LATERAL STABILITY BRACING
DESIGN CRITERIA FOR GIRDER BRIDGES

PRIOR TO DECK COMPLETION

THE CRITERIA IN THIS STANDARD APPLIES ONLY TO COMPLETELY ERECTED STEEL GIRDERS AS SHOWN IN THE DIAGRAM. THE STABILITY OF STEEL AND COMPLETE GIRDERS IN THE VARIOUS STAGES OF ERECTION PRIOR TO INSTALLATION OF ALL ENRONS AND TANKS IS NOT SPECIFIED IN THE CONTRACT AS DESCRIBED IN PUBLICATION 408 SECTION 1050.3(c). (APPLIES TO TANGENT, SKEWED AND CURVED GIRDERS. APPLIES TO SINGLE AND MULTI-SPAN BRIDGES.)

1. PROVIDE LATERAL BRACING FOR BRIDGES WITH SPANS IN EXCESS OF 300 FT. TO AID IN CONSTRUCTION OF THE BRIDGE. DESIGN BRACING FOR THE PRESCRIBED WIND LOADS.

2. EVALUATE THE NEED FOR LATERAL BRACING FOR SPANS IN EXCESS OF 200 FT. BASED ON LATERAL DEFORMATION.

3. GIRDERS SHALL BE DESIGNED SO THAT NO LATERAL BRACING IS NECESSARY FOR SPANS 200 FT. OR LESS. LATERAL BRACING IS OBLIGATORY WHEN THE DEFORMATION DECREASES THE DEFORMATION IN THE DIRECTION OF THE WIND BY 50% OR MORE OF THE DEFORMATION DUE TO WIND ALONE. THIS PERFORMANCE CAN BE MET BY PROVIDING ENRONS AND TANKS TO MAINTAIN THE DESIGN STABILITY OF THE STRUCTURE.

4. EVALUATE LATERAL DEFORMATION OF STEEL SUPERSTRUCTURE FOR A PERMISSIBLE DEFORMATION OF L/150 LATERAL DEFLECTION LIMIT L/150 IS EXCEEDED. AN ACCEPTABLE ANALYSIS METHOD IS THE PRANDTL METHOD CALCULATION FOR A SINGLE PASS BY LP END CONDITION WITH AN UNBROKEN TOP FLANGE, AND IF NECESSARY, MODIFY THE STABILIZATION.

5. EVALUATE LATERAL DEFORMATION OF STEEL SUPERSTRUCTURE FOR A PERMISSIBLE DEFORMATION OF L/150 WITH BRACING IF DEFORMATION LIMIT L/150 IS EXCEEDED. AN ACCEPTABLE ANALYSIS METHOD IS THE PRANDTL METHOD CALCULATION FOR A SINGLE PASS BY LP END CONDITION WITH AN UNBROKEN TOP FLANGE, AND IF NECESSARY, MODIFY THE STABILIZATION.

6. ENSURE LATERAL STABILITY BRACING DESIGN CRITERIA FOR A PERMISSIBLE DEFORMATION OF L/150 WITH BRACING IF DEFORMATION LIMIT L/150 IS EXCEEDED. AN ACCEPTABLE ANALYSIS METHOD IS THE PRANDTL METHOD CALCULATION FOR A SINGLE PASS BY LP END CONDITION WITH AN UNBROKEN TOP FLANGE, AND IF NECESSARY, MODIFY THE STABILIZATION.

7. WIND LOAD PER FOOT OF BRIDGE IS (GIRDER DEPTH + DECK DEPTH)/4. WIND LOADS MUST BE INCREASED BY 5 PSF FOR WIND FORCES ONLY. PROVIDE OVERSIZED OR SLOTTED HOLES AND DESIGN THE CONNECTION DETAILING IS ACCEPTABLE.

