PENNDOT e-Notification

Bureau of Design
Engineering Computing Management Division

PENNDOT

BRADD
No. 011

April 7, 2006

Problem with bearing stiffener specification checks

Problem Statement:

For example job 14, US units, the reanalysis of the nongoverning left first interior girder shows a specification check failure for the designed bearing stiffener:

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                              BEARING STIFFENER CHECK
                              -----------------------
    Span            Maximum  Stiff.    Bearing      Axial    Max. Fact.   Code
     No.   Dist.     Width   Width   Resistance  Resistance  Reaction   Check*
           (ft)      (in)     (in)     (kips)      (kips)     (kips)
      1    0.000    11.921   8.000     485.10      688.50     503.68      B

          *  Legend of Code Checks:
             A. Projecting stiffener width greater than maximum allowed
             B. Provided resistance less than maximum factored reaction
             C. Bearing stiffener is required at this location
             D. Bearing stiffener was defined at this location
                but is not required
```

The bearing stiffener failure occurs because of BRADD logic in choosing the governing girder and the governing bearing stiffener. The governing girder is not necessarily the same as the girder for which the governing bearing stiffener was designed.

For this particular example, the governing beam is the left fascia (beam 1) and the governing bearing stiffener is based on the design of beam 2 which has the largest reaction. The problem results because the bottom flange of the governing beam is 16" wide, while the bottom flange of beam 2 is 18" wide.

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The bearing stiffener design output provided in the BRADD generated superstructure controller log file (asupe_c.out) is:

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 Bearing Stiffener Summary


 The following bearing stiffener table summarizes the bearing
 stiffeners designed above and selects the bearing stiffener to
 be used for the final analysis of all the beams based on the
 critical beam design.

 Beam    Thickness      Width      tweld      Reaction
  No.       (in)         (in)       (in)        (lb)
   2        0.88         8.00      0.3125     503278.8
   3        0.88         8.00      0.3125     497991.1
   1        0.88         7.00      0.3125     474667.6
   4        0.88         7.00      0.3125     469379.9

======================================================================
======================================================================
 Bearing Analysis Summary

 STLRFD designed the critical beam, Beam No. 1, as    90. in deep
 The flanges and web sections of this beam will be used in the analysis
 of the other designed beams.

 Bearing Stiffener and Weld Size given below, which is based on the
 maximum beam reaction,  will be used in the analysis of the designed
 beams.

 Thickness    Width    tweld    Reaction
    (in)       (in)     (in)      (lb)

    0.88       8.00    0.3125   503278.8

 Note: The weld size applies to web-bearing stiffener weld,
       top flange-bearing stiffener weld, and
       bottom flange-bearing stiffener weld.
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When determining the bearing resistance of the bearing stiffener (as opposed to the axial resistance), only the portion of the bearing stiffener that bears on the bottom flange can be considered (see BRADD User's Manual 3.2.7.12, step 2).

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When originally designing the bearing stiffener for beam two, the bottom flange width of 18" was used, resulting in a bearing width of 6.5": This is computed using the following information:

Bottom flange width = 18"
Web thickness = 0.625"

Keep stiffener 1/2" back from edge of flange
1.5" clip around weld

Bearing width:

(18" - 0.625") / 2 - 0.5" = 8.1875"

Round down to nearest half inch = 8.0"

Subtract clip around weld = 8" - 1.5" = 6.5"

However, when reanalyzing beam 2, the bearing width was reduced to 5.5" because the bottom flange was only 16" wide, leading to the bearing failure.

Depending on the difference in total reactions and the reserve introduced to the bearing stiffener by rounding the plate dimensions, this problem may occur any time the girder with the maximum reaction is not the same as the girder chosen as the governing girder and the girder designed in the maximum reaction location has a wider bottom flange than the governing girder.

Problem Workaround:

To get a good bearing stiffener design, run BRADD once to find the governing girder, then rerun the superstructure design after setting the upper limit of the bottom flange width to the flange width of the governing girder (in this case 16") to ensure that no girders will be designed with a flange wider than the governing girder. By doing this, the bearing stiffener will be designed with the governing flange width.

For this example, after changing the maximum bottom flange width to 16", the bearing stiffener is designed as 7" wide x 1" thick, with no bearing stiffener failures on reanalysis.

Problem Resolution:

This issue will be addressed in a future version of BRADD.

Please direct any questions to:

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