APPENDIX F

DRAWINGS OF FULL-DEPTH DECK PANELS FROM UTAH DOT

FULL DEPTH PRECAST CONCRETE DECK PANELS GENERAL NOTES

IMPLEMENTATION

IT IS THE DESIGNER'S RESPONSIBILITY TO:

- Design and check the shear and moment design and check the continuity in the deck by ensuring adequate continuity between all panels.
- Design and check the deck elevation and top of panel elevations sheets.
- Design and check all characteristics related to required closure details.
- Design and check the structural capacity of the existing girders/steel beams for shear force and moment in the panels are placed orthogonally to the existing girders/steel beams.
- Design and check all characteristics related to required shear connector details.
- Design and check all characteristics related to required closure details.

DEFINITIONS

- PRECAST PANEL - CONCRETE SHEET REINFORCED WITH PRESTRESSING STEEL AND DESIGNED STEEL BARS.
- PRESTRESSED PANEL - CONCRETE SHEET REINFORCED WITH PRESTRESSING STEEL AND DESIGNED STEEL BARS.

OPTIONAL DETAILS

- These drawings are based on the use of blind blockouts and welded reinforcement placed in "plane" steel angles.
- These blockout details shown on drawing number X are also acceptable.

GENERAL NOTES

- PRECAST CONCRETE PANEL DESIGNED IN ACCORDANCE WITH UDOT SPECIFICATIONS AND APPLICABLE CODES.
- PRECAST PANEL CONNECTOR: f = 6,000 PSI (CLASS A)
- PRESTRESSED PANEL CONNECTOR: f = 7,500 PSI (CLASS A)
- CLOSURE POUR CONCRETE: f = MATCH PRECAST ELEMENTS
- NON-MIXING CEMENT: f = 5,000 PSI @ 28 DAYS
- REINFORCING STEEL CONNECTING THE GIRDERS/BEAMS TO PRECAST PANELS IS PLACED ORTHOGONALLY TO THE BEAM/GIRDER.

INDEX OF SHEETS

- PDP-1 GENERAL NOTES
- PDP-2 GENERAL LAYOUTS
- PDP-3 TYPICAL DECK PANEL PLANS AND SECTIONS
- PDP-4 PANEL PLANS - NON-SKEWED
- PDP-5 PANEL PLANS - SKewed
- PDP-6 PRECAST PANEL CONNECTING DETAILS
- PDP-7 PRESTRESSED PANEL CONNECTING DETAILS
- PDP-8 CLOSURE POUR DETAILS
- PDP-9 SHEAR CONNECTOR BLOCKOUT DETAILS
- PDP-10 SHEAR CONNECTOR DETAILS NEW SHEAR CONNECTOR DETAILS
- PDP-11 CAST PANEL DETAILS EXISTING GIRDERS
- PDP-12 VERTICAL ADJUSTMENT DETAILS
- PDP-13 TYPICAL POST-TENSIONING DETAILS 1
- PDP-14 TYPICAL POST-TENSIONING DETAILS 2
- PDP-15 PANEL DETAILS 1
- PDP-16 PANEL DETAILS 2
- PDP-17 DECK PANEL TOLERANCES

PANELS DESIGNED FOR AN H-93 LOAD INCLUDING A 40 PSF LOAD FOR TOTAL RESIDUALS, 4TH EDITION.
NOTE: PARTIAL WIDTH PANELS MAY BE USED IN COMBINATION WITH CLOSURE POURS.

NON-SKEWED BRIDGES

SKewed BRIDGES (GREATER THAN 15º)

STANDARD PRECAST CONCRETE PANEL APPLICATIONS - NON-SKEewed

STANDARD PRECAST CONCRETE PANEL APPLICATIONS - SKewed

NOTE: PARTIAL WIDTH PANELS MAY BE USED IN COMBINATION WITH CLOSURE POURS.
1. Designer will determine number and location of lifting points.

2. A minimum of 2 vertical adjustment assemblies are required at each girder.

3. For vertical adjustment devices, see "Vertical Adjustment Details" sheet.

4. For details of blind blockout for post-tensioning duct splice - see "Typical Post-Tensioning Details" sheets.

5. See "Precast Panel Reinforcing" and "Prestressed Panel Reinforcing" sheets for outlined reinforcing.

6. See "Typical Post-Tensioning Details 2" sheet for connection details.

NOTES

See panel reinforcing requirements at overhang.
1. DESIGNER WILL DETERMINE NUMBER AND LOCATION OF LIFTING POINTS.

2. A MINIMUM OF 2 VERTICAL ADJUSTMENT ASSEMBLIES ARE REQUIRED AT EACH GIRDER.

3. FOR VERTICAL ADJUSTMENT DEVICES SEE "VERTICAL ADJUSTMENT DETAILS" SHEET.

4. FOR DETAILS OF BLIND BLOCKOUT SEE "SHEAR CONNECTOR BLOCKOUT DETAILS" SHEET.

5. SEE "PRECAST PANEL REINFORCING" AND "PRESTRESSED PANEL REINFORCING" SHEETS FOR REQUIRED REINFORCING.

6. SEE "TYPICAL POST-TENSIONING DETAILS 2" SHEET FOR CONNECTION DETAILS.
NOTES

1. Adjust location of bars to avoid conflicts with blockouts as approved by designer. Rotate #6 hooks top bars to provide adequate cover.

2. Steel girder shown. Prestressed bulb tee girders allowed.

3. Hook top bars STD 180° each end. Crowned roadways require a closure pour at the crown. This will require multiple panels in a cross section. See crown closure pour details.

#5 bars average spa. @ 6" C-C RUN FROM REAR FACE OF PARAPET TO TOP MAT OF PANEL REINFORCING

#4 bars average spa. @ 6" C-C RUN FROM FRONT FACE OF PARAPET TO BOTTOM MAT OF PANEL REINFORCING

#6 bars average SPA. @ 12" C-C TOP AND BOTTOM

FRONT FACE OF PRECAST PARAPET (WHERE APPLICABLE)

VERTICAL ADJUSTMENT (TYP.)

SHEAR KEY PANEL CONNECTION (TYP.)

INTRODUCTION PANEL REINFORCING PLAN

SECTION D: PRECAST PANEL

SECTION C: PRECAST PANEL

SEE "PARAPET DETAILS" SHEETS
1. Adjust location of bars and strands to avoid conflicts with blockouts as approved by designer.

2. Steel girders shown, prestressed bulb tee girders allowed.

3. Crowned roadways require a closure pour at the crown. This will require multiple panels in a cross section. See crown closure pour details.

NOTES:
1. Adjust location of bars and strands to avoid conflicts with blockouts as approved by designer.

2. Steel girders shown, prestressed bulb tee girders allowed.

3. Crowned roadways require a closure pour at the crown. This will require multiple panels in a cross section. See crown closure pour details.

4. Vertical adjustment (Typ.)

5. Blanking:

6. #6 @ 12" Avg. Spacing C-C top and bottom. See Note 1

7. Additional #6 @ 6" overhang reinforcement extend 8'-3" past girder, see Note 3

8. Lifted point reinforcing (by others)

9. See "Parapet Details" Sheet

10. Section F: Prestressed panel

11. Full depth precast concrete deck panels

12. Prestressed panel reinforcing

13. Interior panel reinforcing plan non-skewed

14. Overall panel width 24'-0" min. to 40'-0" max.

15. Addtional #6 @ 6" overhang reinforcement extend 8'-3" past girder, see Note 3

16. #4 bars average spa. @ 6" C-C run from front face of parapet to bottom mat of panel reinforcing

17. 0.600" dia. prestressing strands avg. spa. @ 12" C-C top and bottom

18. 4'-0" max. overhang

19. #5 bars average spa. @ 6" C-C run from rear face of parapet to top mat of panel reinforcing

20. #4 bars average spa. @ 6" C-C run from front face of parapet to bottom mat of panel reinforcing

21. 4'-0" min. to 16'-0" max., nominal panel length

22. Direction of traffic

23. Front face of parapet (where applicable)

24. Interior panel reinforcing plan skewed

25. Overall panel width 24'-0" min. to 40'-0" max.

26. Addition #6 @ 6" overhang reinforcement extend 8'-3" past girder, see Note 3

27. #4 bars average spa. @ 6" C-C run from front face of parapet to bottom mat of panel reinforcing

28. 0.600" dia. prestressing strands avg. spa. @ 12" C-C top and bottom

29. #5 bars average spa. @ 6" C-C run from rear face of parapet to top mat of panel reinforcing

30. #6 bars average spa. @ 12" C-C top and bottom. See Note 1

31. Additional #6 @ 6" overhang reinforcement extend 8'-3" past girder, see Note 3

32. Lifted point reinforcing (by others)

33. See "Parapet Details" Sheet

34. Parapet:

35. #5 bars spaced @ 6" C-C over all panel width 24'-0" min. to 40'-0" max.

