The “Precast Concrete Bent Cap Option” Standards

Courtney Holle, P.E.
TxDOT
Bridge Division
Pre-cast Bent Cap Standards

- **Standard Drawings**
  - Background
  - Round Columns (PBC-RC)
  - Piles (Concrete and H-Piles) (PBC-P)

- **Construction**
  - Grout Mock Up
  - Placing Cap

- **Using the Standards**
  - Do’s and Don’ts
  - Location of Standard Drawings

- **Questions**
Precast Bent Cap Standards

- **Standard Drawings**
- **Background**
  - Round Columns (PBC-RC)
  - Piles (Concrete and H-Piles) (PBC-P)
- **Construction**
  - Grout Mock Up
  - Placing Cap
- **Using the Standards**
  - Do’s and Don’ts
  - Location of Standard Drawings
- **Questions**
Background

- Round Columns posted in April 2011
- Piles posted in January 2012
- Optional construction methods (Not mandatory)
- Based on Research Projects
  - 1748 “Development of a Precast Bent Cap System”
  - 4176 “Anchorage for Grouted Vertical-Duct Connectors in Precast Bent Cap Systems”
- Benefits
  - Accelerated Bridge Construction (ABC)
  - Increases construction zone safety
  - Contractor’s Choice ~ Precast vs. Cast-In-Place
Precast Bent Cap Standards

- Standard Drawings
  - Background
  - Round Columns (PBC-RC)
    - Piles (Concrete and H-Piles) (PBC-P)
- Construction
  - Grout Mock Up
  - Placing Cap
- Using the Standards
  - Do’s and Don’ts
  - Location of Standard Drawings
- Questions
PART ELEVATION
(36" Dia Column)

See Interior Bent Details for Cap reinforcing not shown.

6 Bars PS1(#4)
6 Bars PD(#11)

PART PLAN
(36" Dia Column)

See Bridge Layout for Foundation type. See FD standard for details.

Top of Drilled Shaft or Footing

End Column Bars v 1/4" and Bars Z 2" below top of concrete.

Bent Cap & E Column

6 Bars PD(#11)

4" Dia galvanized 26 Gage spiral steel ducts. Install plumb.

Bent into Cap

6" Min

2'-10" Min

-0.5

3'-0"

9 1/2"

9 1/2"

Precast Concrete Bent Cap Option
For Round Columns

PBC-RC
4" Dia galvanized 26 Gage spiral steel ducts. Install plumb.

See Interior Bent sheet for Cap reinforcing not shown.

6 Bars PS3(#4) at 6” Spa

6 Bars PD(#11) 1/2" Min to 9 1/2"

6 Bars PD(#11) 1/2" Min to 9 1/2"

4" Dia galvanized 26 Gage spiral steel ducts. Install plumb.

PART PLAN
(36" Dia Column)

PART ELEVATION
(36" Dia Column)

See Bridge Layout for Foundation type. See FD standard for details.

6 Bent Cap & 6 Column

Top of Drilled Shaft or Footing

Texas Department of Transportation
Bridge Division

PRECAST CONCRETE
BENT CAP OPTION
FOR ROUND COLUMNS

PBC-RC
PART ELEVATION
(36” Dia Column)

See Interior Bent Details for Cap reinforcing not shown.

6 Bars PS (4)
at 6” Spa

6 Bars PD (#11)

4” Dia galvanized
26 Gage spiral steel conduits. Install plumb.

Embed into
Bent Cap

Top of Drilled Shaft or Footing

See Bridge Layout for Foundation type.
See FD standard for details.

PART PLAN
(36” Dia Column)

See Interior Bent Cap reinforcing not shown.

6 Bars PD (#11)

4” Dia galvanized
26 Gage spiral steel ducts. Install plumb.
See Interior Bent Details for Cap reinforcing not shown.

6 Bars PS3(#4) - 6 Bars PD(#11)

3' - 3"

Min

4" Dia galvanized 26 Gage spiral steel ducts. Install plumb.

PART PLAN

(36" Dia Column)

4" Dia galvanized 26 Gage spiral steel ducts. Install plumb.

See Interior Bent sheet for Cap reinforcing not shown.

6 Bars PS3(#4) at 6' Spa

Bars PD(#11) Embed into Bent Cap

2'-10"

Min

1/2"

Min

5' - 6" Min

3' - 0"

9 1/2"

9 1/2"

9 1/2"

9 1/2"

1/2" and Top of concrete.

3/4" Column

1/2" Min

4" Max

PRECAST CONCRETE BENT CAP OPTION FOR ROUND COLUMNS

PBC-RC

Texas Department of Transportation Bridge Division
PART ELEVATION
(36" Dia Column)

PART PLAN
(36" Dia Column)

See Interior Bent Details for Cap reinforcing not shown.

6 Bars PS3(#4)
6 Bars PD(#11)

6 Bars PD(#11)
6 Bars PS3(#4)

4" Dia galvanized 26 Gage spiral steel ducts. Install plumb.

See Interior Bent sheet for Cap reinforcing not shown.

6 Bars PD(#11)
6 Bars PS3(#4)

4" Dia galvanized 26 Gage spiral steel ducts. Install plumb.

PART PLAN
(36" Dia Column)
PART ELEVATION
(36" Dia Column)

See Interior Bent Details for Cap reinforcing not shown.

6 Bars PD(#11)
6 Bars PS1(#4)

PART PLAN
(36" Dia Column)

See Bridge Layout for Foundation type. See FD standard for details.

