. Depressed Strands Review Output
(Next 4 Pages)

```
* THIS IS A NON-STANDARD BEAM WITH DEPRESSED STRANDS REVIEW SAMPLE.
* USING CARD TYPE 1 AND CARD 'BLANK' TO SPECIFY SECTION PROPERTIES.
* AGAIN, THREE COMMENTS CARDS ARE REQUIRED.

***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY *****

DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD    D E P R E S S E D    S T R A N D S    DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD

                                  ***** S T R E S S  -  R E L I E V E D *****
*** INPUT DATA ***

BEAM TYPE          =  NS            UNIT WT. BEAM CONC.    =  150.   PCF          STRAND SIZE              =  9/16 IN
SPAN LENGTH        = 126.92 FT      UNIT WT. SLAB CONC.    =  150.   PCF          STRAND ULT STRENGTH      =   270 K
BEAM SPACING       =   7.69 FT      28-DAY ST.(SLAB CONC.) = 3400.   PSI          NO. OF WEB STRANDS       =     1
SLAB THICKNESS     =   7.50 IN      E(BM.CONC.)            =    3.55 E(06)PSI     GRID SIZE                =  2.25 IN
L.L. DIST. FACTOR  =   0.70         E(SLAB CONC.)          =    2.93 E(06)PSI     STRAND CL. BOTT. BEAM    =  3.00 IN
TRANS. SLAB WIDTH  =  76.10 IN      E(PRESTRESS STEEL)     =   28.00 E(06)PSI     STRAND CL. SIDE BEAM     =  3.00 IN
UNIF. D.L. N-COMP  =  0.000 KLF     AASHTO L.L.            =   HS-20              MAX COMP BM. CONC(ALLOW) = 2000. PSI
UNIF. D.L. COMP    =  0.347 KLF     RAILROAD L.L.          =    E- 0.             MAX. TENSION AT DES. LOAD= -212. PSI
DIAPHRAGM          =  NONE                                                       COPE DIMENSION           =  0.00 IN

*** SECTION PROPERTIES ***
                              PRECAST          COMPOSITE

AREA                    =   1085.00            1655.72 IN2
WEIGHT                  =   1130.21            1851.15 PLF
MOMENT OF INERTIA       = 733320.00         1315687.00 IN4
YB BEAM                 =     36.38              49.95 IN
SECTION MODULUS BOTTOM  =  20157.22           26339.73 IN3
YT BEAM                 =     35.62              22.05 IN
SECTION MODULUS TOP     =  20587.31           59670.15 IN3
YTS SLAB                =                        29.55 IN
SECTION MODULUS SLAB    =                     44525.10 IN3
HEIGHT                  =     72.00              79.50 IN

*** BEAM DIMENSIONS (INCHES) ***
B= 28.00  W=  8.00  C=  8.00  E= 10.00  A= 42.00  H=  8.00  G=  4.00  Q=  0.00  R=  0.00

*** CONCENTRATED LOADS APPLIED TO NON-COMPOSITE SECTION ***
LOAD (KIPS)                  3.23   3.23   3.23   0.00   0.00   0.00   0.00   0.00   0.00   0.00
DIST. FROM LT. REACT. (FT)  31.73  63.46  95.19   0.00   0.00   0.00   0.00   0.00   0.00   0.00

*** CONCENTRATED STATIC LOADS APPLIED TO COMPOSITE SECTION ***
LOAD (KIPS)                  0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
DIST. FROM LT. REACT. (FT)   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00

*** CONCENTRATED LIVE LOADS APPLIED TO COMPOSITE SECTION ***
LOAD (KIPS)                  0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
DIST. FROM LT. LOAD (FT)     0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
LOAD (KIPS)                  0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
DIST. FROM LT. LOAD (FT)     0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
```

```
* THIS IS A NON-STANDARD BEAM WITH DEPRESSED STRANDS REVIEW SAMPLE.
* USING CARD TYPE 1 AND CARD 'BLANK' TO SPECIFY SECTION PROPERTIES.
* AGAIN, THREE COMMENTS CARDS ARE REQUIRED.

***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY *****

DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD    D E P R E S S E D    S T R A N D S    DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD

                                  ***** S T R E S S  -  R E L I E V E D *****
*** BEAM DESIGN ***

TYPE OF BEAM              =  NS                      D.L. DEFLECTION AT MID-SPAN =  1.615 IN (SLAB)     0.000 IN (DIAF)
NO. OF STRANDS            =  50.                     D.L. DEFLECTION AT 1/4 PT.  =  1.151 IN (SLAB)     0.000 IN (DIAF)
SIZE OF STRANDS & PULL    =  9/16  IN AT 36290. LB
TYPE OF STRANDS           =  270K                    ULTIMATE MOMENT REQUIRED  =  9659. FT-KIPS
ECCENTRICITY AT C.L.      =  28.93 IN                ULTIMATE MOMENT PROVIDED  = 13722. FT-KIPS  UNDER REINF. FLGD. SECT.
ECCENTRICITY AT SUP.      =  22.66 IN                1.2 TIMES CRACKING MOMENT =  8150. FT-KIPS
ECCENTRICITY AT END       =  22.60 IN
NO. OF DEPRESSED STRANDS  =   6                      STIRRUP SPACING AT  39.75  INCHES
DEPRESS TOP 1 STRANDS TO POSITION @ 67.00 IN         FROM FACE OF SUPPORT  =  NO. 4 (GR. 60) AT  8.27 IN. (ONE BAR)
CONCRETE RELEASE STRENGTH =  4000.   PSI
CONCRETE 28-DAY STRENGTH  =  5000.   PSI             TOP FIBER DESIGN STRESS (C.L.)    = 2770. PSI
HOLD DOWN FROM C. L.      =  12.50 FT                BOTTOM FIBER DESIGN STRESS (C.L.) = 3425. PSI

BEAM END TO CTR BEARING   =   6.50 IN

SHIELD LENGTH FROM CTR BRG=  24.23 FT                PRESTRESS LOSS  = 27.19 PERCENT
                                                     LOSS AT RELEASE = 13.50 PERCENT
MAX. END TENSION AT REL.  =  -759. PSI
MAX. CTR TENSION AT REL.  =  -379. PSI               AGE OF BEAM CONCRETE          RELEASE 30 DAYS 60 DAYS 120 DAYS 240 DAYS
                                                     NET CAMBER  (PSTRES-BEAM) IN.   3.08    4.31    4.58     4.85     5.19
                                                     BUILD-UP REQD (CAMBER-SL-DF)IN. ----    2.69    2.96     3.23     3.58

                                                     ELASTIC AND TIME-DEPENDENT
                                                     SHORTENING EFFECTS (EST.) IN.   0.84    1.30    1.40     1.51     1.61

L.L. STRESS IN TOP FIBER OF SLAB AT MIDSPAN =  373. PSI

                                  *** STRAND TRANSFER AND DEVELOPMENT LENGTHS ***

                         TYPE OF STRAND        AASHTO MULT    TRANSFER LENGTH    DEVELOPMENT LENGTH
                         FULLY BONDED.........   1.00           2.34 FT              7.63 FT
                         PATRIALLY DEBONDED...   1.00           4.69 FT             15.26 FT
                             (SHIELDED)
                                                  *** STRAND PATTERN ***
    (C.L. OF BEAM)            (END OF BEAM)
ROW  1 HAS 11. STRANDS    ROW  1 HAS 10. STRANDS WITH  6. STRANDS SHIELDED    ROW 55.750 INCHES FROM BOTTOM HAS  1. STRANDS
ROW  2 HAS 11. STRANDS    ROW  2 HAS 10. STRANDS WITH  6. STRANDS SHIELDED    ROW 58.000 INCHES FROM BOTTOM HAS  1. STRANDS
ROW  3 HAS  9. STRANDS    ROW  3 HAS  8. STRANDS WITH  0. STRANDS SHIELDED    ROW 60.250 INCHES FROM BOTTOM HAS  1. STRANDS
ROW  4 HAS  9. STRANDS    ROW  4 HAS  8. STRANDS WITH  0. STRANDS SHIELDED    ROW 62.500 INCHES FROM BOTTOM HAS  1. STRANDS
ROW  5 HAS  7. STRANDS    ROW  5 HAS  6. STRANDS WITH  0. STRANDS SHIELDED    ROW 64.750 INCHES FROM BOTTOM HAS  1. STRANDS
ROW  6 HAS  3. STRANDS    ROW  6 HAS  2. STRANDS WITH  0. STRANDS SHIELDED    ROW 67.000 INCHES FROM BOTTOM HAS  1. STRANDS
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5/12/93 FLORIDA DEPARTMENT OF TRANSPORTATION 08:47:51

PRESTRESSED CONCRETE BRIDGE GIRDER DESIGN PROGRAM - VERSION 2.40

* THIS IS A NON-STANDARD BEAM WITH DEPRESSED STRANDS REVIEW SAMPLE.
