GUIDELINES FOR PRECAST SUBSTRUCTURES USED IN ABC

These guidelines and guide details have been developed for the purpose of promoting a greater degree of uniformity among owners, engineers and industry with respect to the planning, designing, fabricating, and constructing of precast concrete substructure elements for bridges built with Accelerated Bridge Construction (ABC) methods.

WWW.PCINE.ORG

Precast/Prestressed Concrete Institute Northeast Covering New England and New York

The details shown are guidelines and should not be considered standards. The information has been obtained from sources believed to be reliable. PCI Northeast or its membership shall not be responsible for any errors, omissions or damages arising out of this information. PCI Northeast has published this work with the understanding that PCI Northeast is supplying information only. PCI Northeast is not rendering engineering or other professional services through this guideline. If such services are required, please seek an appropriate professional.

Report Number:
PCINE-22-GPSABC

By: Precast/Prestressed Concrete Institute Northeast

Guidelines for Precast Substructures used in ABC
1st Edition 2022
Issue Date: 05/13/2022

This document supersedes the PCI Northeast document entitled *"Guidelines for Accelerated Bridge Construction Using Precast/Prestressed Concrete Elements Including Guideline Details – Second Edition PCINER-14-ABC"*

The PCI Northeast Bridge Technical Committee	
The following list contains the members of the PCI Northeast Bridge Technical Committee	
Name	**Affiliation**
Rita Seraderian *	PCI Northeast
Michael Culmo *	CHA Consulting, Inc.
Raymond Basar	Connecticut DOT
Bryan Reed	Connecticut DOT (Ret.)
Richard Myers	Maine DOT
Taylor Clark	Maine DOT
Alex Bardow	Mass. DOT
Edmund Newton *	Mass. DOT (Ret.)
Michael Merlis	Mass. DOT
David Scott	New Hampshire DOT
Jason Tremblay *	New Hampshire DOT
Duane Carpenter	NYSDOT
Scott Lagace	NYSDOT
Ramiz Turan	NYSDOT
Adrienne LiBritz-Cooley	NYSDOT
Stephen Coley	VTRANS
Rob Young *	VTRANS
Scott Harrigan *	The Fort Miller Co., Inc
Joe Carrara	J. P. Carrara & Sons
Troy Jenkins	Northeast Prestressed Products
Bruce Miller	Unistress Corp.
James Cutler	Unistress Corp.
Chris Moore	United Concrete Precast
Bill Augustus	United Concrete Precast
Eric Calderwood	Calderwood Engineering
John Byatt	BETA Group
Ben Cota	GCP Applied Tech
Joseph Gill	Gill Engineering
Darren Conboy *	Jacobs Engineering
Ed Barwicki	Lin Associates
Sergio Brena	University of Mass.

Notes:
1. Asterisk denotes member of a special ABC sub-committee that developed this document
2. Blue text represents hyperlinks to detail sheets

INDEX OF DETAIL SHEETS

Guidelines for Precast Substructures used in ABC

Introduction

This guide is a replacement for the previously published *Guidelines for Accelerated Bridge Construction* developed by the PCI Northeast Bridge Technical Committee (2014). Previous editions of that document included general information on Accelerated Bridge Construction (ABC) including the use of full-depth precast concrete deck panels. In recent years, there has been a significant amount of publication of ABC related information including the *2018 AASHTO LRFD Guide Specifications for ABC*. Based on this, a significant reduction in information in this document was in order to avoid conflicting information. This document focuses on recommended guide details for precast substructure elements. These guideline drawings represent typical details for the design and detailing of precast concrete substructures. The details presented provide an example of the drafting layout of typical precast concrete substructures. Several different substructure types are shown. The details cover a majority of the substructures used in the Northeast. Details and reinforcement shown are schematic. The designer should design and detail each substructure according to the specific requirements of each bridge.

Pertinent information from the previous PCI Northeast *Guidelines for Accelerated Bridge Construction (2014)* are included below.

The use of precast elements such as abutments, pier caps, pier columns, and precast footings can effectively minimize construction time, traffic disruption, and the impact of construction activities on the environment. Details have been revised and developed for the various substructure elements that represent the technologies that are covered in *2018 AASHTO LRFD Guide Specifications for ABC*. **This guide is not intended as a stand-alone document and does not supersede the AASHTO specifications.**

Designer Responsibilities

It is the designer's responsibility to:

- Design and detail all substructure elements, including but not limited to, components such as piers, abutments, footings and foundations.
- Design precast concrete substructure elements in accordance with the latest edition of the *AASHTO LRFD Bridge Design Specifications* and the *AASHTO LRFD Guide Specifications for Accelerated Bridge Construction.*
- Design and check the substructure elements for all anticipated loads.
- Detail dimensions of all elements including internal reinforcing.
- Specify and detail tolerances for both fabrication and installation of all elements. See tolerance notes and details.
- Calculate elevations of top of all precast elements. Elevations to be included on all details.
- Determine the geotechnical requirements of the site and place the applicable information on the plans.
- Place applicable general notes on the plan set.
- Show the estimated weight of each element on the plans.

Special Notes to Designers

This document depicts schematic reinforcement details. These details have been simplified for clarity by representing reinforcing as a single line. When developing specific project design details, it is important for the designer to detail all embedded items and reinforcing using actual bar diameters (including deformations), actual bend diameters, and tails used in development hooks. This will help identify conflicts during the design process. The reinforcement depicted is not guaranteed. The final design of each element may require additional reinforcing bars and different bar layouts.

Geometric Configurations

It is preferable to have angles between abutment and wingwalls that are in-line or 90 degrees, although odd angles can be accommodated. The designer should detail elements sizes to promote repetition of forming with consideration given to transportation, fabrication, and construction. Footing widths may be detailed such that there are common dimensions on each bridge project. For instance, on a particular bridge, all footings for wingwalls that are of approximately equal height could be kept identical (dimensions and reinforcing). The economies of repetition may outweigh the perceived benefits of individually sized elements.

Battered elements should be avoided. Batters on abutment and wing stems should be eliminated and the overall thickness of the stems should be minimized to reduce the overall weight of the element. Wall type elements typically are cast horizontally as slabs.

Tolerances

Designers should specify and account for tolerances in layout of elements and in the width of joints. Designers should specify tolerances for precast elements including fabrication tolerances, erection tolerances (both horizontal and vertical), pile driving tolerances (if applicable), and joint width tolerances. The specified width of joints should be based on the specified tolerances. A recommended guideline for specifying tolerances is *Proposed Guidelines for Prefabricated Bridge Elements and Systems Tolerances*, published under NCHRP Project 12-98. This guideline is available at the PCI Northeast website (www.pcine.org). These guide details include examples of tolerance detailing based on this document.

Recommended element fabrication tolerances are shown on Sheets SUB 15 and SUB 16. These are based on industry practice and should only be reduced after consultation with fabricators. If precast elements are to be connected to cast-in-place concrete, coordinate tolerances between shop and field personnel.

Recommended element erection tolerances are shown on various details within these guide details. Horizontal erection tolerances are always based on measurements from a common working point or line. Erection of elements based on center to center spacing should not be used as this could lead to build up of tolerances.

Recommended joint width tolerances are shown on various details within these guide details. The width of joints between elements are a function of element tolerances, erection tolerances, and placement of fill materials. The width of joints shown in these guide details should not be reduced without careful consideration of tolerances. If narrower joints are desired, smaller tolerances would need to be specified for element tolerances and erection tolerances (Refer to *Proposed Guidelines for Prefabricated Bridge Elements and Systems Tolerances* listed in the reference section of this document for guidance on specifying joint width tolerances based on specified tolerances). Note that smaller tolerances will lead to higher costs.

Vertical erection tolerances should be measured during erection at the top of each element as shown on the guide details. Horizontal joints are provided to accommodate element height tolerances during erection.

Shipping and Handling

The size of precast elements should be determined with consideration of shipping restrictions, equipment availability, and site constraints. In general, the maximum weight of precast substructure elements weighing on the order of 30 tons should be anticipated. In special cases, very large pieces can be detailed; however, the shipping, handling, and installation costs should be considered. It is possible to ship pieces in excess of 30 tons; however, the equipment required, and the limitation of local bridge load postings may restrict this. Off-loading of pieces can also be problematic. Larger pieces may be feasible if the pieces can be fabricated in close proximity to the bridge and shipped a short distance.

The designer should consider each state's requirement for allowable shipping widths and lengths. The following are general recommendations for maximum sizes of elements (including any projecting reinforcing):

- Width: 12 feet
- Height: 10 feet
- Length: 120 feet

The maximum dimensions noted are chosen to avoid cost premiums typically associated with shipping of large elements over the road. Precast elements shall be checked for stresses induced during handling and shipping. The design for handling is the responsibility of the fabricator (or contractor). The *AASHTO LRFD Guide Specifications for Accelerated Bridge Construction* contains recommended provisions for shipping and handling calculations.

Guidelines for Precast Substructures used in ABC

Special Materials and Devices

The details contained herein show common precast concrete elements. Some of the details show materials and products that may not be typically found in precast bridge elements. The following is a list of special materials and devices that are shown in these guide details:

- Corrugated Metal Pipe (CMP) Voids: Research has shown that standard galvanized CMP drainage pipes can be used to form voids within precast elements. These voids can be used to make connections between elements and to reduce the weight of the elements.
- Grouted Splice Couplers: These devices can be used to connect reinforcing steel bars. They are mechanical devices that meet the requirements of mechanical connectors as defined in the *AASHTO LRFD Guide Specifications for Accelerated Bridge Construction*. These devices are proprietary; however, they are available from multiple manufacturers.
- Leveling Devices: These are devices that are fabricated to allow for fast and accurate adjustment of the vertical elevation of elements. They are typically designed by the fabricator as part of the element lifting and placement hardware. The details depict one type of device. Alternate devices should also be allowed in the project specifications.
- Non-Compressible Shims: Several details depict the use of non-compressible shims between precast elements. The Contractor should be given leeway to select an appropriate material; however, steel shims should be avoided as there is potential for the shims to concentrate forces under the shims due to the relative stiffness of the shim versus the adjacent grout. There are specialty multipolymer shim products in the precast industry that are formulated for this purpose and are acceptable and recommended for this application.

Construction on Bedrock

A more extensive soils boring program should precede construction of precast footings so that the degree of variation of top of rock elevations can be assessed prior to construction. The uneven nature of construction of footings on bedrock may require preparation of the site prior to installation of precast footings. Over-blasting of rock by approximately 12" to provide room to prepare for a level work area is recommended. This will facilitate the installation of flowable fill or lean concrete under the footings. Designers should consider the use of cast-in-place concrete footings for footings founded on bedrock.

Construction on Soil

Prior to construction on soil, the area must be excavated and prepared as in conventional cast-in-place construction. Once the area is prepared, there are two recommended methods for preparing the area for installation of precast footings. The first is to pour a low-strength concrete sub-footing to a level that is just below the proposed bottom of footing elevation. The second method is to provide small level areas under the proposed leveling devices or shims. Temporary load distribution plates will be required under the leveling devices or shims when a sub-footing is not used in order to spread the loads to the soil. This method is more cost effective; therefore, it should be considered for most situations.

Construction on Piles

The use of precast footings (or pile caps) can be difficult. Typical pile driving tolerances lead to oversized voids for pile connections. It is recommended that cast-in-place concrete footings and pile caps be used for footings on pile foundations. These guidelines contain several options for footings on pile foundations.

Precast integral abutment stems are recommended. The typical width of integral abutment stems can often include larger voids that can accommodate pile driving tolerances. The size of the void should be based on driving tolerances. These guide details include recommended void sizes for different driving tolerances (See Sheet SUB 16).

Grade Control for Precast Footings

Leveling devices are critical in maintaining proper vertical grade control on precast concrete substructures. Embedded leveling devices can be used to allow for adjustment of the footing grade and elevation during installation. A minimum of four leveling devices should be specified for each spread footing element. Each device should be designed to support half the self-weight of the footing element. Experience has shown that these leveling devices provide fast and easy grade adjustment; however, it comes at a cost. Leveling shims can be used; however, the elevation of the non-compressible shim packs should be carefully established in order to erect the footings within the specified erection tolerance.

Concrete and Grout Notes

Precast concrete:

In general, designers should specify concrete with a minimum compressive strength of 5000 psi. The mix design of the precast concrete should normally be developed by the precast fabricator and approved by the owner.

Site cast concrete and grout:

The designer shall specify the minimum concrete properties for the final construction (strength, cure time, etc.). The engineer responsible for the assembly plan shall specify the required concrete strengths for various stages of the assembly based on calculations developed for the assembly plan. For example: the assembly plans could specify a concrete strength in a closure pour of 2 ksi for a certain stage of construction, provided that the concrete gains the full design strength prior to opening the bridge to traffic.

Recommendations for site cast concrete mixes:

Most states have standard concrete mixes for bridge construction using conventional construction. Accelerated bridge construction projects often require concrete that can gain strength and cure in a rapid manner. Material performance specifications are recommended in lieu of rigid prescriptive specifications. The following concrete strength parameters are suggested for use on prefabricated bridge projects.

- Very early strength concrete: Concrete that will attain the design strength in less than 12 hours
- Early strength concrete: Concrete that will gain the design strength in less than 24 hours
- Conventional concrete: Concrete that will gain the design strength in 7* to 28 days (* Agencies have found that their standard conventional bridge deck concretes can reach a typical strength of 4 ksi in as little as 7 days.)

Shrinkage of early strength concrete can lead to cracking. For this reason, shrinkage compensating admixtures should be considered. Liquid admixtures should be used in lieu of expansive metallic powders.

It is recommended that the states work with local ready-mix producers to develop acceptable mix designs that can meet the required parameters. Ideally, these mixes should be developed prior to bidding an accelerated bridge construction project.

Controlled density fill (flowable fill):

Controlled density fill can be used to fill voids that are not subjected to high unit stresses and are not reinforced. The strength of controlled density fill is often less than non-shrink grout: however, the required strength under a footing is typically well within the limits of common controlled density fills, as most spread footings exert pressures that are less than 100 psi. This will normally include areas that are used to seat footings and slabs. Typical areas include voids under footings and approach slabs. Controlled density fills have relatively slow set times. Use grout to fill voids if fast set times are required. Designers should verify the acceptability of the use of flowable fills with the owner.

Grout:

Grout should only be used for small void grouting. The required strength of the grout should be determined and specified by the design engineer. Normally the design strength is the same strength as the surrounding concrete.

Flowable grout should be specified in areas that require significant horizontal flow of the grout in order to fill the void. This would normally include horizontal joints between vertical elements. For complex voids, the engineer may specify a test mock-up grout pour prior to the actual construction. The mock-up should be similar to the final configuration. The contractor should be required to demonstrate that the grout can be placed without voids. This can be proven by dismantling of the mock-up after grout curing.

Joints and Connections between Elements

Joints fall under two categories. The first category is structural connections that transmit moment, axial, or shear forces between elements. The second category is non-structural connections that may be used for thermal movements or to separate discrete portions of the structure (e.g., abutment to wingwall joint). This guide contains multiple details for different joints and connections between various precast elements. In most cases, several options are provided.

Surfaces of joints should be specified to have an exposed aggregate finish. This is achieved through the use of retarders applied to the forms and/or water blasting after stripping. A specific profile amplitude need not be specified. If the designer prefers to specify an amplitude, it should be specified as 1/8".

Vertical Joints

A flowable, cementitious grout should be used for vertical joints. It should be introduced at the top of the joint, filling it from bottom to top. Designers should specify the use of rigid formwork for the joints and rodding of grout during installation to minimize voids as a significant hydraulic head will be created due to the typical height of the joints being filled. Backer rods placed at the edges of the enclosed vertical joint as a dam against the fluid grout will not be adequate in restraining the grout due to the fluid pressure. It is recommended that such a joint be restrained with formwork in most cases.

If shear transfer is not required, consider filling this joint with expanding foam sealant or other fillers. This treatment may be considered adequate if the joint is deemed non-structural. The expanding foam keeps the joint free of foreign material. Pre-applied rigid joint filler materials are not recommended. Inserting rigid fillers after assembly is also not recommended. Experience has shown that tolerance between the elements will be compromised with the use of rigid fillers. Installation of rigid fillers after assembly is nearly impossible and results in a poor quality joint. Note that non-structural joints are not shown in the enclosed details.

Design of Connections

The design of connections shall be in accordance with the *AASHTO LRFD Guide Specifications for Accelerated Bridge Construction*. The design provisions for the connections shown in these guide details are covered in this AASHTO Specification. Seismic connections are included in these guide details. Refer to the *AASHTO LRFD Guide Specifications for Accelerated Bridge Construction* for special design requirements for seismic applications. Several of these connections require additional reinforcement within the precast element to achieve the proper seismic performance. It is acceptable to use seismic details in non-seismic regions.

Construction Specifications

The previous versions of these guide details included significant construction specifications and recommendations. The AASHTO LRFD Guide Specifications for Accelerated Bridge Construction now contains similar provisions and more; therefore, they should be used for the development of construction specifications for precast elements.

Repair of Non-conformances and Damage during Fabrication and Shipping

As with any manufacturing process, non-conformances and damage can occur in precast concrete bridge products. Examples may include voids, cracks, as well as missing, improperly located, or damaged reinforcement and hardware. The repairs of non-conformances and damage should be in accordance with the document entitled *Guidelines for Resolution of Non-Conformances in Precast Concrete Bridge Elements (Report No: PCINE-18-RNPCBE)* and can be found at www.pcine.org.

References:

The following references should be used for the development of designs, details, and construction specifications for precast bridge elements. Edition numbers are not included in this list. Designers should use the latest edition of these documents unless the owner places specific limitations on usage of editions.

1. *AASHTO LRFD Bridge Design Specifications*, American Association of State Highway and Transportation Officials.
2. *AASHTO LRFD Guide Specifications for Accelerated Bridge Construction*, American Association of State Highway and Transportation Officials.
3. PCI Documents (located at www.pci.org)
    a. *PCI Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products*, PCI MNL-116. Precast/Prestressed Concrete Institute, Chicago, IL.
    b. *Bridge Design Manual*, PCI MNL-133. Precast/Prestressed Concrete Institute, Chicago, IL.
    c. *PCI Design Handbook Precast and Prestressed Concrete*, The Precast Prestressed Concrete Institute, Chicago, IL
    d. *Erection Safety for Precast and Prestressed Concrete*, PCI MNL-132, Precast/Prestressed Concrete Institute, Chicago, IL.
    e. *Erectors Manual—Standard and Guidelines for the Erection of Precast Concrete Products*, PCI MNL-127, Precast/Prestressed Concrete Institute, Chicago, IL.
4. PCI Northeast Documents (located at www.pcine.org)
    a. *Guidelines for Resolution of Non-Conformances in Precast Concrete Bridge Elements,* (Report No: PCINE-18-RNPCBE)
5. FHWA Manuals and Guidelines
    a. *Accelerated Bridge Construction - Experience in Design, Fabrication and Erection of Prefabricated Bridge Elements and Systems,* (FHWA-HIF-12-013), U.S. Department of Transportation, Federal Highway Administration, November 2011.
    b. *Engineering Design, Fabrication and Erection of Prefabricated Bridge Elements and Systems*, (FHWA-HIF-17-019), U.S. Department of Transportation, Federal Highway Administration, November 2013.
    c. *Contracting and Construction of ABC Projects with Prefabricated Bridge Elements and Systems*, (FHWA-HIF-17-020), U.S. Department of Transportation, Federal Highway Administration, November 2013.
6. NCHRP Project 12-98, *Proposed Guidelines for Prefabricated Bridge Elements and Systems Tolerances,* (available at www.pcine.org), National Cooperative Highway Research Program, Washington, D.C.

Usage of this Document:

The following page contains a usage table for each detail contained herein. The table includes the following:

- The connection detail title and sheet location where connection details reside
- Sheet reference where the connection details are recommended for use
- Advantages of each connection detail
- Design/Construction Considerations for each connection detail

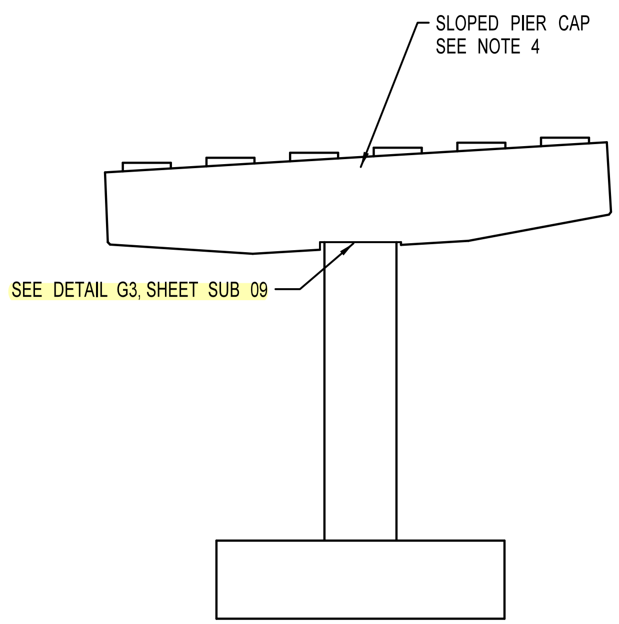
The table contains hyperlinks that will bring users to the referenced sheet. Each detail sheet also contains a hyperlink that will return the users back to the table.

Guidelines for Precast Substructures used in ABC

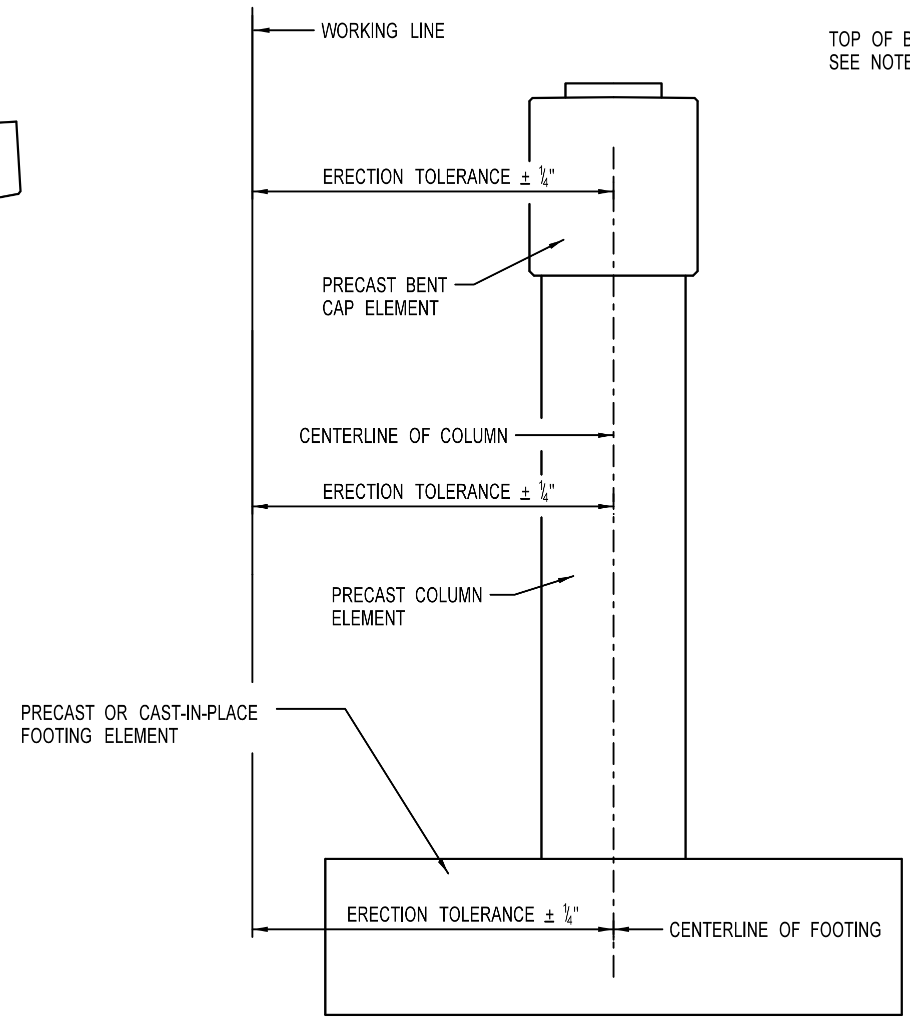
There are options for each connection depicted in these guide details. The designer should choose connection details that are appropriate for the bridge being designed and approved by the owner. It is recommended that the number of different connections in a project be minimized in order to simplify the fabrication and construction. The following table outlines the advantages and disadvantages of each connection to aid in the selection of details.