Top of Drilled Shaft or Footing

Texas Department of Transportation
Bridge Division

PRECAST CONCRETE
BENT CAP OPTION
FOR ROUND COLUMNS
PBC-RC
See Interior Bent Details for Cap reinforcing not shown.

6 Bars PS3(#4)

3'-3" Min

4" Dia galvanized 26 Gage spiral steel ducts. Install plumb.

End Column Bars v 1/4" and Bars 2 1/2" below top of concrete.  

6 Bars PD(#11)

4" Dia galvanized 26 Gage spiral steel ducts. Install plumb.

6 Bars PD(#11)

See Bridge Layout for Foundation type. See FD standard for details.

Top of Drilled Shaft or Footing

6 Bars PD(#11)

See Bridge Layout for Foundation type. See FD standard for details.

4'-6" Min

3'-0"

9 1/2" 9 1/2"

© Bent & © Column

PART PLAN

(36" Dia Column)

PART ELEVATION

(36" Dia Column)
Bars PD may need to be embedded in footing or drilled shaft for short columns.
**TABLE OF GROUT SPECIFICATIONS**

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compaction</td>
<td></td>
</tr>
<tr>
<td>Compressive Strength</td>
<td>2,500 psi, bone placement 5,000 psi, bone placement strength three cubes, Mhy. for bone placement strength three cubes, Mhy. for 28-day strength 5,000 psi.</td>
</tr>
<tr>
<td>Sample size</td>
<td>three cubes, Mhy. for bone placement 28-day strength 5,000 psi.</td>
</tr>
<tr>
<td>Sampling and Testing</td>
<td>ASTM C109 (modified by C1071)</td>
</tr>
<tr>
<td>Groutability</td>
<td></td>
</tr>
<tr>
<td>Expansion Requirements</td>
<td>Expansion per 28 days, C109 (identified by C1071)</td>
</tr>
<tr>
<td>Moisture of Elasticity</td>
<td>2,800 psi to 5,000 psi (identified by Manufacturer)</td>
</tr>
<tr>
<td>Coefficient of Inertial</td>
<td>5,000 psi to 10,000 psi (identified by Manufacturer)</td>
</tr>
<tr>
<td>Construction</td>
<td></td>
</tr>
<tr>
<td>Flexibility</td>
<td>Fluid Consistency Efflux Time 20-30 seconds</td>
</tr>
<tr>
<td>Weight Initial Vital</td>
<td>2.5 to 5.0 lbs. per cubic foot (identified by Manufacturer)</td>
</tr>
<tr>
<td>Weight Final Vital</td>
<td>4.0 to 8.0 lbs. per cubic foot (identified by Manufacturer)</td>
</tr>
<tr>
<td>Drying Time</td>
<td>300 cycles, ASTM C866 (identified by Manufacturer)</td>
</tr>
</tbody>
</table>

**CONSTRUCTION NOTES:**

- Make sure that the grout is cured using the same material and equipment as the original grout. This ensures that the grout remains consistent with the original material.
- Inspect the grout for any defects before placing it in the formwork. Any defects found should be repaired before placing the grout.
- Ensure that the grout is properly mixed before placing it in the formwork. The grout should be mixed to the correct consistency to ensure proper fill of the formwork.
- Follow the manufacturer's instructions for the proper placement and compaction of the grout. This will ensure that the grout is placed properly and compacted to the desired level.
- Inspect the grout after placement to ensure that it meets the required specifications. Any deviations from the specified requirements should be corrected immediately.
- Allow the grout to cure according to the manufacturer's recommendations. This will ensure that the grout reaches its full strength.

**MATERIAL NOTES:**

- The grout used should meet the specifications of ASTM C390. This ensures that the grout is of the highest quality and meets the required standards.
- The grout should be placed and compacted as per the manufacturer's instructions. This will ensure that the grout is properly placed and compacted to the desired level.
- The grout should be cured according to the manufacturer's recommendations. This will ensure that the grout reaches its full strength.

**GENERAL NOTES:**

- This document is intended for use by authorized personnel only. Unauthorized personnel should not attempt to modify or reproduce this document.
- This document is subject to change without notice. Always check for the latest version of this document before use.
- This document is copyright protected. Reproduction or distribution of this document without the written consent of the copyright holder is prohibited.

---

**Texas Department of Transportation**

**Bridge Division**

**PRECAST CONCRETE BENT CAP OPTION FOR ROUNDED COLUNMS**

**PBC-RC**

**FILE**

**PRECAST-RC.DWG**

**DATE**

**APRIL 2011**

**REVISIONS**

**PROJECT**

**FEDERAL AID**

**SHEET**

**CONT.**

**DET.**

**CONSTRUCTION**

**SET**

**JOB NO.**

---

**PARAMETERS**

- **Cap Height:** 8 ft.
- **Cap Width:** 6 ft.
- **Cap Depth:** 3 ft.
- **Bent Cap:** Round
- **Reinforcement:** Steel bars placed over the bent cap to match the bent cap dimensions.
- **Finish:** Smooth finish with a brushed texture.
**CONSTRUCTION NOTES:**

Make a trial batch of grout using the same materials, equipment, and personnel to be used for actual grouting operations and group all group heads on a clean, dry, flat surface. The procedures shall be performed in the presence of the Engineer. The mix-up test shall demonstrate the ability of the Contractor to produce and control grout that meets the requirements specified in this document. The mix-up test shall consist of preparing and testing grout samples to determine their consistency with the grout as received from the supplier. The grout sample shall be tested for the following:

- **Consistency:**
  - Flowability: Use the slump test for consistency. The slump of the grout shall be within the range specified in the contract documents.