36. See Note 1

37. #6 bars average spa. @ 12" C-C top and bottom

38. Additional #6 @ 6" overhang reinforcement extend 8'-3" past girder, see Note 3

39. 0.600" dia. prestressing strands avg. spa. @ 12" C-C top and bottom

40. #5 bars avg. spa. @ 6" C-C run from front face of parapet to bottom mat of panel reinforcing

41. 0.600" dia. prestressing strands avg. spa. @ 12" C-C top and bottom

42. Lifted point reinforcing (by others)

43. See "Parapet Details" Sheet

44. Parapet:

45. #5 bars spaced @ 6" C-C over all panel width 24'-0" min. to 40'-0" max.

46. See Note 1

47. #6 bars average spa. @ 12" C-C top and bottom

48. Additional #6 @ 6" overhang reinforcement extend 8'-3" past girder, see Note 3

49. 0.600" dia. prestressing strands avg. spa. @ 12" C-C top and bottom

50. #5 bars avg. spa. @ 6" C-C run from front face of parapet to bottom mat of panel reinforcing

51. 0.600" dia. prestressing strands avg. spa. @ 12" C-C top and bottom

52. Lifted point reinforcing (by others)

53. See "Parapet Details" Sheet

54. Parapet:

55. #5 bars spaced @ 6" C-C over all panel width 24'-0" min. to 40'-0" max.

56. See Note 1

57. #6 bars average spa. @ 12" C-C top and bottom

58. Additional #6 @ 6" overhang reinforcement extend 8'-3" past girder, see Note 3

59. 0.600" dia. prestressing strands avg. spa. @ 12" C-C top and bottom

60. #5 bars avg. spa. @ 6" C-C run from front face of parapet to bottom mat of panel reinforcing

61. 0.600" dia. prestressing strands avg. spa. @ 12" C-C top and bottom

62. Lifted point reinforcing (by others)

63. See "Parapet Details" Sheet

64. Parapet:

65. #5 bars spaced @ 6" C-C over all panel width 24'-0" min. to 40'-0" max.

66. See Note 1

67. #6 bars average spa. @ 12" C-C top and bottom

68. Additional #6 @ 6" overhang reinforcement extend 8'-3" past girder, see Note 3

69. 0.600" dia. prestressing strands avg. spa. @ 12" C-C top and bottom

70. #5 bars avg. spa. @ 6" C-C run from front face of parapet to bottom mat of panel reinforcing

71. 0.600" dia. prestressing strands avg. spa. @ 12" C-C top and bottom

72. Lifted point reinforcing (by others)

73. See "Parapet Details" Sheet

74. Parapet:

75. #5 bars spaced @ 6" C-C over all panel width 24'-0" min. to 40'-0" max.

76. See Note 1

77. #6 bars average spa. @ 12" C-C top and bottom

78. Additional #6 @ 6" overhang reinforcement extend 8'-3" past girder, see Note 3

79. 0.600" dia. prestressing strands avg. spa. @ 12" C-C top and bottom

80. #5 bars avg. spa. @ 6" C-C run from front face of parapet to bottom mat of panel reinforcing

81. 0.600" dia. prestressing strands avg. spa. @ 12" C-C top and bottom

82. Lifted point reinforcing (by others)

83. See "Parapet Details" Sheet

84. Parapet:

85. #5 bars spaced @ 6" C-C over all panel width 24'-0" min. to 40'-0" max.

86. See Note 1

87. #6 bars average spa. @ 12" C-C top and bottom

88. Additional #6 @ 6" overhang reinforcement extend 8'-3" past girder, see Note 3

89. 0.600" dia. prestressing strands avg. spa. @ 12" C-C top and bottom

90. #5 bars avg. spa. @ 6" C-C run from front face of parapet to bottom mat of panel reinforcing

91. 0.600" dia. prestressing strands avg. spa. @ 12" C-C top and bottom

92. Lifted point reinforcing (by others)

93. See "Parapet Details" Sheet

94. Parapet:

95. #5 bars spaced @ 6" C-C over all panel width 24'-0" min. to 40'-0" max.

96. See Note 1
NOTES:
1. MINIMUM REQUIREMENTS SHOWN. IT IS THE RESPONSIBILITY OF THE DESIGNER TO DETERMINE THE
   ADDITIONAL REQUIREMENTS FOR THE壎pecific STRUCTURAL COMPONENT AS REQUIRED.
2. PRECAST PANELS SHOWN. FOR PRECAST PANELS ADD
   MINIMUM REQUIREMENTS FOR THE PRECAST PANELS. FOR Cast-IN-PLACE CONCRETE, THE
   LENGTH OF SPACING SHOWN ON THIS SHEET IS MINIMUM AND IS BASED ON 6" MAX.
   MILLER MAY BE ADDED TO ACHIEVE A LAP SPlice.
3. AS AN ALTERNATIVE TO EMBEDDING BARS IN PRECASTED PANELS, REBAR SPLICE MAY BE ALLOWED AND
   EXTENDED INTO THE CLOSURE POUR. IN PRECAST PANELS, EXISTING PLACEMENT AND PLACEMENTCLEARANCE
   OF THE REBAR SPLICE IN A CLOSURE POUR WILL BE CONTAINED WITH THE CLOSURE POUR.
4. DESIGNER TO CHECK OVERHANG REINFORCING FOR ANTICIPATED LOAD.
5. CLOSURE POURS CAN BE USED FOR:
   - ROADWAY CLOSING
   - PRECAST DECKS
   - BRIDGE WIDENING PROJECTS
   - BRIDGES GREATER THAN 40 FT WIDE
   - STAGE CONSTRUCTION JOINTS
   - ROADWAY CROWNS
6. THE MINIMUM LAP SPlice LENGTH SHOWN IS BASED ON THE
   FOLLOWING PARAMETERS:
   - #6 @ 6" SPACING
   - TYPICAL PANEL REINF.
   - MINIMUM COVER REQUIREMENTS
   - CONCRETE CURING
   - CONCRETE ULTIMATE STRENGTH
   - TEAR LENGTH TO 3'-10". DESIGNER TO ADJUST LENGTH
   TO ACHIEVE MINIMUM LAP SPlice.
7. FOR STAGE CONSTRUCTION CLOSURE POURS, PLACE CONCRETE
   OF SPLICE FOR DESIGNS BEYOND THESE PARAMETERS.
8. FOR NON-STAGE CONSTRUCTION CLOSURE POURS, PLACE CONCRETE
   OF SPLICE FOR DESIGNS BEYOND THESE PARAMETERS.
9. THE MINIMUM LAP SPlice LENGTH SHOWN IS BASED ON THE
   FOLLOWING PARAMETERS:
   - #6 @ 6" SPACING
   - TYPICAL PANEL REINF.
   - MINIMUM COVER REQUIREMENTS
   - CONCRETE CURING
   - CONCRETE ULTIMATE STRENGTH
   - TEAR LENGTH TO 3'-10". DESIGNER TO ADJUST LENGTH
   TO ACHIEVE MINIMUM LAP SPlice.
10. FOR NON-STAGE CONSTRUCTION CLOSURE POURS, PLACE CONCRETE
   OF SPLICE FOR DESIGNS BEYOND THESE PARAMETERS.
TYPICAL BLIND BLOCKOUT PLAN

NOTES:
1. REINFORCEMENT NOT SHOWN FOR CLARITY.
2. USE PLASTIC PIPE FOR PORTS AND VENT TUBES.
3. GALVANIZE STEEL FOR BLOCKOUTS
4. PLACE AT LEAST TWO MAIN BARS OVER TOP OF BLOCKOUT
5. USE PLASTIC PIPE FOR PORTS AND VENT TUBES.