Detail Title (sheet #)	Detail Usage Reference (sheet #)	Advantages	Design/Construction Considerations
G1 Grouted Coupler Connection Precast Column or Wall Panel to Footing (08)	(01) (02) (03) (04) (05) (06)	• Placement of couplers is outside the potential plastic hinge zone • Coupler can be pre-grouted just prior to placement of the upper element • Upper element bars can be placed closer to the column face	• Potential for debris to get into coupler during construction (will require covers and cleaning prior to placement of upper element) • Upper element will have projecting bars that may get damaged during handling
G2 Grouted Coupler Connection Precast Column or Wall Panel to Footing (08)	(01) (02) (03) (05) (06)	• Less chance of debris getting into the coupler during construction • Upper element is easier to handle without projecting bars	• Grout must be pumped into coupler after placement of upper element • Upper element bars need to be placed deeper into the section to provide cover over the couplers
G3 Grouted Coupler Connection Column to Bent Cap (09)	(01) (02) (03) (05)	• Same as G2	• Same as G2
P1 Pocket Connection Column to Bent Cap (10)	(01) (02) (03) (05)	• Simple connection made with conventional concrete • Placement of concrete is easy • Can accommodate significant tolerances • Can be used in seismic regions	• Layout of bars in cap and column need to be carefully coordinated to avoid conflicts during erection • Temporary support of cap may require temporary supports and braces
P2 Pocket Connection Wall Panel to Cap (11)	(03) (05)	• Simple connection made with conventional concrete • Can accommodate significant tolerances	• Ports required to place concrete
P3 Pocket Connection Column to Bent Cap Connection Using Post-Tensioning (PT) Duct Pockets (11)	(01) (02) (03) (05)	• Simple connection made with either conventional concrete or grout • Placement of fill concrete is easy • Can accommodate larger tolerances when compared to grouted coupler connections • Can be used in seismic regions	• Requires smaller tolerance when compared to connection P2 • PT ducts may interfere with layout of cap reinforcement. Special detailing may be required.
P4 Pocket Connection Cast-In-Place Footing to Precast Column or Wall Panel (12)	(01) (02) (03) (05) (06)	• Simple connection made with conventional concrete • Can accommodate significant tolerances • Good for pile-supported footings • Can be used in seismic regions • Bottom mats of reinforcement can be placed prior to erection of upper element	• Requires temporary support and bracing • Top mats of footing reinforcement cannot be placed until after the upper element is erected
P5 Pocket Connection Footing to Wall Panel (12)	(03) (05) (06)	• Simple connection made with conventional concrete • Can be used in seismic regions • Can accommodate significant tolerances • Can be less expensive than grouted coupler connections	• Layout of projecting footing bars needs to be coordinated with wall panels • Requires temporary bracing of wall panel • Size of voids may require wider wall panels • Clusters of projecting bars from footing are not as efficient as grouted coupler bars, which may limit height of wall.
S1 Socket Connection Cast-In-Place Footing to Column (13)	(01) (02)	• Simple connection made with conventional concrete • Can be used in seismic regions • Can accommodate significant tolerances • Good for pile-supported footings • All footing reinforcement can be pre-tied and placed before erection of the column	• Requires temporary bracing of column • Requires special surface treatment of embedded portion of column
S2 Socket Connection Pile to Wall Panel (13)	(04) (06)	• Simple connection made with conventional concrete • Can be used in seismic regions • Backwall can be integral or a separate element	• Requires tighter pile installation tolerances in order to keep pipe size and stem width reasonable
K1 Key Connection Abutment and Wall Pier Stem Shear Key (14)	(03) (04) (05)	• Simple connection made with conventional concrete	• Forming required to retain concrete
K2 Key Connection Footing Key (14)	(03) (05)	• Same as K1	• Same as K1
K3 Key Connection Wall Key (14)	(04) (05) (06)	• Simple connection made with non-shrink grout	• Forming required to retain grout
RC1 Reinforced Closure Joint (07)	(02) (03) (04) (05)	• Can be used to create a flexurally continuous footing or other element	• Footing can be designed as individual footings for dead loads and continuous for live loads

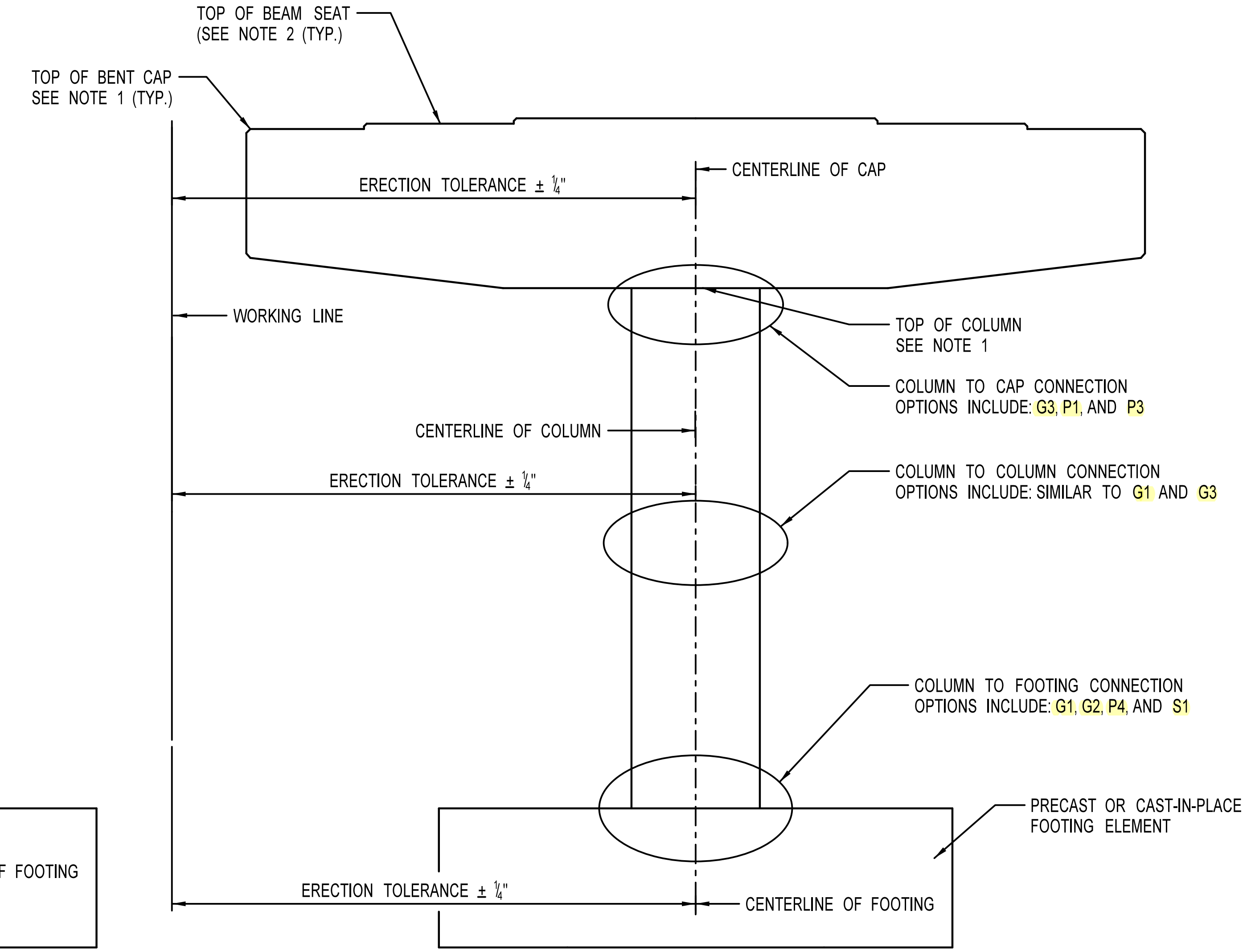
Note: Blue text represents hyperlinks to detail sheets



SCHEMATIC SLOPED
PIER CAP DETAIL



PRECAST SINGLE COLUMN BENT
SIDE VIEW

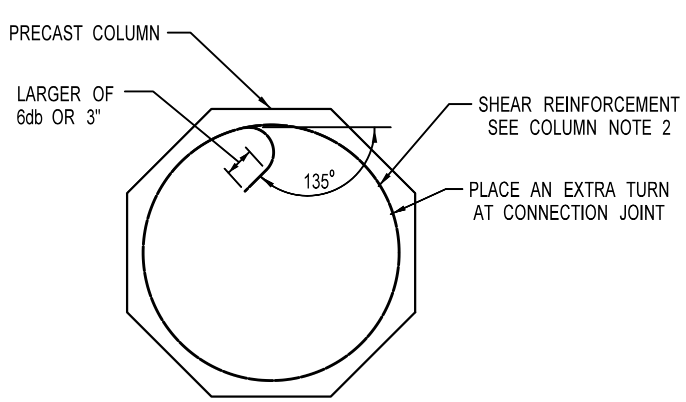


PRECAST SINGLE COLUMN BENT
ELEVATION

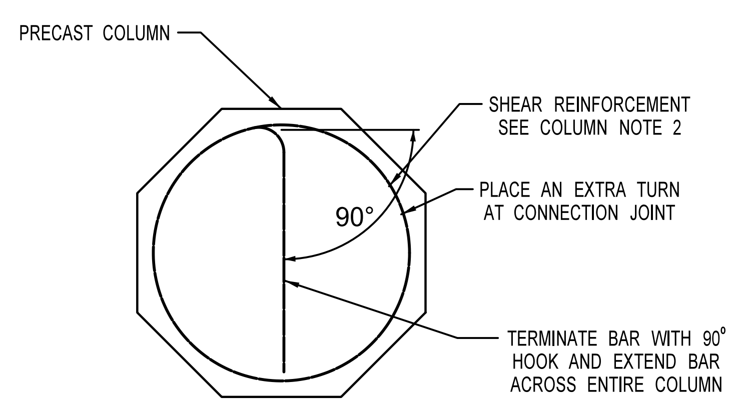
NOTE: PIER CAP DETAILS CAN BE MODIFIED TO MEET STATE STANDARDS

COLUMN NOTES

1. OCTAGONAL CROSS SECTIONS ARE PREFERRED DUE TO EASE OF FABRICATION. OTHER SECTIONS ARE ALLOWED.
2. SHEAR REINFORCEMENT USED FOR TRANSVERSE COLUMN CONFINEMENT REINFORCEMENT CONSISTS OF SPIRALS OR HOOPS.



OPTION 1



OPTION 2

COLUMN SPIRAL REINFORCEMENT
TERMINATION DETAIL AT JOINT
AASHTO LRFD SEISMIC GUIDE SPECIFICATIONS

NOTE: COLUMN VERTICAL REINFORCEMENT NOT SHOWN FOR CLARITY

NOTES

1. ERECTION TOLERANCE ON TOP OF ELEMENT ELEVATION ±1/4".
2. ERECTION TOLERANCE ON BEAM SEAT ELEVATION ±1/4". MAY BE SET HIGH AND GROUND TO SPECIFIED ELEVATION.
3. REINFORCEMENT NOT SHOWN FOR CLARITY.
4. A LEVEL PIER CAP IS PREFERRED TO REDUCE FABRICATION COSTS. SLOPED CAPS ARE PERMITTED AS SHOWN IN THE SCHEMATIC DETAIL.
5. FOOTING TO BE SET TO A LEVEL TOLERANCE OF ±¼" IN 4 FEET.
6. MULTIPLE CONNECTION OPTIONS ARE RECOMMENDED FOR EACH CONNECTION. SEE PAGE vi FOR DISCUSSION ON ADVANTAGES AND DESIGN/CONSTRUCTION CONSIDERATIONS FOR EACH CONNECTION.

Note: Highlighted notes represent hyperlinks

RETURN TO DETAIL USAGE TABLE

ISSUE DATE: 5/13/2022	SHEET SUB 01
SINGLE COLUMN BENT PIERS	

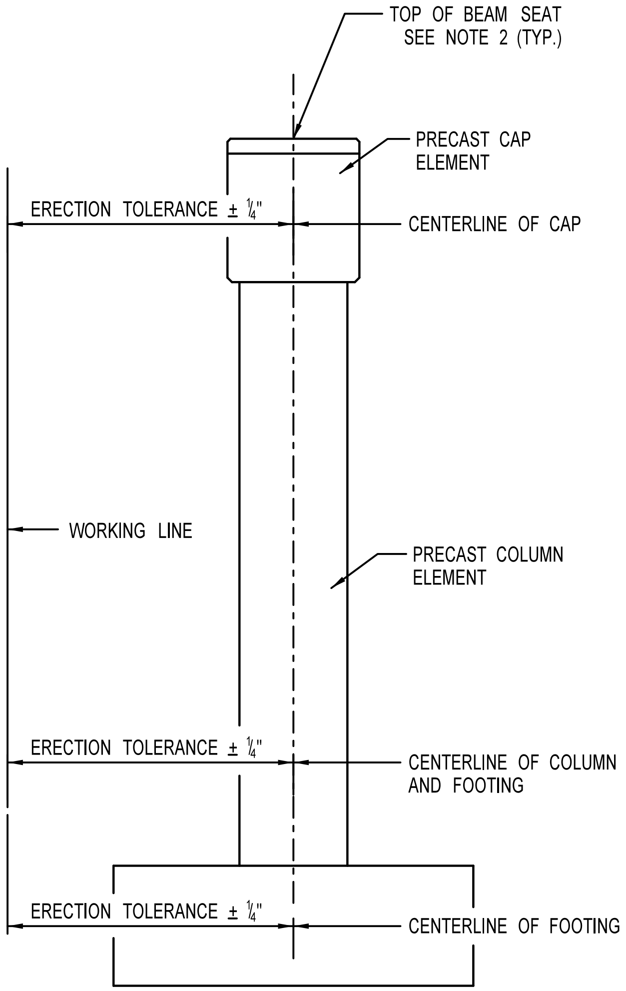
WWW.PCINE.ORG

PRECAST/PRESTRESSED CONCRETE INSTITUTE NORTHEAST

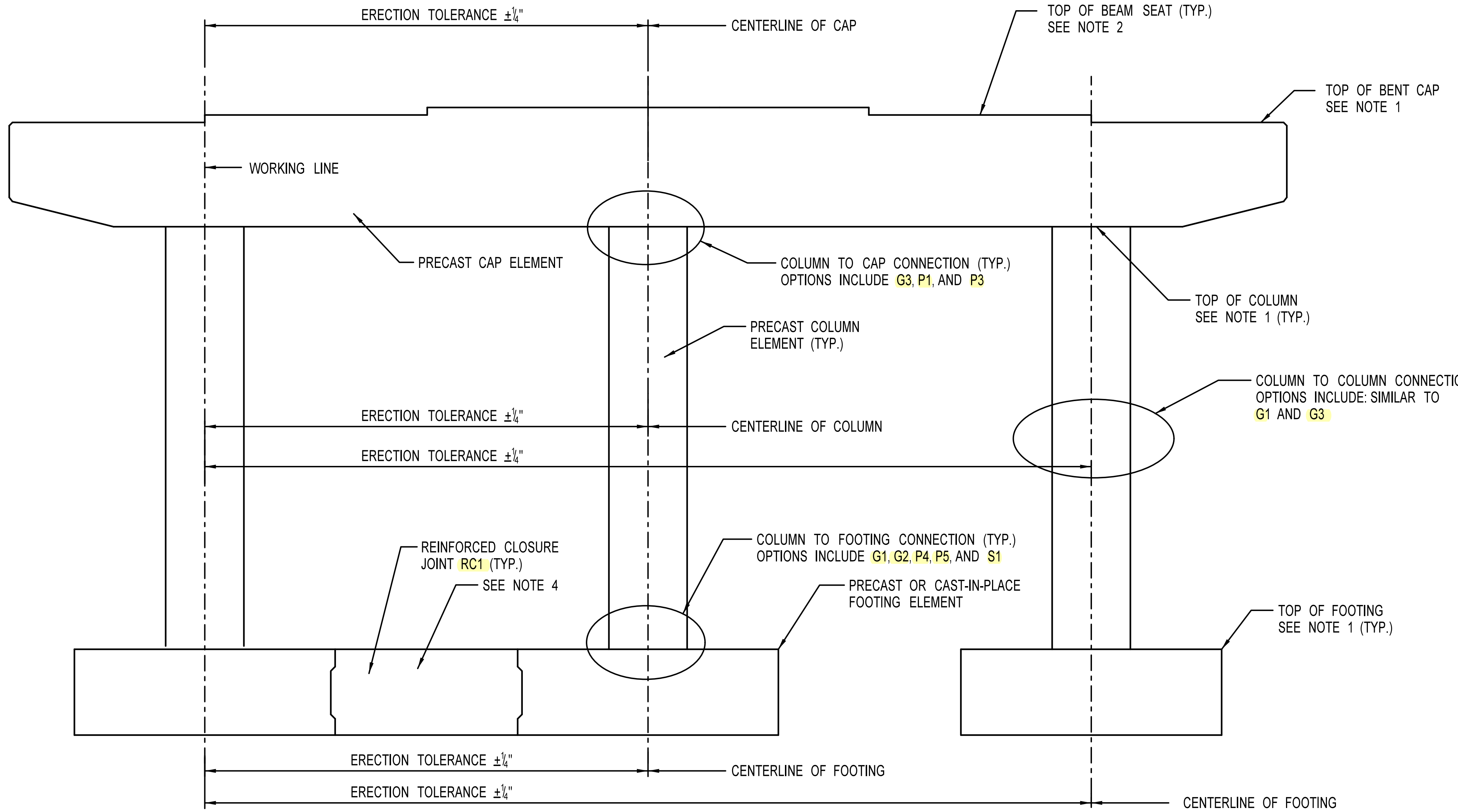
GUIDELINES FOR PRECAST SUBSTRUCTURES

REVISIONS

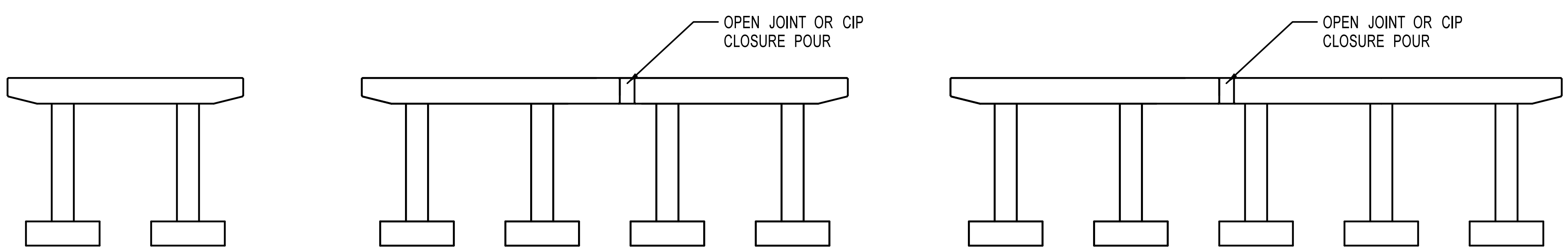
NO.	DATE	DESCRIPTION



PRECAST COLUMN BENT
SIDE VIEW



PRECAST MULTI-COLUMN BENT
ELEVATION



SCHEMATIC PIER BENT DETAILS

NOTES

1. ERECTION TOLERANCE ON TOP OF ELEMENT ELEVATION ±1/4"
2. ERECTION TOLERANCE ON BEAM SEAT ELEVATION ±1/4" MAY BE SET HIGH AND GROUND TO SPECIFIED ELEVATION
3. ERECTION TOLERANCE ON FOOTING ±1/4" IN 4 FEET
4. FOOTINGS MAY BE MADE CONTINUOUS BY EXTENDING REINFORCEMENT AND CASTING A CLOSURE POUR. SEE DETAILS, SHEET SUB 07.
5. CAST-IN-PLACE FOOTING EXTENSIONS CAN BE USED TO KEEP SIZE AND WEIGHT OF PRECAST FOOTING WITHIN THE RECOMMENDED MAXIMUM SIZE LIMITS.
6. IF FOOTING CLOSURE POURS ARE USED, THE PRECAST FOOTING SHOULD BE DESIGNED TO SUPPORT THE DEAD LOAD OF THE ENTIRE STRUCTURE. THE ENTIRE FOOTING SHOULD BE DESIGNED TO SUPPORT ALL LOADS.
7. A LEVEL PIER CAP IS PREFERRED TO REDUCE FABRICATION COSTS. SLOPED CAPS ARE PERMITTED. SEE DETAILS ON SHEET SUB 09.