**MATERIALS:**

- Grout shall be supplied in accordance with the specifications of the contract documents.
- The Contractor shall ensure that the grout is mixed properly and that it meets the required consistency before use.

**PROCEDURE:**

1. **Preparation:**
   - Ensure that the grout is in a good state of hydration.
   - Mix the grout according to the manufacturer's directions.
   - Use the slump test to determine the consistency of the grout.

2. **Grouting:**
   - Apply the grout to the construction areas.
   - Ensure that the grout is applied uniformly and that the required consistency is maintained.

3. **Curing:**
   - Allow the grout to cure according to the manufacturer's recommendations.
   - Perform visual inspection and additional testing as required.

---

**PLUG DETAIL:**

A plug detail is shown to illustrate the proper placement and use of grout plugs. The detail includes the location and orientation of the grout plugs, as well as the method of installation.

---

**TABLE OF GROUT SPECIFICATIONS**

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>VALUES</th>
<th>SAMPLING AND TESTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressive Strength</td>
<td>2,500 psi, 28 days</td>
<td>ASTM C109 (modified by C1091)</td>
</tr>
<tr>
<td>Flakiness</td>
<td>No more than 0.5%</td>
<td>ASTM C1239</td>
</tr>
<tr>
<td>Water Reducing</td>
<td>No more than 3%</td>
<td>ASTM C1239</td>
</tr>
<tr>
<td>pH Value</td>
<td>5.5 to 7.5</td>
<td>ASTM C1239</td>
</tr>
<tr>
<td>Setting Time</td>
<td>Initial: 10 min, Final: 30 min</td>
<td>Tens test ASTM C476-91</td>
</tr>
<tr>
<td>Flexibility</td>
<td>300 cycles, ASTM C666</td>
<td>ASTM C191</td>
</tr>
<tr>
<td>Durability</td>
<td>300 cycles, ASTM C666</td>
<td>ASTM C191</td>
</tr>
</tbody>
</table>

---

**TYPICAL SECTION THRU CAP**

A typical section through a cap detail is shown to illustrate the various components and features of the cap. The section includes the placement of reinforcing bars, the connection to the cap, and the overall structural integrity of the cap.

---

**SECTION A-A**

A section through reinforcing bars is shown to illustrate the proper placement of the bars. The section includes the orientation and spacing of the bars, as well as the method of connection to the cap.

---

**PLUG DETAIL**

A detail of the grout plugs is shown to illustrate the proper placement and use of the plugs. The detail includes the location and orientation of the plugs, as well as the method of installation.

---

**EXAMPLES OF PRECAST BENTS WITH DOWELS**

Examples of precast bents with dowels are shown to illustrate the proper use of dowels in the construction of bents. The examples include the orientation and placement of the dowels, as well as the overall structural integrity of the bents.

---

**PRECAST CONCRETE BENT CAP OPTION FOR ROUND COLUMNS**

A precast concrete bent cap option for round columns is shown to illustrate the proper use of precast concrete caps. The option includes the orientation and placement of the cap, as well as the overall structural integrity of the column.

---

**PBC-RC**

A symbol or label indicating the option for round columns is shown to illustrate the proper use of precast concrete caps. The symbol includes the label "PBC-RC," indicating the option for round columns.

---

**MATERIALS:**

- Grout shall be supplied in accordance with the specifications of the contract documents.
- The Contractor shall ensure that the grout is mixed properly and that it meets the required consistency before use.

**PROCEDURE:**

1. **Preparation:**
   - Ensure that the grout is in a good state of hydration.
   - Mix the grout according to the manufacturer's directions.
   - Use the slump test to determine the consistency of the grout.

2. **Grouting:**
   - Apply the grout to the construction areas.
   - Ensure that the grout is applied uniformly and that the required consistency is maintained.

3. **Curing:**
   - Allow the grout to cure according to the manufacturer's recommendations.
   - Perform visual inspection and additional testing as required.

---

**CONSTRUCTION NOTES:**

Make a trial batch of grout using the same materials, equipment, and personnel to be used for actual grouting operations and group all group heads on a clean, dry, flat surface. The procedures shall be performed in the presence of the Engineer. The mix-up test shall demonstrate the ability of the Contractor to produce and control grout that meets the requirements specified in this document. The mix-up test shall consist of preparing and testing grout samples to determine their consistency with the grout as received from the supplier. The grout sample shall be tested for the following:

- **Consistency:**
  - Flowability: Use the slump test for consistency. The slump of the grout shall be within the range specified in the contract documents.

**MATERIALS:**

- Grout shall be supplied in accordance with the specifications of the contract documents.
- The Contractor shall ensure that the grout is mixed properly and that it meets the required consistency before use.

**PROCEDURE:**

1. **Preparation:**
   - Ensure that the grout is in a good state of hydration.
   - Mix the grout according to the manufacturer's directions.
   - Use the slump test to determine the consistency of the grout.

2. **Grouting:**
   - Apply the grout to the construction areas.
   - Ensure that the grout is applied uniformly and that the required consistency is maintained.

