Chapter 03 - Superstructure

SECTION 06

CONCRETE GIRDER
(SUP-CG)
Chapter 03 - Superstructure

Section 06 – Concrete Girder

SUB-SECTION 01

GENERAL

(SUP-CG(GEN))
Typical Reinforcing Detail

Scale: 1" = 1'-0"

Notes:

1. Prestressing steel and additional bars at piers not shown.
2. The longitudinal bars in web may be discontinuous to allow for passage of deflected strands in girder web.
3. For embedment depth of stirrup into deck, see Detail No. SUP-CG-401.
4. Unless otherwise shown in the detail (***), all clear cover shall be 2".
5. Horizontal splices are allowed for transverse bars in the top and bottom flanges.
6. Vertical splices are prohibited in the main shear stirrups.
7. A 180 or 90 degree hook that conforms to detail no. REBAR-DL-203 must be used on the bottom of every main shear stirrup. This hook can be placed either transverse or longitudinal to the beam. Main shear stirrup bars without hooks at the bottom are prohibited.
8. The main shear stirrup cannot flare out to the sides of the flanges except for the hook at the bottom of the girder.
9. A hook of 180 degrees is required for any bar that protrudes out of the girder.

* FOR OFFICE USE ONLY *

State of Maryland
Department of Transportation
Office of Structures

Typical Non-Prestressing Reinforcing Detail for PCEF Bulb Tee Prestressed Concrete Girder

Detail No. SUP-CG(GEN)-101
**TYPICAL DIMENSION DETAIL**

Scale: 1" = 1'-0"

**BASIC BEAM PROPERTIES**

<table>
<thead>
<tr>
<th>D (in)</th>
<th>Volume (CY/FT)</th>
<th>Area (in. 2)</th>
<th>Y_b (in.)</th>
<th>I (in. 4)</th>
<th>Z_t (in. 3)</th>
<th>Z_b (in. 3)</th>
<th>WT/FT KLF</th>
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**Note:** Prestressing steel and reinforcing steel not shown.
**TYPICAL DIMENSION DETAIL**

Scale: 1" = 1'-0"

**BASIC BEAM PROPERTIES**

<table>
<thead>
<tr>
<th>Volume (CY/FT)</th>
<th>Area (in. 2)</th>
<th>(Y_b) (in.)</th>
<th>I (in. 4)</th>
<th>(Z_y) (in. 3)</th>
<th>(Z_b) (in. 3)</th>
<th>WT/FT KLF</th>
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**Notes:**

Prestressing steel and reinforcing steel not shown.

*GUIDE SHEET FOR PLAN DEVELOPMENT ONLY – DO NOT INCLUDE THIS SHEET IN CONTRACT PLANS*
Notes:
1. Reinforcing steel bars not shown.
2. Details show maximum number of strand locations. Not all locations will be filled for each girder.
3. The designer shall determine the number of strands based on design loads. Strand shall be placed starting at the bottom row and working upward as needed.
4. Some strands in the girder web locations shall be harped as needed at approximately the 4/10 and 6/10 points along the span length.
5. If more than 12 strands are harped, the harped strands shall be broken into two groups. The harping points shall be separated by approximately 5'-0".
TYPICAL SPACING OF STRANDS

Scale: $\frac{\text{1}}{4''} = 1'-0''$

Notes:
1. Reinforcing steel bars not shown.
2. Details show maximum number of strand locations. Not all locations will be filled for each girder.
3. The designer shall determine the number of strands based on design loads. Strand shall be placed starting at the bottom row and working upward as needed.
4. Some strands in the girder web locations shall be harped as needed at approximately the 4/10 and 6/10 points along the span length.
5. If more than 12 strands are harped, the harped strands shall be broken into two groups. The harping points shall be separated by approximately 5'-0''.

*GUIDE SHEET FOR PLAN DEVELOPMENT ONLY – DO NOT INCLUDE THIS SHEET IN CONTRACT PLANS*
Top surface of all girders shall be rough finished to a full amplitude of 1/4" and scubbed transversely with a course wire brush to remove all laitance to produce a roughened surface for bonding.