* USING CARD TYPE 1 AND CARD 'BLANK' TO SPECIFY SECTION PROPERTIES.
* AGAIN, THREE COMMENTS CARDS ARE REQUIRED.

***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY *****

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***** S T R E S S - R E L I E V E D *****

*** MOMENT SUMMARY (FT-KIPS) ***

SECTION	DEAD LD.	NCOMP DL	COMP DL	L.L.+I	TOTAL
0	0.000	0.000	0.000	0.000	0.000
1	1341.878	61.493	251.537	632.773	2287.678
2	2385.560	122.985	447.177	1112.418	4068.137
3	3131.048	163.980	586.920	1438.935	5320.879
4	3578.340	184.478	670.766	1631.091	6064.672
5	3727.440	204.975	698.714	1679.505	6310.633
6	3578.340	184.478	670.766	1631.091	6064.672
7	3131.048	163.980	586.920	1438.935	5320.879
8	2385.560	122.985	447.177	1112.418	4068.137
9	1341.878	61.493	251.537	632.773	2287.678
10	0.000	0.000	0.000	0.000	0.000
HOLD-DOWN	3582.817	184.788	671.605	1632.964	6072.172

*** SHEAR SUMMARY (KIPS) ***

DEAD LD.	NCOMP DL	COMP DL	L.L.+I	TOTAL
117.474	4.845	22.021	55.890	200.229
93.979	4.845	17.616	49.858	166.298
70.484	4.845	13.212	43.825	132.367
46.989	1.615	8.808	37.793	95.205
23.495	1.615	4.404	31.760	61.274
0.000	1.615	0.000	25.728	27.343
23.495	1.615	4.404	31.760	61.274
46.989	1.615	8.808	37.793	95.205
70.484	4.845	13.212	43.825	132.367
93.979	4.845	17.616	49.858	166.298
117.474	4.845	22.021	55.890	200.229
23.139	4.845	4.338	55.890	88.212

**** STRESSES IN EXTREME FIBERS DUE TO EXTERNAL LOADS (LBS PER SQ. IN.) ****

SECTION	BEAM		SLAB		TOTAL D.L. NON-COMP SEC.		TOTAL D.L. NON-COMP SEC.		L.L. + IMPACT COMP SECT.		L.L. + IMPACT COMP SEC.		TOTAL	
	TOP	BOT	TOP	BOT	TOP	BOT	TOP	BOT	TOP	BOT	TOP	BOT	TOP	BOT
0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1	478.	-488.	305.	-311.	36.	-37.	818.	-835.	51.	-115.	127.	-288.	996.	-1238.
2	849.	-867.	542.	-553.	72.	-73.	1462.	-1493.	90.	-204.	224.	-507.	1776.	-2204.
3	1114.	-1138.	711.	-726.	96.	-98.	1921.	-1962.	118.	-267.	289.	-656.	2328.	-2885.
4	1273.	-1301.	812.	-830.	108.	-110.	2193.	-2240.	135.	-306.	328.	-743.	2656.	-3289.
5	1327.	-1355.	846.	-864.	119.	-122.	2292.	-2341.	141.	-318.	338.	-765.	2770.	-3425.
6	1273.	-1301.	812.	-830.	108.	-110.	2193.	-2240.	135.	-306.	328.	-743.	2656.	-3289.
7	1114.	-1138.	711.	-726.	96.	-98.	1921.	-1962.	118.	-267.	289.	-656.	2328.	-2885.
8	849.	-867.	542.	-553.	72.	-73.	1462.	-1493.	90.	-204.	224.	-507.	1776.	-2204.
9	478.	-488.	305.	-311.	36.	-37.	818.	-835.	51.	-115.	127.	-288.	996.	-1238.
10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
HOLD-DOWN	1275.	-1302.	813.	-831.	108.	-110.	2196.	-2243.	135.	-306.	328.	-744.	2660.	-3293.

PRESTRESSED CONCRETE BRIDGE GIRDER DESIGN PROGRAM - VERSION 2.40

* THIS IS A NON-STANDARD BEAM WITH DEPRESSED STRANDS REVIEW SAMPLE.
* USING CARD TYPE 1 AND CARD 'BLANK' TO SPECIFY SECTION PROPERTIES.
* AGAIN, THREE COMMENTS CARDS ARE REQUIRED.

***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY ***** REVIEW ONLY *****

DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD D E P R E S S E D S T R A N D S DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD

***** S T R E S S - R E L I E V E D *****

**** STRESSES DUE TO EXTERNAL LOADS PLUS PRESTRESS (LBS PER SQ. IN.) ****

	INITIAL PREST.		BEAM PLUS INITIAL PREST. - LOSSES @ REL.		FINAL PREST. PLUS TOT. D.L.(N/C SEC.)		ALL LOADS PLUS FINAL PREST.	
	TOP	BOT	TOP	BOT	TOP	BOT	TOP	BOT
0	-10.	604.	-9.	523.	-7.	440.	-7.	440.
1	-182.	2754.	321.	1895.	686.	1170.	864.	767.
2	-600.	3993.	330.	2587.	1025.	1414.	1339.	703.
3	-737.	4133.	476.	2437.	1384.	1048.	1791.	125.
4	-875.	4274.	517.	2396.	1556.	872.	2019.	-177.
5	-877.	4276.	568.	2344.	1654.	772.	2132.	-311.
6	-875.	4274.	517.	2396.	1556.	872.	2019.	-177.
7	-737.	4133.	476.	2437.	1384.	1048.	1791.	125.
8	-600.	3993.	330.	2587.	1025.	1414.	1339.	703.
9	-182.	2754.	321.	1895.	686.	1170.	864.	767.
10	-10.	604.	-9.	523.	-7.	440.	-7.	440.
HOLD-DOWN	-877.	4276.	516.	2396.	1558.	870.	2021.	-180.

**** SHEAR VALUES AND STIRRUP SPACING (ONE BAR) ****
(AASHTO 1983 SPECS.)

