GENERAL NOTES
1. All reinforcement steel bars shown meet the requirements of ASTM A 416, A 615, A 706, OR A 996.
2. Materials and workmanship are to be in accordance with Publication 408.
3. Pier dimensions are determined by design.
4. Provide the following within concrete cover for reinforcement:
   - Concrete cover shall be 2" minimum for columns and piers and 1" minimum for beams.
   - Reinforcement shall be placed so as to prevent construction through and long-term repositioning.
5. Use class C cement concrete in piers, footings, and drilled shafts.
6. Use class C cement concrete below bottom of footings, if specified.
7. Embed cast-in-place reinforcement bars 1"- 8" projecting from pier footings into column or pier and cap shell below foot joints.
8. For additional embedment reinforcement bar requirements, see design manual, Part 4, Concrete Structures, Sections 6.5.3.4.4.5.
9. Key for construction joint may be formed into the column or into the footing.
10. See rev. for standard splice and development lengths.
11. Provide 2% separation in columns of piers at finish ground line for "S" type noise.
12. For footings founded on soft ground a maximum of 1 ft. soil cover is preferred. Not permitted soil cover may be any depth in order to avoid unnecessary excavation.
13. For checking crack control, the side clearance shall be 3". 4.3" cover is indicated to allow for embedment of columns or stems and caps below open joints.
14. Apply an even pitch coating to ensure pipe column/wall that are within splash zone (11" P.O. of ground level), to protect against salt spray.

DESIGN DATA
- Unit weight of backfill material = 100 lb/ft³
- Unit weight of concrete = 150 lb/ft³
- Equivalent fluid earth pressure = 35 psf/ft of depth
- For footings use a minimum embedment of 1" x 7" for spread footings.
- For round, square, and rectangular columns use a 2" x 7" with column base percent.
- Use increments of 4" baseline to increase column resistance.
- Shear keys must not be used in first caps to eliminate partial or total sandstone.
- Shear keys must be located at the upper portion of an embankment. Increase the shear plane against the face of the footing and column to include the effect of the adjacent embankment.
- Piers located in the embankment must be investigated for stability and considering superstructure loads.
- For steel bridges with multiple fixed piers and continuous superstructure, provide temporary/equipment stores for placement at times other than 7/7.

CONSTRUCTABILITY CONSIDERATIONS
- To allow placement of the first cap reinforcement bars, provide construction tolerance and long-term serviceability.
- To prevent construction tolerance in the first cap, do not extend spirals into the first cap.
- Provide spliced ties.
- For vertical column reinforcement stability, extend vertical column steel overlap to bottom mat of footing reinforcement.
- For simple columns, provide 2" minimum / 3" minimum for all other.
- For simple columns, recommend maximum column length of 7.5" increments for all flows.
- For round columns, recommend maximum column cycles 12" to 15/2 ft.

SPECIFICATIONS
- Pipe: 3" - side cover to stirrups in pier caps to provide construction tolerances.
- Concrete: 2" - concrete exposed to weather
- Concrete: 3" - concrete exposed to earth
- Unit weight of backfill material = 35 psf/ft of depth
- Unit weight of concrete = 150 lb/ft³
- Equivalent fluid earth pressure = 35 psf/ft of depth
- For footings use a minimum embedment of 1" x 7" for spread footings.
- For round, square, and rectangular columns use a 2" x 7" with column base percent.
- Use increments of 4" baseline to increase column resistance.
- Shear keys must not be used in first caps to eliminate partial or total sandstone.
- Shear keys must be located at the upper portion of an embankment. Increase the shear plane against the face of the footing and column to include the effect of the adjacent embankment.
- Piers located in the embankment must be investigated for stability and considering superstructure loads.
- For steel bridges with multiple fixed piers and continuous superstructure, provide temporary/equipment stores for placement at times other than 7/7.

CONSTRUCTABILITY CONSIDERATIONS
- To allow placement of the first cap reinforcement bars, provide construction tolerance and long-term serviceability.
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- For vertical column reinforcement stability, extend vertical column steel overlap to bottom mat of footing reinforcement.
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- For round columns, recommend maximum column cycles 12" to 15/2 ft.