Top of all stirrups to extend into hatched portion of slab as shown.

For prestressed concrete girder stirrup spacing and details, see pertinent superstructure sheets.

Note:
For prestressed concrete girder
stirrup spacing and details, see
pertinent superstructure sheets.
After girder is in final position, cut off flush with top of girder and epoxy coat exposed strands.

Top of girder

End of girder

$\frac{1}{2}$'' dia. strand loops at center line girder. For number of loops see chart below.

Notes:
1. One lifting device is required at each end of all girders.
2. Scale: $\frac{\frac{1}{2}''}{1'-0''}$
3. All loops shall consist of $\frac{1}{2}''$ diameter 7-wire low relaxation strands conforming to the requirements of ASTM A416 grade 270.
4. The exact location of the lifting device may be altered to avoid all prestressing strands, stirrups, mild reinforcing steel and studs on plates as long as the embedment depth of the lifting device and a clear cover of 2'' on each face of the web is maintained.

<table>
<thead>
<tr>
<th>Type of Girder</th>
<th>Number of Loops</th>
<th>Dimension ''A''</th>
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<tbody>
<tr>
<td>AASHTO III 45''</td>
<td>3</td>
<td>3'-0''</td>
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<tr>
<td>AASHTO IV 54''</td>
<td>4</td>
<td>3'-6''</td>
</tr>
<tr>
<td>AASHTO V 63''</td>
<td>4</td>
<td>4'-3''</td>
</tr>
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<td>AASHTO VI 70''</td>
<td>4</td>
<td>4'-10''</td>
</tr>
<tr>
<td>PCEF 29''</td>
<td>3</td>
<td>2'-3''</td>
</tr>
<tr>
<td>PCEF 31''</td>
<td>3</td>
<td>2'-5''</td>
</tr>
<tr>
<td>PCEF 37'' &amp; 39''</td>
<td>3</td>
<td>2'-11''</td>
</tr>
<tr>
<td>PCEF 45'' &amp; 47''</td>
<td>3</td>
<td>2'-11''</td>
</tr>
<tr>
<td>PCEF 53'' &amp; 55''</td>
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<td>3'-5''</td>
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<tr>
<td>PCEF 61'' &amp; 63''</td>
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<td>PCEF 69'' &amp; 71''</td>
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<td>PCEF 77'' &amp; 79''</td>
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<td>5'-5''</td>
</tr>
<tr>
<td>PCEF 85'' &amp; 87''</td>
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<td>6'-4''</td>
</tr>
<tr>
<td>PCEF 93'' &amp; 95''</td>
<td>4</td>
<td>6'-9''</td>
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</table>

Notes:
1. The lifting devices shown are designed with a minimum factor of safety of 2 for an assumed 180 ft maximum girder length.
2. At the Contractor's option, alternate lifting details with a minimum factor of safety of 2 will be considered subject to the approval of the Engineer, before use.
3. All loops shall consist of $\frac{1}{2}''$ diameter 7-wire low relaxation strands conforming to the requirements of ASTM A416 grade 270.
4. The exact location of the lifting device may be altered to avoid all prestressing strands, stirrups, mild reinforcing steel and studs on plates as long as the embedment depth of the lifting device and a clear cover of $2''$ on each face of the web is maintained.
**END OF BEAM REINFORCING SECTION AT PIER**

Scale: 1\(\frac{1}{2}\)" = 1'-0"

<table>
<thead>
<tr>
<th>Location</th>
<th>Development Length</th>
<th>Bar Size *</th>
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<tr>
<td>Pier</td>
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</tbody>
</table>

*All additional reinforcing bars to be #5 unless otherwise noted in this column.*

**Note:** These bars may be placed in casting bed straight and bent in shop after casting of beam to allow for passage of prestressing strands.
Notes:
1. Prestressing strands, typical reinforcing, and studs not shown for clarity.
2. For bar size and development length see chart on sheet 1 of 2.
3. For hook dimensions see Detail No. REBAR-0L-103.
**END OF BEAM REINFORCING SECTION AT PIER**

Scale: 1\(\frac{\text{\prime\prime}}{2}\) = 1'-0''

<table>
<thead>
<tr>
<th>Bridge #</th>
<th>Description</th>
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<tr>
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</tbody>
</table>

*All additional reinforcing bars to be #5 unless otherwise noted in this column.*

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**End of drawing**
Notes:
1. Prestressing strands, typical reinforcing, and studs not shown for clarity.
2. For bar size and development length see sheet 1 of 2.
3. For hook dimensions see Detail No. REBAR-DL-103.