SECTION	VCI	VCW	VS	SIZE	GRADE	SPACING
0	0.000	221.769	121.274	NO. 4	(GR. 60)	AT 8.27 IN
1	387.063	268.313	19.907	NO. 4	(GR. 60)	AT 12.00 IN
2	244.154	339.177	-10.754	NO. 4	(GR. 60)	AT 12.00 IN
3	142.532	369.635	31.382	NO. 4	(GR. 60)	AT 12.00 IN
4	88.669	388.884	30.423	NO. 4	(GR. 60)	AT 12.00 IN
5	69.283	395.419	-5.012	NO. 4	(GR. 60)	AT 12.00 IN
6	88.669	388.884	30.423	NO. 4	(GR. 60)	AT 12.00 IN
7	142.532	369.635	31.382	NO. 4	(GR. 60)	AT 12.00 IN
8	244.154	339.177	-10.754	NO. 4	(GR. 60)	AT 12.00 IN
9	387.063	268.313	19.907	NO. 4	(GR. 60)	AT 12.00 IN
10	0.000	221.769	121.274	NO. 4	(GR. 60)	AT 8.27 IN

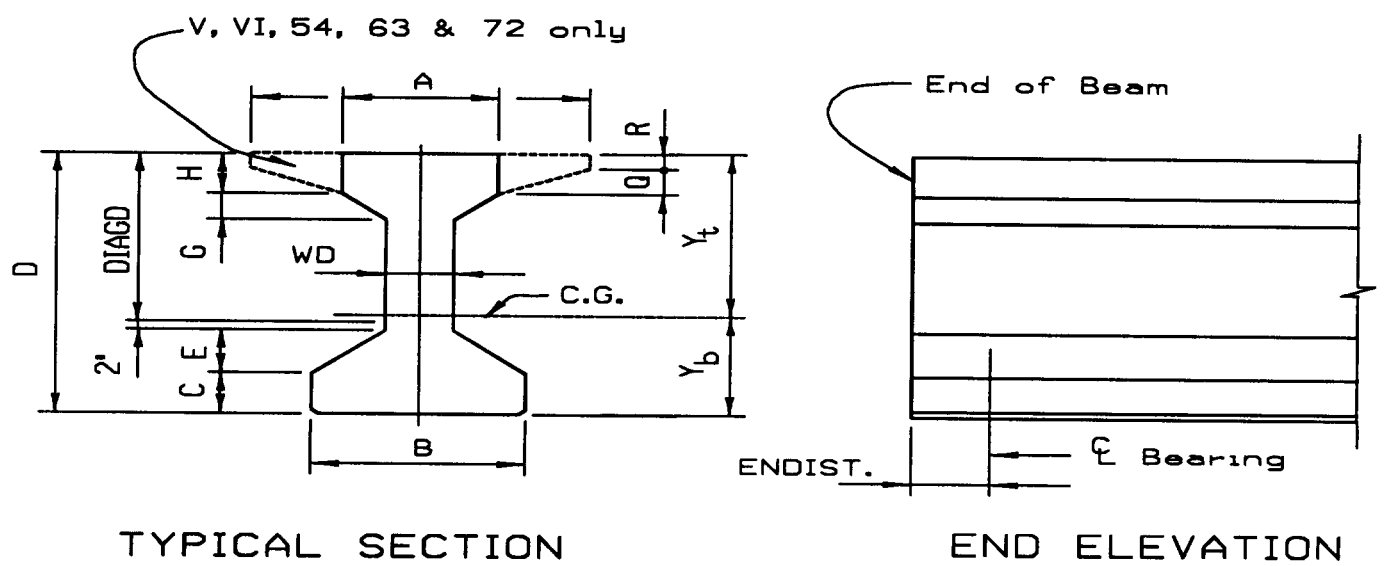
**** MAX. ULT. HORIZ. SHEAR (VQ/IB) ****
(BETWEEN SL. AND GIR. FLANGE)

SECTION	
0	39.9 PSI
1	34.9 PSI
2	29.9 PSI
3	24.9 PSI
4	19.9 PSI
5	14.9 PSI
6	19.9 PSI
7	24.9 PSI
8	29.9 PSI
9	34.9 PSI
10	39.9 PSI

APPENDIX 1
Non-Composite Standard Beam Properties

BEAM TYPE	II	III	IV	V	VI	54	63	72
I (in.^{4})	50,979	125,390	260,741	521,163	733,320	311,765	458,521	638,672
Area (in.^{2})	369.00	559.50	789.00	1013.00	1085.00	784.91	843.41	901.26
YB (in.)	15.83	20.27	24.73	31.96	36.38	25.89	30.12	34.36
YT (in.)	20.17	24.73	29.27	31.04	35.62	28.11	32.88	37.64
D (in.)	36	45	54	63	72	54	63	72
B (in.)	18	22	26	28	28	30	30	30
C (in.)	6	7	8	8	8	7.5	7.5	7.5
E (in.)	6	7.5	9	10	10	5.5	5.5	5.5
WD (in.)	6	7	8	8	8	6.5	6.5	6.5
A (in.)	12	16	20	42	42	48	48	48
H (in.)	6	7	8	8	8	5.21	5.21	5.21
G (in.)	3	4.5	6	4	4	4.08	4.08	4.08
Q (in.)	0.0	0.0	0.0	3.0	3.0	3.2140	3.2140	3.2140
R (in.)	0.0	0.0	0.0	5.0	5.0	2.0	2.0	2.0
DIAGD (in.)	22	28.5	35	43	52	39	48	57
ENDIST(in.)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5

For FBT 54, 63, 72 or any "NS" beam with a circular fillet joining the web to the top flange, dimensions "G", "H" and "Q" are calculated by determining the largest 45-degree fillet that can be incorporated within the outline of the actual circular fillet. The values are automatically included in runs of Type V, VI and FBT series beams and may be input for "NS" beams as necessary.



APPENDIX 2
Properties of Seven-Wire Uncoated Strands for Prestressed Concrete

GRADE (FPS)	TYPE	NOM.DIA. (IN.)	DIAMETER (IN.)	AREA (SQ.IN.) (ASTRN)	MIN. ULT. STRENGTH (LBS.)	*PULL (LBS.)
250KSI	Stress-Relieved	3/8	0.3750	0.080	20,000	14,000
		7/16	0.4375	0.109	27,000	18,900
		1/2	0.5000	0.144	36,000	25,200
		6/10	0.6000	0.216	54,000	37,800
270KSI	Stress-Relieved	3/8	0.3750	0.085	23,000	16,070
		7/16	0.4375	0.115	31,000	21,740
		1/2	0.5000	0.153	41,300	28,920
		1/2S	0.5160	0.167	45,000	31,570
		9/16	0.5625	0.192	51,700	36,290
		9/16S	0.5740	0.196	53,000	37,050
		6/10	0.6000	0.217	58,600	41,020
270KSI	Low-Relaxation	3/8	0.3750	0.085	23,000	17,220
		7/16	0.4375	0.115	31,000	23,790
		1/2	0.5000	0.153	41,300	30,990
		1/2S	0.5160	0.167	45,000	33,820
		9/16	0.5625	0.192	51,700	38,880
		9/16S	0.5740	0.196	53,000	39,690
		6/10	0.6000	0.217	58,600	43,950

*PULL = C_1 x FPS x ASTRN
C_1 = 0.70 for stress-relieved strand
C_1 = 0.75 for low relaxation strand (AASHTO 9.15.1)

APPENDIX 3

Default Values

1. Live load distribution factor = beam spacing / 11.0
2. Strand diameter = 1/2 in.
3. Strand area = 0.153 sq. in.
4. Strand Type = Stress Relieved (SR)
5. Unit weight of beam and slab = 150 pcf
6. Compressive strength of slab concrete = 3,400 psi
7. Modulus of elasticity for beam concrete = 3.55 x 10^6 psi (see p. 3)
8. Modulus of elasticity for slab concrete = 2.93 x 10^6 psi (see p. 3)
9. Modulus of elasticity for steel = 28 x 10^6 psi
10. Ultimate strength of strand = 270,000 psi
11. Yield point stress for web reinforcement = 60,000 psi
12. Number of strands in the web = 1
13. Strand clearance of 3" on the side and bottom of beam with a 2" grid spacing for all strands 1/2" nominal diameter and smaller and 2-1/4" grid spacing for all strands larger than 1/2" nominal diameter.
14. Release strength f'_c = 4,000 psi
15. Beam compressive strength = 5,000 psi
16. Strand profile = STRAIGHT
17. Maximum percent of debonded strands = 25%
18. Allowable tensile stress in top fiber at end region of beam at release = $-12(f'_{ci})^{0.5}$ (see p. 6)
19. Allowable tensile stress in bottom fiber at working loads:

    $-3\sqrt{f'_c}$ *for extremely aggressive environments*

    $-6\sqrt{f'_c}$ *for slightly/moderately aggressive environments*

20. No diaphragm nor diaphragm load allowance
21. End distance (centerline bearing to end of beam) = 6.5 in.
22. AASHTO transfer length factor = 1.00
23. AASHTO development length factor = 1.00

APPENDIX 4
Variable Definitions

A: Width of top flange (in.) (see Appendix 1).
ABLANK-FBLANK: Stored data for comparative purposes to eliminate confusion when using Beam Types 1 through 11.
ACI: Web reinforcement spacing (in.)