REFERENCES
- Index of Drawings
- Sheet 1 of 15
- BD-629M

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
REINFORCED CONCRETE PIERS

GENERAL NOTES AND DESIGN CRITERIA
**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
**STANDARD REINFORCED CONCRETE PIERS**  
**MULTI-COLUMN BENT**  
**COLUMN DETAILS**

**BD-629M**

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**NOTES:**

1. **COORDINATE VERTICAL COLUMN REINFORCEMENT WITH BOTTOM REINFORCEMENT TO AVOID INTERFERENCE.**
2. **SLICE CRITERIA:**
   - **THE SLICE LENGTH MUST NOT BE LESS THAN CLASS B SPLICE.**
   - **STAGGER CLASS B SPLICES SUCH THAT NO MORE THAN 50% OF THE REINFORCING BARS ARE SPLICED AT THE LOCATION.**
   - **USE A MAXIMUM SPACING ALONG THE LENGTH OF THE SLICE.**
   - **IF THE ABOVE SLICE CRITERIA CANNOT BE MET, FULL-MECHANICAL CONNECTION SPLICES CAN BE USED PROVIDED NOT MORE THAN 50% OF THE BARS ARE SPLICED AT A LOCATION.**
3. **FOR BUNDLED BARS OR LARGER, VERTICAL TIE SPACING OR Pitch of Vertical bars must not exceed:**
4. **COLUMN CONNECTIVE:**
   - **SYSTEM TO MAX. COL. DIMENSION OR 18"**
5. **PLASTIC HINGE ZONE:**
   - **SHOWN BY MAX. COLUMN DIMENSION. 1/6 COL. DIAMETER OR 18"**
6. **VERTICAL REINFORCEMENT IS A PITCH MAXIMUM FIXED. BUT NOT LESS THAN 1/8 THE WIDTH OF THE COLUMN.**
7. **THE SPLICE LENGTH MUST BE GREATER THAN OR EQUAL TO 0.10 TIMES THE COLUMN DIAMETER.**
8. **FOR BUNDLED BARS OR LARGER, VERTICAL TIE SPACING OR Pitch of Vertical bars must not exceed:**

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**FOR SECTIONS A-A, B-B, C-C**

**NOTE:**

- **FOR BUNDLED #10 BARS OR LARGER, VERTICAL TIE SPACING OR Pitch of Vertical bars must not exceed:**
- **THE SPLICE LENGTH MUST BE GREATER THAN OR EQUAL TO 0.10 TIMES THE COLUMN DIAMETER.**

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**PERMITTED SPLICING LOCATION**

- **IN NON-SPLASH ZONE**
- **IN SPLASH ZONE**

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**DEPARTMENT OF TRANSPORTATION**  
**BUREAU OF PROJECT DELIVERY**

**STANDARD REINFORCED CONCRETE PIERS**  
**MULTI-COLUMN BENT**  
**COLUMN DETAILS**

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**DIRECTOR, BUR. OF PROJECT DELIVERY**

APR. 29, 2016
**Commonwealth of Pennsylvania**

**Department of Transportation**

**Standard Reinforced Concrete Piers**

**Hammerhead BD-629M**

**Details Sheet of 6**

**Chief Bridge Engineer**

**Recommended**

**Bureau of Project Delivery**

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**Notes:**

1. **CAP ELEVATION**
   - Level (see top cap details on sheet 14 for column details & sections)
   - See detail "A" on sheet 14 for column ties extending into cap for column reinforcement. See column details & sections.

2. **Other Requirements**
   - Frost, scour, pavement depth, roadway drainage or any other requirements as determined by the engineer.

3. **Recommended Hammerhead Pier Configurations**
   - **Pier Type**
   - **Grade Separation**
   - **River**
   - **Railroad Within 25 FT. Of CL Track**
     - **A**
     - **B**
     - **C**
     - **D**

4. **Recommended HD details for shear blocks**
   - See BD-658M for shear block details on sheet 14 for cap details.