ELEVATION
Scale: $\frac{3}{8}'' = 1'-0''$

PIER CONNECTION PLAN VIEW
Scale: $\frac{3}{8}'' = 1'-0''$

Development length
see chart on sheet 1 of 2

Bend ends of bars in field as necessary to clear bars in opposing girders (typ.)

End of concrete girders
Additional reinforcing at piers with 180° hooks

End of concrete girders
Additional reinforcing at piers with 180° hooks

Bottom Flange

Prestressing strands, typical reinforcing, and studs not shown for clarity.

For bar size and development length see sheet 1 of 2.

For hook dimensions see Detail No. REBAR-DL-103.
Chapter 03 - Superstructure

Section 06 – Concrete Girder

SUB-SECTION 02
INTERMEDIATE DIAPHRAGMS (SUP-CG(DIA))
Notes:
1. For Section A-A see sheet 2 of 3.
2. Normal concrete girder, slab and parapet reinforcing not shown.
3. All reinforcing steel, threaded bars and threaded inserts shall be epoxy coated.
4. F-Shape barrier is for illustrative purposes only. See plans for barrier type.

Scale: 1" = 1'-0"
Notes:
1. All reinforcing steel and threaded bars shall be epoxy coated.
2. All reinforcing steel in girders shall be spaced to miss holes and threaded inserts in web.
3. Intermediate diaphragms shall be in place at least 40 hours prior to placement of deck.
Timber blocking

Steel deck forms which remain in place

Timber forming for intermediate diaphragm

Intermediate diaphragm 1'-0"

DECK FORMING DETAIL AT INTERMEDIATE DIAPHRAGM
Scale: 1/4" = 1'-0"

Note:
Holes shall be cast parallel to diaphragm and follow the slope of the bottom of the diaphragm.

PLAN

DIAPHRAGM HOLE DETAIL
Scale: 1" = 1'-0"

ELEVATION

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
OFFICE OF STRUCTURES

INTERMEDIATE DIAPHRAGM FOR
29" AND 31" PCEF BULB TEE GIRDER

DETAIL NO. SUP-CG/DIA-101 SHEET 3 OF 3
INTERMEDIATE DIAPHRAGM - ELEVATION

Scale: \( \frac{\text{1/4"}}{\text{1'-0"}} \)

Notes:
1. For Section A-A see sheet 2 of 3.
2. Normal concrete girder, slab and parapet reinforcing not shown.
3. All reinforcing steel, threaded bars and threaded inserts shall be epoxy coated. See plans for barrier type.
3. F-Shape barrier is for illustrative purposes only. See plans for barrier type.

4. Interior girder web (typ.)
5. Hole shall be grouted before diaphragm is cast. See sheet 3 of 3 for details.
6. 3-6 bars extended to end of deck slab as shown.
7. 4 - 1" dia. threaded inserts (2 per layer) cast in exterior girder as shown and parallel to \( \ell \) diaphragm.
8. \( \ell \) 37" or 39" PCEF bulb tee girder (typ.)
9. 4 - 1" dia. threaded bars (2 per layer) placed in inserts to lap with \#6 bars (typ.)
1. All reinforcing steel and threaded bars shall be epoxy coated.
2. All reinforcing steel in girders shall be spaced to miss holes and threaded inserts in web.
3. Intermediate diaphragms shall be in place at least 40 hours prior to placement of deck.
End closure for steel deck forms as required

Roughened construction joint
Bridge deck slab

Steel deck forms which remain in place

Timber blocking

Timber forming for intermediate diaphragm

Intermediate diaphragm

1'-0"

DECK FORMING DETAIL AT INTERMEDIATE DIAPHRAGM

Scale: 1/4" = 1'-0"

Note:
Holes shall be cast parallel to the diaphragm and follow the slope of the bottom of the diaphragm.

