CALIFORNIA DIVISION OF HIGHWAYS
BRIDGE DEPARTMENT COMPUTER SERVICE

COMPOSITE GIRDER CROSS SECTION
ANALYSIS - FLANGE DESIGN

INSTRUCTIONS FOR USERS

This service will compute composite girder section properties, stresses in the girder flanges and reinforcing steel and flange sizes required to produce near allowable flange stresses.

DATA PREPARATION (On Form H-BD D 34, Rev. 7-72)

Identification: IDENT and accounting data are standard, See General Instructions for Users, 1-1.

Use TRIAL and COMMENTS to identify the problem.

TRIAL	COMMENTS	SLAB		BAR STEEL		WEB		
		DIMENSION A (IN.)	AREA OF EFFECTIVE SLAB (SQ. IN.)	DIMENSION B (IN.)	AREA OF BAR STEEL (SQ. IN.)	DIMENSION Y (IN.)	DEPTH (IN.)	THICKNESS (IN.)

Girder Description: SLAB data are needed if the slab is in compression, but not if it is in tension. DIMENSION A is the distance from the top of the deck to the C. G. of the slab. AREA OF EFFECTIVE SLAB is the actual area to be used, not the transformed area.

Give BAR STEEL data if the steel in the slab is to be considered. DIMENSION B is the distance from the top of the deck to the C. G. of the steel in the slab. Show the AREA OF BAR STEEL per girder in square inches.

Some WEB data must be given. DIMENSION Y, the distance from the top of the deck to the top of the web, must be given if SLAB or BAR STEEL data is given. The DEPTH and THICKNESS of the web must always be given.

FLANGES				APPLIED MOMENTS				
TOP		BOTTOM						
WIDTH IN.	THICKNESS 1/8 in IN.	WIDTH IN.	THICKNESS 1/8 in IN.	DEAD LOAD ON STEEL ONLY F.T.K.	CURB & RAILING ON 3n CONCRETE F.T.K.	LIVE LOAD ON 1n CONCRETE F.T.K.	n	ALLOWABLE STEEL STRESS KSI
40	42	43	44	51	50	51	55	56

Various combinations of FLANGE and MOMENT data will produce the following results:

1. Analysis

   Section properties and stresses are reported when MOMENTS and all the FLANGE dimensions are given. When MOMENTS are not given, section properties can be obtained for any logical combination of other data.

2. Design

   When MOMENTS are given, the design of one or both FLANGES may be left to the computer. Either or both dimensions of a flange may be left blank. The stress in the designed flange(s) will be near allowable. If both dimensions of a flange are given, the stress in that flange is not compared to the allowable stress. When both dimensions of a flange are calculated, it will be approximately 15 times as wide as it is thick. Section properties and stresses are reported for all conditions.

MOMENTS may be applied to the steel girder alone, the 3(n) composite section and/or the 1(n) composite section.

n, the ratio of the modulus of elasticity of steel to that of concrete, is assumed to be 10 if not given.

If the ALLOWABLE STEEL STRESS in the girder flanges is not given, it is assumed to be 20 ksi.

RESULTS

For each problem, the input is reported first, as given or computed. Second, section properties and areas of steel are reported. Last, the stresses in the bar steel and the top and bottom flanges are reported.

The units of the results are:

C/I -- $in/in^4 \times 12 \times 1000$. If the moment is in ft-kips, then M x C/I will produce stresses in psi.

Y-BAR -- inches. The distance from the base of the bottom flange to the C.G. of the section.

I -- in^4

Q/I -- in^3/in^4

STRESS -- $kips/in^2$

AREAS -- in^2

EXAMPLES

Following are examples intended to illustrate the main features of the program.

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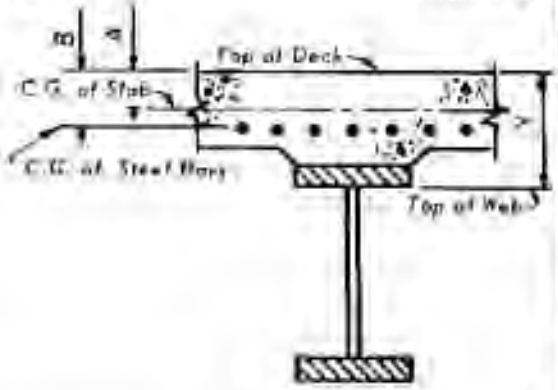
NAME L.I. BIDO

PHONE 5-6518

COMPOSITE GIRDER

CROSS SECTION ANALYSIS-FLANGE DESIGN

BDE00C



IDENT DIST	IDENT GROUP	IDENT BATCH	PROB
14	T	0501	

S/C 1248 2091

SOURCE DIST	SOURCE UNIT	CHARGE DIST	CHARGE UNIT	EXP. AUTH. GRN. LED	EXP. AUTH. SUB-ACCT	SPECIAL DESIGNATION (USE WHEN APPLICABLE)
14	033	14	033	910002		