3. **Curing:**
   - Allow the grout to cure according to the manufacturer's recommendations.
   - Perform visual inspection and additional testing as required.
TYPICAL SECTION THRU CAP
(Showing Example of Ducts and Cap Reinforcing)

Remove 4" Dia Plugs formed at top of Ducts. See "Plug Detail". Remove prior to grouting.

Typical Column

Grout/ Air Outlet Tube

Bars PD not shown for clarity.

SECTION A-A

PLUG DETAIL
(To keep concrete out of ducts during concrete placement. Remove prior to grouting)
Slope top of cap between bearing seats in accordance with Item 420.4 "Treatment and Finishing of Horizontal Surfaces Other Than Bridge Slabs", unless directed otherwise by the Engineer.

Top of Bearing Seats level w/ wood float finish (Typ). See Interior Bent sheet for Bearing Seat Detail, if applicable. 5

Dowels D plumb. 5

Slope top of cap between bearing seats in accordance with Item 420.4 "Treatment and Finishing of Horizontal Surfaces Other Than Bridge Slabs", unless directed otherwise by the Engineer.

Top of Bearing Seats level w/ wood float finish (Typ). See Interior Bent sheet for Bearing Seat Detail, if applicable. 5

Dowels D plumb. 5

CAP SET AT SLOPE

CAP SET LEVEL

EXAMPLES OF PRECAST BENTS WITH DOWELS D
<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>VALUES</th>
<th>SAMPLING AND TESTING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mechanical</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compressive Strength</td>
<td>2,500 psi, beam placement</td>
<td>ASTM C109 (Modified by C1107)</td>
</tr>
<tr>
<td></td>
<td>5,800 psi, 28 days</td>
<td>Three cubes, Min, for beam placement strength</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Three cubes, Min, for final 28-day strength</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Per Bent</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(All samples must meet or exceed requirements)</td>
</tr>
<tr>
<td><strong>Constructability</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flowability</td>
<td>Fluid Consistency Efflux Time</td>
<td>Test Method Tex-437-A</td>
</tr>
<tr>
<td></td>
<td>20-30 Seconds</td>
<td>One test Min per Bent, and as needed to calibrate mix</td>
</tr>
<tr>
<td></td>
<td></td>
<td>proportions</td>
</tr>
<tr>
<td>Set Time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial</td>
<td>2.5 to 5.0 hrs</td>
<td>ASTM C191</td>
</tr>
<tr>
<td>Final</td>
<td>4.0 to 8.0 hrs</td>
<td>(Certified by Manufacturer)</td>
</tr>
<tr>
<td>Durability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freeze Thaw</td>
<td>300 cycles, RDF 90%</td>
<td>ASTM C666</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Certified by Manufacturer)</td>
</tr>
</tbody>
</table>
**Construction Notes:**

Make a trial batch of grout using the same materials, equipment, and procedures that will be used for actual grouting operations at the site. The trial batch of grout must be representative. The result of grouting must serve to demonstrate to the owner the ability of the grout to perform its intended function. The grouting must be performed in the presence of the owner's representative. The grouting must be performed as specified in the plans and specifications.

**General Notes:**

This specification is intended to provide a guide for the construction of precast concrete bent cap options for round columns. The specification includes details for the design, fabrication, and installation of precast concrete bent caps. The specification may be used for both new construction and rehabilitation projects. The specification is based on the latest edition of the American Concrete Institute (ACI) standards and guidelines.

**Material Notes:**

Material selection is critical for the successful design and construction of precast concrete bent caps. The materials used should meet the requirements specified in the ACI standards and guidelines. The specification includes details for the selection and specification of materials, including reinforcement, concrete, and other components.

**General Notes:**

This specification is intended to provide a guide for the construction of precast concrete bent caps options for round columns. The specification includes details for the design, fabrication, and installation of precast concrete bent caps. The specification may be used for both new construction and rehabilitation projects. The specification is based on the latest edition of the American Concrete Institute (ACI) standards and guidelines.

**Material Notes:**

Material selection is critical for the successful design and construction of precast concrete bent caps. The materials used should meet the requirements specified in the ACI standards and guidelines. The specification includes details for the selection and specification of materials, including reinforcement, concrete, and other components.
Notes: (Construction/Material/General)

- Grout mock up (one week)
- Cap lifting ~ Cap concrete min 2,500 psi
- Cap placement ~ Column concrete min 2,500 psi
- Friction collar removal and beam placement ~ Grout min 2,500 psi
- Other loadings ~ Grout @ 28 day strength
- Plastic shims or friction collars (NO steel shims)
- All grouted connections must be free of voids
Precast Bent Cap Standards

- Standard Drawings
  - Background
  - Round Columns (PBC-RC)
  - **Piles (Concrete and H-Piles) (PBC-P)**

- Construction
  - Grout Mock Up
  - Placing Cap

- Using the Standards
  - Do’s and Don’ts
  - Location of Standard Drawings

- Questions
PART PLAN
CONCRETE PILE

Min Cap Width
= Pile Width plus 1'-6" ①

Bars C (#5)

G. Bent & Q. Pile

Bars PC (#4)

Cap Bars S

PART ELEVATION
CONCRETE PILE

See Plug Detail

See Interior Bent sheet for Cap reinforcing not shown.

Cap Bars S

Pile Pocket edge

3" - Cap Bars S

4" Dia galvanized
26 Gage spiral steel ducts.