ACOMPR: Allowable compressive stress at design load after losses (psi).
AR: Array of beam cross-sectional areas (in.^{2}) (see Appendix 1).
AREA: Beam cross-sectional area (in.^{2}) (see Appendix 1).
AREAC: Total area of the composite section (in.^{2}).
ASL: Effective area of slab for computing composite section properties (in.^{2}).
ASTRN: Cross-sectional area of prestressing strand (in.^{2}).
AV: Area of web reinforcement (in.^{2}).
B: Width of the bottom flange (in.) (see Appendix 1).
BB: Array of bottom flange width (in.) (see Appendix 1).
BEAM: List of beam sections.
BMBM: Array of values for bending moment at the inspection points due to weight of beam (in.-lbs.)
BMCDL: Array of values for bending moments at the inspection points due to composite dead load (in.-lbs.)
BMDL: Array of values for bending moments at the inspection points due to weight of beam, slab and diaphragms (in.-lbs.)
BMHS: Array of values for bending moments at the inspection points due to HS loading (in.-lbs.)
BMLL: Array of values for bending moments at the inspection points due to lane loads(in.-lbs.)
BMMA: Array of values for bending moment at the inspection points due to live load times impact times distribution factor (in.lbs.)
BMNCDL: Array of values for bending moment at the inspection points due to all non-composite loading (in.-lbs.)
BMSL: Array of values for bending moment at the inspection points due to weight of slab(in.-lbs.)
BMSP: Array of values for bending moment at the inspection points due to H loading (in.-lbs)
BMSUM: Array of values for bending moment at the inspection points due to all loads (in.-lbs.)
BNSTD: A term defined as "NS" to compare with "BTYPE".
BP: Web thickness (in.) (see "WD", Appendix 1).
BPRIME: Array of web thicknesses (in.) (see Appendix 1).
BSPAC: Beam spacing (ft.)
BTYPE: Beam designation, number 1 through 11 or "NS".
C: Depth of the bottom flange (in.) (see Appendix 1).
C1-C5: Constants used to compute prestress losses for stress relieved or stabilized strands.
C6: Coefficient for computing "FTP".
C7: Coefficient for computing "TTEN".
CC: Array of depths of the bottom flanges (in.)(see Appendix 1).
CCD: Array of distances from left reaction to location of "CCP" beginning with "CCD(2)"."CCD(K)" is set to zero internally.
CCP: Array of concentrated live loads applied to the composite section (kips).
CDL: Uniform dead load applied to the composite section.
CHRCTR: Stored data for comparative purposes used to determine live loading condition.
CMAXA-CMAXE: Net camber due to prestress and dead load of beam (in.) at ages A=Release, B=30, C=60, D=120 and E=240 days.
CNCD: Array of distances from left reaction to the location of the concentrated loads (ft.)
CNCP: Array of concentrated static loads applied to the non-composite section (kips).
COPE: Distance from bottom of slab to top of beam (in.)

COPE: Distance from bottom of slab to top of beam (in.)
CRKMOM: 1.2*((FCR*FPC$^{0.5}$)+FBP*(1-PLOSS))*ZBBC-((FBDL(6)+FBCDL(6)*(ZBBC-ZBB))) (1.2 Times Cracking Moment)
D: Beam depth (in.) (see Appendix 1). Also, identifying character for depressed strand profile.
D1: Array of beam depths (in.) (see Appendix 1).
DEFK1: Deflection at 1/4 span due to slab weight (in.)
DEFK2: Deflection at 1/2 span due to slab weight (in.)
DEFL12: Deflection at 1/2 span due to diaphragms (in.)
DEFL14: Deflection at 1/4 span due to diaphragms (in.)
DFACT: Live load distribution factor.
DIA: Diameter of the prestressing strand (in.)(see Appendix 2).
DIAB: Diameter of a 1/2 inch prestressing strand (in.) (see Appendix 2).
DIAGD: Array of depths of interior diaphragm (in.) (see "K", Appendix 1).
DIAGW: Array of widths of interior diaphragm (in.)
DIA1: Stored sizes of prestressing strands (see Appendix 2).
DIST: Distance from end of beam to hold-down point.
DNCDL1: Deflection at 1/4 span due to uniform load on the composite section (in.)
DNCDL2: Deflection at 1/2 span due to uniform load on the composite section (in.)
DROW: Array containing the number of depressed strands.
E: Depth of bottom flange fillet (see Appendix 1).
EC: Elastic modulus of beam concrete (10^6psi).
ECAL: Distance between bottom of beam and cgs of strands (in.)
ECALE: Eccentricity of the bonded strands at the end of beam (in.)
ECCL: Eccentricity of the strand pattern at the centerline of the beam measured from the cg. (in.)
ECSL: Elastic modulus of the slab concrete (10^6psi).
EE: Array of vertical depths of the bottom flange fillet (in.) (see Appendix 1).
EFW: Effective flange width (ft.)
ENDECC: Eccentricity of the strand pattern at the end of the beam measured from the cg. of the beam (in.)
ENDIST: Distance from end of beam to centerline of bearing (in.) (see Appendix 1).
ENDMAX: Maximum allowable end eccentricity (in.)
ES: Elastic modulus of prestressing steel (10^6psi).
FBII: Temporary allowable stress before losses due to creep and shrinkage (psi).
FBLL: Array of stresses at tenth points in bottom fibers of the beam due to live load(psi.)
FBSL: Array of stresses at tenth points in bottom fibers of the beam due to slab weight (psi).
FO: Total initial prestressing force (lbs.)
FPC: Minimum 28-day concrete strength (psi).
FPCI: Minimum release strength for concrete (psi).
FPS: Ultimate stress for prestressing strand (psi).
FPY: Yield point stress for non-prestressed reinforcement (psi).
FTBM: Stress in the top fiber of beam due to the weight of beam (psi).
FTLL: Stress in the top fiber of the beam due to the live load (psi).
FTP: Allowable tensile stress at working loads (psi).
FTSL: Array of stresses at tenth points in top fibers of the beam due to slab weight(psi).
G: Depth of top flange fillet (in.) (see Appendix 1).
H: Depth of the top flange (in.) (see Appendix 1).
HDPT: Distance from the centerline of the beam to the hold-down point (ft.)
HX: Distance to critical shear analysis at "h/2" from face of support (in.)
IB: Beam moment of inertia (in.^{4}).
IB1: Array of beam moments of inertia (in.^{4}) (see Appendix 1).
IBSL: Moment of inertia of ASL about a horizontal axis at mid-depth of the slab (in.^{4}).
ICARD: Alphanumeric array that contains design data that can later be read using specified format.
IERR: Numeric code denoting nature of error encountered in program.

INA: Composite area moment of inertia (in.^{4}).
IVIEW: Code denoting design or review mode.
IW: Number of parallel strands in web.
IWCH: Term that indicates whether or not the maximum depressed position has been reached.
K: Counter - number of strands placed.
KASE: Number between 1 and 11 in the stored list of stored beams that indicates the type of beam selected.
KDIST: Distance to the topmost strand at the end of debonding.
KGRID: Position of the topmost depressed strands at the end of beam.
KODE: Number of diaphragms as a function of length.
LOLAX: Code used to denote the use of stabilized strand.
LTYPE: Indicator of the type live loading selected.
MCDL: Moment due to dead load on the composite section.
MCR: Cracking moment.
MIL: Code used to indicate military loading.
MNCDL: Moment due to dead load on the non-composite section.
MNS: Moment due to slab and non-composite dead load.
NCDL: Uniformly distributed dead load applied to the composite section (kips/ft.)
NROW: Counter used to identify rows of strands.
NSTATE: Indicator that determines which one of four (4) messages will be printed along/with the ultimate moments.
NSTRNS: 1/2 number of "STRNS".
NTYPE: Term used to test for proper format when reading input cards.
P: Total prestressing force after losses (lbs.)
PLOSS: Percentage loss of prestress.
PPERST: Force per strand after losses (lbs.)
Q: Array containing values of "Q" (in.) (see Appendix 1).
R: Array of depths of the top flange (in.) (see Appendix 1).
REQULT: Required ultimate moment (in.-lbs.)