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**Director, Bur. of Project Delivery**

**APR.29, 2016**
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
STANDARD REINFORCED CONCRETE PIERS
HAMMERHEAD BD-629M
COLUMN DETAILS AND SECTIONS

CHIEF BRIDGE ENGINEER
RECOMMENDED
BUREAU OF PROJECT DELIVERY

OPTIONAL END TREATMENTS

ROADWAY, STREAMS OR RIVERS

STREAMS OR RIVERS

ELEVATION (RESPONSE ACCELERATION COEFFICIENT, $S_1 > 0.10$)

ELEVATION (SITE CLASS E, F OR RESPONSE ACCELERATION COEFFICIENT, $S_1 < 0.10$)

NOTES:

1. COORDINATE VERTICAL COLUMN REINFORCEMENT WITH TOP CAP REINFORCEMENT TO AVOID INTERFERENCE.
2. FOR SPLICE CRITERIA, SEE SHEET 3, NOTE 2.
3. FOR BUNDLED #10 BARS OR LARGER, VERTICAL TIE SPACING MUST NOT EXCEED 6".
4. COLUMN CONNECTION: SPLINTER SP: 1/6 MAX. "Y" DIMENSION OR 15".
5. PLASTIC HINGE ZONE: GREATER SP: 1/2 MAX. "Y" DIMENSION, 1/6 CLR. WEIGHT OF COLUMN OR 12".
6. ALL HOOKS ON TIES MUST ENGAGE VERTICAL COLUMN REINFORCING STEEL. ALTERTA HOOKS OR TEST WORKS OR CROSS TIES SHALL NOT VERTICALLY OR HORIZONTALLY.
7. WHEN NON-CONTINUOUS TIES ARE USED, THEY SHALL BE LAY SPLICED WITH A CLASS A SPLICE AND HAVING A 180 DEGREE HOOK WITH AN EXTENSION OF SIX BAR DIAMETERS.
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
STANDARD
REINFORCED CONCRETE PIERS

ELEVATION
(REASON ACCELERATION COEFFICIENT, S
LES THAN 0.10)

ELEVATION
(SITE CLASS E, F OR RESPONSE
ACCELERATION COEFFICIENT, S
GREATER THAN OR EQUAL TO 0.10)

NOTES:

1. FOR SPLICE CRITERIA, SEE SHEET 3, NOTE 2.
2. FOR SINGLED #10 BARS OR LARGER, VERTICAL TIE SPACING
   MUST NOT EXCEED 6".
3. COLUMN CONNECTION
   GREATER OR 1/6 MAX. "Y" DIMENSION OR 15"
4. PLASTIC HINGE ZONE
   GREATER OR MAX. "Y" DIMENSION, 1/6 CLR. HEIGHT OF COLUMN
   GREATER OR 12".
5. ALL BARS ON TIES MUST ENGAGE VERTICAL COLUMN REINFORCING STEEL.
   ALTERNATE 90° & 135° HOOKS ON CROSS TIES
   ALL HOOKS ON TIES MUST ENGAGE VERTICAL COLUMN REINFORCING STEEL.
   ALTERNATE 90° & 135° HOOKS ON CROSS TIES
6. WHERE NON-CONTINUOUS TIES ARE USED, THEY SHALL BE LAP-SPICED WITH A
   TIE SPACING GREATER THAN OR EQUAL TO 6" AND ADJACENT TIES
   MUST NOT EXCEED 6".
7. FOR SPLICE CRITERIA, SEE SHEET 3, NOTE 2.

ROADWAY, STREAMS
OR RIVERS

STREAMS
OR RIVERS

OPTIONAL END TREATMENTS

RECOMMENDED SOLID SHAFT
CONFIGURATION

RECOMMENDED ATY, ITC
STANDARD
REINFORCED CONCRETE PIERS
SOLID SHAFT (WALL)
DETAILS

DIRECTOR, BUR. OF PROJECT DELIVERY
APR.29, 2016
MULTI-DRILLED SHAFT CONFIGURATIONS

DETAILS NOT SHOWN

NOTES:
1. DRILLED SHAFTS NOT DESIGNED OR SPECIFIED INTO ROCK ARE GENERALLY NOT PERMITTED IN THE DEPT., AND IF USED, MUST BE APPROVED BY THE CHIEF BRIDGE ENGINEER.