OPTIONAL SHEAR STUD BLOCKOUT PLAN WITH SHEAR STUDS

NOTES:
1. SHEAR STUDBS MUST BE FULL DENSITY PRECAST CONCRETE
2. PLACE AT LEAST TWO MAIN BARS OVER TOP OF BLOCKOUT
3. USE PLASTIC PIPE FOR PORTS AND VENT TUBES.
1. INCLUDE COST OF WELDED STUD SHEAR CONNECTORS IN THE COST OF THE PRESTRESSED CONCRETE DECK PANEL.
2. INCLUDE COST OF ALL NON-SHRINK GROUT IN THE COST OF THE PRESTRESSED CONCRETE GIRDER.
3. USE A HEAVY BROOM FINISH ON TOP SURFACE OF DECK.
4. DESIGNER TO DETERMINE AND DETAIL THE MINIMUM SPACING OF SHEAR STUDS AND SHEAR BARS.
5. FOR SKEWED PANELS, ROTATE BLOCKOUTS TO BE PARALLEL WITH THE PANEL REINFORCING.
6. BLIND BLOCKOUTS FORMED WITH STEEL BOX SHOWN. OPTIONAL FORMED BLOCKOUTS SIMILAR.

NOTE: ONE BAR SHOWN. MULTIPLE BARS MAY BE USED AND BUNDLED TO PROVIDE ADEQUATE SHEAR RESISTANCE.

NOTE: ONE ROW OF CONNECTORS SHOWN. MULTIPLE ROWS MAY BE USED.

FILL BLOCKOUT WITH NON-SHRINK GROUT.

FORM HAUNCH AND FILL WITH NON-SHRINK GROUT. METHOD OF FORMING HAUNCH TO BE DETERMINED BY THE CONTRACTOR. REMOVE FORMS AFTER 24 HOURS.
1. INCLUDE COST OF WELDED STUD SHEAR CONNECTORS AND T-STUD SHEAR CONNECTORS IN THE COST OF THE PRESTRESSED CONCRETE DECK PANEL.

2. INCLUDE COST OF ALL NON-SHRINK GROUT IN THE COST OF THE PRESTRESSED CONCRETE DECK PANEL.

3. USE A HEAVY BROOM FINISH ON TOP SURFACE OF DECK.

4. FOR SKEWED PANELS, ROTATE BLOCKOUTS TO BE PARALLEL WITH THE PANEL REINFORCING.

5. BLIND BLOCKOUTS FORMED WITH STEEL BOX SHOWN.
   OPTIONAL FORMED BLOCKOUTS SIMILAR.

PLAN T-HEADED SHEAR STUD CONNECTOR ON CONCRETE GIRDER

NOTE: ONE ROW OF CONNECTORS SHOWN. MULTIPLE ROWS MAY BE USED.

PLAN STEEL GIRDER DETAILS

NOTE: ONE ROW OF CONNECTORS SHOWN. MULTIPLE ROWS MAY BE USED.

SECTION N

NOTE: ONE ROW OF CONNECTORS SHOWN. MULTIPLE ROWS MAY BE USED.

SECTION P

NOTE: ONE ROW OF CONNECTORS SHOWN. MULTIPLE ROWS MAY BE USED.
**VERTICAL ADJUSTMENT DETAIL**

**ON STEEL GIRDER**

- **Reinforcing steel** welded to plate
- **1 1/2" steel pipe sleeve**
- **2 (2) #5 bars with 15" extension past end**
- **Expanded polystyrene** may be used to form void (typ.)
- **Concrete deck panel**
- **2 1/2" min. heavy hex nut welded to plate**
- **Fillet weld joint**

**VERTICAL ADJUSTMENT DETAIL**

**ON CONCRETE GIRDER**

- **Reinforcing steel** welded to plate
- **1 1/2" steel pipe sleeve**
- **2 (2) #5 bars with 15" extension past end**
- **Expanded polystyrene** may be used to form void (typ.)
- **Concrete deck panel**
- **2 1/2" min. heavy hex nut welded to plate**
- **Fillet weld joint**

**VERTICAL ADJUSTMENT SCHEDULE**

<table>
<thead>
<tr>
<th>Service Load</th>
<th>Bolt Dia.</th>
<th>Steel Plate with Hole for Bolt Centered</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 K</td>
<td>1&quot;</td>
<td>4&quot;x4&quot;x&quot;1/2&quot;</td>
</tr>
<tr>
<td>20 K</td>
<td>1 1/2&quot;</td>
<td>4&quot;x4&quot;x&quot;1/2&quot;</td>
</tr>
</tbody>
</table>

**EXPANDED POLYSTYRENE**

- **May be used to form haunch (typ.)**
- **Haunch filled with non-shrink grout**

**LEVELING BOLT**

(See schedule)
POST-TENSION END ANCHORAGE DETAIL

SECTION BB: TYPICAL LONGITUDINAL PANEL SECTION

SECTION AA: TYPICAL TRANSVERSE PANEL SECTION

POST-TENSIONING NOTES:

1. USE 0.5" DIA. GRADE 270 LOW RELAXATION STRANDS CONFORMING TO ASTM A416.
2. USE 4 STRANDS PER DUCT MAXIMUM.
3. KILLARIE PLACING IN THE DESIGN HEADS AND METAL TRUMPETS AT ANCHORAGE.
   DO NOT GALVANIZE STRAND GRIPPING WEDGES.
4. BEGIN STRESSING AT CENTER OF PANELS. DO NOT ALLOW MORE THAN 12.5% OF
   INITIAL STRESS OF STRANDS AT ANY TIME. SUBMIT STRESSING VALUES, THEN THE
   CONTRACTOR TO ADJUST THE JACKING FORCE TO PRODUCE THE FINAL
   VALUES, THEN THE CONTRACTOR TO ADJUST THE
   IF THE PROPOSED DUCT DOES NOT MEET THESE
   SHORTENING).

POST-TENSION END ANCHORAGE DETAIL
POST-TENSIONING NOTES:
1. ANCHORAGE ASSEMBLY AND DUCTS MAY BE LOWERED UP TO 2'-6" FROM MID-DEPTH OF SLAB IN ORDER TO PROVIDE 2'-0" TOP COVER FOR REINFORCING ABOVE THE DUCT.
1. Extend sealant and foam backer rod from deck top to top of parapet on the inside parapet face, and across top of parapet.

2. Adjust bar spacing as required to not exceed maximum spacing shown.

3. Fractured fin parapets and constant slope are shown, others may be used.

**Parapet Details 2**

*No. 5 Dowel (Type)*

Parapet reinforcing
See "Parapet Details 1" sheet

Reinforcing (Type)

2" CL.

Fill void with non-shrink grout (Type)

2" CL.

> Transverse joint

FRACTURED FIN (Type)

#5 Loop Dowel

2'-10" Lap splice of long parapet skewed section X: Precast parapet through shear key

Sealant (Type)

4" 1/2" (Type)

Foam backer rod (Type)

1" (Type)

1'-5" Parapet and parapet shear key

1'-3" 8" 3'-6" Parapet and Deck panel

1'-5" 3'-8" 16" 1'-10" 16" 3'-6" 9" 4'-9" 16" 1'-5" 1'-10" 16" 3'-6" 9" 4'-9"

Shear key section through parapet and deck panel

Section W: Shear key through deck panel and parapet

Note: Parapet and shear key reinforcing not drawn for clarity.

Section V: Shear key through deck panel

Skewed Section V: Precast parapet through shear key

Parapet reinforcing details 1 sheet
APPENDIX G

DRAWINGS OF BULB-TEE GIRDERS FROM UTAH DOT

Note: These are direct extract from <http://www.udot.utah.gov/main/uconowner.gf?n=14493404283799689> (Last accessed June 25, 2012)
GENERAL NOTES

POINTER FOR SPAN LENGTHS GREATER THAN 160'-0".

- POINTS OF SPAN FOR SPAN LENGTHS 80'-0" TO 120'-0".

- REMARKS

INDEX OF SHEETS

IMPLEMENTATION

7/19/2010

GNBT-1 BULB TEE NOTES

DESIGN.

- POINTS OF SPAN FOR SPAN LENGTHS LESS THAN 80'-0".

- POINTS OF SPAN FOR SPAN LENGTHS 120'-0" TO 160'-0".