3-Bars PC (#4) Spa as shown

6" Min

3" Typ

SECTION A-A
Showing example Cap reinforcing

Min Cap Width
- Pile Width
plus 1'-6" ①

4" Dia galvanized
26 Gage spiral steel ducts.

2 1/4" Typ

1/8"/foot
draft

Provide watertight forms

3-Bars PC (#4) Spa as shown

Pile Embed

Texas Department of Transportation
Bridge Division

PRECAST CONCRETE
BENT CAP OPTION
FOR CONCRETE PILES
AND STEEL H PILES

PBC-P
**PART PLAN**

**CONCRETE PILE**

- Bars C (#5)
- Cap Bars S
- Pile Width
- Min Cap Width

**SECTION A-A**

- Min Cap Width = Pile Width plus 1'-6"'
- 4" Dia galvanized 26 Gage spiral steel ducts.
- 2 1/4" Typ
- 1/2"/foot draft
- Provide water-tight forms
- 6" Min
- 3" Typ
- 3-Bars PC (#4)—Spa as shown

**PART ELEVATION**

**CONCRETE PILE**

- See Interior Bent Details for Cap reinforcing not shown.
- Cap Bars S
- Pile Pocket edge
- Pile size + 6"
See Interior Bent Details for Cap reinforcing not shown.

PART PLAN
CONCRETE PILE

Min Cap Width
= Pile Width
plus 1'-6"

Bars C
(#5)

4 Bent &
4 Pile

Cap Bars S

PART ELEVATION
CONCRETE PILE

SECTION A-A
Showing examples Cap reinforcing

SECTIONS
Min Cap Width
- Pile Width
+ 1'-6"

4" Dia galvanized
26 Gage spiral
steel ducts.

2 1/4" Typ

1/8"/foot
draft

Provide water-tight
forms

6" Min

Bars C
(#5)

3 Bars PC
(#4) Spans
as shown

4 1

3 Bars PC
(#4) Spans

Pile Embed

Texas Department of Transportation
Bridge Division

PRECAST CONCRETE
BENT CAP OPTION
FOR CONCRETE PILES
AND STEEL H PILES

PBC-P
PART PLAN
CONCRETE PILE

Min Cap Width
= Pile Width
plus 1'-6''

Bars C
(#5)

Bars PC
(#4)

Cap Bars S

SECTION A-A
Showing example Cap reinforcing

Min Cap Width
- Pile Width
plus 1'-6''

4" Dia galvanized
26 Gage spiral
steel ducts.

2 1/4"
Typ

1/8"/foot
draft

Provide water-tight
forms

6" Min
3" Typ

3-Bars PC
(#4) Spa
as shown

Pile Embed

1. Provide wider cap if necessary. Adjust cap
bars S dimensions accordingly. All quantity
adjustments are at the Contractor’s expense.

2. 1'-0" (+2 1/2", -0") with 16" and 18" piles;
1'-6" (+2 1/2", -0") with 20" and 24" piles

3. 1'-3" with 16" and 18" piles;
1'-9" with 20" and 24" piles
PART PLAN
CONCRETE PILE

Min Cap Width
= Pile Width plus 1'-6".

Bars C (#5)

Cap Bars S

Bands PC (#4)

PART ELEVATION
CONCRETE PILE

See Interior Bent Details for Cap reinforcing not shown.

Bands C (#5)

Cap Bars S

4" Dia galvanized 26 Gage spiral steel ducts.

Provide water-tight forms

SECTION A-A
Showing example Cap reinforcing

Min Cap Width
- Pile Width plus 1'-6".

4" Dia galvanized 26 Gage spiral steel ducts.

1'-0" (+2 1/2", -0") with 16" and 18" piles;
1'-6" (+2 1/2", -0") with 20" and 24" piles
1'-3" with 16" and 18" piles;
1'-9" with 20" and 24" piles

Provide wider cap if necessary. Adjust cap bars S dimensions accordingly. All quantity adjustments are at the Contractor's expense.

3 Bars PC (#4) - Spa as shown

3'-0"/foot draft

6" Min
3" Typ

Pile Embedment

1. Provide wider cap if necessary. Adjust cap bars S dimensions accordingly. All quantity adjustments are at the Contractor's expense.

2. 1'-0" (+2 1/2", -0") with 16" and 18" piles; 1'-6" (+2 1/2", -0") with 20" and 24" piles

3. 1'-3" with 16" and 18" piles; 1'-9" with 20" and 24" piles
7. A certified welder is required.

8. If Cap height is less than 2’-9”, Deformed Bar Anchor length is 6” less than Cap height.
See Interior Bent sheet for Cap reinforcing not shown.

PART PLAN
STEEL H-PILE

See Interior Bent Details for Cap reinforcing not shown.

PART ELEVATION
STEEL H-PILE

18 ~ 3/8" Deformed Bar Anchors x 2'-3" ③

1/8" Max gap between Pile and Connection Plate

18 ~ 3/8" Deformed Bar Anchors

Place bars to avoid Deformed Bar Anchors

SECTION B-B
Showing example Cap reinforcing

Pile size plus 6" ④
Pile size (Example: 1'-2" for HPI4) ⑤

A certified welder is required.

If Cap height is less than 2'-9", Deformed Bar Anchor length is 6" less than Cap height.