Note: Highlighted notes represent hyperlinks

RETURN TO DETAIL USAGE TABLE

ISSUE DATE: 5/13/2022	SHEET SUB 02
MULTI-COLUMN BENT PIERS	

WWW.PCINE.ORG

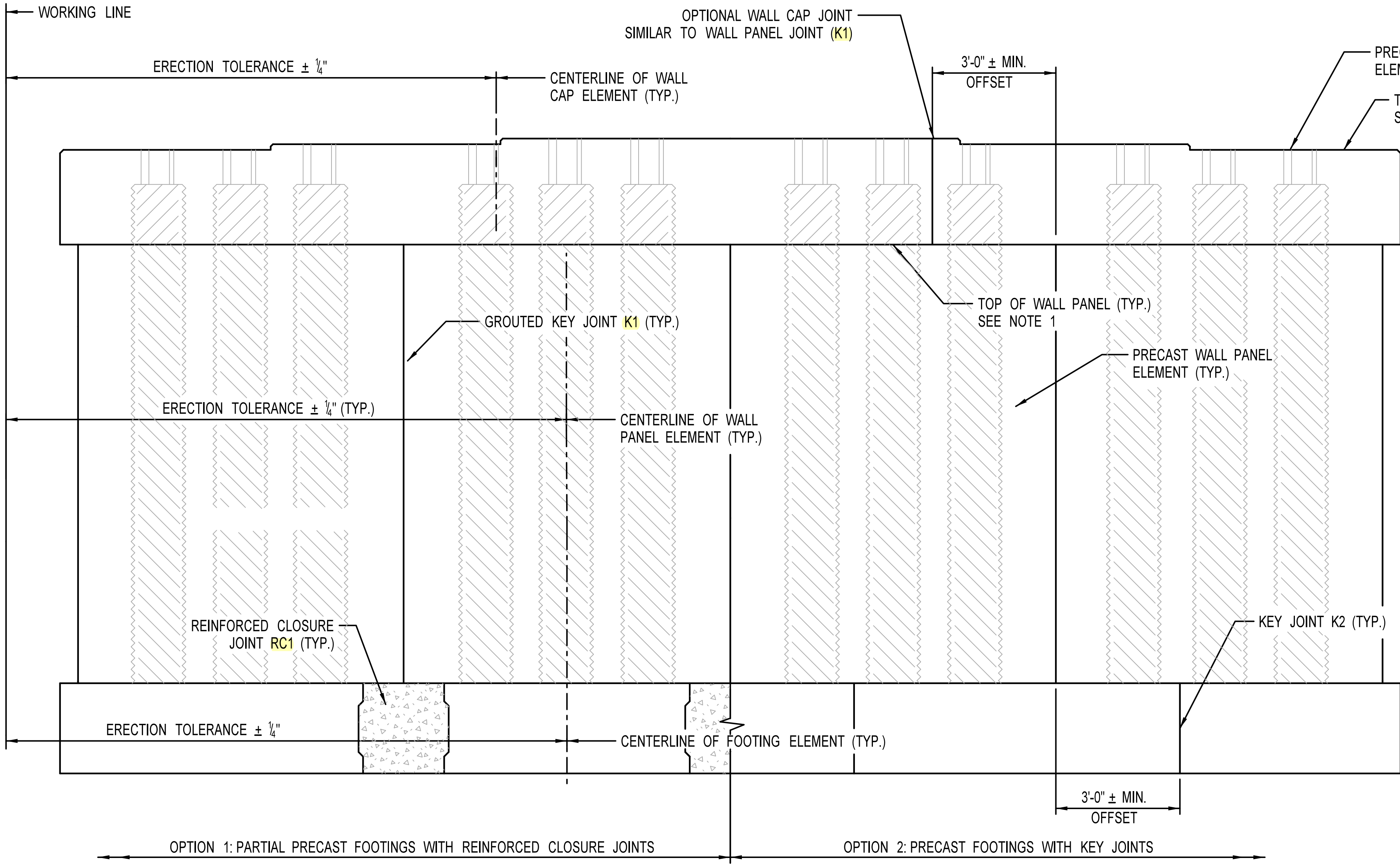
PCI®

PRECAST/PRESTRESSED CONCRETE INSTITUTE NORTHEAST

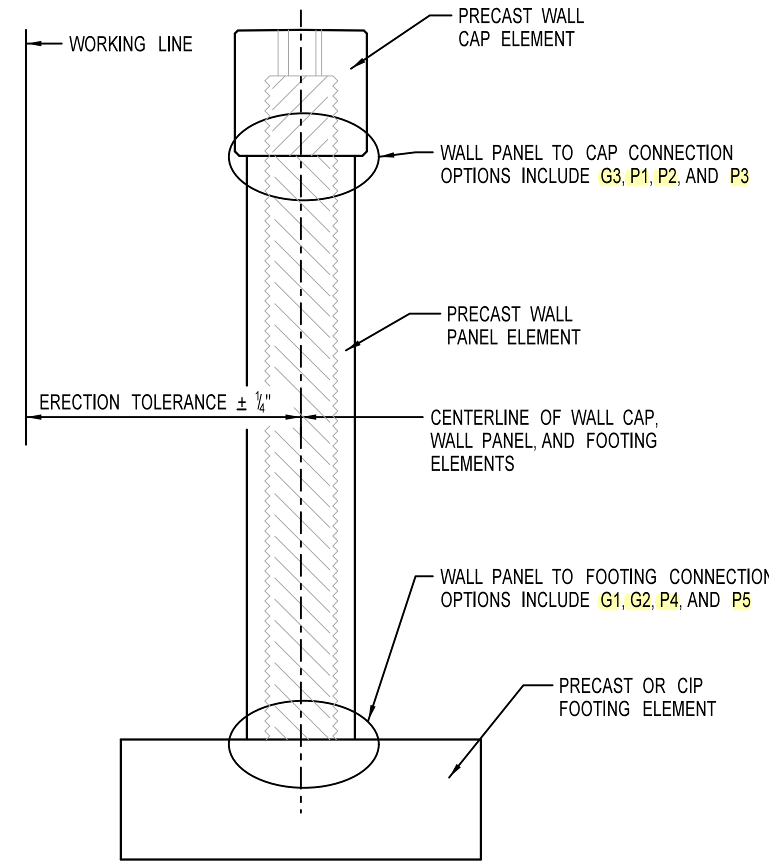
GUIDELINES FOR PRECAST SUBSTRUCTURES

REVISIONS

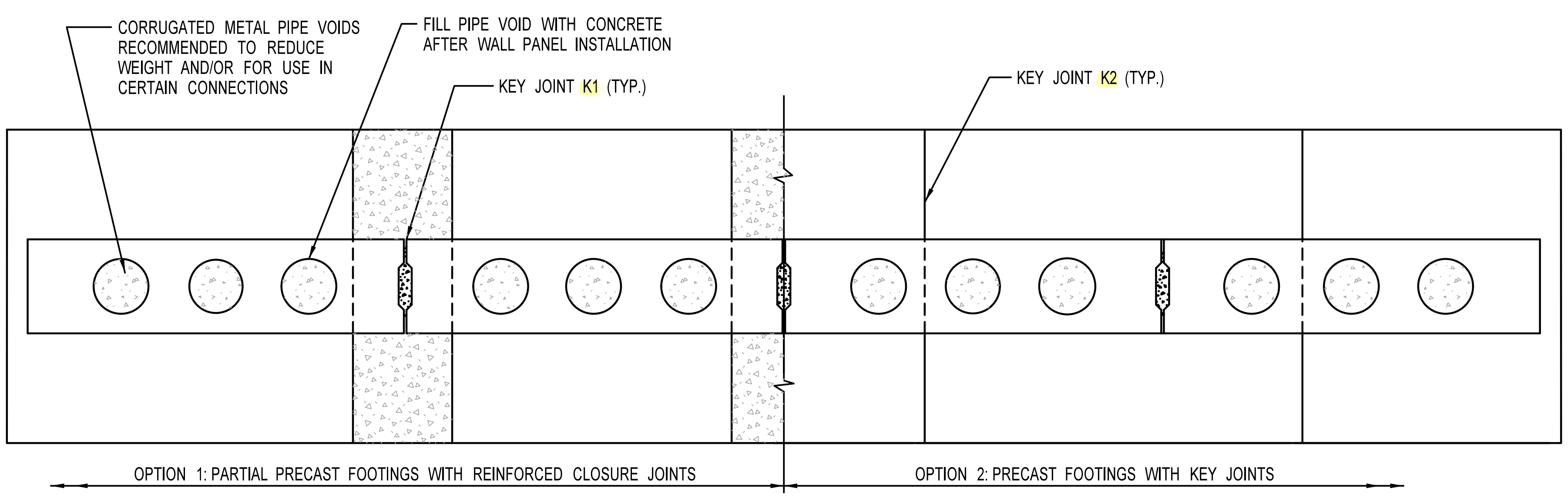
NO.	DATE	DESCRIPTION



PRECAST WALL PIER ELEVATION



PRECAST WALL PIER SIDE VIEW



PRECAST WALL PIER PLAN

NOTES

1. ERECTION TOLERANCE ON ELEVATION ±1/4" MEASURED AT THE CENTERLINE OF THE WALL PANEL.
2. ERECTION TOLERANCE ON BEAM SEAT ELEVATION ±1/4".
3. CAP AND WALL SHEAR REINFORCEMENT NOT SHOWN FOR CLARITY.
4. FOOTINGS CAN BE DETAILED WITH EITHER GROUTED KEYS OR CLOSURE JOINTS. IF CLOSURE JOINTS ARE USED, THE PRECAST FOOTING SHOULD BE DESIGNED TO SUPPORT THE DEAD LOAD OF THE ENTIRE STRUCTURE. THE ENTIRE FOOTING SHOULD BE DESIGNED TO SUPPORT ALL LOADS.

Note: Highlighted notes represent hyperlinks

RETURN TO DETAIL USAGE TABLE

ISSUE DATE: 5/13/2022

SHEET SUB 03

WALL PIERS

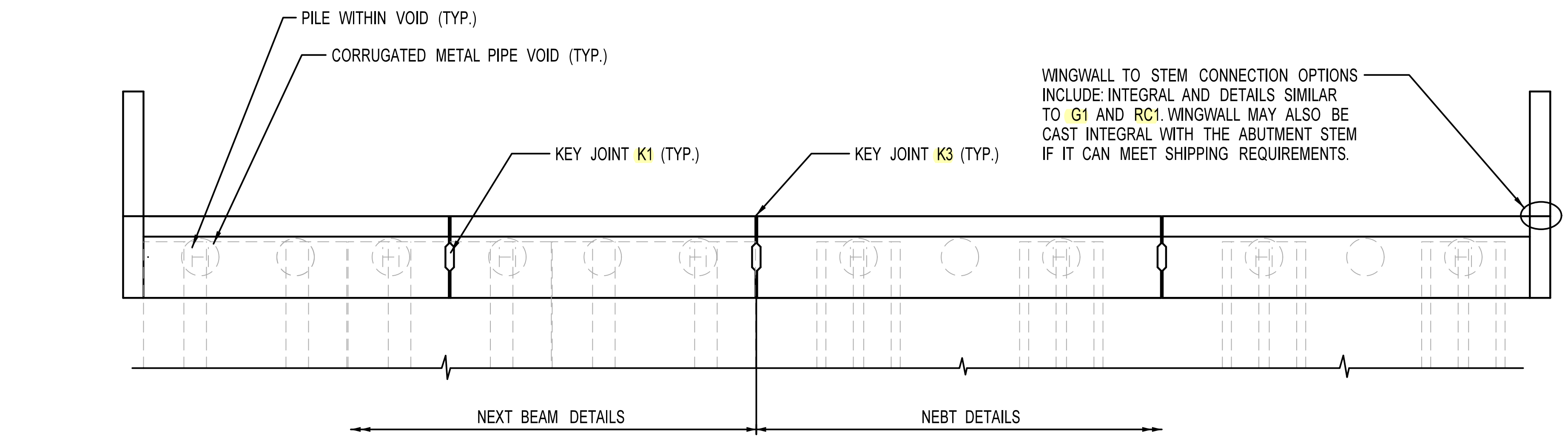
WWW.PCINE.ORG

PRECAST/PRESTRESSED CONCRETE INSTITUTE NORTHEAST

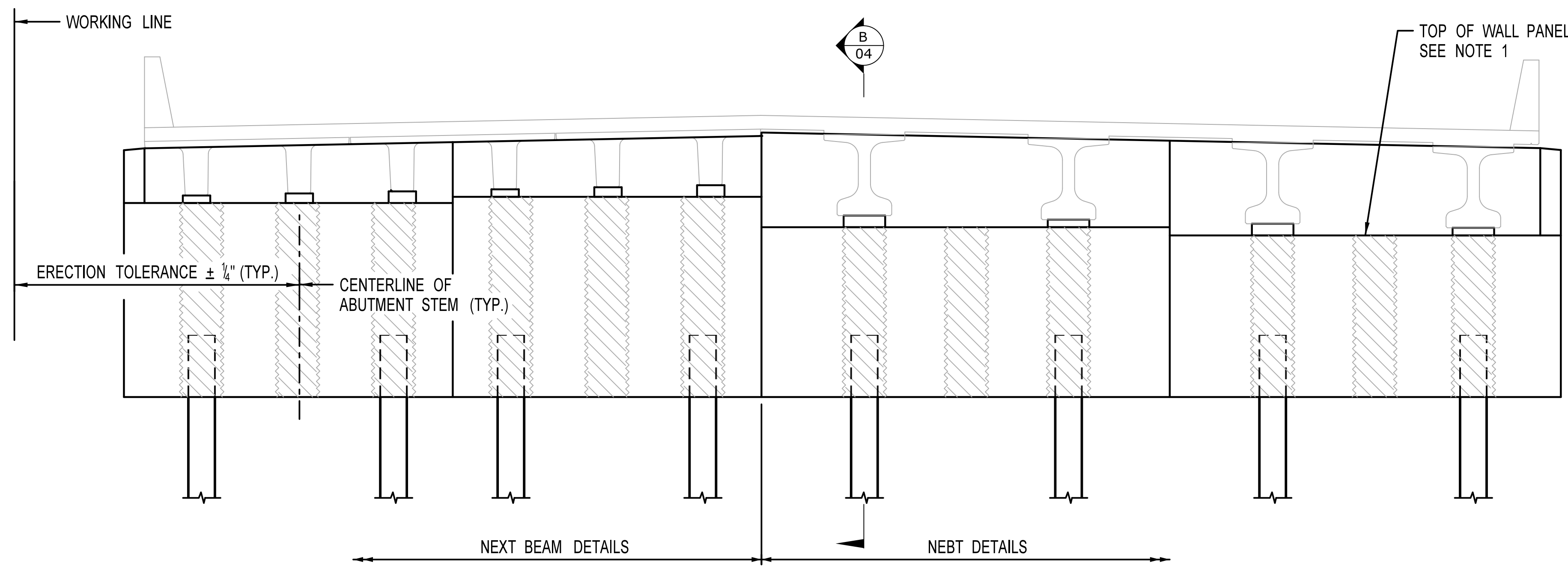
GUIDELINES FOR PRECAST SUBSTRUCTURES

REVISIONS

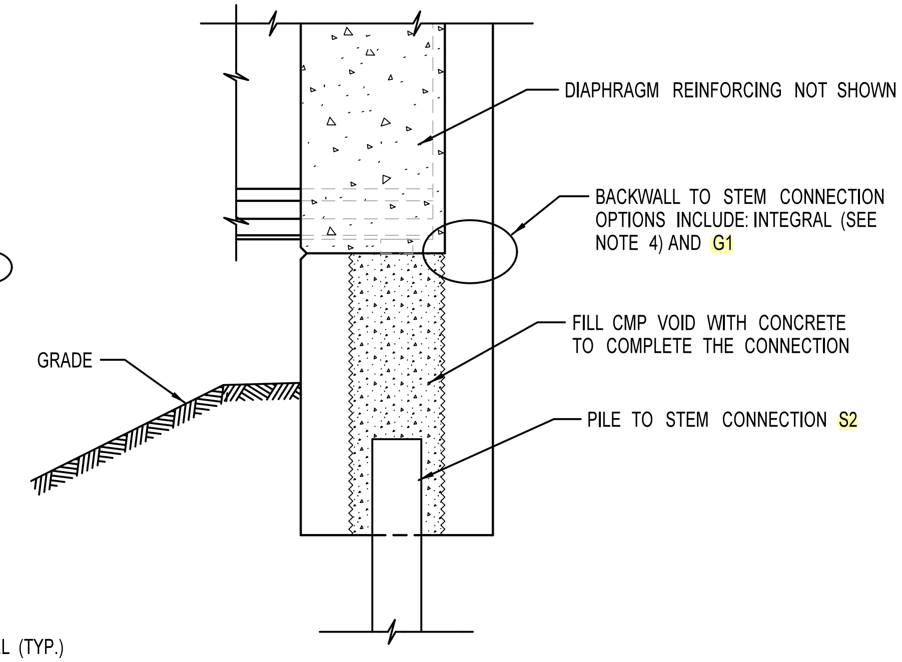
NO.	DATE	DESCRIPTION



PRECAST INTEGRAL ABUTMENT PLAN

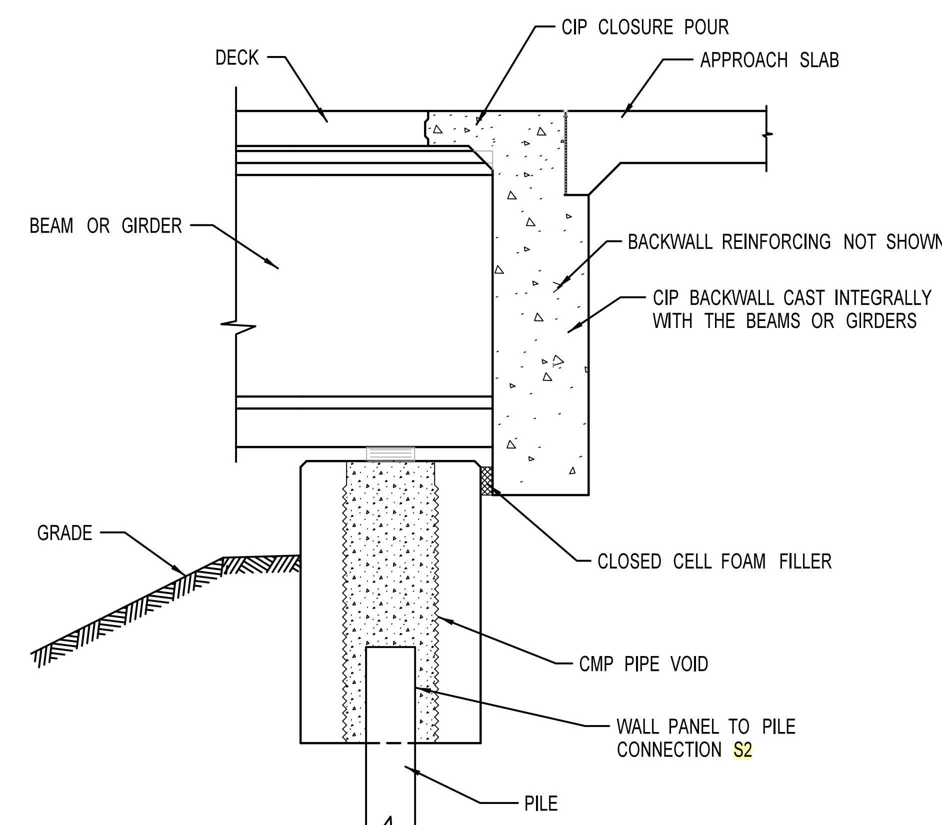


PRECAST INTEGRAL ABUTMENT ELEVATION



SECTION B: INTEGRAL ABUTMENT

NOTES:
1. THIS DETAIL IS BASED ON DETAILS FROM SEVERAL STATES.
2. ALL ABUTMENT REINFORCEMENT NOT SHOWN FOR CLARITY.
3. BACKWALL MAY BE PRECAST INTEGRALLY WITH THE ABUTMENT CAP.
4. INTEGRAL CONNECTION REFERS TO A PORTION OF AN ELEMENT CAST INTEGRAL WITH THE OTHER PORTION OF THE ELEMENT IN THE FABRICATION SHOP.



SECTION B: SEMI-INTEGRAL ABUTMENT

INTEGRAL ABUTMENT NOTES

1. ERECTION TOLERANCE ON ELEVATION ±1/4" MEASURED AT THE CENTERLINE OF THE WALL PANEL.
2. ERECTION TOLERANCE ON BEAM SEAT ELEVATION ±1/4".
3. TEMPORARY ABUTMENT DIAPHRAGMS NOT SHOWN FOR CLARITY. BACKWALL MAY BE USED AS THE END DIAPHRAGM FOR SEMI-INTEGRAL ABUTMENTS.
4. STEEL H-PILES SHOWN. OTHER PILE TYPE AND DRILLED SHAFTS MAY BE USED. DO NOT COMBINE DIFFERENT FOUNDATIONS ON ANY ONE SUBSTRUCTURE ELEMENT UNLESS REQUIRED BY DESIGN.
5. INTERMEDIATE VOIDS BETWEEN PILES MAY BE USED TO REDUCE WEIGHT OF STEM ELEMENTS.
6. PILE NOT REQUIRED UNDER EACH BEAM.
7. USE TWO PILES PER ABUTMENT CAP ELEMENT. IF THIS IS NOT POSSIBLE, CONSIDER CLOSURE POUR MOMENT CONNECTION RC1 BETWEEN SINGLE PILE CAP ELEMENT AND ADJACENT MULTI-PILE CAP ELEMENT.
8. IF VOIDS ARE FILLED WITH CONCRETE, THE DESIGN OF THE VOID CAN BE IGNORED IN THE DESIGN OF THE REINFORCING FOR THE STEM. DESIGN HORIZONTAL REINFORCING IN STEMS ASSUMING A PINNED JOINT AT THE VERTICAL SHEAR KEYS. VERTICAL BARS SHOULD BE USED AS THE MAIN REINFORCEMENT AND SHOULD BE DESIGNED TO RESIST THE SOIL PRESSURES BEHIND THE ABUTMENT STEM ASSUMING FIXITY AT THE STRUCTURE CONNECTION.

