SUMMARY REPORT 149-1F(S)

PRESTRESSED CONCRETE BRIDGE GIRDER DESIGN PROGRAM

SUMMARY REPORT
of
Research Report Number 149-1F
Study 2-5-69-149

Cooperative Research Program of the
Texas Transportation Institute and the Texas Highway Department
In Cooperation with the
U. S. Department of Transportation, Federal Highway Administration

November, 1970

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Prestressed Concrete Bridge Girder Design Program

by

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Automated design procedures are very beneficial in the design of structural members which require iterative types of calculations. The prestressed concrete beam, as an element in a structural system, is one member which requires such calculations. The Prestressed Concrete Beam Design Program was developed to perform the necessary calculations for the design of simple span beams of pretensioned prestressed concrete for use in highway and railroad bridges. This program is written in FORTRAN IV language for IBM 360/50 and 360/65 computers. The program is comprised of one main calling routine, twenty-three subroutines, and one Block Data set. Compile time for a FORTRAN version of the program is approximately three minutes and the required storage is approximately 100,000 bytes.

Two types of data input forms are provided for use with this program. The program is written so that these forms may be used independently or together. One form is for use when a "standard" beam is to be designed while the other is to be used when a "nonstandard" beam is to be designed. A "standard" beam is defined as one having the properties and dimensions shown in Table 1 and is designed using the design criteria shown in Table 2. Any beam not in this category is considered to be a "nonstandard" beam.

All the data in Tables 1 and 2 are contained in the Block Data set and one subroutine within the program; therefore additions and/or modifications to the "standard" beams may be made quite easily.

Two types of output are also provided for users of the program. One is a brief, one-page output, which contains input data and details of the designed beam. The other type is a multipage output which contains all the above information plus summaries of moments, shears, stresses, etc., tabulated at various points along the beam for the different stages of loading.

Use of this program is limited to simply-supported I-shaped beams which are similar in shape to the Texas Highway Department and AASHO standard sections. By use of the appropriate type of output, the following information may be obtained from this program:

1. Vertical shears, moments, and stresses at tenth points and hold-down points in the beam.

2. Maximum ultimate horizontal shear between slab and girders at tenth points.

3. Stirrup spacing, based on ACI Specifications, at tenth points.

Table 1. Properties and Dimensions for Standard Beams

Beam Type	Moment of Inertia (in.[4])	Area in.[2]	y_b in.	y_t in.	Depth in.	Section Dimensions B in.	C in.	E in.	WD in.	A in.	H in.
A	22,658	275.44	12.61	15.39	28	16.0	5.0	5.0	6.0	12.0	4.0
B	43,177	360.31	14.93	19.07	34	18.0	6.0	5.75	6.5	12.0	5.5
C	82,602	494.94	17.09	22.91	40	22.0	7.0	7.5	7.0	14.0	6.0
48	101,950	403.44	22.87	25.13	48	14.0	7.0	4.0	6.0	14.0	3.5
54	164,022	493.44	25.53	28.47	54	16.0	8.0	5.0	6.0	16.0	4.0
60	255,319	628.44	28.41	31.59	60	18.0	9.0	5.5	7.0	18.0	4.5
66	374,688	740.94	31.07	34.93	66	20.0	10.0	6.5	7.0	20.0	5.0
72	532,060	863.44	33.73	38.27	72	22.0	11.0	7.5	7.0	22.0	5.5
IV	260,403	788.44	24.75	29.25	54	26.0	8.0	9.0	8.0	20.0	8.0
V	521,180	1013.00	31.96	31.04	63	28.0	8.0	10.0	8.0	42.0	5.0
VI	733,320	1085.00	36.38	35.62	72	28.0	8.0	10.0	8.0	42.0	5.0

Beam Types A - 72—THD standard beams
Types IV, V, VI—AASHO standard beams

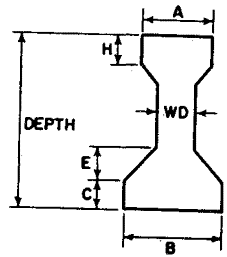

Table 2. Design Criteria for Standard Beam

1. Live load distribution factor = beam spacing ÷ 11
2. Strand diameter. = ½ in.
3. Strand area = 0.153 sq. in.
4. Unit weight of beam and slab = 150 pcf
5. Compressive strength of slab concrete = 3,600 psi
6. Modulus of elasticity for beam and slab concrete = 5×10^6 psi
7. Modulus of elasticity for steel = 28×10^6 psi
8. Ultimate strength of strand = 270,000 psi
9. Yield point stress for web reinforcement = 40,000 psi
10. Dead load applied to the composite section = zero
11. Number of strands to be draped in the web = 2 (a design for three strands in the web is also provided for AASHO IV beams.)

4. Stirrup spacing, based on AASHO Specifications, at midspan and quarter points.
5. Ultimate moment required for design loads and provided by the designed section.
6. Dead load deflections at midspan and quarter points due to slab and diaphragms.
7. Predicted maximum camber.
8. Predicted loss of prestress.
9. Arrangement of prestressing strands at ends and center line of beam.
10. Required concrete strengths (release and 28-day).

In outline form, the basic steps of the program are:

1. Read in input data.
2. Determine composite and noncomposite section properties.
3. Calculate moments and shears due to all loads.
4. Calculate dead load deflections.
5. Determine allowable stresses.
6. Calculate stresses due to all loads.
7. Determine number and location of prestressing strands.
8. Calculate required web reinforcement.
9. Calculate ultimate moments (required and provided).
10. Print out results.

The published version of this report may be obtained by addressing your request as follows:

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