Texas Department of Transportation
Bridge Division

PRECAST CONCRETE BENT CAP OPTION
FOR CONCRETE PILE AND STEEL H-PILES

PBC-P
1. See Interior Bent Details for Cap reinforcing not shown.
2. Bent, Pile and Connection Plate
3. Pile and Connection Plate
4. PART PLAN
   STEEL H-PILE
5. See Interior Bent sheet for Cap reinforcing not shown.
6. Pile size plus 6" (Example: 1'-2" for HP14)
7. Pile size (Example: 1'-2" for HP14)
8. Place bars to avoid Deformed Bar Anchors
9. 18 - 7/8" Deformed Bar Anchors x 2'-3 1/2"
10. Bottom of Cap
11. 1/4" Max gap between Pile and Connection Plate
12. 18 - 7/8" Deformed Bar Anchors
13. Precoat concrete bent cap option for concrete piles and steel H-piles
14. A certified welder is required.
15. If Cap height is less than 2'-9". Deformed Bar Anchor length is 6" less than Cap height.
A certified welder is required.

If Cap height is less than 2'-9", Deformed Bar Anchor length is 6" less than Cap height.
PART PLAN
STEEL H-PILE

See Interior Bent sheet for Cap reinforcing not shown.

See Interior Bent Details for Cap reinforcing not shown.

PART ELEVATION
STEEL H-PILE

18 - \( \frac{3}{4} \)" Deformed Bar Anchors x 2'-3"

SECTION B-B
Showing example Cap reinforcing

Place bars to avoid Deformed Bar Anchors

Bent, Pile and Connection Plate

Plan

18 - \( \frac{3}{8} \)" Deformed Bar Anchors

PL \( \frac{3}{4} \)"

Pile size plus 6"

Pile size (Example: 1'-2" for HP14)

A certified welder is required.

If Cap height is less than 2'-9", Deformed Bar Anchor length is 6" less than Cap height.

Texas Department of Transportation
Bridge Division

PRECAST CONCRETE BENT CAP OPTION
FOR CONCRETE PILES AND STEEL H-PILES

PBC-P
PART PLAN
STEEL H-PILE

PART ELEVATION
STEEL H-PILE

SECTION B-B
Showing example Cap reinforcing

Pile size plus 6"

Pile size (Example: 1'-2" for HP14)

A certified welder is required.

If Cap height is less than 2'-9", Deformed Bar Anchor length is 6" less than Cap height.

CONNECTION PLATE DETAIL
Electric arc and weld deformed bar anchors with complete fusion.

18 ~ ½" Deformed Bar Anchors
× 2'-3" (6)
PART PLAN
STEEL H-PILE

PART ELEVATION
STEEL H-PILE

SECTION B-B
Showing example Cap reinforcing

1. Pile size plus 6"
2. Pile size (Example: 1"-2" for HP14)

18 ~ 7/8" Deformed Bar Anchors x 2'-3"

Placed bars to avoid Deformed Bar Anchors

If Cap height is less than 2'-9", Deformed Bar Anchor length is 6" less than Cap height.

PRECAST CONCRETE BENT CAP OPTION FOR STEEL H-PILES

Texas Department of Transportation
Bridge Division
PART PLAN
STEEL H-PILE

See Interior Bent details for Cap reinforcing not shown.

PART ELEVATION
STEEL H-PILE

See Interior Bent sheet for Cap reinforcing not shown.

SECTION B-B
Showing example Cap reinforcing

1. 18 ~ 7/8" Deformed Bar Anchors x 2'-3"[6]
2. Bottom of Cap
3. 1/2" Max gap between Pile and Connection Plate

4. Pile size plus 6"
5. Pile size (Example: 1'-2" for HP14)

6. A certified welder is required.
7. If Cap height is less than 2'-9", Deformed Bar Anchor length is 6" less than Cap height.

CONNECTION PLATE DETAIL
Electric arc and weld deformed bar anchors with complete fusion.

PRECAST CONCRETE BENT CAP OPTION FOR CONCRETE PILES AND STEEL H-PILES

Texas Department of Transportation
Bridge Division
PBC-P
**TABLE OF GROUT SPECIFICATIONS**

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>VALUES</th>
<th>SAMPLING AND TESTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressive Strength</td>
<td>2,500 psi, 28 day</td>
<td>3 cubes, mix, for 28 day</td>
</tr>
<tr>
<td></td>
<td>5,000 psi, 3 day</td>
<td>1 dry mix</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conductivity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flowability</td>
<td>Fluid Consistency Efflux Time</td>
<td>20-30 Seconds</td>
</tr>
</tbody>
</table>

**Grouting Notes for Concrete Piles**

When a trial batch of grout is used on the site, the grout must be used for actual grouting operations and for a test of the connection of the piling. The piling must be grouted in the presence of the Engineer. All work on the piling must be done in accordance with the specifications. The methods of grouting are determined by the Engineer. Grouting shall be done by means of grouting units, such as those specified in the specifications. Grouting shall be done in such a manner as to provide a connection free of voids. Field test the trial batch grout to the same level required for the actual grouting.

Surfaces in contact with grout shall be clean and free from all substances that would impair the quality of the grout. All work on the piling shall be done in the presence of the Engineer. Grouting shall be done in such a manner as to provide a connection free of voids. Field test the trial batch grout to the same level required for the actual grouting.

**Welding Notes for Steel H-Piles**

After field welding is complete, clean and paint top of site and weld plates as specified in the specifications. Welds may be set on Cap after completing Cap to Plate welds are completed.