Note: Highlighted notes represent hyperlinks

RETURN TO DETAIL USAGE TABLE

ISSUE DATE: 5/13/2022	SHEET SUB 04
INTEGRAL/SEMI-INTEGRAL ABUTMENTS	

WWW.PCINE.ORG

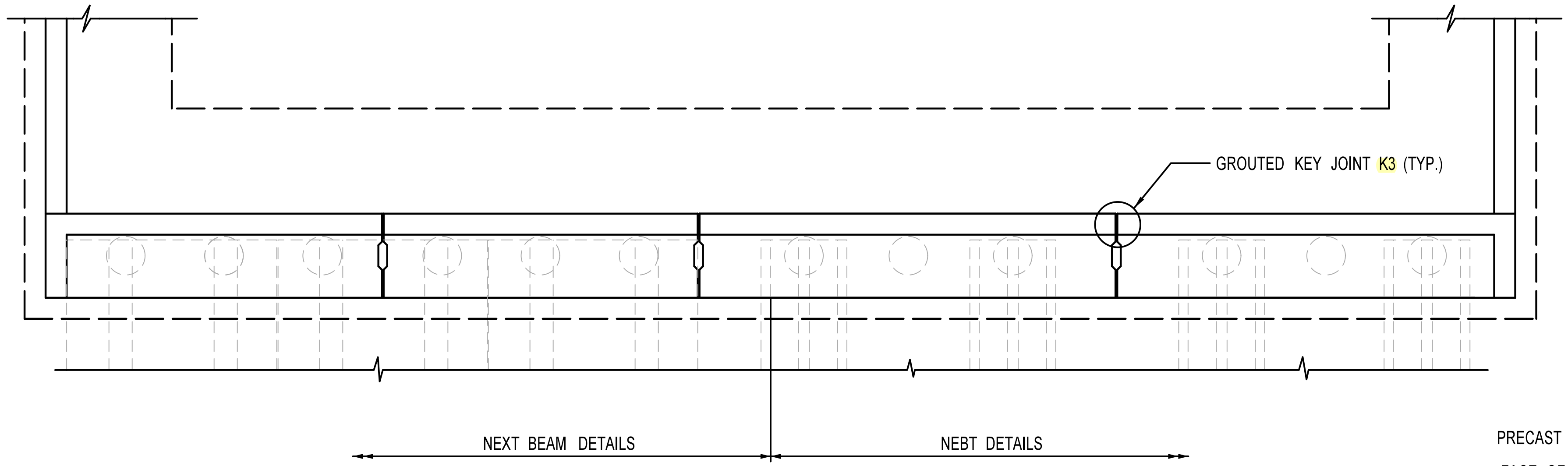
PCI®

PRECAST/PRESTRESSED CONCRETE INSTITUTE NORTHEAST

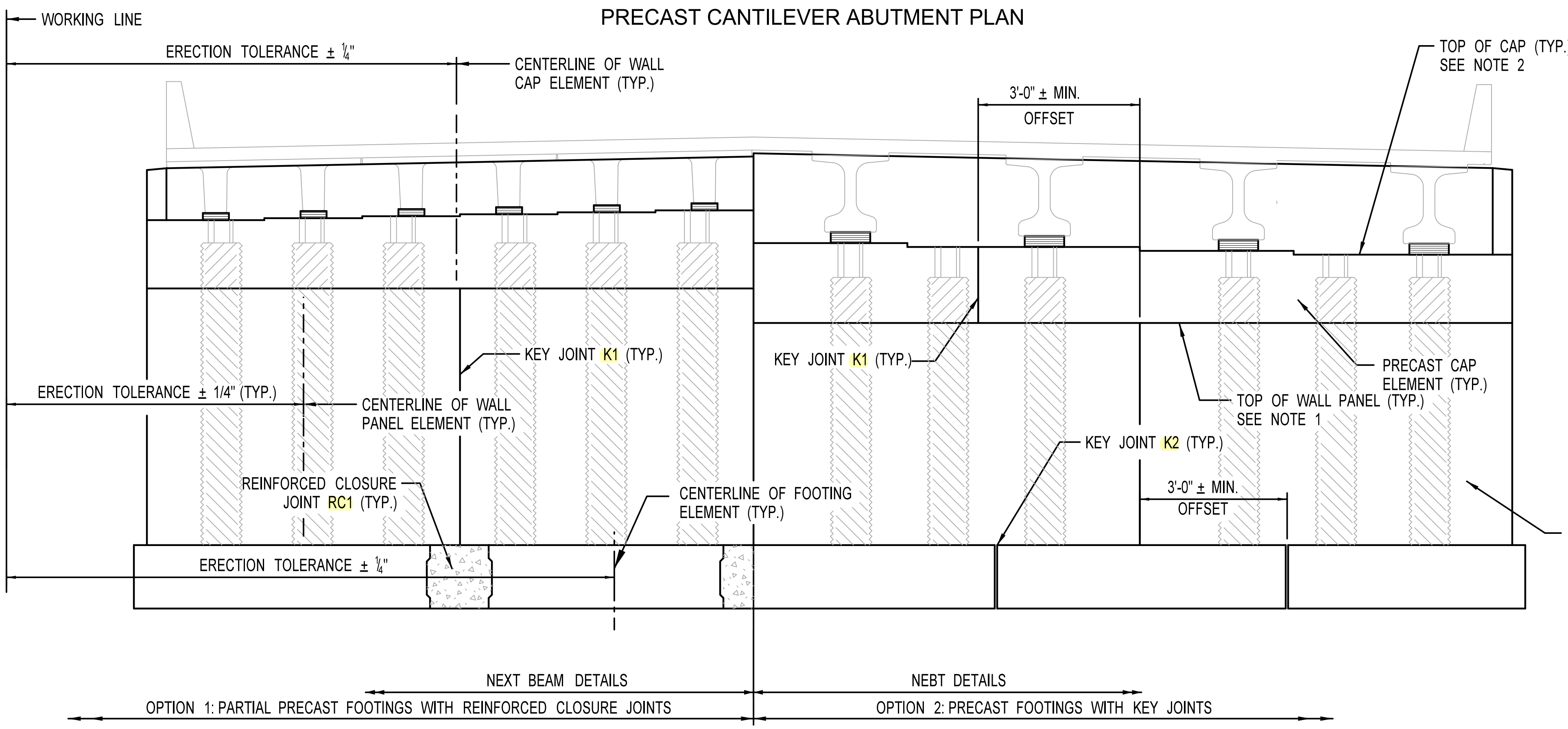
GUIDELINES FOR PRECAST SUBSTRUCTURES

REVISIONS

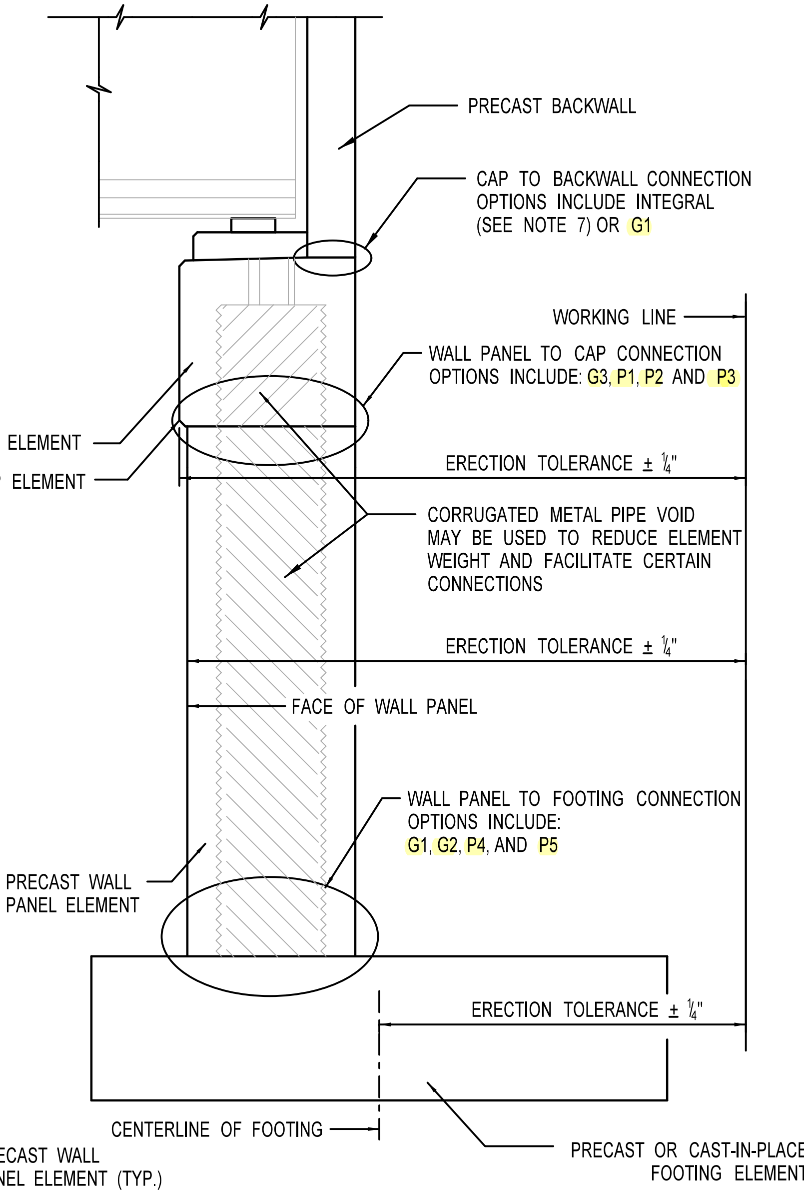
NO.	DATE	DESCRIPTION



PRECAST CANTILEVER ABUTMENT PLAN



PRECAST CANTILEVER ABUTMENT ELEVATION



PRECAST CANTILEVER ABUTMENT TYPICAL SECTION

NOTES

1. ERECTION TOLERANCE ON ELEVATION ±1/4" MEASURED AT THE CENTERLINE OF THE WALL PANEL.
2. ERECTION TOLERANCE ON BEAM SEAT ELEVATION ±1/4".
3. CAP AND WALL REINFORCEMENT NOT SHOWN FOR CLARITY.
4. FOOTINGS CAN BE DETAILED WITH EITHER GROUTED KEYS OR CLOSURE JOINTS. IF CLOSURE JOINTS ARE USED, THE PRECAST FOOTING SHOULD BE DESIGNED TO SUPPORT THE DEAD LOAD OF THE ENTIRE STRUCTURE. THE ENTIRE FOOTING SHOULD BE DESIGNED TO SUPPORT ALL LOADS.
5. SUPERSTRUCTURE DIAPHRAGMS NOT SHOWN.
6. THE USE OF CORRUGATED METAL PIPE VOIDS IS RECOMMENDED FOR ALL OPTIONS TO REDUCE SHIPPING AND HANDLING WEIGHTS.
7. INTEGRAL CONNECTION REFERS TO A PORTION OF AN ELEMENT CAST INTEGRAL WITH THE OTHER PORTION OF THE ELEMENT IN THE FABRICATION SHOP.

Note: Highlighted notes represent hyperlinks

RETURN TO DETAIL USAGE TABLE

ISSUE DATE: 5/13/2022 | SHEET SUB 05

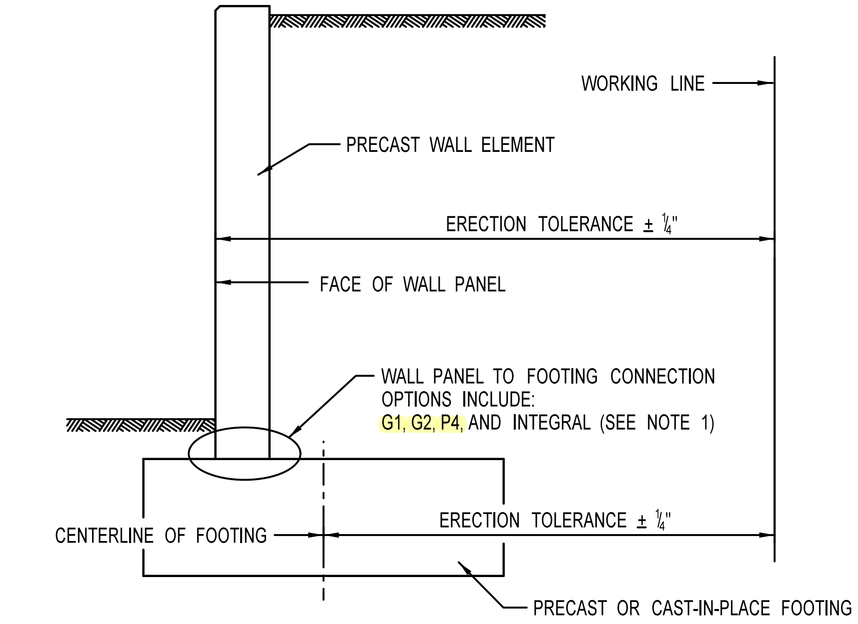
CANTILEVER ABUTMENTS

WWW.PCINE.ORG

PCI PRECAST/PRESTRESSED CONCRETE INSTITUTE NORTHEAST

GUIDELINES FOR PRECAST SUBSTRUCTURES

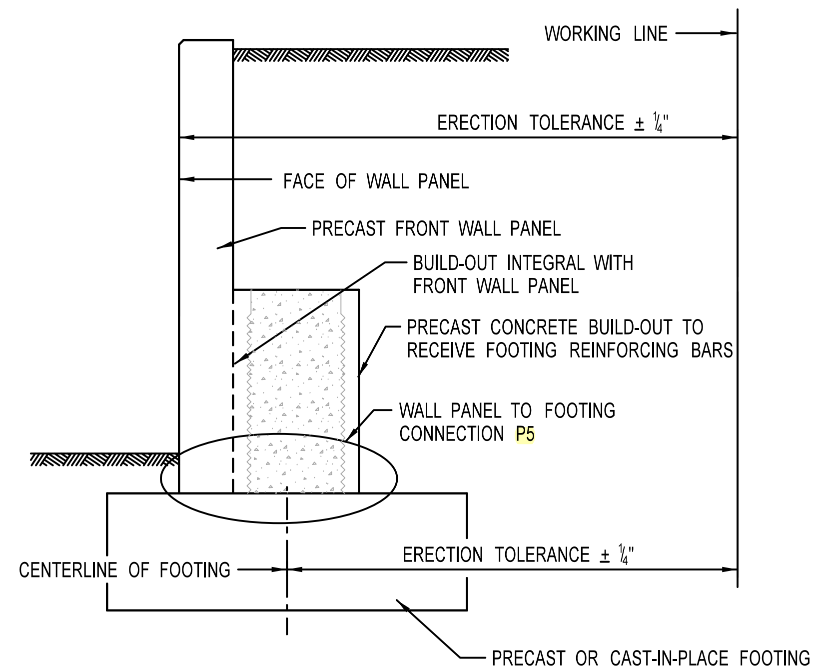
REVISIONS
NO. | DATE | DESCRIPTION



TYPICAL SECTION

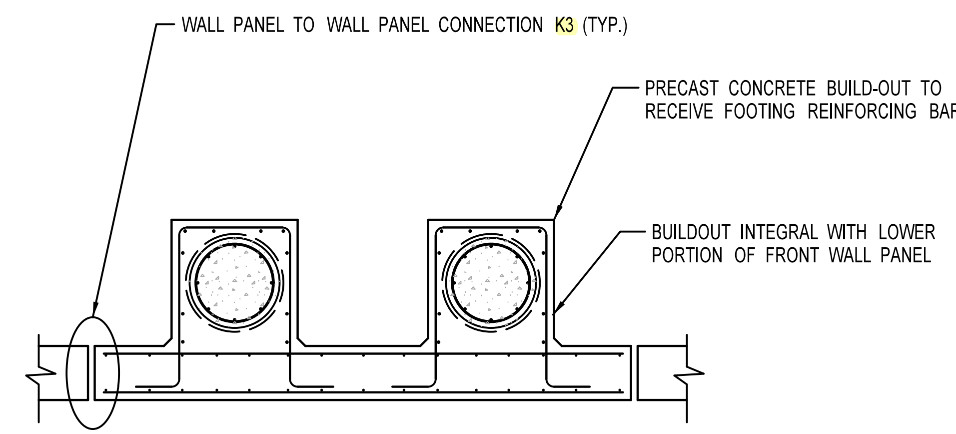
CANTILEVER RETAINING WALL OPTION 1

NOTE 1: INTEGRAL CONNECTION REFERS TO A PORTION OF AN ELEMENT CAST INTEGRAL WITH THE OTHER PORTION OF THE ELEMENT IN THE FABRICATION SHOP.



TYPICAL SECTION

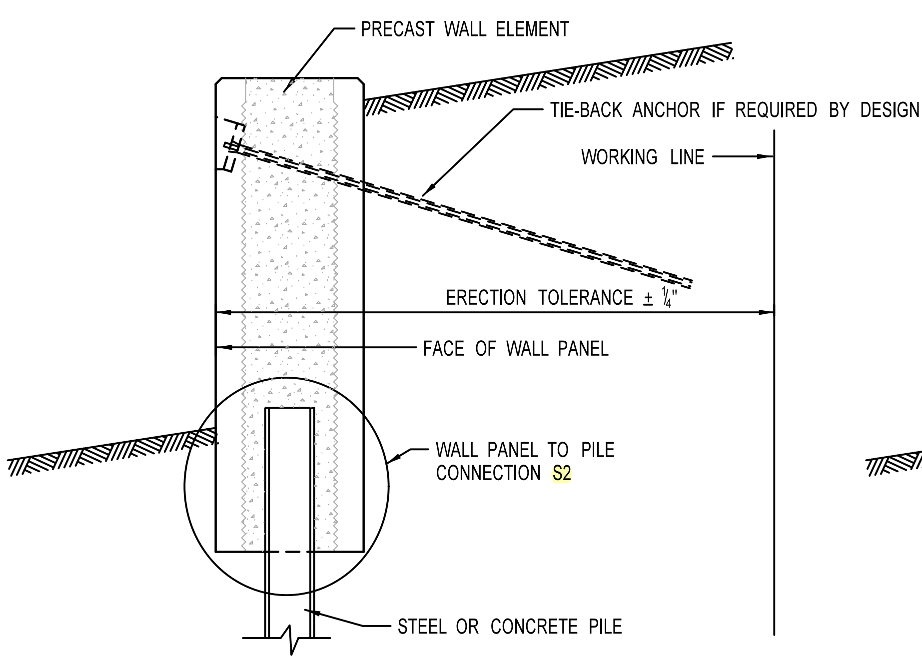
CANTILEVER RETAINING WALL OPTION 2



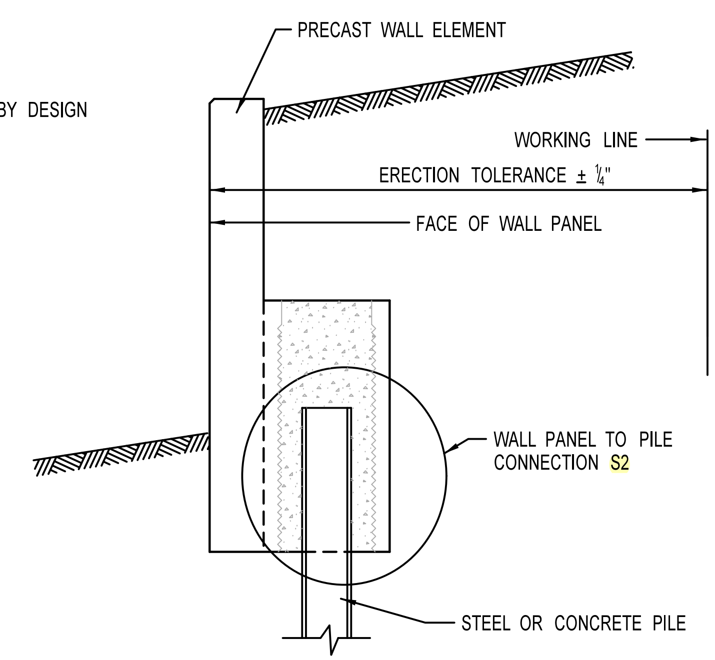
PLAN

CANTILEVER RETAINING WALL OPTION 2

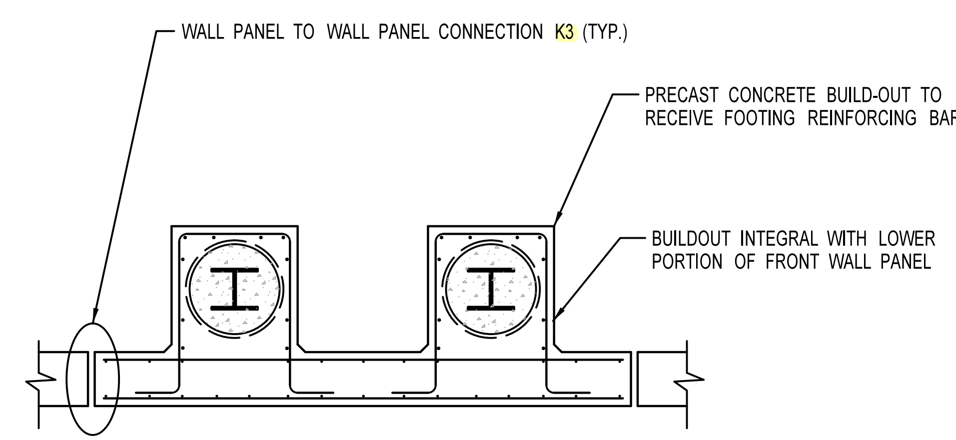
NOTE: WALL REINFORCEMENT SHOWN SCHEMATICALLY



SOLDIER PILE RETAINING WALL OPTION 1



SOLDIER PILE RETAINING WALL OPTION 2



PLAN

SOLDIER PILE RETAINING WALL OPTION 2

RETURN TO DETAIL USAGE TABLE

ISSUE DATE: 5/13/2022

SHEET SUB 06

RETAINING WALLS

Note: Highlighted notes represent hyperlinks

NO.	DATE	DESCRIPTION

REVISIONS

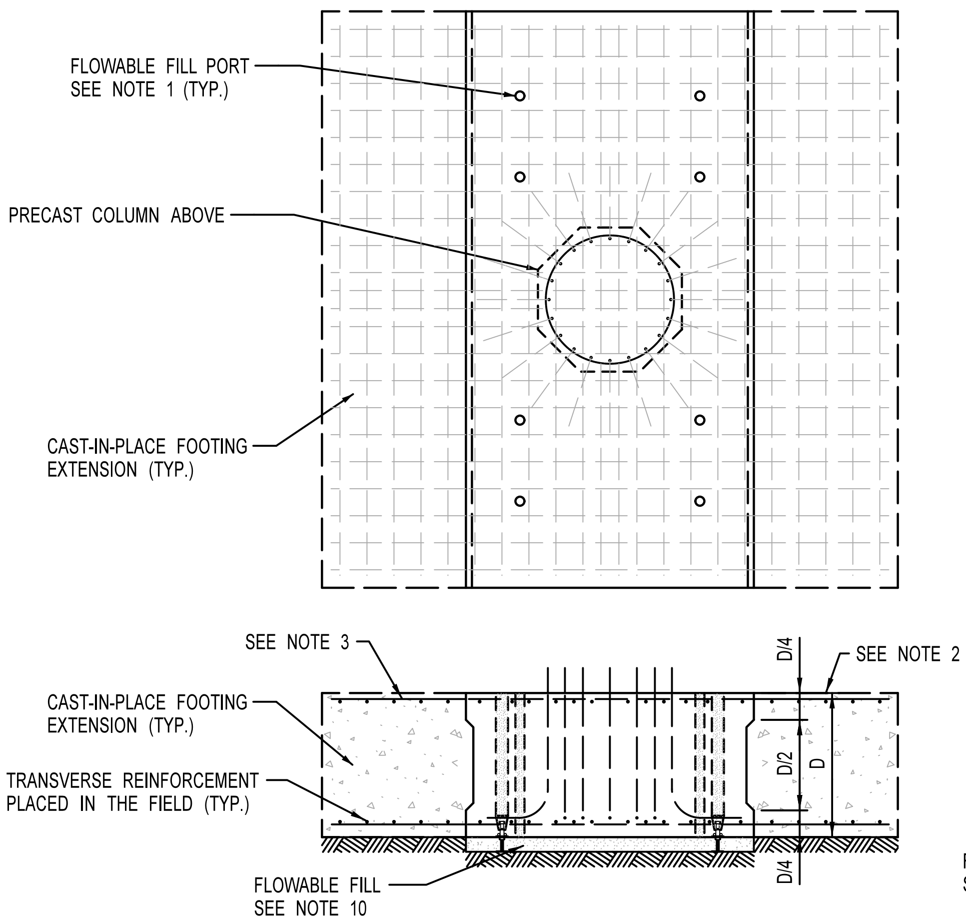
GUIDELINES FOR PRECAST SUBSTRUCTURES

DISCLAIMER:
The details shown are guidelines and should not be considered standards. The information has been obtained from sources believed to be reliable. PCI Northeast or its membership shall not be responsible for any errors, omissions or damages arising out of this information. PCI Northeast has published this work with the understanding that PCI Northeast is supplying information only. PCI Northeast is not rendering engineering or other professional services through this guideline. If such services are required, please seek an appropriate professional.

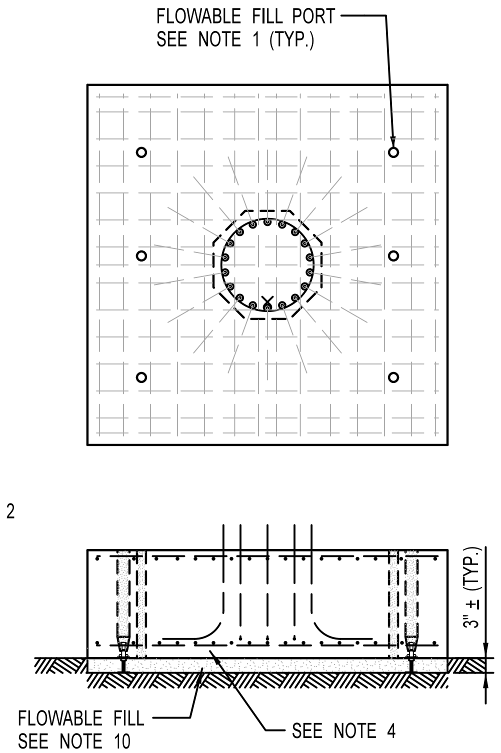
PCI®

PRECAST/PRESTRESSED CONCRETE INSTITUTE NORTHEAST

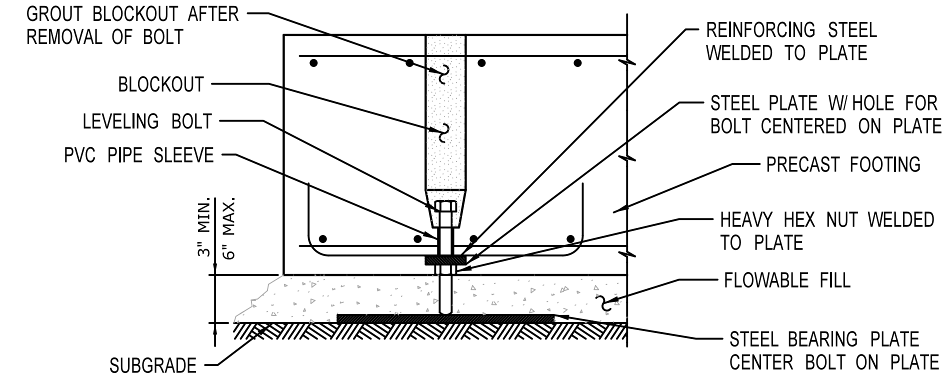
WWW.PCINE.ORG



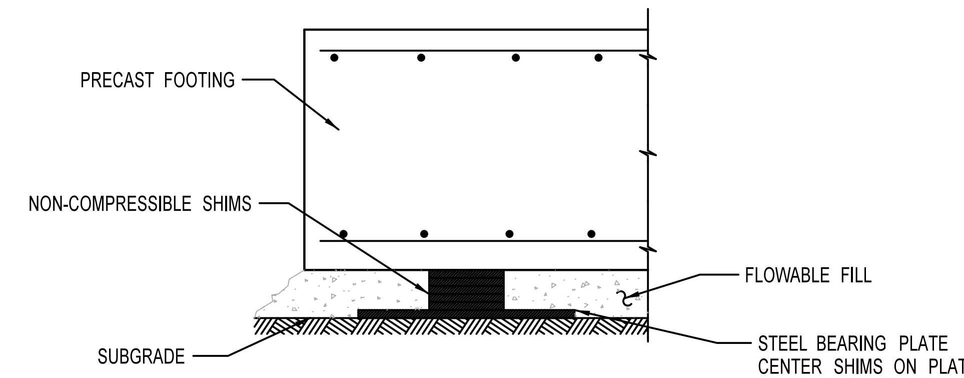
PARTIAL PRECAST SPREAD FOOTING



PRECAST SPREAD FOOTING



OPTIONAL LEVELING DEVICE



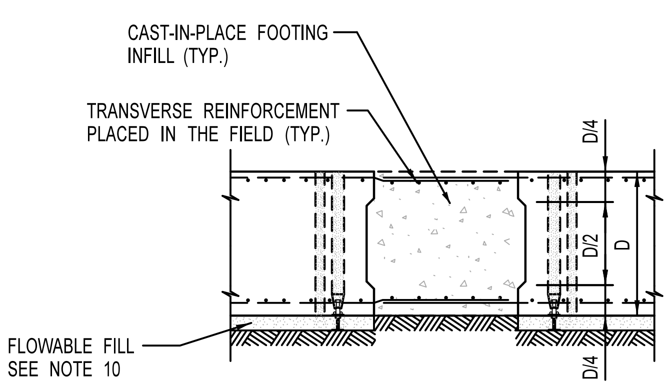
OPTIONAL LEVELING DEVICE

LEVELING DEVICE NOTES

1. ALTERNATE LEVELING DEVICES MAY BE SUBSTITUTED BY THE CONTRACTOR WITH THE APPROVAL FROM THE ENGINEER.
2. STEEL PLATES ARE ASTM A36, BOLTS ARE ASTM F3125. STEEL PLATES TO BE GALVANIZED ACCORDING TO ASTM A123, AND BOLTS TO BE GALVANIZED ACCORDING TO ASTM A153.
3. REINFORCEMENT BARS ARE WELDABLE ASTM A706.
4. GREASE OR OIL NUT & BOLT THREADS TO FACILITATE LEVELING AND REMOVAL.
5. BOLT MAY BE REMOVED AFTER THE FLOWABLE FILL HAS SET.