INTERMEDIATE DIAPHRAGMS:

SPECIAL CONSIDERATIONS WITH PRECAST/PRESTRESSED PANELS:

- SKEW ANGLE: 0 TO 45 DEGREES

 WHICH HAVE ALL OF THE FOLLOWING CHARACTERISTICS:

- MINIMUM OVERHANG = 1'-0"

- MAXIMUM OVERHANG = 4'-0"

- SPACING = 12'-0"

FOR USE WITH PRESTRESSED PANELS - MAXIMUM BEAM/GIRDER SPACING = 10'-0"

FOR USE WITH PRECAST PANELS - MAXIMUM BEAM/GIRDER SPACING = 10'-0"

ENSURE APPLICABLE GENERAL NOTES ARE INCLUDED IN THE CONSIDER IT IN THE COMPOSITE SECTIONS PROPERTIES.

- ACCOUNT FOR THE HAUNCH LOAD CALCULATIONS, BUT DO NOT DESIGN AND CHECK ALL CHARACTERISTICS RELATED TO SATISFIES ALL APPLICABLE CODE PROVISIONS.

- DESIGN AND CHECK THAT END REINFORCEMENT DETAILED GIRDER SPAN.

- DESIGN AND CHECK WEB SHEAR REINFORCEMENT ALONG OF LIVE LOAD.

- DESIGN AND CHECK STRESS HANDBOOK AS, VARYING GEOMETRIC END TREATMENTS, EXTENSIONS CREATE SPECIAL GIRDER END DETAILS AS NEEDED. SUCH PRECAST BULB TEE GIRDER MANUAL SECTION 4.

- CREATE TYPICAL TRANSVERSE SECTIONS AS NEEDED. SEE BULB TEE GIRDER MANUAL SECTION 4.

- CREATE A FRAMING PLAN OF EACH SPAN. SEE PRECAST FILL IN TABLE FOR EACH GIRDER TYPE ON A PROJECT.

IT IS THE DESIGNER'S RESPONSIBILITY TO:

PRECAST BULB TEE GIRDERS

- OTHERWISE NOTED.

COAT ALL MILD REINFORCEMENT PER UDOT SPECIFICATIONS UNLESS PREPARATION REQUIREMENTS.

03372 IN THE STANDARD SPECIFICATIONS FOR SURFACE CONCRETE GRINDING OR STEEL SHOT IS COMPLETE. SEE SECTION APPLY CONCRETE POLYMER OVERLAY ON BRIDGE DECK AFTER LOSS OF "" OF TOP FLANGE TO BE ACCOUNTED FOR IN DESIGN. CORRECTING UNEVEN ROADWAY SURFACES AT LONGITUDINAL JOINTS. DECK BULB TEES HAVE A "" CONCRETE GRINDING ALLOWANCE FOR USE A HEAVY BROOM FINISH ON RIDING SURFACE OF TOP FLANGE. FOR TOP SURFACE OF BULB TEE AND POST TENSIONED BULB TEE, INTERIMS AND ERRATA (NO CRACKING CRITERIA). PRECAST AND PRESTRESSED CONCRETE, FIFTH EDITION WITH ALL CONSIDERATIONS IN ACCORDANCE WITH THE PCI DESIGN HANDBOOK, CONSTRUCTION AND WORKMANSHIP.

STANDARD PRECAST CONCRETE DECK PANELS FOR MATERIALS, EFFECT AT THE DATE OF REQUEST FOR BIDS) ALONG WITH LATEST EDITION AND SUPPLEMENTS THERETO WHICH ARE IN SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION (THE USE UTAH DEPARTMENT OF TRANSPORTATION STANDARD LOW RELAXATION STRAND: 0.6" DIAMETER REINFORCING STEEL (COATED) fy = 60,000 PSI FOR POST TENSIONED GIRDER CONCRETE: f'c = MATCH GIRDER STRENGTH CLOSURE POUR CONCRETE SPECIFY CONCRETE RELEASE STRENGTH FOR EACH USED WITH PRIOR APPROVAL FROM THE DEPARTMENT. CONCRETE STRENGTH UP TO 10,000 PSI MAY BE PRESTRESSED GIRDER CONCRETE: f'c = 8,500 PSI USE AN HL-93 LOAD INCLUDING A 35 PSF LOAD FOR FUTURE FOR ALL BULB TEE GIRDER DESIGNS USE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 4TH EDITION

PRECAST BULB TEE GIRDER DETAILS

UBT98-(1,2) PRECAST DECK BULB TEE GIRDER DETAILS

UDBT98-(1,2) PRECAST DECK BULB TEE GIRDER DETAILS

UBT82-(1,2) PRECAST DECK BULB TEE GIRDER DETAILS

UDBT82-(1,2) PRECAST DECK BULB TEE GIRDER DETAILS

UBT74-(1,2) PRECAST DECK BULB TEE GIRDER DETAILS

UDBT74-(1,2) PRECAST DECK BULB TEE GIRDER DETAILS

UBT66-(1,2) PRECAST DECK BULB TEE GIRDER DETAILS

UDBT66-(1,2) PRECAST DECK BULB TEE GIRDER DETAILS

UBT58-(1,2) PRECAST DECK BULB TEE GIRDER DETAILS

UDBT58-(1,2) PRECAST DECK BULB TEE GIRDER DETAILS

UBT50-(1,2) PRECAST DECK BULB TEE GIRDER DETAILS

UDBT50-(1,2) PRECAST DECK BULB TEE GIRDER DETAILS

UBT42-(1,2) PRECAST DECK BULB TEE GIRDER DETAILS

UDBT42-(1,2) PRECAST DECK BULB TEE GIRDER DETAILS

UBT98-(1,2) PRECAST BULB TEE GIRDER DETAILS

UBT90-(1,2) PRECAST BULB TEE GIRDER DETAILS

UBT82-(1,2) PRECAST BULB TEE GIRDER DETAILS

UBT74-(1,2) PRECAST BULB TEE GIRDER DETAILS

UBT66-(1,2) PRECAST BULB TEE GIRDER DETAILS

UBT50-(1,2) PRECAST BULB TEE GIRDER DETAILS

UBT42-(1,2) PRECAST BULB TEE GIRDER DETAILS

OPTION BT-5 PRECAST DECK BULB TEE GIRDER WELDED STUD STANDARD GIRDER SIZES

BT-2 PRECAST DECK BULB TEE GIRDER STANDARD GIRDER SIZES

BT-1 PRECAST BULB TEE GIRDER STANDARD GIRDER SIZES

GNBT-1 BULB TEE GIRDER GENERAL NOTES
**Typical Design Sheet**

**BT-1**

**Precast Bulb Tee Girder**

**Standard Girder Sizes**

<table>
<thead>
<tr>
<th>Girder Type</th>
<th>Depth (in)</th>
<th>Weight (Lbs/Ft)</th>
<th>Area (in²)</th>
<th>Ix c.g. (in⁴)</th>
<th>Iy c.g. (in⁴)</th>
<th>Yt (in)</th>
<th>Yb (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UBT42</td>
<td>42</td>
<td>159</td>
<td>729</td>
<td>184042</td>
<td>11781</td>
<td>21.67</td>
<td>20.33</td>
</tr>
<tr>
<td>UBT50</td>
<td>50</td>
<td>810</td>
<td>778</td>
<td>263124</td>
<td>13141</td>
<td>24.12</td>
<td>22.84</td>
</tr>
<tr>
<td>UBT58</td>
<td>58</td>
<td>861</td>
<td>827</td>
<td>72067</td>
<td>30.07</td>
<td>27.93</td>
<td>25.95</td>
</tr>
<tr>
<td>UBT66</td>
<td>66</td>
<td>912</td>
<td>876</td>
<td>72221</td>
<td>34.23</td>
<td>31.69</td>
<td>29.93</td>
</tr>
<tr>
<td>UBT74</td>
<td>74</td>
<td>963</td>
<td>925</td>
<td>72374</td>
<td>38.38</td>
<td>35.92</td>
<td>33.66</td>
</tr>
<tr>
<td>UBT82</td>
<td>82</td>
<td>1014</td>
<td>974</td>
<td>72527</td>
<td>42.51</td>
<td>39.49</td>
<td>36.47</td>
</tr>
<tr>
<td>UBT90</td>
<td>90</td>
<td>1065</td>
<td>1023</td>
<td>72680</td>
<td>46.64</td>
<td>43.36</td>
<td>40.61</td>
</tr>
<tr>
<td>UBT98</td>
<td>98</td>
<td>1116</td>
<td>1073</td>
<td>72833</td>
<td>50.14</td>
<td>47.26</td>
<td>44.83</td>
</tr>
</tbody>
</table>