**Construction Notes**

Consolidate grouted piles to form a cap at the top of the pile. Use concrete and other materials in accordance with the specifications. Site cast and grout in accordance with the specifications. Site cast and grout in accordance with the specifications. Site cast and grout in accordance with the specifications. Site cast and grout in accordance with the specifications. Site cast and grout in accordance with the specifications. Site cast and grout in accordance with the specifications.

**Material Notes**

Provisions are made for the testing of concrete, grout, and other materials in accordance with the specifications. The test results shall be submitted to the Engineer for approval. The test results shall be submitted to the Engineer for approval. The test results shall be submitted to the Engineer for approval. The test results shall be submitted to the Engineer for approval. The test results shall be submitted to the Engineer for approval. The test results shall be submitted to the Engineer for approval.

**Examples of Precast Bents with Dowels D**

![Diagram of Examples of Precast Bents with Dowels D]
TABLE OF GROUT SPECIFICATIONS

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>VALUES</th>
<th>SAMPLING AND TESTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit Weight</td>
<td>145 lbs/1000 cu ft</td>
<td>Actual 1000 cu ft by C3185</td>
</tr>
<tr>
<td>Compressive Strength</td>
<td>5000 psi, 28 days</td>
<td>Three cubes, mean, for 28 days strength</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Three cubes, min. for 28 days strength</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Three cubes, max. for 28 days strength</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Any samples must meet or exceed requirement</td>
</tr>
<tr>
<td>Flowability</td>
<td></td>
<td>Test method Texas 421-6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>One test on each batch, and is needed to correlate mix proportions</td>
</tr>
</tbody>
</table>

Examples of Precast Bents with Dowels D

PRECAST CONCRETE BENT CAP OPTION FOR CONCRETE PILES AND STEEL-H-PILES

PRECAST BENT CAP OPTION FOR CONCRETE PILES AND STEEL-H-PILES

PBC-P

FILE: 6193023.png  SIZE: 80K BERT: 100% FEEDBACK: FEDERAL AID PROJECT

PRECAST CONCRETE BENT CAP OPTION FOR CONCRETE PILES AND STEEL-H-PILES

PBC-P

PBC-P
# Table of Grout Specifications

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
<th>Sampling and Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical</td>
<td></td>
<td><strong>ASTM C109 (Modified by C1107)</strong></td>
</tr>
<tr>
<td>Compressive Strength</td>
<td>2,500 psi, beam placement</td>
<td>Three cubes, Min, for beam placement strength</td>
</tr>
<tr>
<td></td>
<td>5,800 psi, 28 days</td>
<td>Three cubes, Min, for final 28-day strength</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Per Bent</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(All samples must meet or exceed requirements)</td>
</tr>
<tr>
<td>Constructability</td>
<td></td>
<td><strong>Test Method Tex-437-A</strong></td>
</tr>
<tr>
<td>Flowability</td>
<td>Fluid Consistency Efflux Time</td>
<td>One test Min per Bent, and as needed to</td>
</tr>
<tr>
<td></td>
<td>20-30 Seconds</td>
<td>calibrate mix proportions</td>
</tr>
</tbody>
</table>

---

**Slope top of cap between bearing seats in accordance with Item 420.4** "Treatment and Finishing of Horizontal Surfaces Other Than Bridge Slabs", unless directed otherwise by the Engineer.

**Top of Bearing Seats level w/ wood float finish (Typ); See Interior Bent sheet for Bearing Seat Detail, if applicable.**

**Reinforce bearing seats over 3' tall and slope top of cap between bearing seats in accordance with Item 420.4** "Treatment and Finishing of Horizontal Surfaces Other Than Bridge Slabs", unless directed otherwise by the Engineer.

**Top of Bearing Seats level w/ wood float finish (Typ); See Interior Bent sheet for Bearing Seat Detail, if applicable.**

**Examples of Precast Bents with Dowels D**

---

**Texas Department of Transportation**

**Bridge Division**

**Precast Concrete Bent Cap Option**

**For Concrete Piles and Steel H-Piles**

**PBC-P**

---

**Texas Department of Transportation**

**Bridge Division**

**Precast Concrete Bent Cap Option**

**For Concrete Piles and Steel H-Piles**

**PBC-P**
Notes: (Construction/Material/General)

- Same as the round column standard except:
- Place beams after all pile welds are complete
- Clean and Paint top of pile and connection plate
Precast Bent Cap Standards

- Standard Drawings
  - Background
  - Round Columns (PBC-RC)
  - Piles (Concrete and H-Piles) (PBC-P)
- Construction
  - Grout Mock Up
    - Placing Cap
- Using the Standards
  - Do’s and Don’ts
  - Location of Standard Drawings
- Questions
Grouting Issues

- Clumps
- Segregation
- Air Voids
Grout Pump

Flow Cone Grout Test (Water)

Flow Cone Grout Test (Grout)
Placing Friction Collar

Placing “Cap”
Mock Set Up

Grout Pump Connection

Grouting
Mock Set Up

Grout Pump Connection

Grouting
Precast Bent Cap Standards

- Standard Drawings
  - Background
  - Round Columns (PBC-RC)
  - Piles (Concrete and H-Piles) (PBC-P)
- Construction
  - Grout Mock Up
  - Placing Cap
- Using the Standards
  - Do’s and Don’ts
  - Location of Standard Drawings
- Questions
Steel Ducts in Cap