DIAPHRAGM HOLE DETAIL

Scale: 1" = 1'-0"

PLAN

ELEVATION

Girder web

Skew angle of diaphragm

3/4", 3/4"

3/4", 3/4"

2"

1'-0"

2"

Near side openings

Far side openings

Intermediate diaphragm

1/2" dia. holes through girder webs

Intermediate diaphragm

1'-0"

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
OFFICE OF STRUCTURES

INTERMEDIATE DIAPHRAGM FOR 37" AND 39" PCEF BULB TEE GIRDER

DETAIL NO. SUP-CG(DIA)-102

SHEET 3 OF 3
4.5" AND 47" PCEF BULB TEE GIRDERS

INTERMEDIATE DIAPHRAGM FOR SUPERSTRUCTURE CONCRETE GIRDER

SUP-CG(DIA)-103

1. For Section A-A see Sheet 2 of 3.
2. Normal concrete girder, slab and parapet reinforcing not shown.
3. All reinforcing, threaded bars and threaded inserts shall be epoxy coated.
4. F-Shaped barrier is for illustrative purposes only. See plans for barrier type.

Notes:
1. For Section A-A see sheet 2 of 3.
2. Normal concrete girder, slab and parapet reinforcing not shown.
3. All reinforcing, threaded bars and threaded inserts shall be epoxy coated.
4. F-Shaped barrier is for illustrative purposes only. See plans for barrier type.

- 4-6 bars (2 per layer) between girders as shown (typ.)
- Roughened construction joint (match top of girder)
- 4-6 dowels (2 per layer) placed through holes in interior girder web (typ.)
- 2-5" as shown with #6 dowels (typ.)
- 2-4 #4 bars under girder flange spaced as shown (typ.)
- 4 - 1/2" dia. holes (2 per layer) cast in exterior girder as shown and parallel to L diaphragm
- 4 - 1" dia. threaded inserts (2 per layer) cast in interior girder webs (typ.). Holes shall be grouted before diaphragm is cast. See sheet 3 of 3 for details.

INTERMEDIATE DIAPHRAGM - ELEVATION

Scale: 1/8" = 1'-0"
SECTION A-A

Scale: 1" = 1'-0"

Notes:
1. All reinforcing steel and threaded bars shall be epoxy coated.
2. All reinforcing steel in girders shall be spaced to miss holes and threaded inserts in web.
3. Intermediate diaphragms shall be in place at least 40 hours prior to placement of deck.
DECK FORMING DETAIL AT INTERMEDIATE DIAPHRAGM

Scale: 1/4" = 1'-0"

- End closure for steel deck forms as required
- Steel deck forms which remain in place
- Timber blocking
- Timber forming for intermediate diaphragm
- Roughened construction joint
- Bridge deck slab

Note:
Holes shall be cast parallel to diaphragm and follow the slope of the bottom of the diaphragm.

DIAPHRAGM HOLE DETAIL

Scale: 1" = 1'-0"

- 3/4" x 3/4"
- Skew angle of diaphragm
- 6" x 6" intermediate diaphragm
- 1/2" dia. holes through girder webs
- Near side openings
- Far side openings

PLAN

ELEVATION

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
OFFICE OF STRUCTURES

INTERMEDIATE DIAPHRAGM FOR 45" AND 47" PCEF BULB TEE GIRDER

DETAIL NO. SUP-CG(DIA)-103 SHEET 3 OF 3
NOTES:
1. For Section A-A see sheet 2 of 3.
2. Normal concrete girder, slab and parapet reinforcing not shown.
3. All reinforcing steel, threaded bars and threaded inserts shall be epoxy coated.
4. F-Shape barrier is for illustrative purposes only. See plans for barrier type.
Notes:
1. All reinforcing steel and threaded bars shall be epoxy coated.
2. All reinforcing steel in girders shall be spaced to miss holes and threaded inserts in web.
3. Intermediate diaphragms shall be in place at least 40 hours prior to placement of deck.