**UBT42**

**UBT50**

**UBT58**

**UBT66**

**UBT74**

**UBT82**

**UBT90**

**UBT98**

**Drawing Details**

- **Count Number:**
- **Project Number:**
- **Department of Transportation:**
- **Structure Division:**
- **Senior Designer:**
- **Design: Drawn:**
- **Check:**
- **Approved for Use:**

**Notes:**

- UBT42 to UBT3 Standard Girder Shapes.
- 7/19/2010

**Revision Notes:**

- **Rev.**
- **Date**
- **By**
- **Remarks**
NOTES

1. INCLUDE ALL STEEL FOR DIAPHRAGMS IN THE COST OF THE PRECASTED CONCRETE GIRDER.

2. ALL STEEL TO BE ASTM A709 GRADE 50 AND GALVANIZED IN ACCORDANCE WITH ASTM A 123.

3. FABRICATE INTERMEDIATE AND END DIAPHRAGMS WITH VERTICAL ENDS.

4. STEEL TO STEEL CONNECTIONS TO BE MADE USING $\frac{3}{8}$" DIA. GALVANIZED HIGH-STRENGTH BOLTS.

5. STEEL TO CONCRETE CONNECTIONS TO BE MADE USING ASTM A307 GRADE A BOLTS.

6. WASHERS TO BE ASTM F436. ALL BOLTS, NUTS, AND WASHERS TO BE GALVANIZED IN ACCORDANCE WITH ASTM A 153.

7. FIELD DRILLED HOLES IN DIAPHRAGM CONNECTION ANGLES TO BE PERMITTED AT NO ADDITIONAL EXPENSE. ALL OTHER HOLES TO BE SHOP DRILLED.

8. $\frac{1}{2}$" BENT PLATE OF EQUAL DIMENSIONS MAY BE SUBSTITUTED FOR MC18x42.7.

9. FOR SQUARE SUPERSTRUCTURES, FORM $\frac{1}{2}$" DIA. HOLES IN INTERIOR GIRDERS FOR THRU-BOLTING OF DIAPHRAGM ANGLE. FOR FACIA GIRDERS AND SKEWED STRUCTURES, THREADING INSERTS ARE REQUIRED. CLEAR HOLES AND THREADING INSERTS PERPENDICULAR TO GIRDER WEB.

10. SEE GIRDER DRAWINGS FOR GIRDER CONNECTION REQUIREMENTS

INTERMEDIATE DIAPHRAGM SIZING TABLE

<table>
<thead>
<tr>
<th>SPAN LENGTH</th>
<th>CHANNEL SIZE</th>
<th>SEE NOTE 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 80 FT</td>
<td>MC18x42.7</td>
<td>N/A</td>
</tr>
<tr>
<td>80 FT TO 120 FT</td>
<td>MC18x42.7</td>
<td>N/A</td>
</tr>
<tr>
<td>120 FT TO 160 FT</td>
<td>MC18x42.7</td>
<td>N/A</td>
</tr>
<tr>
<td>&gt; 160 FT</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

INTERMEDIATE DIAPHRAGM LOCATION TABLE

<table>
<thead>
<tr>
<th>SPAN LENGTH</th>
<th>SPAN LOCATION ALONG GIRDER</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 80 FT</td>
<td>N/A</td>
</tr>
<tr>
<td>80 FT TO 120 FT</td>
<td>N/A</td>
</tr>
<tr>
<td>120 FT TO 160 FT</td>
<td>N/A</td>
</tr>
<tr>
<td>&gt; 160 FT</td>
<td>N/A</td>
</tr>
</tbody>
</table>

NOTE TO DESIGNER: INSERT SHEET AS NEEDED INTO DESIGN DRAWINGS AND NUMBER AS FOLLOWS: UTBTXX-X, UDBTXX-X, OR UBTXXPT-X

NOTE: CHANNEL SHOWN, DEPTH DIAPHRAGM SIMILAR.

SECTION A-A: INTERMEDIATE DIAPHRAGM

SECTION B-B: INTERMEDIATE DIAPHRAGMS

NOTE: STOP WELDS $\frac{3}{8}$" SHORT OF ALL PLATE ELEMENTS

INTERMEDIATE - TYPE I

INTERMEDIATE - TYPE II

SKewed INTERMEDIATE DIAPHRAGM - TYPE II

PLATE WELDING DETAIL

NOTE: Steel used $\frac{1}{2}$" short of all plate elements
NOTES

NOTE TO DESIGNER:
INSERT SHEET AS NEEDED INTO DESIGN DRAWINGS AND NUMBER AS FOLLOWS:
UBTXX-X, UDBTXX-X, OR UBTXXPT-X

1. DETAILS DRAWN FOR 1" DIA. SHEAR STUDS.
2. CONTRACTOR TO DETERMINE METHOD FOR ACHIEVING WELDING GROUND FOR ATTACHMENT OF SHEAR STUDS. A WELDED GROUND LUG IS ACCEPTABLE PROVIDED THERE IS NO INTERFERENCE WITH PLACEMENT OF STUDS OR PLACEMENT OF PRECAST PANEL.
3. FORM CAMBER STRIP AND FILL WITH NON-SHRINK GROUT. METHOD OF FORMING CAMBER STRIP TO BE DETERMINED BY THE CONTRACTOR. REMOVE FORMS AFTER NON-SHRINK GROUT OBTAINS A COMPRESSIVE STRENGTH OF 3000 PSI.
4. FOR BLOCKOUT IN PRECAST PANELS SEE OPTIONS IN PRECAST PANEL DRAWINGS.

SECTION A-A: U-SHAPED SHEAR BAR

SECTION B-B: U-SHAPED SHEAR BAR

SECTION C-C: OPTIONAL SHEAR STUD

SECTION D-D: OPTIONAL SHEAR STUD

NOTE: ONE ROW OF STUDS SHOWN ON TOP. MULTIPLE ROWS MAY BE USED.
APPENDIX H

DETAILS OF NEXT D BEAM FROM PCI-NE

Note: These are direct extract from
<http://www.pcine.org/index.cfm/resources/bridge>
(Last accessed June 25, 2012)
NOTES:

1. THE WIDTH OF BEAMS SHOWN ARE THE MINIMUM AND MAXIMUM WIDTH BEAMS. VARIATION BETWEEN THESE LIMITS IS ALLOWED IN ORDER TO CONSTRUCT A BRIDGE TO THE REQUIRED WIDTH. THE VARIATION IN WIDTH IS ACCOMPLISHED BY VARYING THE OVERHANG DIMENSIONS. THE DESIGNER WILL NEED TO CALCULATE BEAM PROPERTIES FOR BEAMS THAT ARE NOT EQUAL TO THE WIDTHS LISTED.

2. THE SPACING OF BEAMS ON A TYPICAL BRIDGE SHALL BE THE WIDTH OF THE BEAM PLUS 8" (EX.: BEAM SPACING = 10'-8" FOR THE 10'-0" SECTION).

3. BRIDGES WITH SMALL CURVATURE CAN BE BUILT USING THESE SECTIONS BY VARYING THE OVERHANG OF THE FASCIA BEAMS ALONG THE LENGTH. INTERIOR BEAMS SHOULD ALWAYS BE SYMMETRICAL ABOUT THE VERTICAL AXIS. NON-SYMMETRICAL SECTIONS ARE POSSIBLE, HOWEVER THE BEAM MAY REQUIRE A SPECIAL DESIGN WITH A NON-SYMMETRICAL STRAND PATTERN.

4. MODIFY THE FASCIA BEAM TO MATCH STATE STANDARDS.

5. THE STEM WIDTH AND SPACING ARE FIXED.

6. THE ENDS OF THE BEAMS SHOULD BE SKEWED FOR SKEWED BRIDGES. THE ACUTE CORNERS OF THE FLANGE OVERHANGS SHOULD BE CHAMFERED 6"x6" IN ORDER TO MINIMIZE CASTING AND HANDLING DAMAGE.
TYPICAL BEAM REINFORCING

DESIGN NOTES:

1. THE REINFORCING SHOWN IS BASED ON A PRELIMINARY DESIGN OF A 10 FOOT WIDE NEXT BEAM. DESIGNERS SHOULD VERIFY THIS REINFORCING FOR EACH DESIGN BASED ON THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS OR STATE STANDARDS.