Lifting Interior Bent
Placing Cap on Round Columns

Grouting using a Pressure Pump
Grout Placement Techniques

Tremie Tube

Pressure Pump
Interior Bent on Steel H-Piles

Interior Bent on Steel H-Piles
Interior Bent on Concrete Piles

Pile Pocket

Interior Bent on Concrete Piles
Precast Bent Cap Standards

- Standard Drawings
  - Background
  - Round Columns (PBC-RC)
  - Piles (Concrete and H-Piles) (PBC-P)
- Construction
  - Grout Mock Up
  - Placing Cap
- Using the Standards
  - Do’s and Don’ts
    - Location of Standard Drawings
- Questions
Do’s

- Recommended with standard interior bents
  - No adjustments to quantities, or special specifications are required
- Conventional multi-column bents
  - Rectangular bent
  - Column Spacing < 18ft
  - Standard span lengths
- Pan Forms on Steel Piles
Don’ts

- NO Pan forms on concrete piles (PBC-P not valid)
- Heavily reinforced bent caps
- Inverted Tee bent caps
- Extra long bent caps
Things to Consider
When using with a non-standard bent cap

- Lifting Weights ~ Max 80-100kips
- Verify reinforcement clearances
- Evaluate connection stresses
- Column Spacing
- Span Lengths
- Minimum Bent Cap Dimensions
Precast Bent Cap Standards

- Standard Drawings
  - Background
  - Round Columns (PBC-RC)
  - Piles (Concrete and H-Piles) (PBC-P)

- Construction
  - Grout Mock Up
  - Placing Cap

- Using the Standards
  - Do’s and Don’ts

  - Location of Standard Drawings

- Questions
### MISCELLANEOUS STANDARDS

<table>
<thead>
<tr>
<th>Rev Date</th>
<th>Std Name</th>
<th>Description</th>
<th>File Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>01-12</td>
<td></td>
<td>index Sh of Miscellaneous Standards</td>
<td>table09e.dgn</td>
</tr>
</tbody>
</table>

### COMMON TO AASHTO STANDARD & LRFD DESIGN SPECIFICATIONS

<table>
<thead>
<tr>
<th>Rev Date</th>
<th>Std Name</th>
<th>Description</th>
<th>File Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-10</td>
<td>AJ</td>
<td>Armor Joint with/without Seal</td>
<td>ajside01.dgn</td>
</tr>
<tr>
<td>04-06</td>
<td>BAS-A</td>
<td>Bridge Approach Slab, (ACP)</td>
<td>basase1.dgn</td>
</tr>
<tr>
<td>04-06</td>
<td>BAS-C</td>
<td>Bridge Approach Slab, (Concrete)</td>
<td>basace1.dgn</td>
</tr>
<tr>
<td>04-06</td>
<td>BL</td>
<td>Bridge Lighting Details</td>
<td>blside01.dgn</td>
</tr>
<tr>
<td>06-07</td>
<td>BMCS</td>
<td>Bridge Mounted Clearance Sign</td>
<td>bmcs06e.dgn</td>
</tr>
<tr>
<td>04-06</td>
<td>BPA</td>
<td>Bridge Protective Assembly</td>
<td>bpa06e.dgn</td>
</tr>
<tr>
<td>01-12</td>
<td>BRSM</td>
<td>Bridge Raised Sidewalk and Median Details</td>
<td>brsase1.dgn</td>
</tr>
<tr>
<td>01-12</td>
<td>BS-EJCP</td>
<td>Bridge Sidewalk Expansion Plate (All Skews)</td>
<td>bsej06e.dgn</td>
</tr>
<tr>
<td>01-12</td>
<td>CP</td>
<td>Prestressed Concrete Filing</td>
<td>cp06e.dgn</td>
</tr>
<tr>
<td>04-11</td>
<td>CRR</td>
<td>Concrete Riprap (Type RR8 &amp; RR9)</td>
<td>crr06e.dgn</td>
</tr>
<tr>
<td>08-07</td>
<td>CSAB</td>
<td>Cement Stabilized Abutment Backfill</td>
<td>csab06e.dgn</td>
</tr>
<tr>
<td>01-12</td>
<td>FD</td>
<td>Common Foundation Details</td>
<td>fddd01.dgn</td>
</tr>
<tr>
<td>04-06</td>
<td>NEBR(S)</td>
<td>Min Erction &amp; Bracing Req (Steel Girders &amp; Beams)</td>
<td>nebr01.dgn</td>
</tr>
<tr>
<td>01-12</td>
<td>PBC-F</td>
<td>Precast Conc Bent Cap Opt for Conc &amp; Steel Flies</td>
<td>pbc06e.dgn</td>
</tr>
<tr>
<td>04-11</td>
<td>PBC-RC</td>
<td>Precast Conc Bent Cap Opt for Round Columns</td>
<td>pbc01.dgn</td>
</tr>
<tr>
<td>10-10</td>
<td>PBC-ECP</td>
<td>Prestressed Concrete Panel Fabrication Details</td>
<td>pbe01.dgn</td>
</tr>
</tbody>
</table>
In Conclusion…
The “Precast Concrete Bent Cap Option” Standards EXIST
They are SIMPLE to USE... so don’t be INTIMIDATED
Use of these standards is NOT mandatory

- Districts can disallow the use of precast bent caps
  - Include a note in the General Notes Item 420
When used...
They only supply a construction method option
– Like PMDF vs. PCP
QUESTIONS?

Contact Information:
Courtney Holle, P.E.
Ph: 512-416-2717
Email: Courtney.Holle@TxDOT.gov