PRECAST FOOTING NOTES

1. CONTRACTOR TO DETERMINE SIZE AND SPACING OF PORTS BASED ON MIX DESIGN AND FOOTING SIZE.
2. ERECTION TOLERANCE ON ELEVATION ±1/4". THIS SHOULD BE SPECIFIED AND DETAILED ON THE CONTRACTOR'S ASSEMBLY PLAN.
3. DETAIL BAR EXTENSIONS TO THE LIMITS OF THE FOOTING IF POSSIBLE. IF TOTAL WIDTH OF FOOTING AND BAR EXTENSIONS EXCEEDS SHIPPING LIMITS, THEN DETAIL AS LAP SPLICES IN REINFORCING OR ADD MECHANICAL BAR SPLICERS.
4. PROVIDE 3" CLEAR COVER FOR BOTTOM MATS OF REINFORCING.
5. THE DESIGNER SHOULD DETAIL ALL PERTINENT FOOTING REINFORCING AND RESOLVE POTENTIAL CONFLICTS WITH PILE VOIDS.
6. USE CAST-IN-PLACE EXTENSIONS TO KEEP SIZE AND WEIGHT OF PRECAST FOOTING WITHIN THE RECOMMENDED MAXIMUM SIZE LIMITS.
7. PARTIAL PRECAST FOOTINGS MAY BE USED WITH PILES OR DRILLED SHAFTS.
8. PARTIAL PRECAST FOOTINGS MAY BE USED TO CONNECT ADJACENT FOOTINGS TO CREATE A CONTINUOUS FOOTING.
9. IN GENERAL, A PILE SHOULD NOT BE PLACED DIRECTLY BELOW THE COLUMNS ABOVE UNLESS ALL REINFORCING CONFLICTS CAN BE RESOLVED.
10. IN MOST CASES FLOWABLE FILL WILL BE ACCEPTABLE FOR SEATING SPREAD FOOTINGS. NON-SHRINK GROUT SHOULD ONLY BE USED WHERE FOOTING PRESSURES ARE EXCESSIVE OR WHERE FAST SET TIMES ARE REQUIRED.
11. SEVERAL OF THE DETAILS SHOWN ARE APPLICABLE TO THE USE OF GROUTED SPLICE COUPLER CONNECTIONS. OTHER CONNECTIONS CAN BE USED WITH SIMILAR DETAILS.



RC1 REINFORCED CLOSURE JOINT

NOTE: DESIGN JOINT FOR THE CALCULATED FORCES ACTING ON THE JOINT

RETURN TO DETAIL USAGE TABLE

ISSUE DATE: 5/13/2022 | SHEET SUB 07

SPREAD FOOTINGS

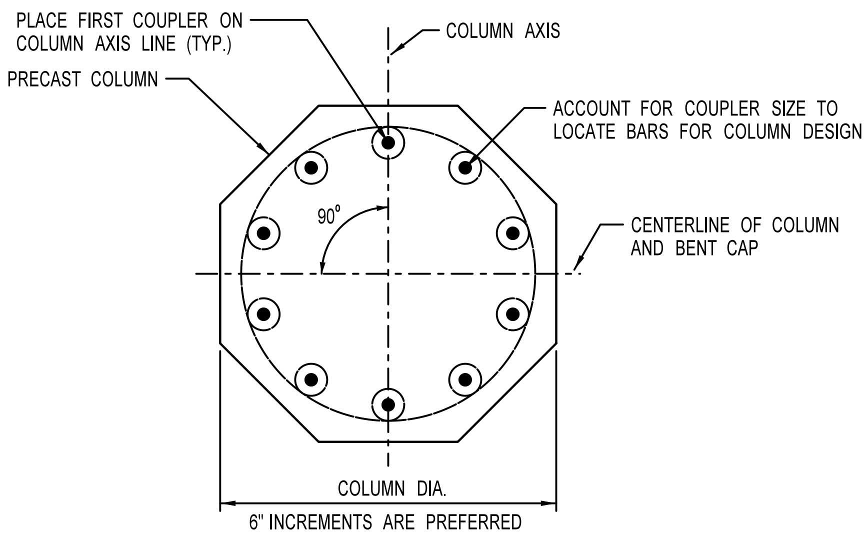
Note: Highlighted notes represent hyperlinks

GUIDELINES FOR PRECAST SUBSTRUCTURES

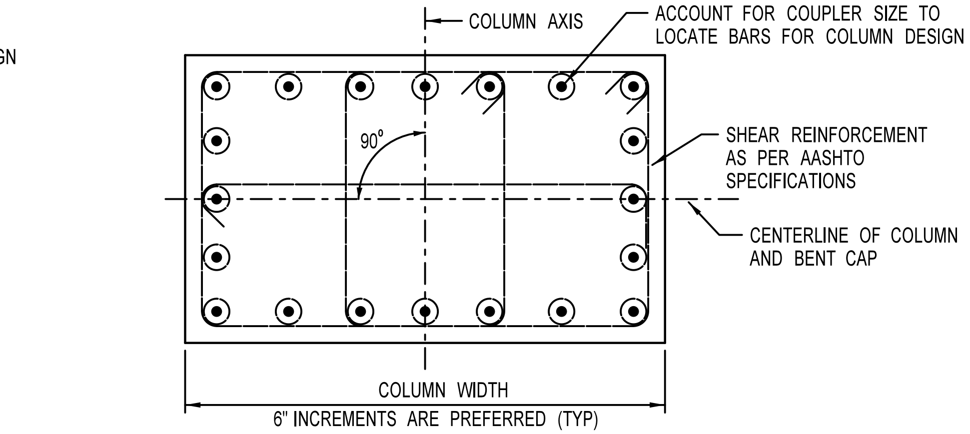
WWW.PCINE.ORG
PRECAST/PRESTRESSED CONCRETE INSTITUTE NORTHEAST

REVISIONS

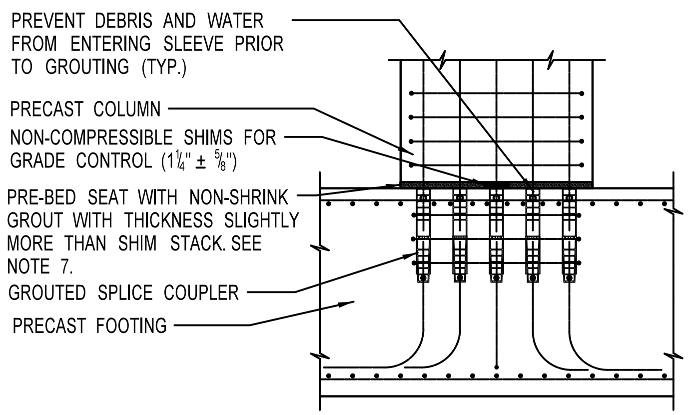
NO.	DATE	DESCRIPTION



G2 TYPICAL OCTAGONAL COLUMN SECTION

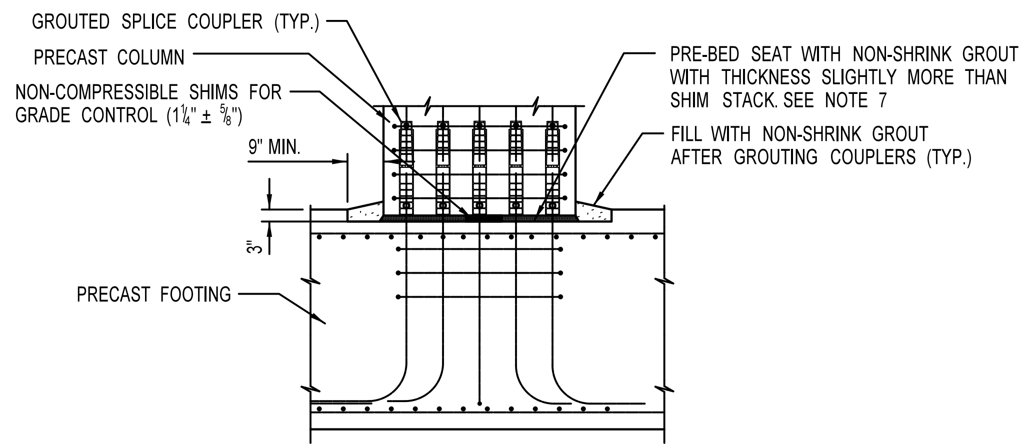


G2 TYPICAL RECTANGULAR COLUMN SECTION



G1 GROUTED COUPLER CONNECTION
PRECAST COLUMN OR WALL PANEL TO FOOTING

NOTE: COLUMN SHOWN, WALL PANEL SIMILAR.



G2 GROUTED COUPLER CONNECTION
PRECAST COLUMN OR WALL PANEL TO FOOTING

NOTE: COLUMN SHOWN, WALL PANEL SIMILAR.

GROUTED SPLICE COUPLER DIMENSIONS

BAR SIZE	OUTSIDE DIAMETER (IN.)	LENGTH OF COUPLER (IN.)
4	2.625	14.125
5	3.000	14.125
6	3.000	14.125
7	3.000	18.75
8	3.500	18.75
9	3.500	18.75
10	3.500	23.5
11	4.000	23.5
14	4.000	28.375
18	4.500	39.625

SOME GROUTED SPLICE COUPLER MANUFACTURERS ALLOW THE USE OF OVERSIZE COUPLERS IN ORDER TO INCREASE THE SETTING TOLERANCES FOR ELEMENTS. THIS SHOULD ONLY BE ALLOWED IF SUPPORTED BY TEST DATA.

USE THIS TABLE FOR DETAILING OF ELEMENT REINFORCEMENT INCLUDING SPACING, COVER, AND EMBEDMENT LENGTHS. IN MOST CASES, THESE DIMENSIONS WILL WORK FOR OVERSIZED COUPLERS. IF THE FABRICATOR ELECTS TO OVERSIZE A COUPLER, THESE REQUIREMENTS SHALL BE CHECKED DURING THE DEVELOPMENT OF SHOP DRAWINGS.

SOURCES: MATERIAL SPECIFICATIONS FROM THE THREE MOST COMMON SUPPLIERS (NMB SPLICE SLEEVE, LENTON-ERICO, DAYTON SUPERIOR). VALUES IN THIS TABLE COVER ALL THREE MANUFACTURERS.

SET THE LOCATION OF THE LONGITUDINAL REINFORCING STEEL BASED ON THE SIZE OF THE GROUTED SPLICE COUPLER, ANY REINFORCING STEEL AROUND THE COUPLER, AND THE CLEAR COVER REQUIREMENTS FOR THE ELEMENT. ACCOUNT FOR THIS IN THE DESIGN OF THE ELEMENT.

GROUTED SPLICE COUPLER CONNECTION SEQUENCE

1. IT IS RECOMMENDED THAT THE GROUTING PROCEDURE BE COMPLETED IN THE PRESENCE OF A CONTRACTOR'S SUPERVISOR THAT IS EXPERIENCED IN THE INSTALLATION OF GROUTED SLEEVES. MANUFACTURER TRAINING MAY BE REQUIRED FOR INEXPERIENCED STAFF.
2. FOLLOW THE WRITTEN INSTALLATION PROCEDURES OF THE COUPLER MANUFACTURER. THE FOLLOWING ARE GENERAL PROCEDURES THAT APPLY TO MOST COUPLER MANUFACTURERS.
3. IT IS RECOMMENDED THAT THE ELEMENT WITH THE REINFORCEMENT BAR EXTENSIONS BE FABRICATED WITH EXTENDED LENGTHS THAT CAN BE TRIMMED IN THE FIELD AFTER ERECTION AND SETTING TO GRADE.
4. SURVEY LOCATION AND ELEVATION OF LOWER ELEMENT.
5. DETERMINE THE REQUIRED REINFORCING BAR EXTENSION LENGTHS AND THE REQUIRED SHIM HEIGHTS BASED ON THE SURVEY.
6. CUT THE BAR EXTENSIONS TO THE REQUIRED LENGTH BASED ON THE SURVEY AND THE COUPLER MANUFACTURER'S RECOMMENDATIONS. FOR COATED BARS, THE ENDS OF THE BARS NEED NOT BE RE-COATED.
7. PLACE BEDDING GROUT ON TOP OF LOWER ELEMENT. THE USE OF EXTRA GROUT THAT IS ALLOWED TO FLOW OUT DURING ELEMENT PLACEMENT IS RECOMMENDED. IF GAPS ARE PRESENT AFTER FINAL SETTING OF THE ELEMENT, THE GROUT SHOULD BE PACKED INTO PLACE TO COMPLETELY FILL THE VOID. IN LIEU OF PRE-PLACEMENT OF BEDDING GROUT, THE BEDDING GROUT CAN BE FLOWED INTO PLACE AFTER ELEMENT ERECTION BUT PRIOR TO GROUTING OF COUPLERS.
8. ERECT UPPER ELEMENT TO WITHIN THE SPECIFIED ERECTION TOLERANCES. PREVENT BEDDING GROUT FROM FLOWING INTO COUPLER.
9. MAINTAIN INTEGRITY OF GROUT BED DURING SETTING OPERATION. REPAIR GROUT THAT IS DISPLACED OR GAPS THAT DEVELOP IN THE GROUT JOINT USING HAND TOOLS.
10. BRACE THE UPPER ELEMENT.
11. INSTALL GROUT IN COUPLERS FOLLOWING THE MANUFACTURER'S WRITTEN PROCEDURES. IF THE COUPLER IS BELOW THE JOINT, THE COUPLER GROUT CAN BE INSTALLED PRIOR TO APPLICATION OF BEDDING GROUT.
12. ERECTION OF SUBSEQUENT ELEMENTS ABOVE A CONNECTION SHOULD NOT COMMENCE UNTIL THE CONNECTION HAS ACHIEVED ADEQUATE STRENGTH AS DETERMINED THROUGH STRENGTH TESTING OF THE GROUT. THE TIMING OF SUBSEQUENT CONSTRUCTION STEPS SHOULD BE SPECIFIED IN THE BRIDGE ASSEMBLY PLAN.

RETURN TO DETAIL USAGE TABLE

ISSUE DATE: 5/13/2022 | SHEET SUB 08

GROUTED COUPLER CONNECTIONS G1 AND G2

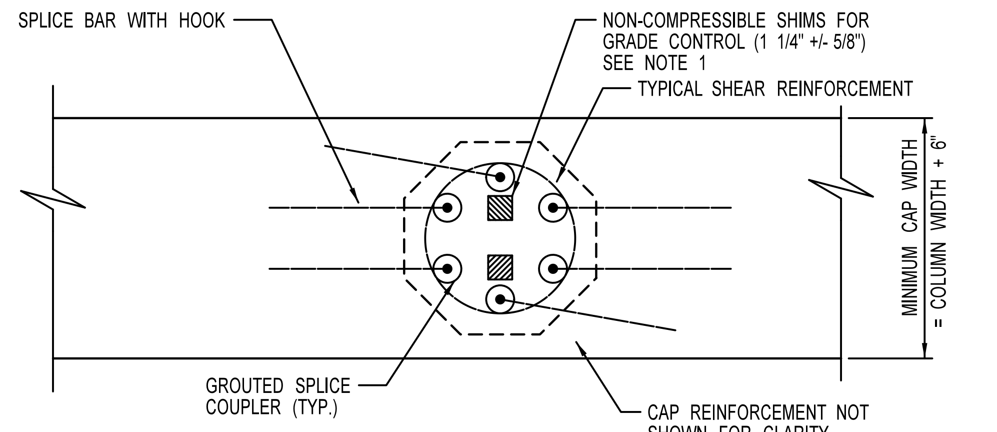
Note: Highlighted notes represent hyperlinks

WWW.PCINE.ORG

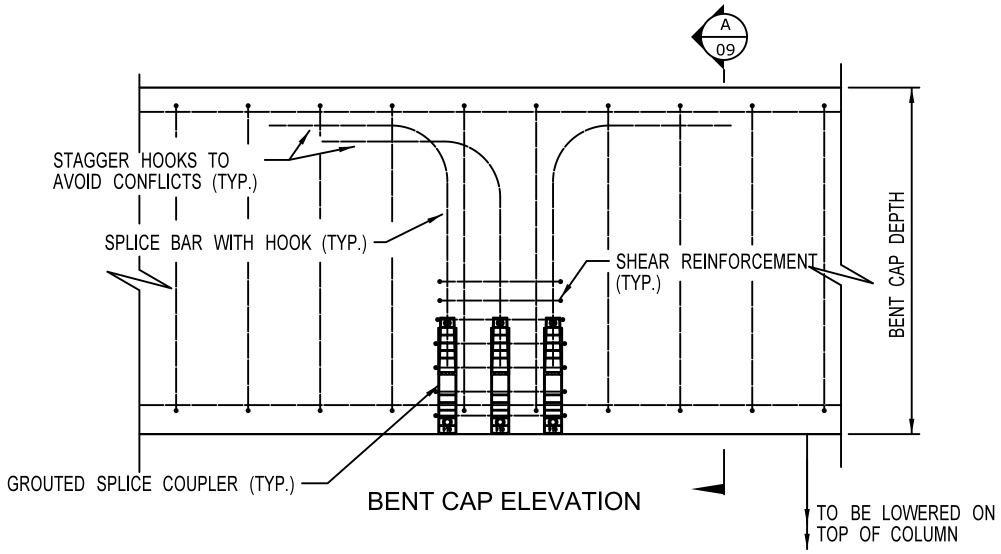
PCI®
PRECAST/PRESTRESSED CONCRETE INSTITUTE NORTHEAST

GUIDELINES FOR PRECAST SUBSTRUCTURES

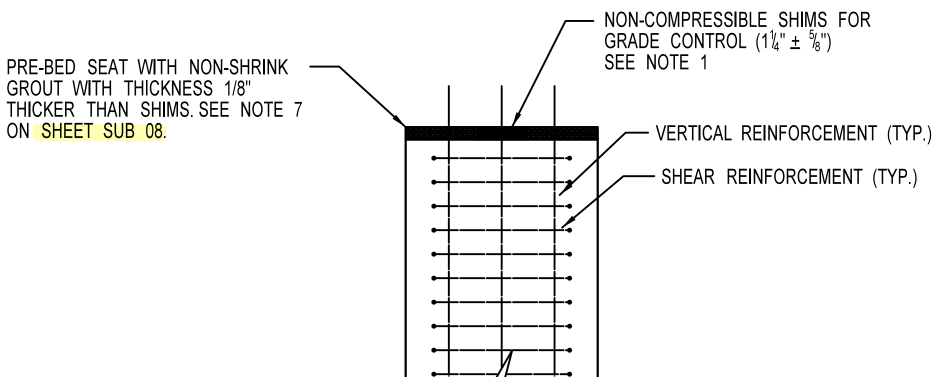
REVISIONS
NO.	DATE	DESCRIPTION



BENT CAP PLAN



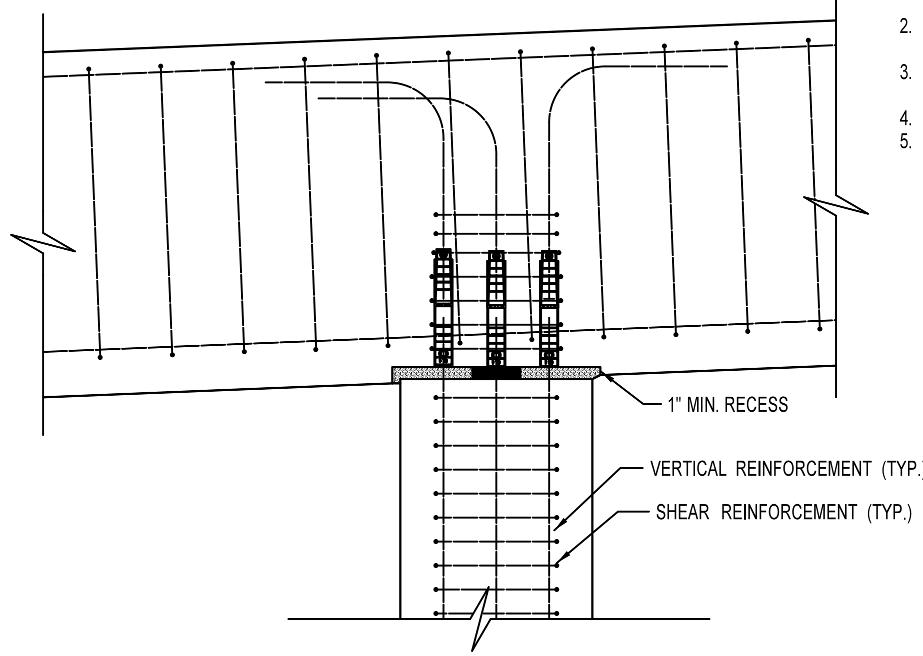
BENT CAP ELEVATION



COLUMN ELEVATION

G3 GROUTED COUPLER CONNECTION
COLUMN TO BENT CAP WITH LEVEL CAP
PRIOR TO CONNECTION

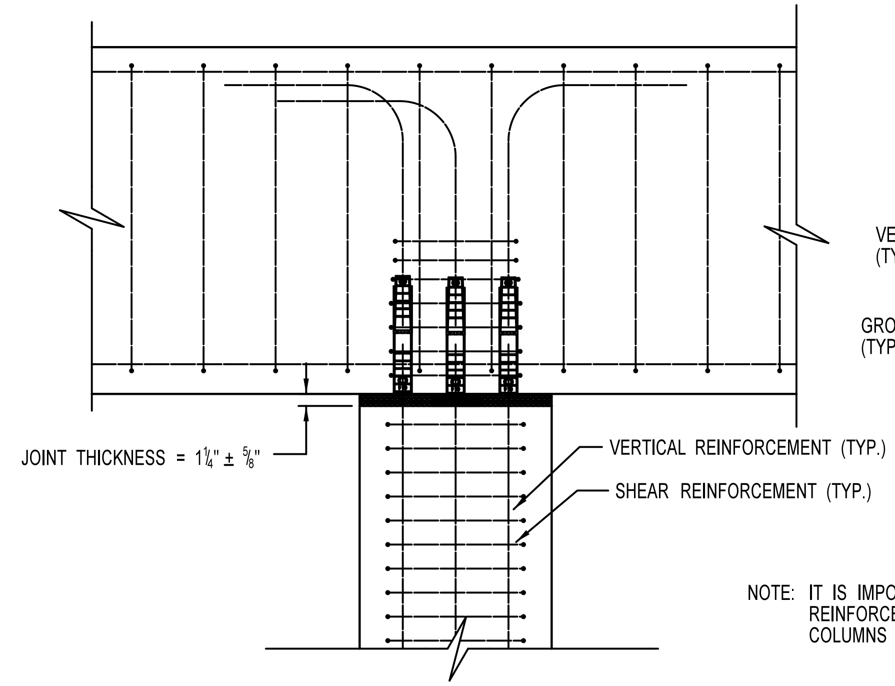
NOTE: THIS DETAIL CAN BE USED FOR A COLUMN-TO-COLUMN SPLICE ALSO.