ROW: Designates the row number when placing strands.
RROAD: Magnitude of Cooper's E-loading selected.
S: Spacing of web reinforcement (in.) Also, identifying character for straight strand profile.
SAREA1: Array of cross-sectional areas for 270K strands (see Appendix 2).
SAREA2: Array of cross-sectional areas for 250K strands (see Appendix 2).
SCNCD: Array of distances from left reaction to location of "SCHCP" (ft.)
SCNCP: Array of concentrated static loads applied to the composite section (kips).
SFPC: Compressive strength of slab concrete (psi).
SHIELD: Distance which the strand is debonded from the end of beam (ft.)
SMBOL1: Combination of letters and numbers that designate the type of highway loading.
SMBOL2: The last number that complete "SMBOL1".
SMBOL3: Letter that designates strand profile.
SPACE: Center to center distance between prestressing strands (in.)
SPANL: Span length (ft.)
SQ: "S" at distance "HX".
SROW: Array of the number of strands in a row after removal of the depressed strands.
STBCL: Strand bottom clearance.
STRNS: Number of prestressing strands.
STSCL: Strand side clearance.
STYPE: Strand profile designator, 1 = straight strands and 2 = depressed strands.
SUMSTR: Sum of the prestressing strands.
TENIN: Initial force per strand (lbs.)
TS: Slab thickness (in.)
TTEN: Maximum allowable initial tensile stress (with auxiliary reinforcement) (psi).
ULTMOM: Ultimate moment.

UWB: Unit weight of beam concrete (lbs./ft.^{3}).
UWS: Unit weight of slab concrete (lbs./ft.^{3}).
VCDL: Array of values for shear at the inspection points due to composite dead loads (lbs.)
VCI: Nominal shear strength provided by concrete when diagonal cracking results from combined shear and moment (AASHTO 9.20.2.2)
VCW: Nominal shear strength provided by concrete when diagonal cracking results from excessive principal tensile stress in web(AASHTO 9.20.2)
VDL: Array of shear values at the inspection points due to beam, slab and diaphragm dead loads (lbs.)
VFACT: Shear distribution factor.
VHS: Array of values for shear at the inspection points due to the HS loading (lbs.)
VLL: Array of values for shear at the inspection points due to lane loading (lbs.)
VMA: Array of stored maximum values of shear at the inspection points due to liveload (lbs.)
VNCDL: Array of values for shear at the inspection points due to non-composite deadloads (lbs.)
VS: Shear at the connections of slab and beam (bond stress).
VSP: Array of values for shear at the inspection points due to the H loadings (lbs.)
VSUM: Array of values for shear at the inspection points due to all loads.
W: WS + WB = Unit composite deal load.
WCP: Diaphragm weights considered as a uniform load (lbs./ft.)
WD: Web width (in.) (see Appendix 1).
WDD: Array of web thickness (see Appendix 1).
WECB: Unit weight of beam concrete only (without reinforcing) for computing "EC" (lbs./ft.^{3}).
WECS: Unit weight of slab concrete only (without reinforcing) for computing "ESCL" (lbs./ft.^{3}).
WORDS: Array that contains the descriptive data on the first three (3) header cards for the problem set.
WTF: Width of the top flange (see "A", Appendix 1).
WTF1: Array of widths of the top flanges (in.) (see Appendix 1).
X1,X2: Terms to describe the beam section for purposes of placing prestressing strands in the section (in.) (see Appendix 1).
Where:
X1 = B
X2 = (B-WD)/2
XDIST:Array of distances (fractions of span length) (ft.)
Y1,Y2: Terms to describe the beam section for purposes of placing prestressing strands in the section (in.) (see Appendix 1).
Where:
Y1 = C
Y2 = E
YB: Distance from cgc to bottom of beam (in.) (see Appendix 1).
YB1: Array of the distances from the cg to the bottom of the beam (in.) (see Appendix 1).
YBC: Distance from the composite cgc to the bottom of the beam (in.)
YT: Distance from the beam cg to top of the beam (see Appendix 1).
YT1: Array of the distances from the cg to the top of the beam (in.)
YTC: Distance from the composite cgc to the top of the beam (in.)
YTCSL: Distance from the composite cgc to the top of the slab (in.)
ZBB: Section modulus for bottom of beam (in.^{3}).

ZBBC: Composite section modulus for bottom of beam (in.^{3}).
ZTB: Section modulus for top of beam (in.^{3}).
ZTBC: Composite section modulus for top of beam (in.^{3}).
ZTSL: Composite section modulus for top of slab (in.^{3}).

APPENDIX 5
Blank Input Coding Forms

PSTDSN65 (VERSION 2.5)

PRESTRESSED CONCRETE BEAM DESIGN PROGRAM

SHEET NO. 1 of 4

(SI (METRIC) UNITS)

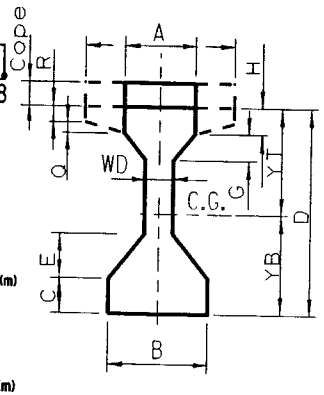
*

*

M E T R I C

1 — INERTIA x 10^6 mm^4 (2–9); AREA x 10^2 (mm^2) (10–15); D (mm) (16–20); YB (mm) (21–24); YT (mm) (25–28); B (mm) (29–32); WD (mm) (33–36); C (mm) (37–40); E (mm) (41–44); A (mm) (45–48); H (mm) (49–52); G (mm) (53–56); Q (mm) (57–60); R (mm) (61–64)

2 — Strand Size 9, 11, 13, 14, 15 mm (2–5); Special (6); Str. Pfl. (7); Ult. Stgth of Strand (MPa) (8–12); Unit Wt kN/m^3 Beam (13–17), Slab (18–22); Conc. Strength (MPa) Slab 28 Day (23–26), Beam 28 Day (27–30), Beam Rel. St. (31–34); Modulus of Elasticity (10^3 MPa) Beam Conc. (35–38), Slab Conc. (39–42), Steel (43–46), Bott. (47–50); Strand Clearance (mm) Side (51–54), Spacing (55–58); Work Load Conc. Ten.(-)(MPA) (59–63); Gr. of Reinf.(MPa) (65–67); Initial Conc. Ten.(-)(MPa) (68–71); Fr. of Debond (72–74); Strand Trans. & Dev. Factors Bonded (75–77), Debonded (78–80)



3 — Concentrated Static Loads Applied to Non-Composite Section (2–6, 7–11, 12–16, 17–21, 22–26, 27–31, 32–36, 37–41, 42–46, 47–51)

3 — Loads (kN)

3 — Distance from Left Support(m)

4 — Concentrated Static Loads Applied to Composite Section (2–6, 7–11, 12–16, 17–21, 22–26, 27–31, 32–36, 37–41, 42–46, 47–51)

4 — Loads (kN)

4 — Distance from Left Support(m)

5 — Concentrated Live Loads Applied to Composite Section (2–6, 7–11, 12–16, 17–21, 22–26, 27–31, 32–36, 37–41, 42–46, 47–51)

5 — Loads (kN)

5 — Distance from Left Load(m)

6 — Concentrated Live Loads Applied to Composite Section (2–6, 7–11, 12–16, 17–21, 22–26, 27–31, 32–36, 37–41, 42–46, 47–51)

6 — Loads (kN)

6 — Distance from Left Load(m)

NOTE: THE FOLLOWING 3 CARDS (7) ARE REQUIRED FOR A DEPRESSED STRAND REVIEW (ANALYSIS) ONLY!