S/C 2091

TRIAL	COMMENTS	SLAB DIMENSION A (0.1 IN.)	SLAB AREA OF EFFECTIVE SLAB SQ. IN.	BAR STEEL DIMENSION B (0.1 IN.)	BAR STEEL AREA OF BAR STEEL (0.1 SQ. IN.)	WEB DIMENSION Y (0.1 IN.)	WEB DEPTH IN.	WEB THICKNESS (1/16 IN.)	FLANGES TOP WIDTH IN.	FLANGES TOP THICKNESS (1/16 IN.)	FLANGES BOTTOM WIDTH IN.	FLANGES BOTTOM THICKNESS (1/16 IN.)	APPLIED MOMENTS DEAD LOAD ON STEEL ONLY FT-K	APPLIED MOMENTS CURB & RAILING ON 3n CONCRETE FT-K	APPLIED MOMENTS LIVE LOAD ON 3n CONCRETE FT-K	n	ALLOWABLE STEEL STRESS
01	DESIGN POS	51	1260	59	125	120	66	5					2875	250	4000		21
02	SECT. PROPS	51	1260	59	125	120	66	5	20	10	30	15					
03	DESIGN NEG			59	125	120	66	5	20		30		3000	300	3000		21
04	ANALYSIS			59	125	120	66	5	20	10	30	14	3000	300	3000		

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TRIAL 01

DESIGN POS                                                  -----FLANGE------
            SLAB     BAR STEEL            WEB              TOP          BOTTOM                MOMENTS
    DIM A=    5.1  DIM B=   5.9  DIM Y = 12.0  WIDTH = 20.  WIDTH = 30.  DEAD LOAD = 2875.  N  =10.
    AREA = 1260.   AREA = 12.5  DEPTH =  66.  THICK = 10.  THICK = 15.  CURB&RAIL =  250.  ALL=21.
                                THICK =   5.                            LIVE LOAD = 4000.
    STEEL GIRDER AREA = 101.9   AREA = 20.6   AREA = 25.0  AREA = 56.3

                  C/I       C/I       C/I    Y-BAR      I        Q/I        ---------- STRESS ----------
                 (BARS) (TOP FL) (BOT FL)                                  (BARS)   (TOP FL)   (BOT FL)
    DEAD LOAD              6.008     3.275   24.4   89355.                            17.3       9.4
    CURB & RAIL   2.149    1.824     2.805   41.9  179214. 0.00995          0.5       0.5       0.7
    LIVE LOAD     1.034    0.790     2.679   53.4  239055. 0.01235          4.1       3.2      10.7

                                                                   TOTAL    4.7      20.9      20.8

TRIAL 02

SECT PROPS                                                  -----FLANGE------
            SLAB     BAR STEEL            WEB              TOP          BOTTOM
    DIM A=    5.1  DIM B=   5.9  DIM Y = 12.0  WIDTH = 20.  WIDTH = 30.
    AREA = 1260.   AREA = 12.5  DEPTH =  66.  THICK = 10.  THICK = 15.
                                THICK =   5.
    STEEL GIRDER AREA = 101.9   AREA = 20.6   AREA = 25.0  AREA = 56.3

                  C/I       C/I       C/I    Y-BAR      I        Q/I
                 (BARS) (TOP FL) (BOT FL)
    DEAD LOAD              6.008     3.275   24.4   89355.
    CURB & RAIL   2.149    1.824     2.805   41.9  179214. 0.00995
    LIVE LOAD     1.034    0.790     2.679   53.4  239055. 0.01235
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TRIAL 03

DESIGN NEG                                                  -----FLANGE------
            SLAB    BAR STEEL            WEB              TOP          BOTTOM              MOMENTS
    DIM A=   0.0  DIM B=  5.9  DIM Y = 12.0  WIDTH = 20.  WIDTH = 30.  DEAD LOAD = 3000.  N  =10.
    AREA =    0.  AREA = 12.5  DEPTH =  66.  THICK = 18.  THICK = 14.  CURB&RAIL =  300.  ALL=21.
                               THICK =   5.                            LIVE LOAD = 3000.
    STEEL GIRDER AREA = 118.1   AREA = 20.6   AREA = 45.0  AREA = 52.5

                  C/I       C/I       C/I   Y-BAR     I        Q/I        --------- STRESS ---------
                 (BARS) (TOP FL) (BOT FL)                                (BARS)   (TOP FL)  (BOT FL)
    DEAD LOAD             3.741     3.279   32.7  119668.                            11.2       9.8
    CURB & RAIL   3.217   2.884     3.167   36.6  138814. 0.00335          1.0       0.9       1.0
    LIVE LOAD     3.217   2.884     3.167   36.6  138814. 0.00335          9.7       8.7       9.5

                                                                   TOTAL  10.6      20.7      20.3

TRIAL 04

ANALYSIS                                                    -----FLANGE------
            SLAB    BAR STEEL            WEB              TOP          BOTTOM              MOMENTS
    DIM A=   0.0  DIM B=  5.9  DIM Y = 12.0  WIDTH = 20.  WIDTH = 30.  DEAD LOAD = 3000.  N  =10.
    AREA =    0.  AREA = 12.5  DEPTH =  66.  THICK = 18.  THICK = 14.  CURB&RAIL =  300.  ALL=20.
                               THICK =   5.                            LIVE LOAD = 3000.
    STEEL GIRDER AREA = 118.1   AREA = 20.6   AREA = 45.0  AREA = 52.5

                  C/I       C/I       C/I   Y-BAR     I        Q/I        --------- STRESS ---------
                 (BARS) (TOP FL) (BOT FL)                                (BARS)   (TOP FL)  (BOT FL)
    DEAD LOAD             3.741     3.279   32.7  119668.                            11.2       9.8
    CURB & RAIL   3.217   2.884     3.167   36.6  138814. 0.00335          1.0       0.9       1.0
    LIVE LOAD     3.217   2.884     3.167   36.6  138814. 0.00335          9.7       8.7       9.5

                                                                   TOTAL  10.6      20.7      20.3

 BATCH CHARGE UNITS =     4   APPROXIMATE MACHINE TIME  0.8 SECS   APPROXIMATE COST $  5.80
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