Intermediate Diaphragm for 53" through 63" PCEF Bulb Tee Girders

SCALE: 1" = 1'-0"

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
OFFICE OF STRUCTURES

INTERMEDIATE DIAPHRAGM FOR 53" THROUGH 63" PCEF BULB TEE GIRDS

DETAIL NO. SUP-CG(DIA)-104

SHEET 2 OF 3
End closure for steel deck forms as required

Steel deck forms which remain in place

Timber blocking

Roughened construction joint

Bridge deck slab

Intermediate diaphragm 1'-0"

Timber forming for intermediate diaphragm

Note:
Holes shall be cast parallel to & diaphragm and follow the slope of the bottom of the diaphragm.

Note:
Openings for Intermediate diaphragm

Diaphragm forming detail at intermediate diaphragm

Scale: 1/4" = 1'-0"

PLAN

DIAPHRAGM HOLE DETAIL

Scale: 1" = 1'-0"

ELEVATION

53" or 55" PCEF Bulb Tee

61" or 63" PCEF Bulb Tee

53" through 63" PCEF Bulb Tee Girders

Intermediate diaphragm for

State of Maryland
Department of Transportation
State Highway Administration
Office of Structures

Approval

Director
Office of Structures
Date 07/25/2019

Detail No. SUP-CG(DIA)-104

Sheet 3 of 3

1.01
Notes:
1. For Section A-A see sheet 2 of 3.
2. Normal concrete girder, slab and parapet reinforcing not shown.
3. All reinforcing steel, threaded bars and threaded inserts shall be epoxy coated.
4. F-Shape barrier is for illustrative purposes only. See plans for barrier type.
**Notes:**

1. All reinforcing steel and threaded bars shall be epoxy coated.
2. All reinforcing steel in girders shall be spaced to miss holes and threaded inserts in web.
3. Intermediate diaphragms shall be in place at least 40 hours prior to placement of deck.
End closure for steel deck forms as required.

Steel deck forms which remain in place.

Timber blocking.

Intermediate diaphragm 1'-0''

Roughened construction joint Bridge deck slab.

Timber forming for intermediate diaphragm.

Note: Holes shall be cast parallel to & diaphragm and follow the slope of the bottom of the diaphragm.

Near side openings.

Far side openings.

Girder web 3/8'' 3/8''

Skew angle of diaphragm.

1'' dia. holes through girder webs.

1/2'' dia. holes through intermediate diaphragm.

State of Maryland
Department of Transportation
State Highway Administration
Office of Structures

Intermediate Diaphragm for 69'' and 71'' PCEF Bulb Tee Girders

Detail No. SUP-C010105 Sheet 3 of 3
Notes:
1. For Section A-A see sheet 2 of 3.
2. Normal concrete, girder, slab and barrier reinforcing not shown.
3. All reinforcing steel, threaded bars and threaded inserts shall be epoxy coated. See plans for barrier type.
4. F-Shape barrier is for illustrative purposes only. See plans for barrier type.

INTERMEDIATE DIAPHRAGM - ELEVATION
Scale: 1/8" = 1'-0"

6-#6 bars (2 per layer) between girders as shown (typ.)
Roughened construction joint (match top of girder)
8-#6 dowels (2 per layer) placed through holes in interior girder web (typ.)
2-5' as shown with #6 dowels (typ.)
2-#6 bars lapped 2'-5" as shown with #6 dowels (typ.)
2-#4 L-shaped bars under girder flange spaced as shown (typ.)
6-#6 bars lapped 2'-5" as shown with #6 dowels (typ.)
8 - 1½" dia. holes (2 per layer) cast in interior girder webs (typ.).
Holes shall be grouted before diaphragm is cast. See sheet 3 of 3 for details.
3/4" cl. (typ.)
3 cl. max. c/c (typ.)
4 U-shaped bars @ 9" (typ.)
3 cl.

Top of bridge deck
8 - 1" dia. threaded inserts (2 per layer) cast in exterior girder as shown and parallel to E diaphragm

8 - 1" dia. threaded bars (2 per layer) placed in inserts to lap with #6 bars (typ.)