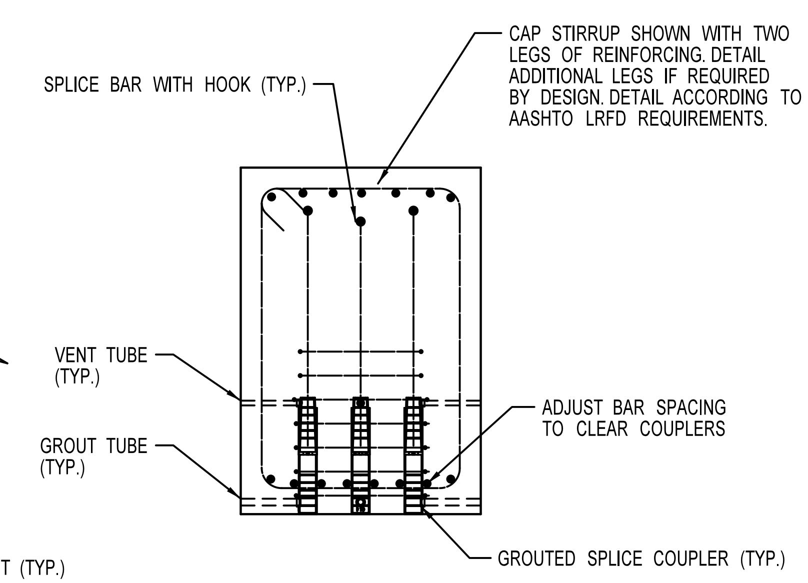
G3 GROUTED COUPLER CONNECTION
COLUMN TO BENT CAP WITH SLOPED CAP
AFTER CONNECTION

NOTES

1. ADJUST SHIM STACK HEIGHT TO CONTROL ERECTION ELEVATIONS. USE MULTIPLE SHIMS TO PROVIDE STABILITY OF CAP ELEMENT.
2. END DOWEL BARS LONGER THAN REQUIRED AND CUT TO PROPER HEIGHT AFTER INSTALLATION OF LOWER ELEMENT.
3. COLUMN TO CAP CONNECTION SHOWN. A SIMILAR DETAIL MAY BE USED TO SPLICE COLUMNS.
4. SHEAR REINFORCEMENT TO BE SPIRALS OR HOOPS WITH RESISTANCE BUTT WELDS.
5. SEE SHEET SUB 08 FOR GROUTED SPLICE COUPLER CONNECTION SEQUENCE.



G3 GROUTED COUPLER CONNECTION
COLUMN TO BENT CAP WITH LEVEL CAP
AFTER CONNECTION



SECTION A
BENT CAP SECTION

NOTE: IT IS IMPORTANT TO LAYOUT THE COUPLER PATTERN WITH CONSIDERATION OF THE REINFORCEMENT IN THE CONNECTED ELEMENT. THIS IS ESPECIALLY IMPORTANT FOR ROUND COLUMNS AND SKEWED BRIDGES.

Note: Highlighted notes represent hyperlinks

RETURN TO DETAIL USAGE TABLE

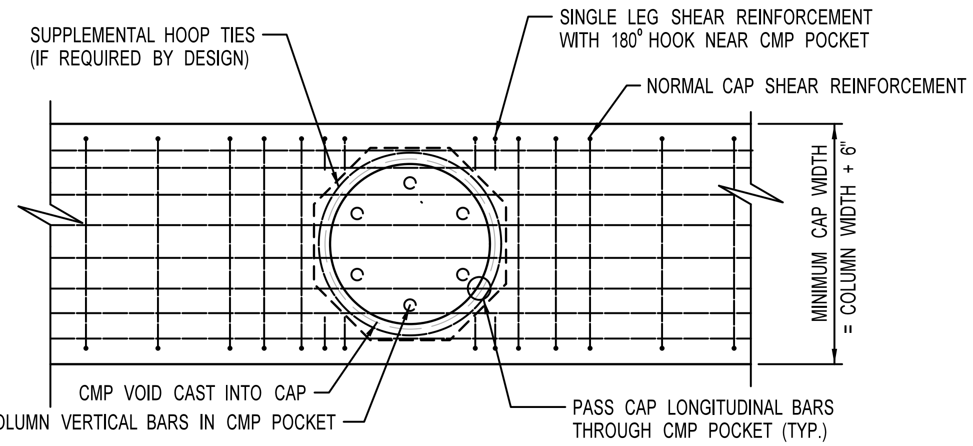
ISSUE DATE: 5/13/2022

SHEET SUB 09

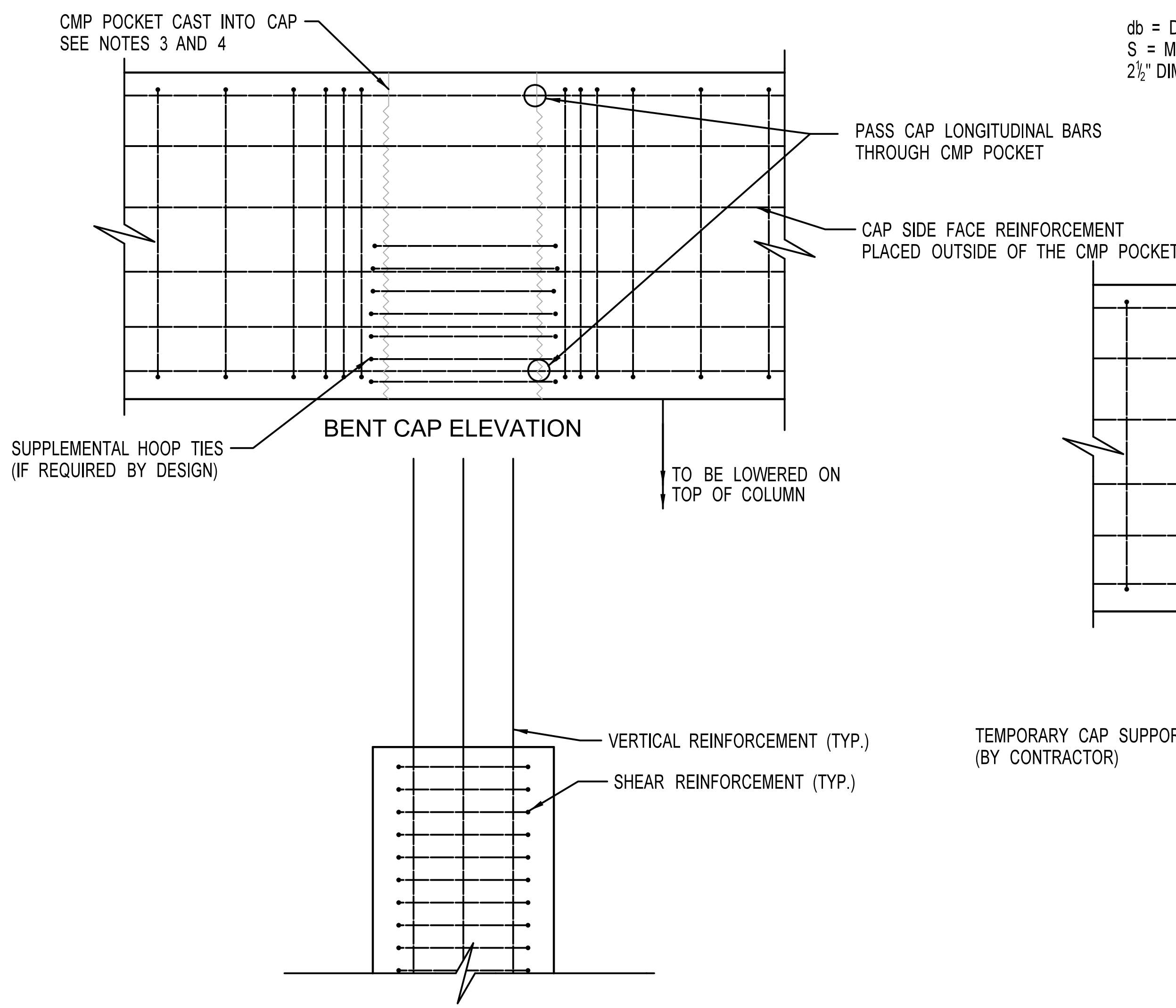
GROUTED COUPLER CONNECTION G3

REVISIONS

NO.	DATE	DESCRIPTION

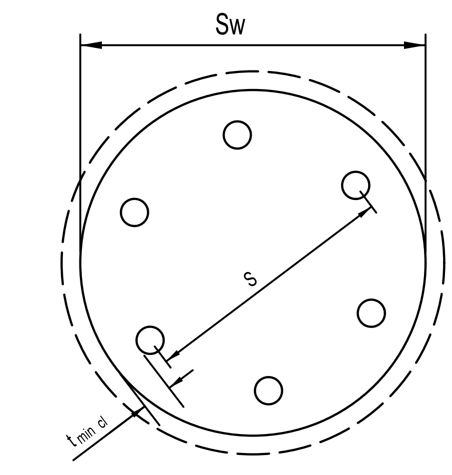


BENT CAP PLAN



COLUMN ELEVATION

P1 POCKET CONNECTION COLUMN TO BENT CAP PRIOR TO CONNECTION



MINIMUM CMP PIPE SIZE

RECOMMENDED MIN. PIPE SIZE = $S_w = 2t_{min\ cl} + d_b + 2\frac{1}{2}" + S$

WHERE:

$t_{min\ cl}$ = MINIMUM ALLOWABLE SPACE BETWEEN BAR AND PIPE FOR MATERIAL PLACEMENT

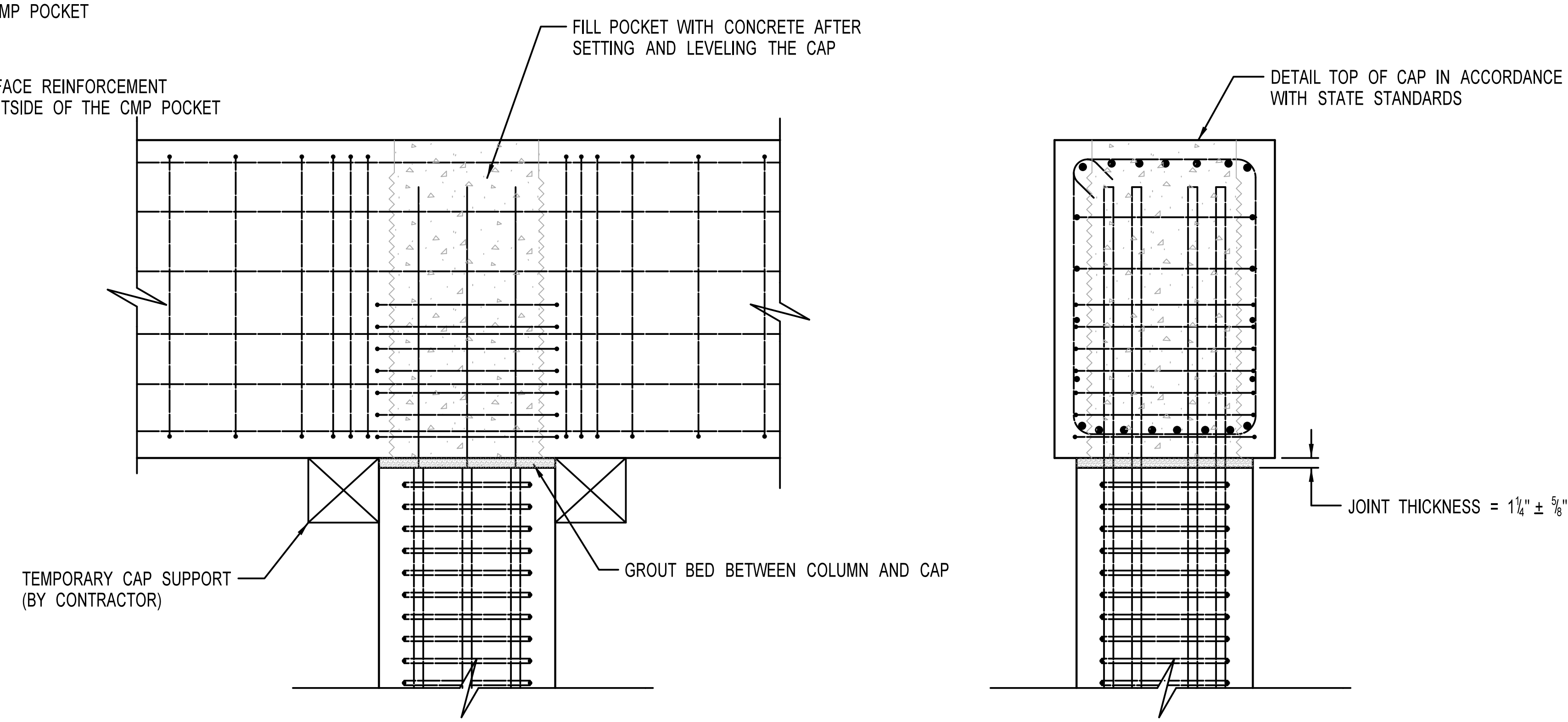
db = DIAMETER OF REINFORCING BAR

S = MAXIMUM CENTER-TO-CENTER DISTANCE BETWEEN BAR EXTREMES

$2\frac{1}{2}$" DIMENSION IN EQUATION IS TO ACCOUNT FOR TOLERANCES

NOTES

1. THE DESIGN OF THIS TYPE OF POCKET CONNECTION SHALL BE IN ACCORDANCE WITH THE AASHTO LRFD GUIDE SPECIFICATIONS FOR ACCELERATED BRIDGE CONSTRUCTION.
2. THE SUPPLEMENTAL HOOPS ON THE OUTSIDE OF THE CMP POCKET MAY NOT BE REQUIRED FOR ALL SITUATIONS. SEE THE PROVISION IN THE ABOVE CITED GUIDE SPECIFICATIONS.
3. THE POCKET MAY BE DETAILED AS PARTIAL HEIGHT WITH PORTS FOR CASTING THE POCKET CONCRETE.
4. IF A FULL HEIGHT POCKET IS DETAILED, THE DESIGNER MAY ELECT TO REQUIRE THE TOP 6" OF THE POCKET TO BE REMOVABLE TO ELIMINATE EXPOSED STEEL AT THE TOP SURFACE OF THE CONNECTION. THE REMOVAL PORTION OF THE FORM CAN BE MADE OF WOOD OR OTHER SUITABLE MATERIAL.
5. THE CONCRETE FOR THE POCKET CAN BE NORMAL CONCRETE THAT IS SPECIFIED FOR BRIDGE PIERS. HIGH EARLY STRENGTH CONCRETE CAN ALSO BE USED.
6. THE TEMPORARY SUPPORT OF THE CAP PRIOR TO THE POCKET POUR IS THE RESPONSIBILITY OF THE CONTRACTOR.
7. IF THE GAP BETWEEN THE COLUMN TOP AND THE BOTTOM OF THE CAP IS GREATER THAN 3", A SUPPLEMENTAL HOOP SHALL BE PLACED WITHIN THE GAP.
8. THE DESIGNER SHOULD CAREFULLY DETAIL THE LOCATION OF ALL REINFORCING BARS TO AVOID CONFLICTS DURING FABRICATION AND ASSEMBLY. THIS IS ESPECIALLY TRUE FOR THE LONGITUDINAL CAP BARS AND THE COLUMN VERTICAL BARS.
9. THE COLUMN VERTICAL BARS SHALL BE DEVELOPED IN THE CAP POCKET. STRAIGHT BARS SHOWN. HEADED BARS MAY BE USED, PROVIDED THEY CAN PASSED THROUGH THE BOTTOM LONGITUDINAL BAR GAPS. HEADED BARS DEVELOPMENT LENGTH SPECIFICATIONS ARE INCLUDED IN THE AASHTO LRFD GUIDE SPECIFICATIONS FOR ACCELERATED BRIDGE CONSTRUCTION.



COLUMN ELEVATION

SIDE ELEVATION

P1 POCKET CONNECTION COLUMN TO BENT CAP AFTER CONNECTION

Note: Highlighted notes represent hyperlinks

RETURN TO DETAIL USAGE TABLE

ISSUE DATE: 5/13/2022	SHEET SUB 10
POCKET CONNECTION P1	

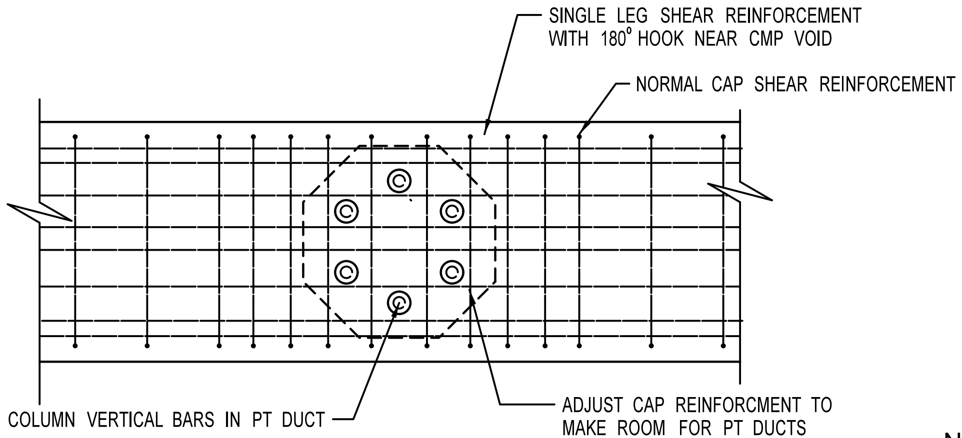
WWW.PCINE.ORG

PCI® PRECAST/PRESTRESSED CONCRETE INSTITUTE NORTHEAST

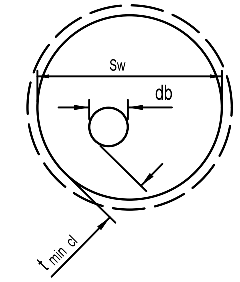
GUIDELINES FOR PRECAST SUBSTRUCTURES

REVISIONS

NO.	DATE	DESCRIPTION



BENT CAP PLAN



MINIMUM PT DUCT SIZE

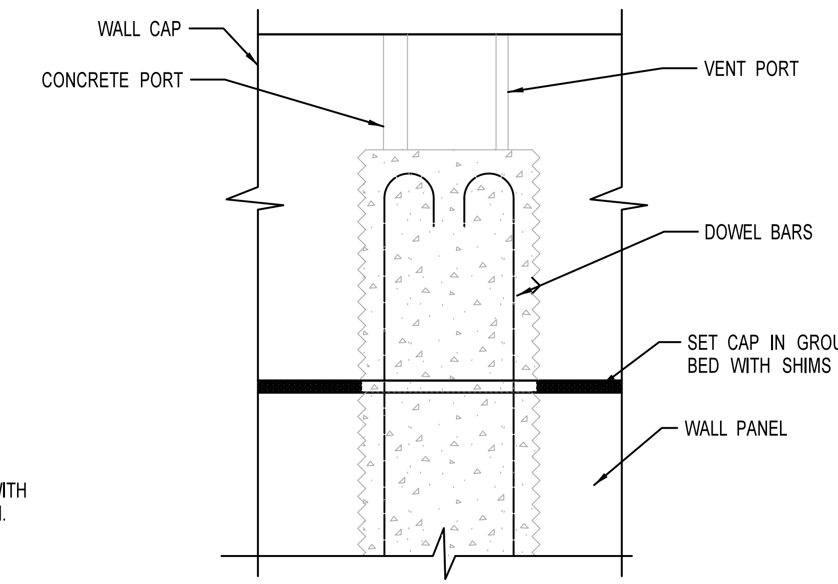
RECOMMENDED MIN. PIPE SIZE = $S_w = 2t_{min\ cl} + db + 2\frac{1}{2}"$

WHERE:

$t_{min\ cl}$ = MINIMUM ALLOWABLE SPACE BETWEEN BAR AND DUCT FOR GROUT PLACEMENT

db = DIAMETER OF REINFORCING BAR

$2\frac{1}{2}"$ DIMENSION IN THE EQUATION IS TO ACCOUNT FOR TOLERANCES

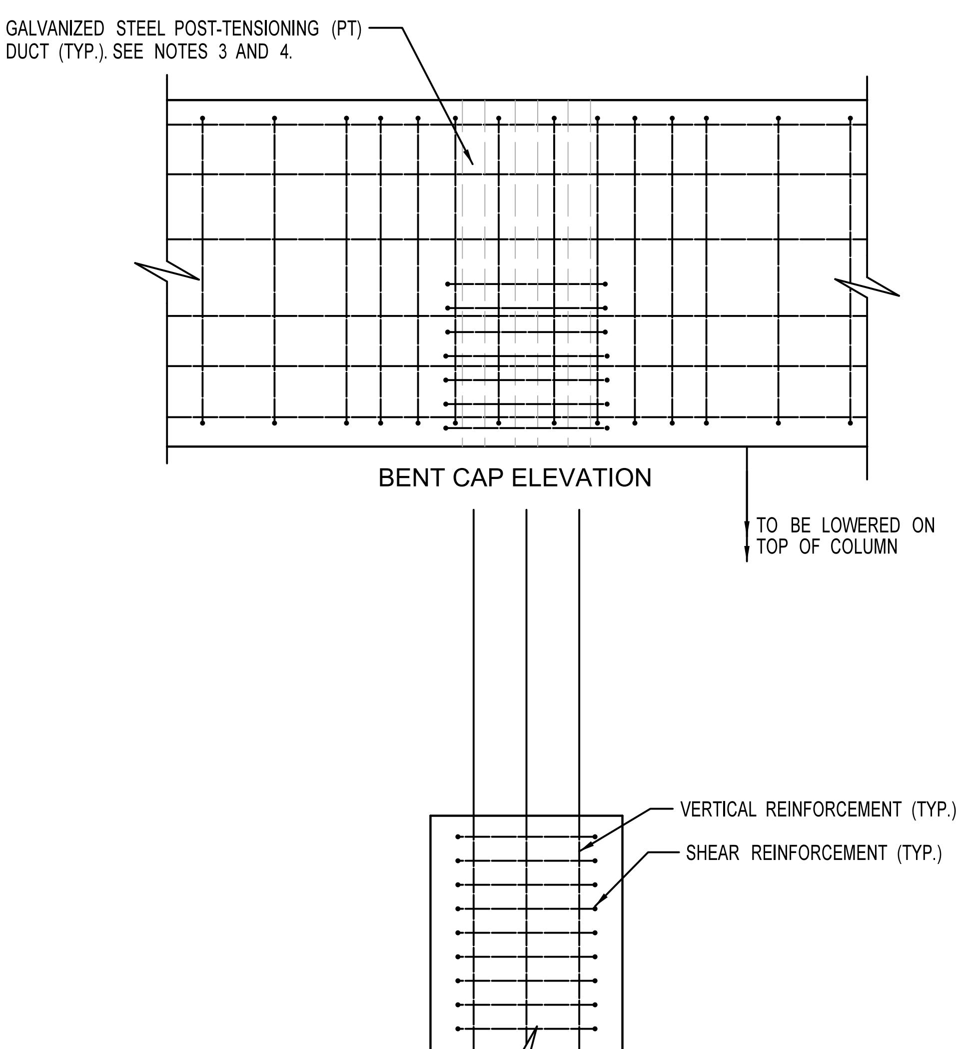


P2 POCKET CONNECTION WALL PANEL TO CAP

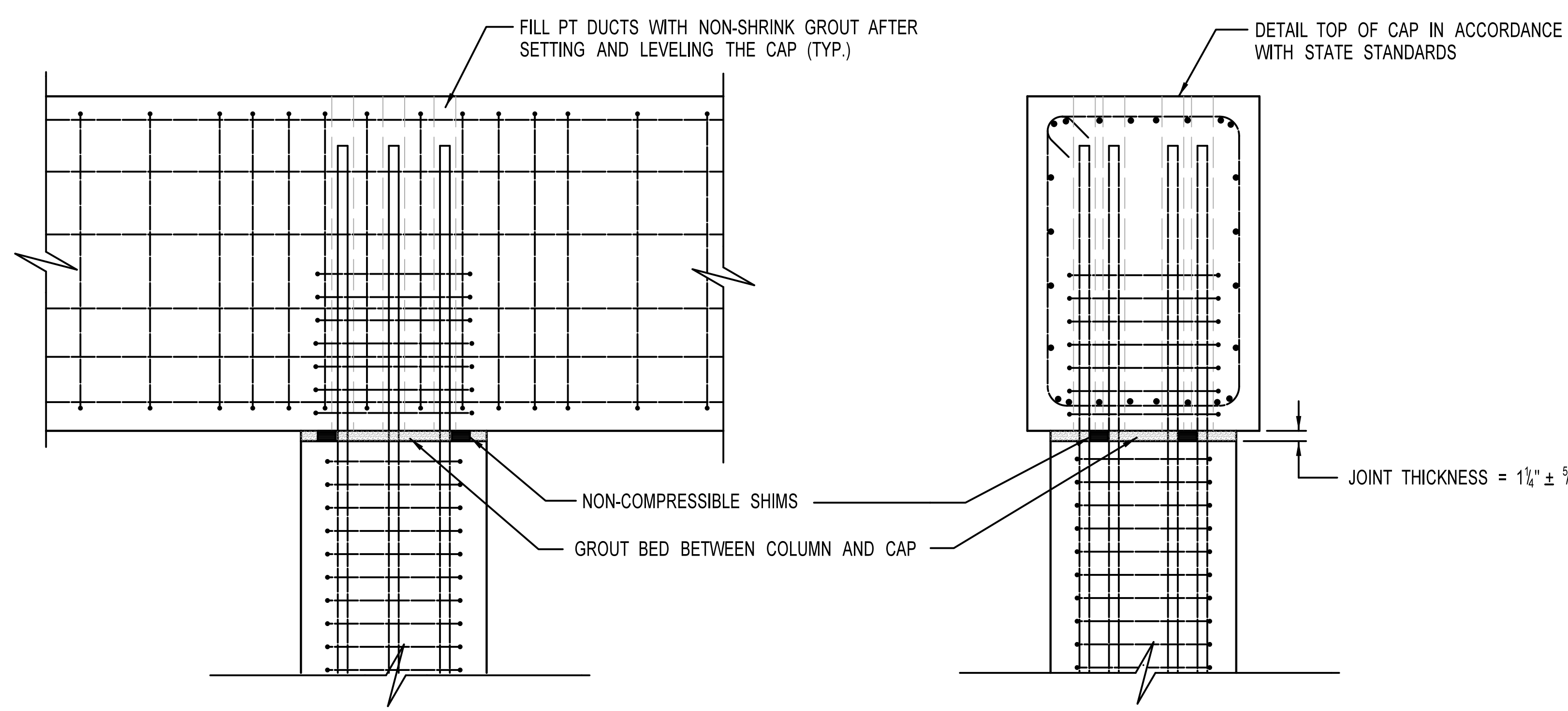
NOTE: WALL AND CAP REINFORCING NOT SHOWN FOR CLARITY