2. THE STRIP METHOD SPECIFIED IN AASHTO LRFD ARTICLE 4.6.2.1 IS RECOMMENDED FOR THE DESIGN.

3. THE HEADED REINFORCING BARS SHOWN SHOULD BE DESIGNED TO RESIST THE POSITIVE BENDING MOMENT AT THE CENTER OF THE JOINT AS SPECIFIED BY AASHTO. THE NESTED HEADED BARS CAN BE CONSIDERED A LAP SPlice WITH THE BARS FULLY DEVELOPED.

4. THE CRACK CONTROL PROVISIONS OF AASHTO ARTICLE 5.7.3.4 SHOULD ALSO BE CHECKED.

5. ADDITIONAL REINFORCEMENT MAY BE REQUIRED FOR DECK OVERHANGS AND BARRIERS.

NOTES:

1. THE TOP FLANGE IS INTENDED TO ACT AS A STRUCTURAL DECK.

2. SHEAR REINFORCING SHOULD BE KEPT TO #4 BARS IN ORDER TO MAXIMIZE THE COVER ON THE SIDE OF THE STEM.

3. SEE SHEET D-11 FOR UTILITY SUPPORT DETAILS.

4. MINOR ADJUSTMENT OF THE SPACING OF THE TOP LONGITUDINAL REINFORCEMENT IS ALLOWABLE TO FACILITATE THE INSTALLATION OF THE STIRRUPS.
TYPICAL STRAND LOCATIONS
(ENDS AND ALONG THE SPAN)

NOTES:

1. = DENOTES STRAIGHT STRAND. DRAPED STRANDS ARE NOT PERMITTED.

2. DEBONDING OF STRAND IS ALLOWED. NO MORE THAN 25% OF THE TOTAL NUMBER OF STRANDS SHALL BE DEBONDED. THE SPACING BETWEEN DEBONDED STRANDS SHALL BE AT LEAST 2.5 INCHES IN ANY DIRECTION. THE RESTRICTIONS OUTLINED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SHALL ALSO BE FOLLOWED.

3. IT IS RECOMMENDED THAT APPROXIMATELY 50% OF ALL STRAND BE DEBONDED FOR THE FIRST 6" FROM THE END OF THE BEAM IN ORDER TO CONTROL END CRACKING. SPACING RESTRICTIONS OUTLINED IN NOTE 2 DO NOT APPLY TO THIS 6" AREA, BUT DO APPLY BEYOND THIS 6" AREA.

4. STRANDS SHALL BE PLACED WITHIN THE 2"x2" GRID. THE PATTERN MAY BE RAISED IN 2" INCREMENTS FOR DESIGNS THAT REQUIRE PRESTRESS AT A HIGHER ELEVATION. THE NUMBER AND LOCATION OF STRANDS SHALL BE AS REQUIRED BY DESIGN.

5. THE PATTERN SHOWN DEPICTS THE MAXIMUM NUMBER OF STRANDS ALLOWED (50 STRAND INCLUDING THE TOP STRAND). THIS IS BASED ON THE CAPACITY OF TYPICAL CASTING BEDS.

6. THE TWO BOTTOM CORNER STRAND IN EACH STEM ARE OMITTED TO PROVIDE ROOM FOR THE SHEAR REINFORCEMENT BAR BENDS.

7. ALL PRESTRESSING STRAND SHALL BE 0.6" DIAMETER, UNCOATED SEVEN WIRE, LOW RELAXATION STRANDS CONFORMING TO AASHTO M203. THE ULTIMATE STRENGTH OF THE STRANDS SHALL BE 270 KSI.

8. ADDITIONAL STRAND TENSIONED TO A NOMINAL VALUE MAY BE ADDED TO THE TOP FLANGE TO SUPPORT THE TOP FLANGE REINFORCING.
**FLANGE CONNECTOR DETAILS**

**NOTES:**
1. CONNECTOR REINFORCING TO BE PLACED ALONG THE ENTIRE SPAN WITH 6" SPACING.
2. FOR SKEWED BRIDGES, PLACE CONNECTOR REINFORCING PERPENDICULAR TO BEAM EDGE. BEND CONNECTOR REINFORCING WITHIN THE FLANGE IN ACUTE CORNERS TO PRODUCE A SQUARE PROJECTION.
3. METHOD OF FORMING CLOSURE POUR TO BE DETERMINED BY THE CONTRACTOR. THE FORMS NEEDS TO BE REMOVABLE AND ABLE TO ACCOMMODATE DIFFERENTIAL CAMBER. FORM SUPPORTS SHOULD NOT PENETRATE THROUGH TOP OF POUR UNLESS APPROVED BY THE ENGINEER.
4. CLOSURE POUR MATERIAL TO BE A NON SHRINK MIX THAT HAS A MINIMUM COMpressive STRENGTH OF 7000 PSI. THE GROUT MAY BE EXTENDED WITH AGGREGATE.
5. SAND BLASTING OF THE FACES OF THE KEYS JUST PRIOR TO INSTALLATION IS RECOMMENDED TO IMPROVE GROUT BOND.
6. DESIGNERS ARE RESPONSIBLE FOR THE VERIFICATION OF THE DESIGN OF THIS JOINT. THIS DETAIL CAN BE CONSIDERED EQUIVALENT TO A TENSION LAP SPILCE. IF MORE MOMENT CAPACITY IS REQUIRED, THE LOCATION OF THE BAR MAY BE LOWERED. SEE SHEET 02 FOR INFORMATION ON THE DESIGN OF THIS JOINT.
#4 bars placed at bottom of top flange. See Note 3

Recommended 30 degrees max. Beams may be fabricated with higher skews, however additional cracking in the top flange may occur.

Bursting zone vertical reinforcing. See Note 1

Plan - Skewed End

Shear reinforcement used for bursting steel in end zone

Stirrups may be bundled in end zone if required

Blockout (see state standards)

Additional end zone verticals

Anchor rear face verticals in middle of strand grid

END ELEVATION - STEM END

ELEVATION - STEM END

Beam end reinforcing details

Notes:

1. The bars shown are approximately the maximum number that can be fitted within the next 28 d beam. Some or all of these additional end vertical bars may not be necessary depending on the design.

2. The amount of splitting reinforcing may be reduced by debonding strand in this area. Additional splitting reinforcing should be placed in areas where debonding is terminated.

3. Place 2-#4 bars at the beam end, then #4 @ 6 inches in the top flange to minimize the potential for top flange end cracking during release and handling. The most common form of potential cracking in this area is a series of vertical hairline cracks through the inside radius of the top flange / beam stem interface running parallel to the stem.
BRIDGE SECTION WITH MAXIMUM WIDTH BEAMS

 TRIAL MAXIMUM SPAN DESIGN = NEXT 40 D x 120"
 MAXIMUM SPAN = APPROX. XX FEET (f’c = 8 KSI)

BRIDGE SECTION WITH MINIMUM WIDTH BEAMS

 TRIAL MAXIMUM SPAN DESIGN = NEXT 40 D x 96"
 MAXIMUM SPAN = APPROX. XX FEET (f’c = 8 KSI)

NOTES:
1. THE TWO BRIDGE SECTIONS DEPICTED REPRESENT THE TYPICAL USE OF THE MINIMUM WIDTH AND MAXIMUM WIDTH NEXT BEAMS.

2. THESE SECTIONS WERE USED TO DEVELOP THE BEAM SPAN TABLES DEPICTED ON SHEETS 08 THROUGH 10. THE SPAN TABLES ARE FOR THREE DIFFERENT CONCRETE STRENGTHS: f’c = 10 KSI, 10 KSI, AND 6 KSI. THE SPAN TABLES ARE FOR REFERENCE ONLY. ALTERNATE BRIDGE CONFIGURATIONS WITH DIFFERENT PARAPETS AND OVERLAYS WILL RESULT IN DIFFERENT MAXIMUM SPAN LENGTHS AND STRINGS.

3. THE ABUTMENT SEATS SHOULD BE CAST TO FOLLOW THE PROFILE OF THE BOTTOM STEM OF THE NEXT BEAMS. SKewed SUBSTRUCTURES MAY REQUIRE ADJUSTABLE BEAM SEATS UNDER THE STEM BEARINGS.
NOTES: THIS DETAIL IS SCHEMATIC. ACTUAL DETAIL WOULD NEED TO BE FULLY DESIGNED. 
STEEL RAIL IN CURB SHOWN, OTHER PARAPETS SIMILAR; THIS DETAIL CAN BE MODIFIED FOR ANY TYPICAL PARAPET SHAPE INCLUDING "F" SHAPE PARAPETS. ANCHOR BOLTS NOT SHOWN IN CURB. ALL REINFORCING IN BEAM NOT SHOWN.
SECTION THROUGH DIAPHRAGM

SAMPLE END DIAPHRAGM DETAIL
CANTILEVER ABUTMENT

NOTES:

1. THE DETAILS SHOWN DO NOT REQUIRE THE USE OF INSERTS OR HOLES IN THE BEAM STEMS. THIS METHOD FACILITATE FABRICATION AND IS PREFERRED.