7 — ROW 1 (2–4), 2 (6–8), 3 (10–12), 4 (14–16), 5 (18–20), 6 (22–24), 7 (26–28), 8 (30–32), 9 (34–36), 10 (38–40), 11 (42–44), 12 (46–48), 13 (50–52), 14 (54–56), 15 (58–60), 16 (62–64), 17 (66–68), 18 (70–72)

7 — ℄ Straight Strands

7 — End Straight Strands

7 — Depressed Strands

7 — Distance to Top Depressed Strands (mm) (38–41)

7 — Debond Length (m) (38–41)

NOTE: SEE SHEET NO. 2 OF 4 FOR THE LAST BLANK CARDS REQUIRED FOR ALL PROGRAM OPTIONS AND CARDS 8 AND 9 REQUIRED FOR STRAIGHT STRAND REVIEW (ANALYSIS) ONLY.

PSTDSN65 (VERSION 2.5)

(SI (METRIC) UNITS)

NOTE: THE FOLLOWING 10 PAIR OF CARDS 8 AND 9 ARE REQUIRED FOR STRAIGHT STRAND REVIEW (ANALYSIS) ONLY!

ROW 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36

1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49 51 53 55 57 59 61 63 65 67 69 71 73 75 77 80

8
9

½ SPACE

℄ BEAM WHEN "W"=0, 1 OR 3

℄ BEAM WHEN "W"=2

Beam Type	Span (C-C Brg.) (m)	Beam Spacing (m)	Slab Thickness (mm)	AASHTO L.L.	Strands in Web	R R L.L.	L.L. Distribution Factor	Shear Distribution Factor	Hold Down From ℄ (m)	Unif. DL on Non-Composite (kN/m)	Unif. DL on Composite Sec. (kN/m)	Width of Composite Slab (m)	Strand Losses (%)	Cope (mm)	Diaphragm 0= None 1= One 5= 5% LL	End (mm) Distance
2 3	4 8	9 12	13 16	17 21	22	23 25	26 29	30 33	34 37	38 42	43 47	48 51	52 54	55 58	59	60 63

DEFAULT VALUES : Same as English Input

PSTDSN65 (VERSION 2.5)

PRESTRESSED CONCRETE BEAM DESIGN PROGRAM

(ENGLISH UNITS)

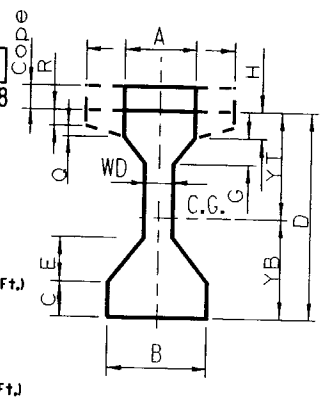
*
*
*

1 — Unit; INERTIA (IN^4); AREA (IN^2); D (IN); YB (IN); YT (IN); B (IN); WD (IN); C (IN); E (IN); A (IN); H (IN); G (IN); Q(IN); R(IN)

1 2 3–10 11–16 17–20 21–24 25–28 29–32 33–36 37–40 41–44 45–48 49–52 53–56 57–60 61–64

2 — Strand Size (3/8 7/16 1/2 9/16 6/10); Special; SR = 0, LL = 1; Ult. Stgth of Strand (ksi); Mass (lbs./cu. ft.) Beam, Slab; Slab Conc. 28 Day St.(psi); Beam Conc. 28 Day St.(psi); Beam Conc. Rel. St. (psi); Modulus of Elasticity (10^6 psi) Beam Conc., Slab Conc., Steel; Strand Clearance Bott., Side, Spacing; Work Load Conc. Ten.(-); Str. Pfl; Gr. of Reinf.; Initial Conc., Ten.(-); Fr. of Debond; Strand Trans. & Dev. Factors Bonded, Debonded

1 2–5 6 7 8–12 13–17 18–22 23–26 27–30 31–34 35–38 39–42 43–46 47–50 51–54 55–58 59–63 64 65 66 67–71 72–74 75–77 78–80



3 3 — Concentrated Static Loads Applied to Non-Composite Section

1 2–6 7–11 12–16 17–21 22–26 27–31 32–36 37–41 42–46 47–51

Loads (kips)
Distance from Left Support(Ft.)

4 4 — Concentrated Static Loads Applied to Composite Section

1 2–6 7–11 12–16 17–21 22–26 27–31 32–36 37–41 42–46 47–51

Loads (kips)
Distance from Left Support(Ft.)

5 5 — Concentrated Live Loads Applied to Composite Section

1 2–6 7–11 12–16 17–21 22–26 27–31 32–36 37–41 42–46 47–51

Loads (kips)
Distance from Left Load(Ft.)

6 6 — Concentrated Live Loads Applied to Composite Section

1 2–6 7–11 12–16 17–21 22–26 27–31 32–36 37–41 42–46 47–51

Loads (kips)
Distance from Left Load(Ft.)

NOTE: THE FOLLOWING 3 CARDS (7) ARE REQUIRED FOR A DEPRESSED STRAND REVIEW (ANALYSIS) ONLY!

7 7 7 — ROW 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

1 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36

℄ Straight Strands
End Straight Strands
Depressed Strands

38–41: Distance to Top Depressed Strands (In.)
Debond Length (Ft.)

NOTE: SEE SHEET NO. 4 OF 4 FOR THE LAST BLANK CARDS REQUIRED FOR ALL PROGRAM OPTIONS AND CARDS 8 AND 9 REQUIRED FOR STRAIGHT STRAND REVIEW (ANALYSIS) ONLY.

PSTDSN65 (VERSION 2.5) (ENGLISH UNITS) SHEET NO. 4 of 4

NOTE: THE FOLLOWING 10 PAIR OF CARDS 8 AND 9 ARE REQUIRED FOR STRAIGHT STRAND REVIEW (ANALYSIS) ONLY!

ROW 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36

1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49 51 53 55 57 59 61 63 65 67 69 71 73 75 77 80

8 9

½ SPACE

℄ BEAM WHEN "IW"=0, 1 OR 3

℄ BEAM WHEN "IW"=2

Beam Type	Span (C-C Brg.) (Ft.)	Beam Spacing (Ft.)	Slab Thickness (In.)	AASHTO L.L.	Strands In Web	R R L.L.	L.L. Distribution Factor	Shear Distribution Factor	Hold Down From ℄ (Ft.)	Unif. DL on Non-Composite (kips/ft.)	Unif. DL on Composite Sec. (kips/ft.)	Width of Composite Slab (Ft.)	Strand Losses (%)	Cope (In.)	Diaphragm 0= None 1= One 5= 5% LL	End (In.) Distance
2 3	4 8	9 12	13 16	17 21	22	23 25	26 29	30 33	34 37	38 42	43 47	48 51	52 54	55 58	59	60 63

DEFAULT VALUES: 1/2" 270 ksi S.R. Strands
1-Strand In Web
.25 Debond
Grade of Reinf. = 60 ksi

2" Spacing of Strand ≤ 1/2" ø
2 1/4" Spacing of Strand > 1/2" ø
f'c Beam = 5000 psi
Strand Profile = S

Stress Relieved Strand
End Dist. = 6.5"
Cope = 0.0"
Strand Trans. Factor = 1.0 x AASHTO
Strand Dev. Factor = 1.0 x AASHTO

3" Clear. Side & Bott.
f'ci = 4000 psi
Initial Ten. = $-12\sqrt{f'ci}$

Work. Ten. = $-3\sqrt{f'c}$ (1 Strand In Web)
Work. Ten. = $-6\sqrt{f'c}$ (2 Strands In Web)
No Diaphragm Load

150 #/cu. ft. Mass of Conc.