2. USE OF BELLED TIP REQUIRES THE PRIOR APPROVAL OF THE CHIEF BRIDGE ENGINEER.

M I N .
1'-0" INCREMENTS

FOR TO 6" INCREMENTS

OF 6"

OF 6"

WITH ROCK SOCKET

2 x DIAMETER OF DRILLED SHAFT

30° (MAX.)

2 x DIAMETER OF DRILLED SHAFT

30° (MAX.)

6" (TYP.)

6" (TYP.)
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
STANDARD
REINFORCED CONCRETE PIERS
BD-629M

SECTION A-A
SECTION B-B

SECTION C-C

NOTE:
1. COORDINATE VERTICAL COLUMN REINFORCEMENT WITH BOTTOM CAP REINFORCEMENT.
2. FOR SPLICE CRITERIA, SEE SHEET 3, NOTE 2.
3. PLASTIC HINGE ZONE FOR SPLICE CRITERIA, SEE SHEET 3, NOTE 2.
4. PLASTIC HINGE ZONE FOR SPLICE CRITERIA, SEE SHEET 3, NOTE 2.
5. PLASTIC HINGE ZONE FOR SPLICE CRITERIA, SEE SHEET 3, NOTE 2.

D1 LESS THAN 0.10 ) COEFFICIENT, S , (RESPONSE ACCELERATION
D1 GREATER THAN OR EQUAL TO 0.10 ) COEFFICIENT, S , (RESPONSE ACCELERATION

APR. 29, 2016
APR. 29, 2016

BUREAU OF PROJECT DELIVERY
COMPUTATIONAL ENGINEER
CHIEF BRIDGE ENGINEER

SHEET OF 12

SINGLE DRILLED SHAFT
SHAFT/COLUMN DETAILS AND SECTIONS

SHEET 12 OF 15

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
REINFORCED CONCRETE PIERS
SINGLE DRILLED SHAFT
SHAFT/COLUMN DETAILS AND SECTIONS

RECOMMENDED APR. 29, 2016
RECOMMENDED APR. 29, 2016

THREE DAILY JOURNALS

BD-629M
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION

STANDARD
REINFORCED CONCRETE PIERS
TYPICAL CAP

ELEVATION
SLOPED CAP WITH PEDESTALS

- TREATMENT (TYP.)
ARCHITECTURAL

DECK JOINTS.
FOR DRAINAGE FROM
BETWEEN PEDESTALS
SLOPE TOP OF CAP

DETAILS
BD-629M

RECOMMENDED
RECOMMENDED

STAIRS AS REQUIRED
SPACING AS REQUIRED

ANCHOR BOLT (TYP.)
OR NEOPRENE PAD

PEDESTALS OVER 6"
MUST BE REINFORCED
TOP OF PIER CAP
MAY BE LEVEL OR
PEDESTAL MOUNTED HORIZONTALLY
AND TOP OF CAP AT DECK JOINT

PIER CAP SECTION

NOTE: STIRRUPS AND SIDE REINF. NOT SHOWN.

ARCHITECTURAL TREATMENT

REINF.
TOP DESIGN

REINFORCING BARS
MAY BE CONSIDERED
FOR SERVICEABILITY
REQUIREMENTS.

FOR OTHER SPACES. (TYP.)
SPACES. 6" PREFERABLE
5'-0" PROVIDE TWO 9"
FOR CAPS GREATER THAN
9" FOR AT LEAST 1 SPACE.
CLEARANCE BETWEEN BARS:

COORDINATE VERTICAL COLUMN REINFORCEMENT
WITH BOTTOM CAP REINFORCEMENT TO AVOID
INTERFERENCE. WITH BOTTOM CAP REINFORCEMENT TO AVOID
COORDINATE VERTICAL COLUMN REINFORCEMENT
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TOP DESIGN

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NOTE: STIRRUPS AND SIDE REINF. NOT SHOWN.

ARCHITECTURAL TREATMENT

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