2. THESE DETAILS ARE SIMILAR TO MASSACHUSETTS DEPARTMENT OF TRANSPORTATION STANDARDS. DETAILS FOR OTHER STATES WILL VARY.

3. THE INSERTS FOR THE THREADED DOWELS IN THE STEMS SHALL BE PLACED SO THAT THEY DO NOT INTERFERE WITH THE PRESTRESSING STRAND PATTERN AND ARE LOCATED A MINIMUM OF 8" FROM THE ENDS OF THE BEAMS.

4. INTERMEDIATE DIAPHRAGMS ARE NOT REQUIRED.

5. IF THE TOP FLANGE IS BLOCKED OUT AS SHOWN, IT IS RECOMMENDED THAT THE SOME OR ALL OF THE STRANDS BE DEBONDED OVER THE SAME LENGTH TO MINIMIZE CRACKING AT RELEASE.
CONCEPTUAL INTEGRAL ABUTMENT SECTION

NOTES:
1. THESE DETAILS ARE BASED ON MASSACHUSETTS DEPARTMENT OF TRANSPORTATION STANDARDS. DETAILS FOR OTHER STATES WILL VARY.
2. A PRECAST PIECE SIMILAR TO THE BACKWALL PIECE CAN BE USED AT THE ENDS OF THE ABUTMENT ALSO.

CONSTRUCTION SEQUENCE
1. DRIVE PILES
2. INSTALL PRECAST ABUTMENT STEM
3. INSTALL NEXT BEAMS AND BACKWALL
4. BACKFILL TO BOTTOM OF APPROACH SLAB
5. INSTALL PRECAST APPROACH SLAB
6. FORM GAPS BETWEEN BEAM STEMS
7. CAST CLOSURE POUR
SAMPLE PIER CONTINUITY DETAIL

NOTES:

1. THE DETAILS SHOWN ARE SCHEMATIC. REFER TO STATE STANDARDS FOR SPECIFIC DETAILS.
SAMPLE UTILITY SUPPORT DETAILS

NOTES:

1. HANGER RODS FOR UTILITIES SHOULD BE ATTACHED TO THE BEAM BY MEANS OF CAST-IN-PLACE INSERTS. OVERHEAD DRILLED-IN ANCHORS SHOULD NOT BE USED. REFER TO STATE POLICIES FOR OVERHEAD ANCHORING.

2. PLACEMENT OF THE ANCHORS IN THE FLANGE IS PREFERRED. PLACEMENT OF ANCHORS IN THE STEM MAY BE CONSIDERED, HOWEVER THE POTENTIAL FOR INTERFERENCE WITH THE STEM REINFORCING AND STRAND SHOULD BE INVESTIGATED.

3. ONE TYPE OF UTILITY SHOWN. OTHER UTILITIES SIMILAR. REFER TO INDIVIDUAL UTILITY COMPANY DETAILS.
TAPERED ELASTOMERIC BEARING DETAILS

NOTES:

1. THESE DETAILS ARE SIMILAR TO MASSACHUSETTS DEPARTMENT OF TRANSPORTATION STANDARDS INCLUDING THE USE OF AN EMBEDDED TAPERED STEEL SOLE PLATE. DETAILS FOR OTHER STATES WILL VARY.

2. BRIDGE SEAT AND BEARING MAY BE SLOPED TO MATCH THE CROSS SLOPE OF THE ROADWAY ABOVE.
OPTIONAL ADJUSTABLE MASONRY PLATE DETAILS

NOTES:

1. THESE DETAILS ARE ONLY REQUIRED FOR NON-INTEGRAL SUBSTRUCTURES.

2. GRADE ADJUSTMENT PLATES CAN BE USED WITH NARROW OR WIDE BEARING DETAILS.

3. SIZE THE SOLE PLATE TO SUPPORT THE SELF WEIGHT OF THE BEAMS. PLACE GROUT PRIOR TO PLACING ADDITIONAL LOAD ON THE BEARING.

4. BRIDGE SEAT AND MASONRY PLATE MAY BE SLOPED TO MATCH THE CROSS SLOPE OF THE ROADWAY ABOVE.

5. IT IS RECOMMENDED THAT THE LEVELING BOLTS BE SET PRIOR TO RELEASE OF THE BEAM FROM THE CRANE.
Chart NEXT-1
Northeast Extreme Tee - NEXT

LRFD
f'c=10 ksi
f'cl=8 ksi

MAXIMUM SPAN (feet)

NEXT BEAM WIDTH (feet)
PRELIMINARY

NOTE: EACH BEAM HAS 4 FULLY TENSIONED STRANDS
LOCATED 7.5 INCHES FROM THE TOP OF THE BEAM

DESIGN PARAMETERS
1. 18 inch wide concrete curbs with steel rail
2. 3 inch thick bituminous concrete overlay
3. Beam f'c = 10000 psi
4. Beam f'ci = 8000 psi
5. Debond up to 25% of strand
6. AASHTO LRFD design with allowable tensile stresses for extreme exposure
7. Straight strand only
8. No utility loads
9. Design for interior beam
10. Live load distribution factor based on composite deck stringer bridge,
    AASHTO cross section Type l

PRECAST/PRESTRESSED CONCRETE
INSTITUTE NORTHEAST

NORTHEAST EXTREME BRIDGE TEE
NEXT D BEAMS

SPAN CHART (f'c=10 KSI)

ISSUE DATE: 01-04-10 SHEET: NEXT D - 14
Chart NEXT-2
Northeast Extreme Tee - NEXT

DESIGN PARAMETERS
1. 18 inch wide concrete curbs with steel rail
2. 3 inch thick bituminous concrete overlay
3. Beam $f_c = 8000$ psi
4. Beam $f_{cl} = 6000$ psi
5. Debond up to 28% of strand
6. AASHTO LRFD design with allowable
tensile stresses for extreme exposure
7. Straight strand only
8. No utility loads
9. Design for interior beam
10. Live load distribution factor based on
composite deck stringer bridge,
AASHTO cross section Type I

PRELIMINARY
NOTE: EACH BEAM HAS 4 FULLY TENSIONED STRANDS
LOCATED 7.5 INCHES FROM THE TOP OF THE BEAM
LIGHTWEIGHT CONCRETE

DESIGN PARAMETERS
1. 18 inch wide concrete curbs with steel nails
2. 3 inch thick bluminous concrete overlay
3. Lightweight concrete beams (120 pcf)
4. Beam f_c = 10 ksi
5. Beam f_p = 8 ksi
6. Debond up to 25% of strand
7. AASHTO LRFD design with allowable tensile stresses for extreme exposure
8. Straight strand only
9. No utility loads
10. Design for interior beam
11. Live load distribution factor based on composite deck stringer bridge, AASHTO cross section Type I

NOTE: EACH BEAM HAS 4 FULLY TENSIONED STRANDS
LOCATED 7.5 INCHES FROM THE TOP OF THE BEAM

Chart NEXT-1-LW
Northeast Extreme Tee - NEXT

LRFD
f_c=10 ksi
f_p=8 ksi

MAXIMUM SPAN (feet)

NEXT BEAM WIDTH (feet)

PRECAST/PRESTRESSED CONCRETE INSTITUTE NORTHEAST

ISSUE DATE: 01-04-10 SHEET: NEXT D - 17
LIGHTWEIGHT CONCRETE

Chart NEXT-2-LW
Northeast Extreme Tee - NEXT

LRFD
\( f'c = 8 \text{ ksi} \)
\( f'ci = 8 \text{ ksi} \)

Next 40 D
Next 38 D
Next 32 D
Next 28 D

Maximum Span (feet)

Next Beam Width (feet)