$E_c = 2.93 \times 10^6$ psi
$E_{BEAM} = 3.55 \times 10^6$ psi
$E_{STEEL} = 28 \times 10^6$ psi

INDEX

250K STRANDS 149
270K STRANDS 149
28-DAY CONCRETE STRENGTH 2, 7, 17, 22, 117, 148
28-DAY STRENGTH 2, 30, 46, 112, 116, 122, 132, 141
45-DEGREE FILLET 144
5% OF THE LIVE LOAD 5, 43
AGE AND CREEP FACTOR 105
AGES OF BEAM CONCRETE 105
ALLOWABLE COMPRESSIVE STRESS 147
ALLOWABLE END ECCENTRICITY 148
ALLOWABLE STRESS 16, 17, 27, 113, 148
ALLOWABLE STRESSES 21, 26, 27
ANALYSIS 1, 17, 22, 117, 124, 135
AREA OF BEAM 105
AREA OF THE COMPOSITE SECTION 147
AREA OF WEB REINFORCEMENT 147
AT SERVICE LOAD 29, 124
AT TENTH POINTS 24, 127, 148
BENDING MOMENT 147
BLANK CARD . . 5, 24, 33, 37, 39, 42, 64, 68, 72, 76, 80, 84, 88, 92, 96, 100, 102, 103, 105, 110, 111-115
BONDED STRAND TRANSFER LENGTH 35
BOTTOM FIBER 6, 13, 14, 16, 112, 122, 132, 141, 146
BOTTOM FIBER STRESS 13, 14, 16
BOTTOM FLANGE WIDTH 147
BUILD-UP 42, 105, 112, 122, 132, 141
CAMBER . . . . . iv, v, 18-21, 28, 104, 105, 112, 122, 132, 141
CARD EIGHT 39, 62-101
CARD FIVE AND SIX 37
CARD NINE 41, 65, 69, 73, 77, 81, 85, 89, 93, 97, 101
CARD ONE 33, 44, 45
CARD SEVEN 38, 56, 58-61
CARD THREE, FOUR, FIVE AND SIX 36
CARD TWO 34, 35, 46, 47
CENTERLINE OF BEARING 41, 43, 65, 69, 73, 77, 81, 85, 89, 93, 97, 101, 113, 123, 148
CENTROID 13, 21, 28
CGS 22, 25, 28, 148
CIRCULAR FILLET 144
CODING FORM 33, 34
CODING INSTRUCTIONS 33
COMPOSITE DEAD LOAD 149
COMPOSITE SECTION 5, 23, 26, 34, 36, 42, 43, 50, 52, 54, 102, 103, 111, 121,127, 131, 135, 140, 147, 148, 149, 151
COMPRESSIVE CONCRETE STRENGTHS 34
COMPRESSIVE STRENGTH 13, 146, 149
COMPRESSIVE STRESS 2, 28, 29, 124, 147
CONCENTRATED LIVE LOAD 36, 37, 42, 52, 54
CONCENTRATED STATIC LOADS 5, 36, 111, 121, 127, 131, 135, 140, 149
CONCRETE 28-DAY STRENGTH 2, 30, 46, 112, 122, 132, 141
CONCRETE PROPERTIES 2, 34
CONCRETE RELEASE STRENGTH 2, 27, 46, 112, 122, 132, 141
CONCRETE SLAB 3
CONCRETE STRENGTH 2, 3, 7, 17, 22, 30, 113, 117, 148
CONFINEMENT REINFORCING 34
CONJUGATE BEAM METHOD 18

CONNECTIONS 28, 150
CONSTANTS 11, 20, 26, 147
COOPER'S E-LOADING 149
COPE 42, 43, 103, 104, 111, 116, 121, 131, 140, 148
CORROSIVE ENVIRONMENT 6
CRACKING MOMENT 14, 28, 29, 112, 122, 124, 132, 141, 148, 149
CREEP 10, 20, 105, 148
CRITICAL SHEAR ANALYSIS 148
CROSS-SECTIONAL AREA 13, 44, 135, 147
CROSS-SECTIONAL AREAS 147, 149
DATA FIELDS 42
DEAD LOAD 3, 14, 28, 42, 102-104, 147,149
DEBOND 16, 17, 22, 41, 47, 59, 65, 69, 73, 77, 81, 85, 89, 93,
97,101,107,113, 136
DEBONDED 16-18, 27, 29, 30, 35, 38, 39, 62, 66, 70, 74, 78, 82, 86,
90,94,98, 105-107, 112, 113, 122-124, 132, 136, 141, 146, 149
DEBONDING LENGTH 127
DEBONDING MATERIAL 16, 41, 65, 69, 73, 77, 81, 85, 89, 93, 97, 101
DEBONDING PRIORITY 17
DEBONDING SEQUENCE FOR STRAIGHT STRANDS 31
DEFAULT VALUES 2, 7, 33, 34, 42, 146
DEFLECTION 21, 23, 104, 112, 122, 132, 141, 148
DEPRESSED POSITION 149
DEPRESSED STRAND 1, 23, 38, 60, 61, 127, 135, 136
DEPTH OF BOTTOM FLANGE 148
DEPTH OF BOTTOM FLANGE FILLET 148
DEPTH OF THE TOP FLANGE 148
DESIGN MODE 2, 14, 34
DESIGN OPTION 104
DESIGN PATTERN 106
DESIGN SECTION 104
DESIGN SPAN 116
DESIGNATION 147
DESIGNATOR 149
DEVELOPMENT LENGTH 30, 35, 47, 112, 122, 124, 132, 141, 146
DEVELOPMENT LENGTH FACTOR 47, 146
DIAMETER OF THE PRESTRESSING STRAND 148
DIAPHRAGM . . 5, 43, 103, 104, 111, 116, 121, 127, 131, 140, 146, 148,149,150
DISTANCE BETWEEN BOTTOM OF BEAM AND CGS OF STRANDS 148
DISTANCE FROM BOTTOM OF SLAB TO TOP OF BEAM 148
DISTANCE FROM END OF BEAM TO CENTERLINE OF BEARING 148
DISTANCE FROM END OF BEAM TO HOLD-DOWN POINT 148
DISTANCES FROM LEFT REACTION 147,149
DISTRIBUTION FACTOR 42, 43, 102, 146-148, 150
ECCENTRICITIES 104
EFFECTIVE AREA OF SLAB 147
EFFECTIVE FLANGE WIDTH 4, 26, 148
ELASTIC AND TIME-DEPENDENT SHORTING EFFECTS 105
ELASTIC MODULUS OF BEAM CONCRETE 148
ELASTIC MODULUS OF THE SLAB CONCRETE 148
ELASTIC SHORTENING 10
END DISTANCE 116, 127, 146
END ECCENTRICITY . . . . . iii, 16, 23, 27, 28, 148
END REGION STRESSES 16
END REGIONS 6, 17
ENVIRONMENT 5-7, 116
ENVIRONMENTAL CLASS 7
EQUIVALENT WIDTH OF BEAM CONCRETE 4
ERROR MESSAGE 24, 36, 42
EXTERNAL LOADS 105, 114, 115, 125, 126, 133, 134, 142, 143
EXTREME FIBER 27

FACE OF SUPPORT 28, 104, 112, 122, 132, 141, 148
FBT 144
FINAL STRESSES 17
FLEXURAL CRACKING MOMENT 28
FORCE PER STRAND AFTER LOSSES 149
FRACTION OF DEBOND 47
FREE FORM 41
FULLY BONDED STRANDS 39, 117
GRAPHIC OUTPUT 30, 107
GRID SPACING 39, 64, 68, 72, 76, 80, 84, 88, 92, 96, 100, 146
GRID SYSTEMS 15
GROSS CROSS-SECTIONAL AREA 13
H LOADING 150
HEADER CARDS 33, 44
HIGHWAY LOADING 149
HOLD DOWN LOCATIONS 5
HOLD DOWNS 18
HOLD-DOWN POSITION 26
HORIZONTAL ROW 39
HORIZONTAL SHEAR 28, 105
HS LOADING 150
IMPACT 32, 37, 42, 114, 125, 133, 142, 147
IMPACT FACTOR 32
INFORMATION CARDS 33
INFORMATIVE MESSAGES 105
INPUT DATA REFLECTION 104
INPUT ERROR 106
INSPECTION POINT STRESSES 17
INSPECTION POINTS 8, 17, 21, 23, 24, 26-30, 36, 147, 150
INTERMEDIATE DIAPHRAGMS 5