NOTES

1. THE DESIGN OF THESE TYPES OF POCKET CONNECTION SHALL BE IN ACCORDANCE WITH THE AASHTO LRFD GUIDE SPECIFICATIONS FOR ACCELERATED BRIDGE CONSTRUCTION.
2. IT IS PREFERABLE TO USE FEWER LARGER LONGITUDINAL BARS IN THE COLUMN TO MINIMIZE THE POTENTIAL FOR CONFLICTS BETWEEN THE PT DUCTS AND THE CAP REINFORCEMENT.
3. THE POCKET IN CONNECTION P2 MAY BE DETAILED AS PARTIAL HEIGHT WITH PORTS FOR CASTING THE POCKET CONCRETE.
4. IF A FULL HEIGHT POCKET IS DETAILED, THE DESIGNER MAY ELECT TO REQUIRE THE TOP 6" OF THE POCKET TO BE REMOVABLE TO ELIMINATE EXPOSED STEEL AT THE TOP SURFACE OF THE CONNECTION. THE REMOVAL PORTION OF THE FORM CAN BE MADE OF WOOD OR OTHER SUITABLE MATERIAL.
5. THE CONCRETE FOR THE POCKET IN CONNECTION P2 CAN BE NORMAL CONCRETE THAT IS SPECIFIED FOR BRIDGE PIERS. HIGH EARLY STRENGTH CONCRETE CAN ALSO BE USED.
6. IF THE GAP BETWEEN THE COLUMN TOP AND THE BOTTOM OF THE CAP IS GREATER THAN 3", A SUPPLEMENTAL HOOP SHALL BE PLACED WITHIN THE GAP.
7. THE DESIGNER SHOULD CAREFULLY DETAIL THE LOCATION OF ALL REINFORCING BARS AND PT DUCTS TO AVOID CONFLICTS DURING FABRICATION AND ASSEMBLY. THIS IS ESPECIALLY TRUE FOR THE LONGITUDINAL CAP BARS AND THE COLUMN VERTICAL BARS.



P3 POCKET CONNECTION COLUMN TO BENT CAP USING POST-TENSIONING (PT) DUCT POCKETS PRIOR TO CONNECTION



P3 POCKET CONNECTION COLUMN TO BENT CAP USING POST-TENSIONING (PT) DUCT POCKETS AFTER CONNECTION

Note: Highlighted notes represent hyperlinks

RETURN TO DETAIL USAGE TABLE	
ISSUE DATE: 5/13/2022	SHEET SUB 11
POCKET CONNECTIONS P2 AND P3	

WWW.PCINE.ORG

PCI®

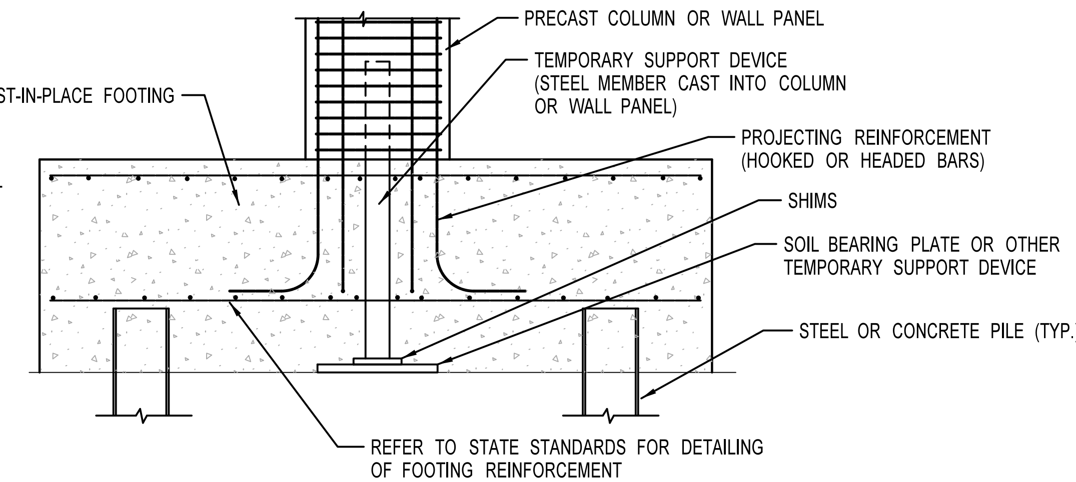
PRECAST/PRESTRESSED CONCRETE INSTITUTE NORTHEAST

GUIDELINES FOR PRECAST SUBSTRUCTURES

REVISIONS

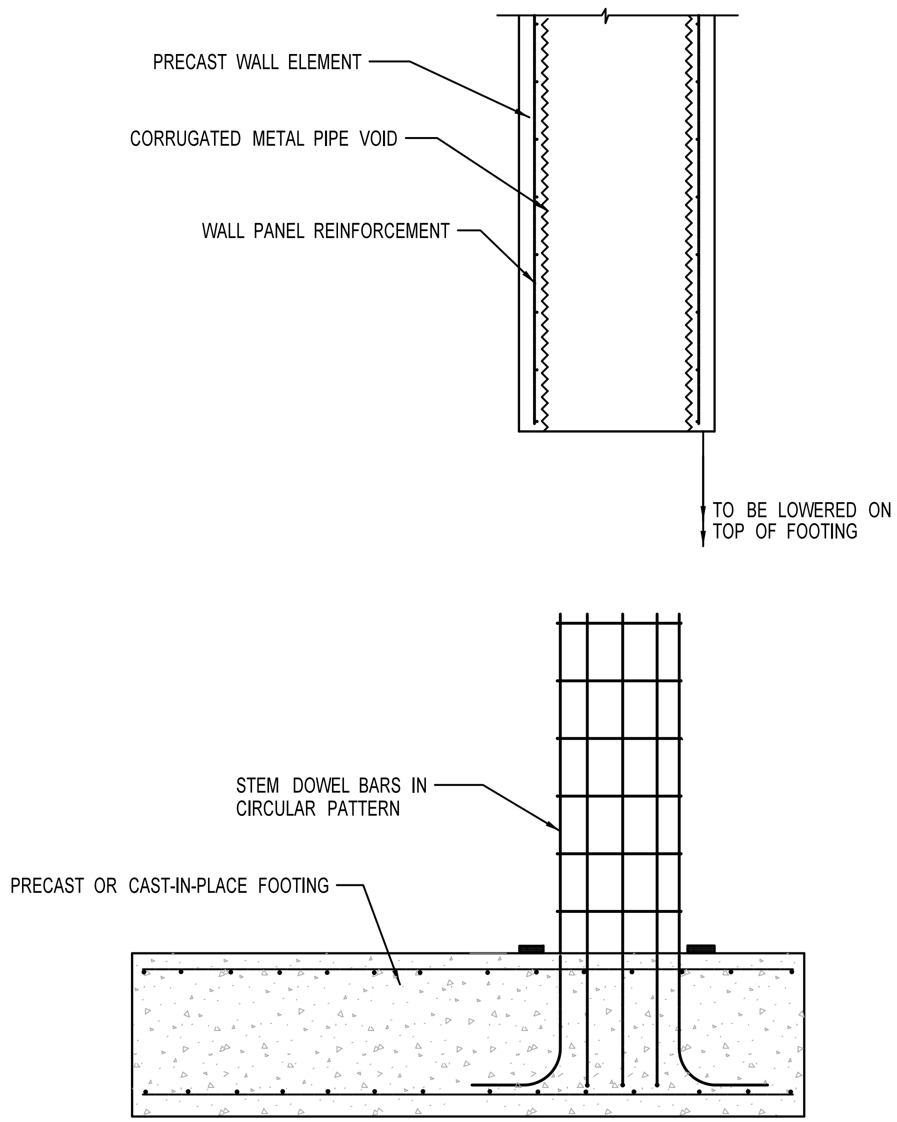
NO.	DATE	DESCRIPTION

CONSTRUCTION NOTES
1. PREPARE SUB-GRADE AND INSTALL PILES (IF PILE SUPORTED).
2. SET SOIL BEARING PLATE.
3. SET PRECAST COLUMN OR WALL ELEMENT. SHIM AS REQUIRED TO MEET THE REQUIRED GRADE.
4. BRACE COLUMN OR WALL TO PREVENT OVERTURNING.
5. INSTALL FOOTING REINFORCING. BARS MAY BE PLACED PRIOR TO SETTING COLUMN OR WALL IF ADEQUATE CLEARANCES ARE PROVIDED. HEADED COLUMN/WALL BARS MAY BE PREFERRED FOR THIS OPTION.
6. CAST AND CURE FOOTING.
7. REMOVE BRACING.

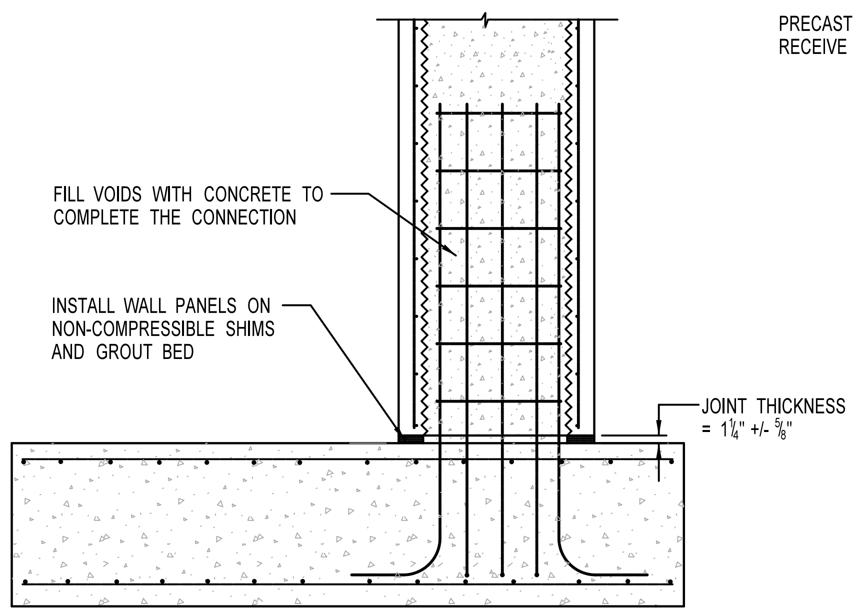


P4 POCKET CONNECTION
CAST-IN-PLACE FOOTING TO
PRECAST COLUMN OR WALL PANEL

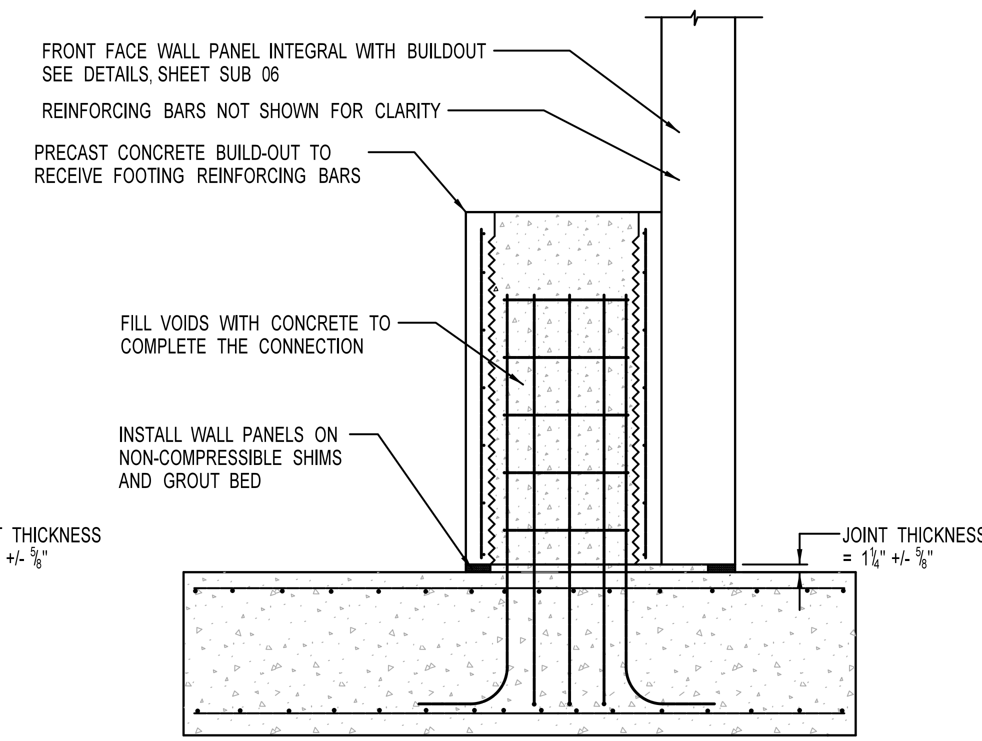
NOTE: PILE FOOTING SHOWN, SPREAD FOOTING SIMILAR



P5 POCKET CONNECTION
FOOTING TO WALL PANEL
BEFORE CONNECTION



P5 POCKET CONNECTION
FOOTING TO WALL PANEL
AFTER CONNECTION



P5 POCKET CONNECTION
FOOTING TO WALL PANEL
AFTER CONNECTION

NOTE: ABUTMENT SHOWN, RETAINING WALL OR WALL PIER SIMILAR

CONSTRUCTION NOTES
1. PREPARE SUB-GRADE AND INSTALL FOOTING (PRECAST OR CAST-IN-PLACE)
2. SET PRECAST WALL ELEMENTS IN GROUT BED.
3. SHIM AS REQUIRED TO MEET THE REQUIRED GRADES.
4. BRACE WALL TO PREVENT OVERTURNING.
5. ALLOW GROUT TO CURE OR FORM PERIMETER TO PREVENT GROUT FROM DISLODGING DURING VOID CASTING.
6. FILL CMP VOID WITH CONCRETE AND CURE
7. REMOVE BRACING.

Note: Highlighted notes represent hyperlinks

RETURN TO DETAIL USAGE TABLE

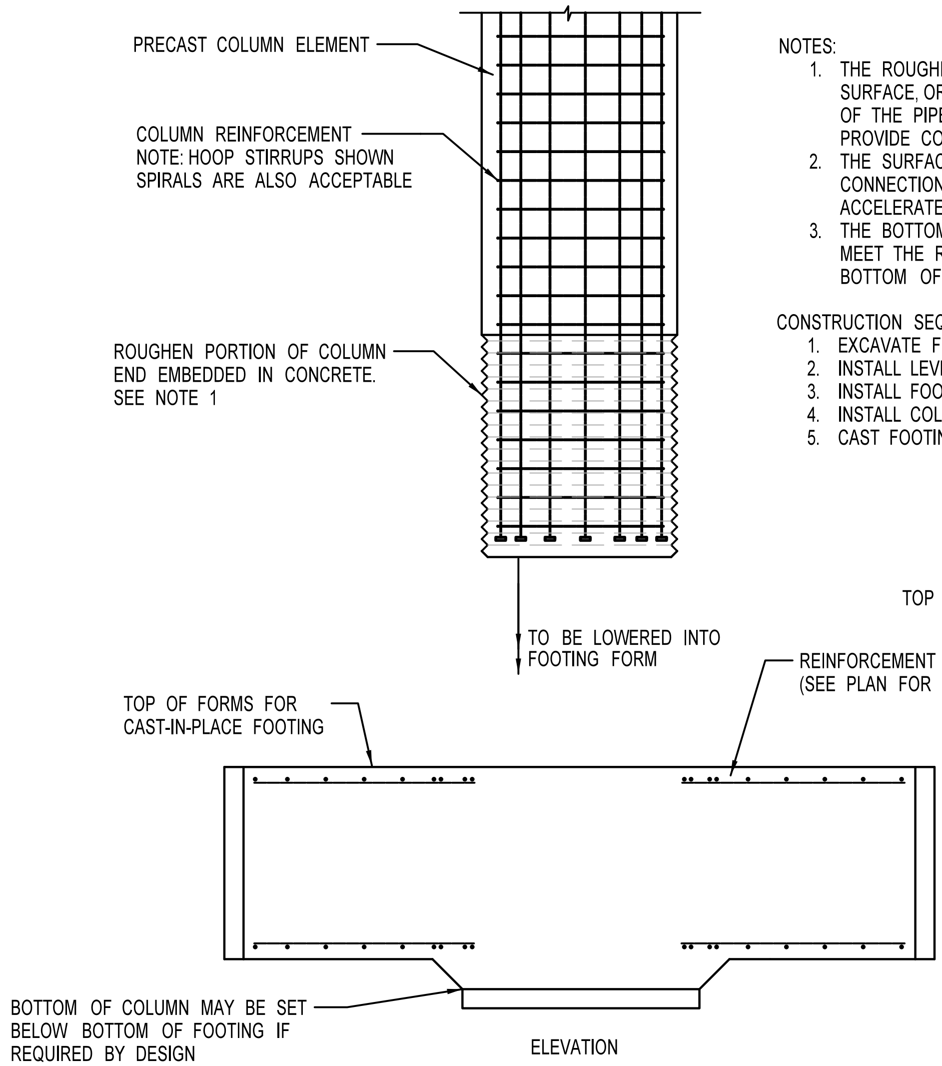
ISSUE DATE: 5/13/2022 | SHEET SUB 12

POCKET CONNECTIONS P4 AND P5

NO.	DATE	REVISIONS DESCRIPTION

GUIDELINES FOR PRECAST SUBSTRUCTURES

PCI®
PRECAST/PRESTRESSED CONCRETE INSTITUTE NORTHEAST
WWW.PCINE.ORG

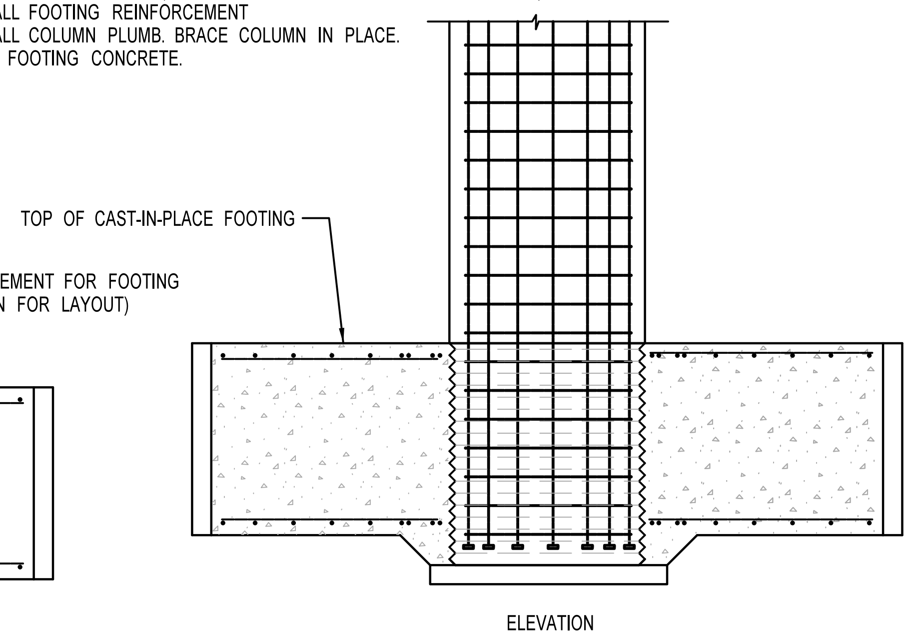


NOTES:

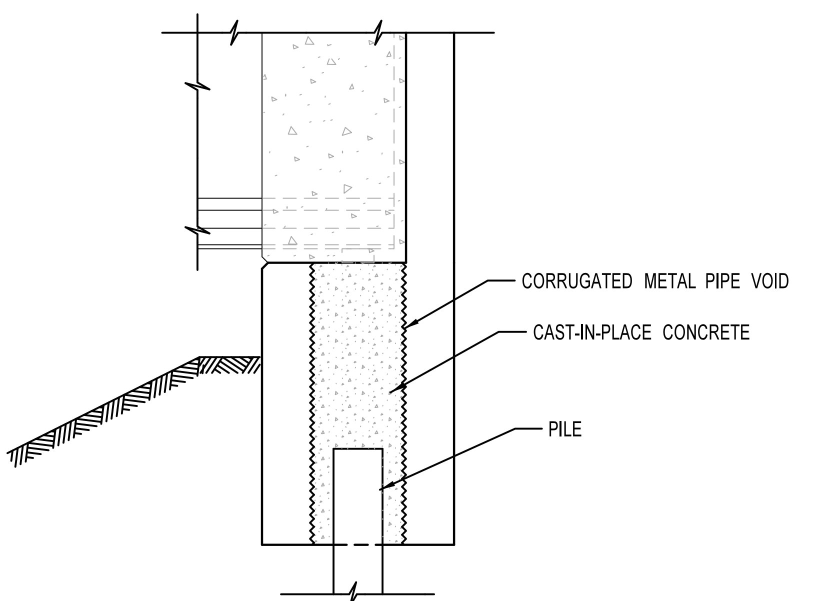
1. THE ROUGHENED SURFACE MAY BE FORMED, FABRICATED WITH AN EXPOSED AGGREGATE SURFACE, OR CAST WITH A CORRUGATED PIPE. IF THE PIPE OPTION IS USED, THE TOP OF THE PIPE SHOULD BE RECESSED BELOW THE TOP OF THE CAST-IN-PLACE CONCRETE TO PROVIDE CORROSION PROTECTION.
2. THE SURFACE OF THE ROUGHENED COLUMN END HAS AN EFFECT ON THE DESIGN OF THE CONNECTION. SEE PROVISIONS IN THE AASHTO LRFD GUIDE SPECIFICATIONS FOR ACCELERATED BRIDGE CONSTRUCTION.
3. THE BOTTOM OF THE COLUMN MAY BE SET BELOW THE BOTTOM OF THE FOOTING TO MEET THE REQUIREMENTS OF THE DESIGN PROCEDURE NOTED ABOVE. IF POSSIBLE, THE BOTTOM OF THE COLUMN SHOULD BE AT THE SAME ELEVATION AS THE BOTTOM OF FOOTING.