8. USE OVERSIZED OR SLOTTED HOLES TO DESIGN THE GUSSET PLATES.

9. WIND LOAD DESIGN CRITERIA FOR THE PERMANENT STAGE.

10. USE THE MINIMUM DESIGN WIND PRESSURE SPECIFIED IN THE TABLE ON THIS SHEET, EXCEPT FOR BRIDGES OVER TRAFFIC, INCREASE THESE PRESSURES BY 5 PSF.

11. USE THE MINIMUM DESIGN WIND PRESSURE SPECIFIED IN THE TABLE ON THIS SHEET, EXCEPT FOR BRIDGES OVER TRAFFIC, INCREASE THESE PRESSURES BY 5 PSF.

NOTES:
1. LINEAR INTERPOLATION FOR INTERMEDIATE VALUES OF HEIGHT IS ACCEPTABLE.
2. BASIC WIND SPEED IS 115 MPH WITH A 1.4 LOAD FACTOR BUILT INTO IT AND AS DESIGNED IN AN APPROPRIATE PROBABILITY OF EXCEEDANCE IN 50 YEARS.
3. EXPANSION CONDITION IS CATEGORY C APPLICABLE TO OPEN GRASSLAND AND SCATTERED OBSTRUCTION GENERALLY LESS THAN 30 FT HIGH.
4. FOR BRIDGES NOT EXPOSED TO CATEGORY C, THESE WIND PRESSURES MUST BE INCREASED BY 5 PSF.
5. FOR BRIDGES NOT EXPOSED TO CATEGORY C, THESE WIND PRESSURES MUST BE INCREASED BY 5 PSF.
6. L/150 IN 300 FT. IS 2 FT. THIS WAS FELT TO BE ACCEPTABLE TO BOTH DESIGN PERSONNEL AND CONTRACTORS.
7. USE THE MINIMUM DESIGN WIND LOAD SPECIFIED IN THE TABLE ON THIS SHEET, EXCEPT FOR BRIDGES OVER TRAFFIC, INCREASE THESE PRESSURES BY 5 PSF.
8. THE LATERAL STABILITY BRACING DESIGN CRITERIA SHALL BE APPLIED FOR EACH STAGE OF BRIDGE CONSTRUCTION TO ENSURE STABILITY. THE WIND BRACING ARRANGEMENT REQUIRED FOR THE FINAL CONDITION OF THE STRUCTURE IS TO BE ADJUSTED ACCORDINGLY. USE REFERENCE IN NOTE R6 AS A GUIDELINE.
9. USE THE MINIMUM DESIGN WIND PRESSURE SPECIFIED IN THE TABLE ON THIS SHEET, EXCEPT FOR BRIDGES OVER TRAFFIC, INCREASE THESE PRESSURES BY 5 PSF.
ADDITIONAL LATERAL STABILITY CRITERIA
FOR SKewed STEEL BRIDGES

APPLIES TO STRAIGHT AND CURVED BRIDGES

1. THE DESIGN ENGINEER SHALL CHECK SKewed BRIDGES FOR THE FOLLOWING LOADING CONDITIONS:
   A) WIND LOADING ON THE STEEL SUPERSTRUCTURE PRIOR TO DECK PLACEMENT - THE PROCEDURE SHALL FOLLOW THAT USED FOR THE STRAIGHT, UNSKewed BRIDGE. THE LOADED AREA SHALL BE THE VERTICAL PLANE AREA OF THE FASCIA GIRDER.
   B) PARTIAL WIDTH LOADING UNDER STAGED CONSTRUCTION FOR DECK PLACEMENT - THE PROCEDURE SHALL FOLLOW THAT USED FOR THE STRAIGHT, UNSKewed BRIDGE. THE LOADED AREA IS THE SURFACE AREA OF THE LONGEST GIRDER. ALLOWABLE HORIZONTAL LOADS ARE DETERMINED FROM THE CRITERIA SHOWN ON SHEET 1. DESIGN LATERAL BRACING TO CARRY WIND LOADS ONLY AND DETAIL THE BRACING SO THAT IT WILL NOT PARTICIPATE IN CARRYING PRIMARY STRUCTURE FORCES.
   C) VERTICAL AND LATERAL DEFLECTIONS SHALL ALSO BE EVALUATED FOR STEEL SELF-WEIGHT AND THE DECK DEAD LOAD.