LANE LOADING 150
LANE LOADS 147
LENGTH OF DEBONDING 16, 17, 27, 30, 41, 107
LIVE LOAD 5, 23, 24, 32, 36, 37, 42, 43, 52, 54, 102, 103, 146-148
LOAD CARD 36
LOCATION OF INSPECTION POINTS 23
LOSSES 2, 10, 11, 14, 21, 27, 28, 43, 115, 126, 134, 143, 147-149
LOW-RELAXATION 104, 116, 127, 130-134, 145
MAXIMUM DEBONDING LIMIT 34
MAXIMUM PERCENT OF DEBONDED STRANDS 146
MAXIMUM SHEARS 22, 24
MILITARY LOADING 42, 149
MINIMUM NUMBER OF STRANDS 13
MODULUS OF ELASTICITY 3, 4, 46, 105, 146
MODULUS OF RUPTURE FACTOR FOR CONCRETE 13
MOMENT 9, 13, 14, 16, 18, 21, 25-29, 42-44, 104, 106, 111, 112, 114, 121, 122, 124, 125, 131-133, 135, 140-142, 147-150
MOMENT OF INERTIA 111, 121, 131, 135, 140,148,149
MOMENT REQUIREMENTS 106
MOMENTS 21-24, 27-29, 32, 43, 127, 147,148,149
NET CAMBER 20, 21, 104, 112, 122, 132, 141,147
NO DIAPHRAGMS 5, 43
NO LIVE LOAD 42
NO LIVE LOAD MOMENT 42
NO SOLUTION 16, 17
NO. OF STRANDS IN THE WEB 136
NON-COMPOSITE SECTION . 5, 23, 36, 42, 43, 102, 103, 111, 121, 127, 131, 135, 140, 147,149
NON-CORROSIVE ENVIRONMENT 6
NON-PRESTRESSED REINFORCEMENT 148
NUMBER OF DEBONDED STRANDS 113

NUMBER OF DIAPHRAGMS 149
NUMBER OF PRESTRESSING STRANDS 13, 149
NUMBER OF STRANDS 13-16, 22, 25, 27, 30, 32, 34, 102, 146, 149, 150
NUMBER OF STRANDS IN THE WEB 146
OUTPUT DATA 33
PERCENTAGE LOSS OF PRESTRESS 149
PERCENTAGE OF DEBONDED STRANDS 16, 17, 30
PREDICTED LOSS 10
PREDICTED NET CAMBER 21, 104
PRESTRESS LOSS 3, 13, 43, 112, 122, 132, 141
PRESTRESSED REINFORCEMENT 3, 148
PRESTRESSING FORCE 13, 21, 28, 148, 149
PRESTRESSING STRAND 147, 148
PRINTING MESSAGES 26
PRIORITY OF DEBONDING 30
PULL 104, 105, 112,122, 132, 141, 145
RATIO OF DEBONDED STRANDS 30
REDESIGN 17, 117
REINFORCEABLE SHEAR VALUE 106
REINFORCING BEND LOCATIONS 34
RELEASE STRESS 27, 106, 117
RESISTING MOMENT CAPACITY 25
RESISTING MOMENTS 27
REVIEW MODE 34, 149
REVISED PATTERN 16
ROWS OF STRANDS 38, 149
SECTION MODULUS 13, 111, 121, 131, 140,150,151
SECTION PROPERTIES . 26, 27, 33, 34, 42, 103, 104, 111, 121, 131, 139-143, 147
SELF-WEIGHT 42
SHEARS . . . . . v, x, 21-24, 28, 29, 32, 43, 127
SHRINKAGE 10, 148
SKEW ANGLE 5, 116
SLAB CONCRETE 4, 42, 46, 146, 148-150
SLAB THICKNESS 42, 102, 107, 111, 116, 121, 127, 131, 136, 140, 149
SLAB WEIGHT 23, 148
SLIGHTLY AGGRESSIVE 5, 116
SPAN LENGTH 4, 5, 42, 102, 105, 107, 111, 121, 131, 140,149,150
SPECIAL LIVE LOAD 37, 42
SPECIAL LIVE LOADS 8
SPECIFICATION REQUIREMENTS 117
SPECIFICATIONS FOR HIGHWAY BRIDGES 1
STANDARD BEAM PROPERTIES 144
STATIC DEAD LOADS 32
STATIC LOADS 5, 36, 43, 111, 121, 127, 131, 135, 140, 147,149
STEEL PERCENTAGE 25
STIRRUP SPACING 104, 105, 112, 115, 122, 126, 132, 134, 141, 143
STIRRUP SPACINGS 8, 105
STIRRUPS 8
STRAIGHT STRAND . 1, iv, v, 16, 17, 22, 29, 39, 62-101, 106, 107, 116, 117, 124
STRAIGHT STRANDS 16, 18, 22, 30, 31, 38, 56, 57, 110-115, 120-127,149
STRAND AREA 146
STRAND DEVELOPMENT LENGTH 35
STRAND DIAMETER 35, 146
STRAND EMBEDMENT LENGTH 107
STRAND GRID SPACE 39
STRAND GROUP ECCENTRICITY 34
STRAND LOSSES 43
STRAND PAIRS 30, 113
STRAND PATTERN . iv, v, 7, 16, 17, 22, 27, 29, 64, 68, 72, 76, 80, 84, 88, 92, 96, 100, 107, 113, 123, 132, 136, 141, 148
STRAND POSITIONS 39

STRAND PROFILE 16, 23, 34, 47, 146,148
STRAND REVIEW . . . . . iv, v, vi, 29, 39, 116, 135
STRAND TRANSFER LENGTH 35, 117
STRAND TYPE 46, 104, 146
STRENGTH OF CONCRETE 3
STRESS RELIEVED 26, 46, 146, 147
SUBROUTINES 21, 29
SUM OF THE PRESTRESSING STRANDS 149
SUPERIMPOSED DEAD LOADS 42
TENSILE STRESS 6, 7, 13, 14, 16, 29, 47, 124, 146, 148,149,150
TOP FIBER 6, 16, 27, 112, 122, 132, 141, 146, 148
TOP FLANGE . . . . . x, 4, 45, 103, 144, 147, 149, 150
TOPMOST POSITION 16, 106
TOPMOST STRANDS 16, 27
TOTAL LOSS OF PRESTRESS 43
TOTAL PRESTRESSING FORCE 149
TRAILING ZEROES 41, 65, 69, 73, 77, 81, 85, 89, 93, 97, 101
TRANSFER LENGTH 35, 47, 107, 112, 117, 122, 132, 141, 146
TRANSFER LENGTH FACTOR 47, 146
TRANSFER LENGTHS 17, 35, 105
TYPE OF BEAM SELECTED 149
TYPE OF LIVE LOADING 42
TYPICAL BEAM SECTION 33
ULTIMATE MOMENT 9, 13, 14, 16, 25, 27-29, 43, 104, 106, 112, 122, 124, 132, 141, 149, 150
ULTIMATE MOMENTS 149
ULTIMATE MOMENTS AND SHEARS 3
ULTIMATE STRENGTH OF STRAND 46, 146
ULTIMATE STRESS 148
UNDERSIDE OF THE SLAB 42
UNIFORM COMPOSITE DL 116, 127, 136
UNIFORM DEAD LOAD 42, 102, 103, 147
UNIFORM LOAD 23, 148, 150
UNIFORMLY DISTRIBUTED DEAD LOAD 149
UPPER ROWS 34
VARIABLE DEFINITIONS 14, 147
VERSION NUMBER 33, 104
VERTICAL AXIS OF THE BEAM 7, 39
VERTICAL COMPONENT OF PRESTRESSING FORCE 28
VERTICAL SHEARS 127
WARNING NOTE 8
WEB REINFORCEMENT 28, 29, 146, 147, 149
WEB REINFORCEMENT SPACING 147
WEB THICKNESS 147, 150
WEB WIDTH 44, 150
WEIGHT OF BEAM 46, 146, 148, 150
WEIGHT OF SLAB 46, 147, 150
WEIGHT OF THE BEAM 21
WEIGHT OF THE COPE 104
WEIGHT OF THE PRECAST AND COMPOSITE SECTIONS 104
WEIGHTS 42, 43, 150
WIDTH OF THE BOTTOM FLANGE 147
WIDTHS 148,150
WIDTHS OF INTERIOR DIAPHRAGM 148
WORKING LOADS 2, 6, 146, 148
YIELD POINT STRESS 146, 148