NOTE: EACH BEAM HAS 4 FULLY TENSIONED STRANDS
LOCATED 7.5 INCHES FROM THE TOP OF THE BEAM

DESIGN PARAMETERS
1. 18 inch wide concrete curbs with steel rail
2. 3 inch thick bituminous concrete overlay
3. Lightweight concrete beams (120pcf)
4. Beam \( f'c = 8000 \text{ psi} \)
5. Beam \( f'ci = 8000 \text{ psi} \)
6. Deband up to 25% of strand
7. AASHTO LRFD design with allowable
tensile stresses for extreme exposure
8. Straight strand only
9. No utility loads
10. Design for interior beam
11. Live load distribution factor based on
composite deck stringer bridge,
AASHTO cross section Type I
LIGHTWEIGHT CONCRETE

DESIGN PARAMETERS

1. 18 inch wide concrete curbs with steel rail
2. 3 inch thick bituminous concrete overlay
3. Lightweight concrete beams (120 pcf)
4. Beam f'c = 6000 psi
5. Beam f'cl = 4000 psi
6. Debond up to 25% of strand
7. AASHTO LRFD design with allowable tensile stresses for extreme exposure
8. Straight strand only
9. No utility loads
10. Design for interior beam
11. Live load distribution factor based on composite deck stinger bridge, AASHTO cross section Type I

NOTE: EACH BEAM HAS 4 FULLY TENSIONED STRANDS LOCATED 7.5 INCHES FROM THE TOP OF THE BEAM
APPENDIX I

STANDARD LONGITUDINAL CONNECTION DETAILS
NOTES:
HIGH PERFORMANCE CONCRETE COMPRESSIVE STRENGTH IS NOT LESS THAN 7 KSI
YIELD STRENGTH OF THE STEEL IS 60 KSI
TEMPERATURE GRADIENT ZONE 3 AND HL-93 MOD LOADS WERE CONSIDERED.
* EK04 BAR SPACING IS : 11" FOR DECKED BOX-BEAM.
** DIAMETER OF BEND (D) SHALL NOT BE LESS THAN 3 IN.
APPENDIX J

SPECIAL PROVISION FOR GROUTING PBES CONNECTIONS

(Template)
SPECIAL PROVISION FOR GROUTING PBES CONNECTIONS

1. General. This work shall consist of furnishing material, equipment, and manpower for grouting prefabricated component connections (or referred as joints in this section) in accordance with the details shown on the plans and the requirements of these Specification.

The work shall also include the furnishing and installing of any appurtenant items necessary for completing the grouting operations, including but not limited to, inlets, vents, outlets, and grout and any material used for mixing and curing and protecting grout during the required period.

2. Contractor Proposed Options: The contractor may propose for consideration certain changes to the connection details (including but not limited to, the shape, size, reinforcement details), material for filling the voids, application procedures, and curing and protection methods than what is shown in the plans and given in this Specification.

3. Restrictions to Contractor Proposed Options: Any changes proposed by the contractor shall comply with the following:

   a. Any changes proposed to the connection details to enhance the grout application procedures shall be demonstrated through mock-up testing or contractors own experience with a previous project.
   
   b. The ultimate strength of the structure with the proposed changes to the connection details shall meet the requirement of Section xx of the AASHTO XXXX, YY edition, 20XX, and all applicable interims and shall be equivalent or greater than the ultimate strength provided by the original design.
   
   c. The contractor fully redesigns and details of all the connections and associated components where the alternate details are proposed, as required.
   
   d. The contractor submits complete shop drawings indicating the locations of the connections and including revised connection and component details, design calculations, and a summary of the specific changes and justification for the changes for Engineer’s review.
4. **Working Drawings**: The contractor shall submit detailed working drawings in accordance with Section XX of the …….. Standard Specification for Construction that include, but are not limited to:

1. Connection detail with multiple views (a minimum of two cross-sections with respect to two perpendicular axes and a plan view)
2. Name (if manufactured grout) or the mix design for each connection in a format similar to Table E–1.
3. Equipment for mixing and placement
4. Formwork, if needed (process of forming and removal; potential challenges such as grout leakage and remedial measures)
5. Surface preparation procedures
6. Grouting procedure and sequence
7. Grout curing, if applicable, and/or protection methods
8. Mock-up testing plan (void if contractor demonstrates prior experience with the specific detail, material, and equipment)
9. QA/QC plan based on the requirements listed in Table E–2

**Table E–1. Connection and the grout/special mix**

<table>
<thead>
<tr>
<th>No</th>
<th>Connection</th>
<th>Grout/special mix</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pier column to pier cap</td>
<td>ABC grout extended</td>
</tr>
<tr>
<td>2</td>
<td>Transverse connection between deck panels</td>
<td>ABC grout</td>
</tr>
<tr>
<td>3</td>
<td>Longitudinal closure</td>
<td>Mix 1</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mix 1: *(example)*

- Cement
- Supplementary cementitious material
- Aggregate
- Water
- Admixtures
5. **Material:** The materials to be incorporated into work covered by this section shall conform to the requirements set out herein.

a. **Grout/Special mixes**

Contractor shall identify a non-shrink grout/concrete mixes based on size, shape, and detailing of the connection, and exposure conditions during mixing, placing, and in-service. Contractor shall submit laboratory test results obtained from an independent testing lab on the following properties as per the specifications listed:

<table>
<thead>
<tr>
<th>Property</th>
<th>Requirement</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength</td>
<td>1 day</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 days</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7 days</td>
<td></td>
</tr>
<tr>
<td></td>
<td>28 days</td>
<td></td>
</tr>
<tr>
<td>Slump/flow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Setting time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early age height change</td>
<td></td>
<td>ASTM C827/C1107</td>
</tr>
<tr>
<td>Height change of hardened grout</td>
<td></td>
<td>ASTM C1090/C1107</td>
</tr>
<tr>
<td>Shrinkage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air content</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freeze/thaw durability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modulus of elasticity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermal expansion coefficient</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b. **Curing**

The contractor shall furnish required grout curing material as per the manufacturer requirement or the Section XX of the Standard Specification for Construction.

c. **Grout protection**

The contractor shall furnish required grout protection material as per the manufacturer requirement or the Section XX of the Standard Specification for Construction.
6. **Grouting plan and qualifications:** At least **XX weeks** before grouting commences, the contractor shall submit to the Engineer for review and approval a "Grouting Operation Plan for Precast Component Connections". Written approval of the plan is required before grouting occurs.

- Names of grouting crew and supervisor
- Experience of crewmembers and supervisor
- Training to be provided or undertaken prior to operations
- Type of equipment to be used, including capacity in relation to demand
- Working condition of equipment, back-up and spare parts
- Types, brands, and certifications of materials
- Identity of independent testing laboratory for certification of materials
- General grouting procedure
- Production of grout, on-site testing, adjustments and controls
- Estimate of grout required amount of each type of grout/special mixes
- Method of controlling consistency of grout
- Grout mixing and placement procedures
- Procedure for controlling w/c ratio, and for ensuring that the water used is acceptable
- Contractor's QC forms that are to be signed daily by grout supervisor

The contractor shall, throughout the duration of the grouting, coordinate his work and cooperate with the engineer. The contractor shall also provide at least one person who shall be present at the all times during formwork installation and grouting who is familiar with the operations involved and will direct the work.

7. **Contribution to knowledge base (Report):** The engineer will determine the locations to sample grout and the number and type of samples collected for field and laboratory testing based on the test methods and applicable standards listed in Table E–2. Report should include at least the followings: (the following includes extracts from ASTM C1107 and presented in *italics*)

- **Source, type and name of grout tested.**
- **Details of any variations and options practiced by the tester that are recommended or allowed by the manufacturer or others. Also, designate by whom exceptions are allowed or recommended.**
- **Number and size of each kind of grout specimen and the date molded.**
- Consistency at the time the specimens were molded and the water to dry solids ratio.
- Mixing temperature and curing temperature.
- Identity of specimens as being from (a) freshly mixed grout or (b) grout from end of maximum allowed usable working time. State the mixing age of grout when the specimens were prepared.
- Height change from placement to time of final setting, %.
- Height change of hardened, moist-cured grout at specimen age of 1, 3, 14, and 28 days, %.
- Height change of hardened grout at 56 days of age when exposed to air drying for 28 days after 28 days of moist-curing, %.
- Compressive strength of cubes at 1, 3, 7, and 28 days.
- Yield of the grout.
- Equipment used for grouting or method of grouting.
- Challenges and lessons learned.
- Recommendations for enhancing performance and construction practices of similar details.