2. BEARINGS SHALL BE DESIGNED TO ACCOMMODATE GIRDER ROTATION DURING THE DECK PLACEMENT. GIRDER AND THEIR BEARING STEPPERS SHALL BE VERTICAL AT THE BEARINGS UNDER FULL DEAD LOAD. UPLIFT SHALL BE CHECKED AT EACH BEARING FOR WORST LOADING CONDITION IN EACH CONSTRUCTION PHASE.

3. INCLUDE LATERAL WIND BRACING IN THE DESIGN OF GIRDERS THAT DO NOT MEET THE CRITERIA AS SHOWN ON SHEET 1. DESIGN LATERAL BRACING TO CARRY WIND LOADS ONLY AND DETAIL THE BRACING SO THAT IT WILL NOT PARTICIPATE IN CARRYING PRIMARY STRUCTURE FORCES.

4. THE ENGINEER SHALL IDENTIFY THE NEED FOR AND LOCATION OF FALSEWORK AND PROVIDE INFORMATION AS PER DM4 D2.5.3 1P; HOWEVER, THE DESIGN AND FOUNDATION OF THE FALSEWORK IS THE RESPONSIBILITY OF THE CONTRACTOR.

5. USE TOP OR BOTTOM FLANGE BRACING FOR STRAIGHT GIRDERS. FOR GIRDERS WITH NARROW TOP FLANGE WIDTH, IT IS RECOMMENDED TO USE BOTTOM FLANGE LATERAL BRACING.

ADDITIONAL LATERAL STABILITY CRITERIA
FOR STRAIGHT STEEL GIRDER BRIDGES

1. USE TOP OR BOTTOM FLANGE BRACING FOR STRAIGHT GIRDERS. FOR GIRDERS WITH NARROW TOP FLANGE WIDTH, IT IS RECOMMENDED TO USE BOTTOM FLANGE LATERAL BRACING.

2. THE ENGINEER SHALL IDENTIFY THE NEED FOR AND LOCATION OF FALSEWORK AND PROVIDE INFORMATION AS PER DM4 D2.5.3 1P; HOWEVER, THE DESIGN AND FOUNDATION OF THE FALSEWORK IS THE RESPONSIBILITY OF THE CONTRACTOR.

3. BEARINGS SHALL BE DESIGNED TO ACCOMMODATE GIRDER ROTATION DURING THE DECK PLACEMENT. GIRDER AND THEIR BEARING STEPPERS SHALL BE VERTICAL AT THE BEARINGS UNDER FULL DEAD LOAD. UPLIFT SHALL BE CHECKED AT EACH BEARING FOR WORST LOADING CONDITION IN EACH CONSTRUCTION PHASE.

4. INCLUDE LATERAL WIND BRACING IN THE DESIGN OF GIRDERS THAT DO NOT MEET THE CRITERIA AS SHOWN ON SHEET 1. DESIGN LATERAL BRACING TO CARRY WIND LOADS ONLY AND DETAIL THE BRACING SO THAT IT WILL NOT PARTICIPATE IN CARRYING PRIMARY STRUCTURE FORCES.

5. DESIGN LATERAL BRACING FOR WIND LOADS. DESIGN AND DETAIL THE LATERAL BRACING SO THAT TORSIONAL FORCES FROM DEAD LOADS AND LIVE LOADS ON THE GIRDERS ARE NOT RESISTED BY THE LATERAL BRACING.
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION

STANDARD
ALTERNATE LATERAL BRACING - TYPE 2
(PREFERRED)