3-#8 bars extended to end of deck slab as shown
Notes:
1. All reinforcing steel and threaded bars shall be epoxy coated.
2. All reinforcing steel in girders shall be spaced to miss holes and threaded inserts in web.
3. Intermediate diaphragms shall be in place at least 40 hours prior to placement of deck.
End closure for steel deck forms as required

Steel deck forms which remain in place

Timber blocking

Intermediate diaphragm 1'-0"

**DECK FORMING DETAIL AT INTERMEDIATE DIAPHRAGM**

Scale: ¼" = 1'-0"

Timber forming for intermediate diaphragm

Roughened construction joint

Bridge deck slab

**Note:**
Holes shall be cast parallel to the diaphragm and follow the slope of the bottom of the diaphragm.

**PLAN**

**DIAPHRAGM HOLE DETAIL**

Scale: 1" = 1'-0"

Note:
Holes shall be cast parallel to the diaphragm and follow the slope of the bottom of the diaphragm.

**ELEVATION**

**STATE OF MARYLAND**

**DEPARTMENT OF TRANSPORTATION**

**STATE HIGHWAY ADMINISTRATION**

**OFFICE OF STRUCTURES**

**INTERMEDIATE DIAPHRAGM FOR 77" THROUGH 87" PCEF BULB TEE GIRDER**

**DETAIL NO. SUP-CODIA1-106**

**SHEET 3 OF 3**
Notes:
1. For Section 4-A see Sheet 2 of 3.
2. Normal concrete girder, slab and parapet reinforcing not shown.
3. All reinforcing steel, threaded bars and threaded inserts shall be epoxy coated.
4. F-Shape barrier is for illustrative purposes only. See plans for barrier type.

8-#6 bars (2 per layer) between girders as shown (typ.)
Roughened construction joint (match top of girder)
8-#6 dowels (2 per layer) placed through holes in interior girder web (typ.)
2" cl. (typ.)

6-#6 bars lapped 2'-5" as shown with #6 dowels (typ.)
2-#6 bars lapped 2'-5" as shown with #6 dowels (typ.)
2-#4 bar lapped under girder flange spaced as shown (typ.)

6-#6 bars lapped 2'-5" as shown with #6 dowels (typ.)
8-1' dia., holes (2 per layer) cast in interior girder webs (typ.). Holes shall be grouted before diaphragm is cast. See Sheet 3 of 3 for details.

8 - 1½ dia., holes (2 per layer) cast in exterior girder as shown and parallel to E diaphragm.

8 - #8 bars extended to end of deck slab as shown

1. Top of bridge deck

INTERMEDIATE DIAPHRAGM - ELEVATION
Scale: ⅛" = 1'-0"

3" cl.
*4 L bars @ 9" max. c/c (typ.)
3¼" cl. (typ.)
6"
9"
2" cl. (typ.)

Top of bridge deck

3-#8 bars extended to end of deck slab as shown

8 - 1" dia., threaded inserts (2 per layer) cast in exterior girder as shown and parallel to E diaphragm.

SCALE: ⅛" = 1'-0"
93'' and 95'' PCEF Bulb Tee Girders

Intermediate Diaphragm for

Notes:
1. All reinforcing steel and threaded bars shall be epoxy coated.
2. All reinforcing steel in girders shall be spaced to miss holes and threaded inserts in web.
3. Intermediate diaphragms shall be in place at least 40 hours prior to placement of deck.
**DECK FORMING DETAIL AT INTERMEDIATE DIAPHRAGM**

*Scale: 1/4" = 1'-0"*

- End closure for steel deck forms as required
- Steel deck forms which remain in place
- Timber blocking

**DIAPHRAGM HOLE DETAIL**

*Scale: 1" = 1'-0"

- Timber forming for intermediate diaphragm
- Roughened construction joint
- Bridge deck slab

**PLAN**

Notes:
- Holes shall be cast parallel to % intermediate diaphragm and follow the slope of the bottom of the diaphragm.

**ELEVATION**

- Near side openings
- Far side openings
- 1 1/2" dia. holes through girder webs