LATERAL BRACING
PLAN

PLA}
SKEW ANGLE

NOTES:
1. USE INTERMEDIATE BRACING POINT (DETAIL B, ON SHEET 4) AS NEEDED IF DESIGN IS CONTROLLED BY LATERAL PLANE BENDING AT FASCIA GIRDERS AND LATERAL STABILITY.
2. USE ANGLE OR STRUCTURAL STEEL BRACING MEMBERS WHENEVER POSSIBLE.
3. LATERAL BRACING FIELD CONNECTIONS SHALL BE MADE FOR 3/4" WELD AND 1/2" WELD OVERSIZED HOLES IN THE GUSSET PLATES, MINIMUM 2 BOLTS PER CONNECTION.
4. FOR EVEN NUMBER OF GIRDERS, CENTER GIRDERS ON SYMMETRICAL ARRAYS ARE ACCEPTABLE. FOR ODD NUMBER OF GIRDERS, EITHER SINGLE BAY BRACING ALONG CENTER GIRDERS IS SYMMETRICAL, BOTH BAYS ADJACENT TO CENTER GIRDERS, OR SYMMETRICAL.
5. PARTIAL LENGTH LATERAL BRACING IS PERMITTED.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
STEEL GIRDER BRIDGES
LATERAL BRACING CRITERIA AND DETAILS
(Straight Girders)

BD-620M
RECOMMENDED APR. 29, 2016
BD-620M
RECOMMENDED APR. 29, 2016
SHEET 3 OF 6
TOP FLANGE LATERAL BRACING CONNECTIONS

Note: Preferred arrangement is to attach lateral bracing to the bottom flange per SC-754M. The top flange attachment details are shown for the infrequent situations that necessitate attachment to the top flange.

TABLE 1

<table>
<thead>
<tr>
<th>Clear Distance Between Girders (Ft)</th>
<th>Dim. &quot;A&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>6'-0&quot; TO 9'-0&quot;</td>
<td>3&quot;</td>
</tr>
<tr>
<td>8'-0&quot; TO 9'-0&quot;</td>
<td>2-1/4&quot;</td>
</tr>
<tr>
<td>UNDER 6'-0&quot;</td>
<td>2&quot;</td>
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</tbody>
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COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
STANDARD
STEEL GIRDER BRIDGES
LATERAL BRACING CRITERIA AND DETAILS (STRAIGHT GIRDERS)

BD-620M
LATERAL BRACING (PREFERRED)

ALTERNATE LATERAL BRACING - TYPE 1

ALTERNATE LATERAL BRACING - TYPE 2

NOTES:

1. USE INTERMEDIATE BRACING POINT DETAIL E, SH. E AS NEEDED. DESIGN IS CONTROLLED BY LATERAL PLANE DESIGN AT FACIA GIRDERS AND LATERAL STABILITY.

2. USE ANGLE OR STRUCTURAL TEE BRACING MEMBERS WHENEVER POSSIBLE.

3. LATERAL BRACING FIELD CONNECTIONS SHALL BE MADE WITH 3/8" x 3/4" ASTM A257 H.S. BOLTS USING OVERSIZED HOLES IN THE GUSSET PLATES. MINIMUM 2 BOLTS PER CONNECTION.

4. FOR ODD NUMBER OF GIRDERS, CENTER GUSSET BAY ON SYMMETRICAL LAYOUT IS ACCEPTABLE. FOR EVEN NUMBER OF GIRDERS, EITHER SINGLE BAY BRACING ADJACENT TO CENTER GIRDER OR SYMMETRICAL, BOTH BAY ADJACENT TO CENTER GIRDER, LAYOUT IS ACCEPTABLE.

5. PARTIAL LENGTH LATERAL BRACING IS PERMITTED.
TOP FLANGE LATERAL BRACING CONNECTIONS

Note: Bottom flange lateral bracing is not permitted without prior approval of Chief Bridge Engineer since the bracing will change the behavior of the girders to behave as a pseudo-box girder.

SECTION G-G
FIELD BOLTED BRACE

ALTERNATE SECTION G-G
SHOP WELDED, FIELD BOLTED BRACE

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
STEEL GIRDER BRIDGES
LATERAL BRACING CRITERIA AND DETAILS
(Curved Girders)