CONSTRUCTION SEQUENCE:

1. EXCAVATE FOR FOOTING AND FORM FOOTING.
2. INSTALL LEVELING PAD (STEEL PLATE OR CONCRETE LEVELING PAD)
3. INSTALL FOOTING REINFORCEMENT
4. INSTALL COLUMN PLUMB. BRACE COLUMN IN PLACE.
5. CAST FOOTING CONCRETE.



S1 SOCKET CONNECTION
CAST-IN-PLACE FOOTING TO COLUMN
AFTER CONNECTION



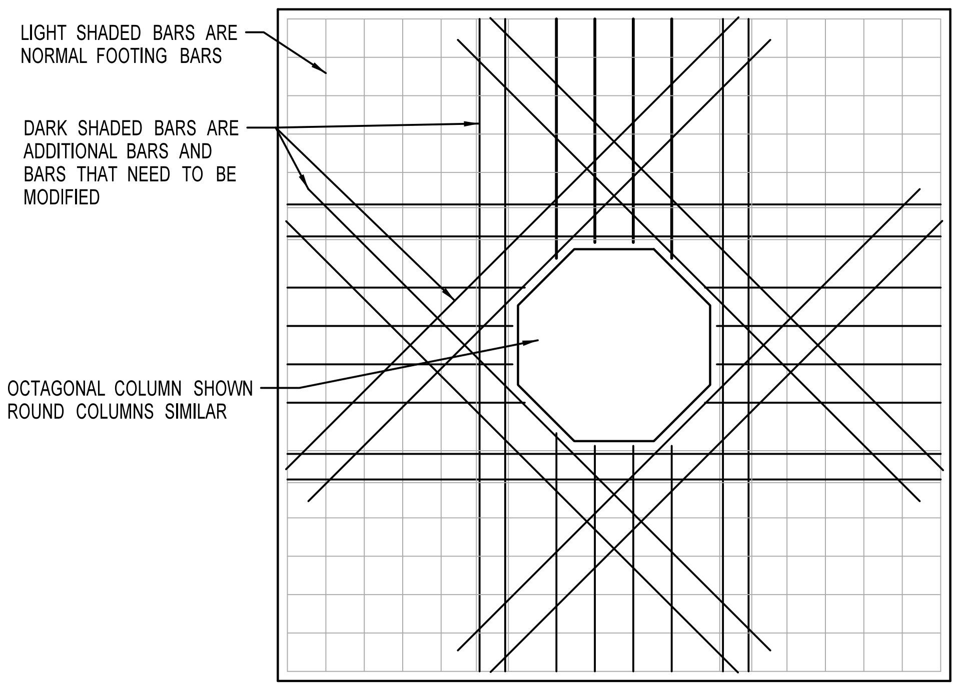
S2 SOCKET CONNECTION
PILE TO WALL PANEL

NOTES:

1. PIPE SIZE SHOULD ACCOMMODATE PILE DRIVING TOLERANCES.
2. DESIGN THE CONNECTION IN ACCORDANCE WITH THE AASHTO LRFD GUIDE SPECIFICATION FOR ABC.
3. DESIGN AND DETAILING OF CAP REINFORCEMENT IS THE SAME AS A CAST-IN-PLACE ABUTMENT CAP.

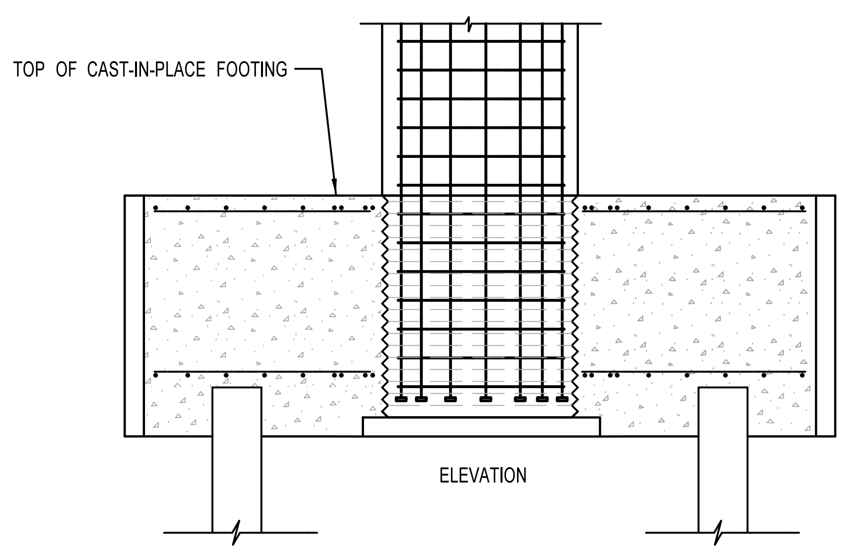
CONSTRUCTION SEQUENCE:

1. INTALL PILES
2. COMPACT SOIL AROUND PILE TO PROVIDE SUPPORT FOR CAP ERECTION
3. INSTALL ABUTMENT STEM
4. FILL CMP VOID WITH CONCRETE



PLAN

S1 SOCKET CONNECTION
CAST-IN-PLACE FOOTING TO COLUMN
BEFORE CONNECTION



S1 SOCKET CONNECTION
CAST-IN-PLACE FOOTING TO COLUMN
AFTER CONNECTION
PILE CAP OPTION

RETURN TO DETAIL USAGE TABLE

ISSUE DATE: 5/13/2022 | SHEET SUB 13

SOCKET CONNECTIONS S1 AND S2

Note: Highlighted notes represent hyperlinks

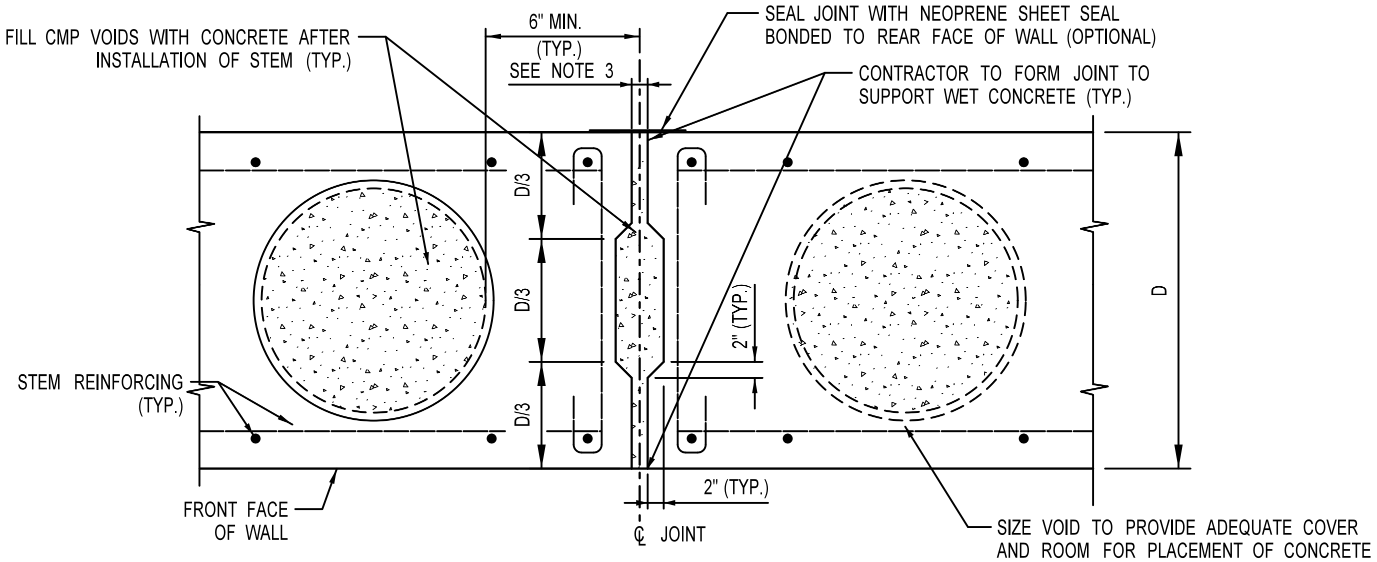
WWW.PCINE.ORG

PRECAST/PRESTRESSED CONCRETE INSTITUTE NORTHEAST

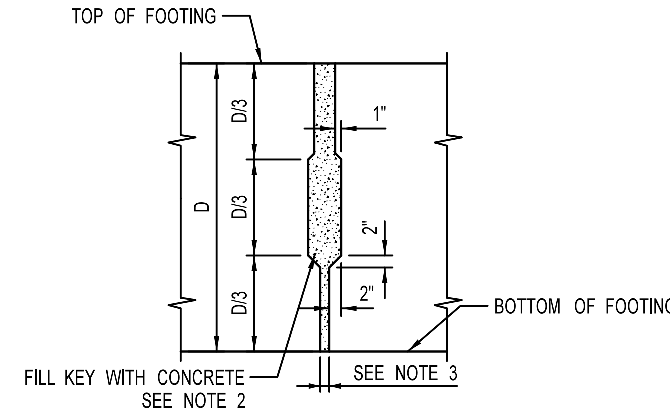
GUIDELINES FOR PRECAST SUBSTRUCTURES

REVISIONS

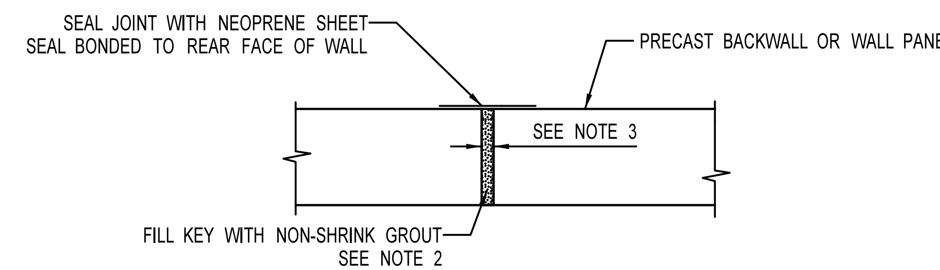
NO.	DATE	DESCRIPTION



K1 KEY CONNECTION
ABUTMENT AND WALL PIER STEM SHEAR KEY



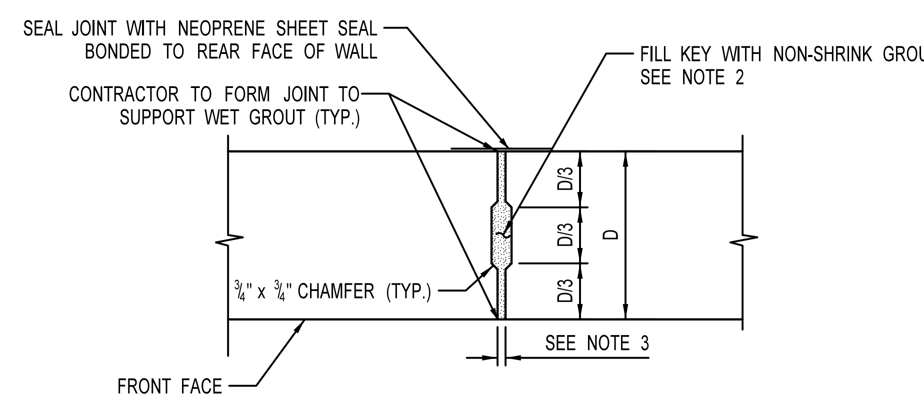
K2 KEY CONNECTION
FOOTING KEY



K3 KEY CONNECTION
WALL KEY
(OPTION 1)

KEY CONNECTION NOTES

1. NOT ALL ELEMENT REINFORCING SHOWN. ELEMENT REINFORCEMENT SHOWN IS NOT TYPICAL. THE ENGINEER SHOULD DETERMINE THE ACTUAL REINFORCEMENT REQUIRED TO SATISFY THE DESIGN REQUIREMENTS.
2. CONTRACTOR TO DESIGN FORM TO RETAIN KEY CONCRETE ON BOTH FACES OF THE ELEMENT.
3. THE WIDTH OF THE KEY WILL VARY BASED ON THE MATERIAL IN THE JOINT, THE ELEMENT TOLERANCES, AND THE ERECTION TOLERANCES. SEE TABLE FOR THE RECOMMENDED CALL OUT FOR JOINT WIDTHS.
4. CMP VOIDS ARE SHOWN FOR ABUTMENTS. MAY NOT BE NECESSARY FOR RETAINING WALLS.
5. THE SURFACES OF THE KEYS SHOULD BE SPECIFIED TO HAVE AN EXPOSED AGGREGATE FINISH. SEE PAGE v OF THESE GUIDELINES.



K3 KEY CONNECTION
WALL KEY
(OPTION 2)

TABLE 1

JOINT WIDTH CALL-OUT FOR PLANS

MATERIAL IN JOINT	DIMENSION CALL OUT
NON-SHIRNK GROUT WITH FINE AGGREGATE OR PEASTONE	1¼" ± ⅝"
CONCRETE WITH ⅜" MAXIMUM SIZED AGGREGATE	1½" ± ⅝"
CONCRETE WITH ¾" MAXIMUM SIZED AGGREGATE	2⅛" ± ⅝"

Note: Highlighted notes represent hyperlinks

RETURN TO DETAIL USAGE TABLE

ISSUE DATE: 5/13/2022

SHEET SUB 14

KEY CONNECTIONS K1, K2, AND K3

WWW.PCINE.ORG

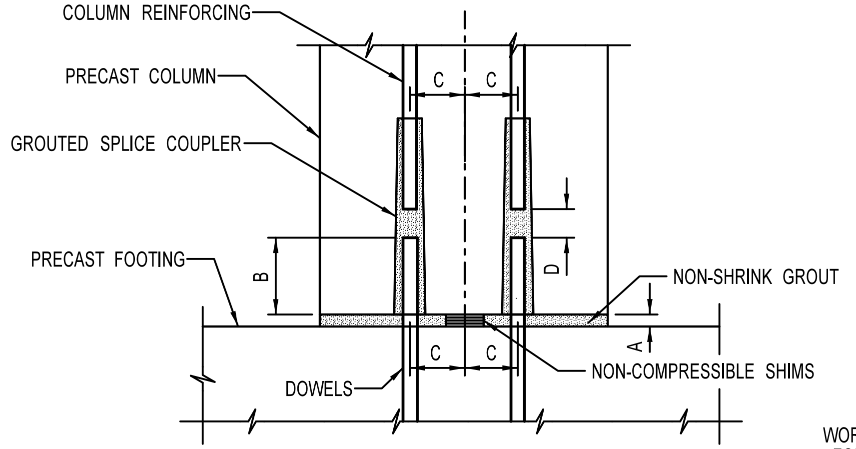
PCI®

PRECAST/PRESTRESSED CONCRETE INSTITUTE NORTHEAST

GUIDELINES FOR PRECAST SUBSTRUCTURES

REVISIONS

NO.	DATE	DESCRIPTION



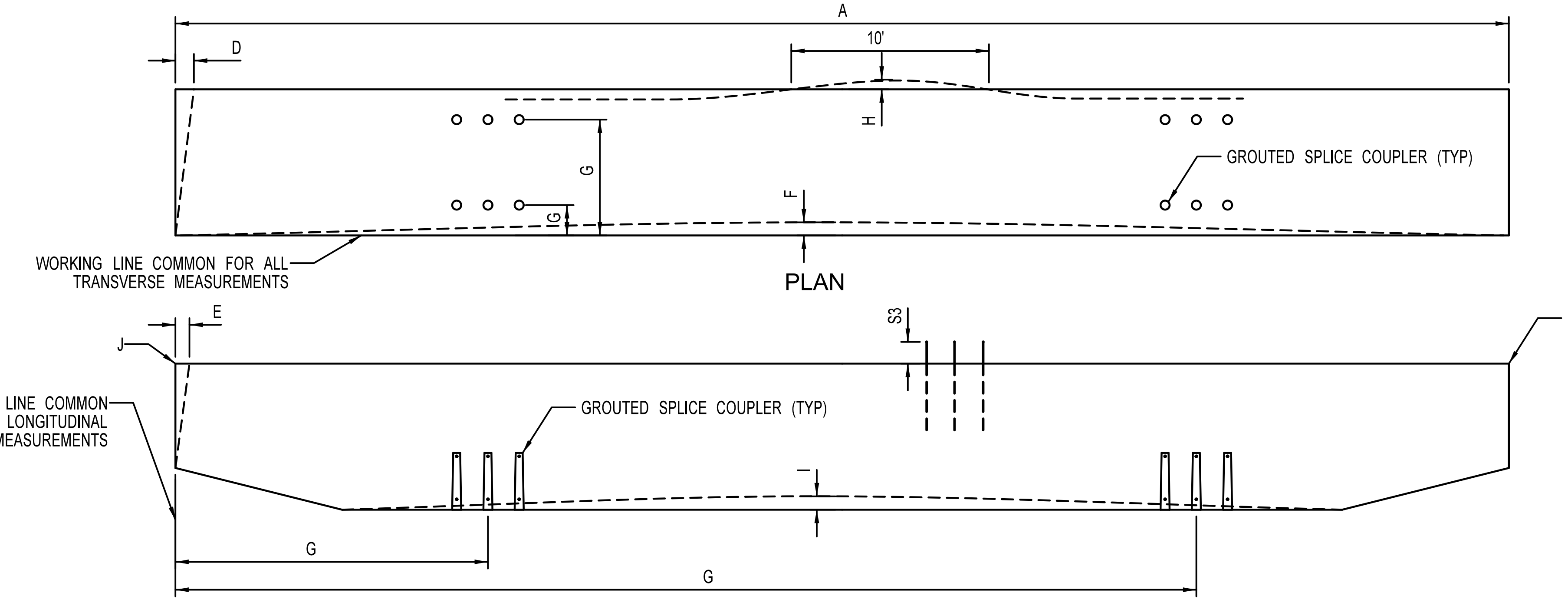
GROUTED SPLICE COUPLER DETAILS

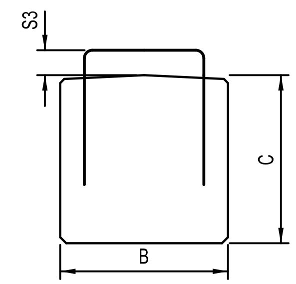
NOTES:

1. USE MATCHING TEMPLATES AND JIGS FOR THE LOCATION OF REINFORCEMENT AND GROUTED SPLICE COUPLER PLACEMENT WITHIN THE ELEMENTS TO CONTROL CRITICAL DIMENSION "C".
2. CONSULT MANUFACTURER OF THE GROUTED SPLICE COUPLER FOR PROPER DIMENSIONS "B" AND "D" AND FOR TOLERANCE ON THESE DIMENSIONS.
3. BEFORE EXECUTING GROUTED SPLICE COUPLER ASSEMBLIES, ALWAYS SEEK INSTALLATION RECOMMENDATIONS FROM THE MANUFACTURER OF THE GROUTED SPLICE COUPLER USED.

GROUTED SPLICE COUPLER TOLERANCES

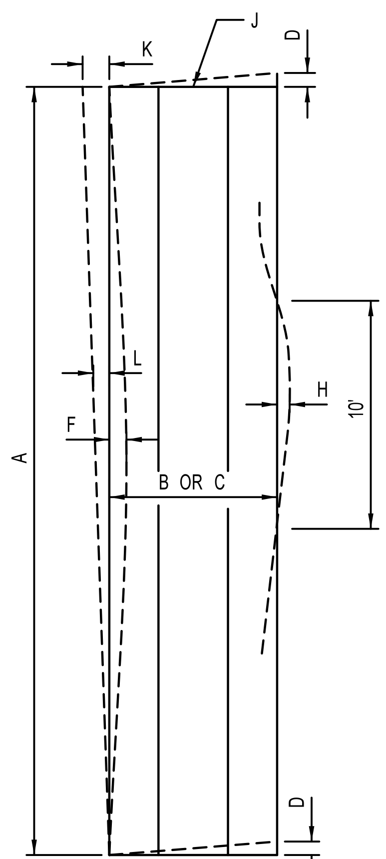
A	SHIM PACK HEIGHT	1¼" ± ⅝"
B	DOWEL HEIGHT	CONSULT MANUFACTURER
C	LOCATION OF COLUMN REINFORCING, GROUTED SPLICE COUPLER, AND FOOTING DOWELS MEASURED FROM A COMMON REFERENCE POINT	± ¼"
D	GAP BETWEEN DOWELS AND COLUMN REINFORCING	CONSULT MANUFACTURER





BENT CAP FABRICATION TOLERANCES

A	LENGTH	± ¾"
B	WIDTH (OVERALL)	± ½"
C	DEPTH (OVERALL)	± ⅜"
D	VARIATION FROM SPECIFIED PLAN END SQUARENESS OR SKEW	± ⅛" PER 12 INCH WIDTH ± ½" MAXIMUM
E	VARIATION FROM SPECIFIED ELEVATION END SQUARENESS OR SKEW	± ⅛" PER 12 INCH WIDTH ± ½" MAXIMUM
F	SWEEP, FOR MEMBER LENGTH: UP TO 40 FEET 40 FEET TO 60 FEET OVER 60 FEET	 ± ¼" ± ½" ± ⅝"
G	LOCATION OF GROUTED SPLICE COUPLER MEASURED FROM A COMMON REFERENCE POINT	± ¼"
H	LOCAL SMOOTHNESS OF ANY SURFACE	± ¼" IN 10 FEET
I	VARIATION FROM SPECIFIED CAMBER (IF PRESTRESSED)	± ⅛" PER 10 FEET ± ½" MAXIMUM
J	ERECTION ELEVATION TOLERANCE	± ¼"
S3	STIRRUP OR BAR PROJECTION FROM CAP SURFACE	+¼", -½"

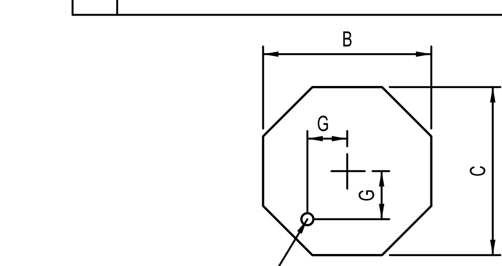


COLUMN FABRICATION TOLERANCES

A	LENGTH	± ½"
B	WIDTH (OVERALL)	± ¼"
C	DEPTH (OVERALL)	± ¼"
D	VARIATION FROM SPECIFIED END SQUARENESS OR SKEW	± ⅛" PER 12 INCH WIDTH ± ⅜" MAXIMUM
F	SWEEP, FOR MEMBER LENGTH:	± ⅛" PER 10 FEET ± ½" MAXIMUM
G	LOCATION OF GROUTED SPLICE COUPLER MEASURED FROM A COMMON REFERENCE POINT	± ¼"
H	LOCAL SMOOTHNESS OF ANY SURFACE	± ¼" IN 10 FEET

COLUMN ERECTION TOLERANCES

J	TOP ELEVATION FROM NOMINAL TOP ELEVATION MAXIMUM LOW MAXIMUM HIGH	 ¼" ¼"
K	MAXIMUM PLUMB VARIATION OVER HEIGHT OF COLUMN	½"
L	PLUMB IN ANY 10 FEET OF COLUMN HEIGHT	¼"



Note: Highlighted notes represent hyperlinks

RETURN TO DETAIL USAGE TABLE

ISSUE DATE: 5/13/2022

SHEET SUB 15

PIER BENT ELEMENT TOLERANCES

WWW.PCINE.ORG

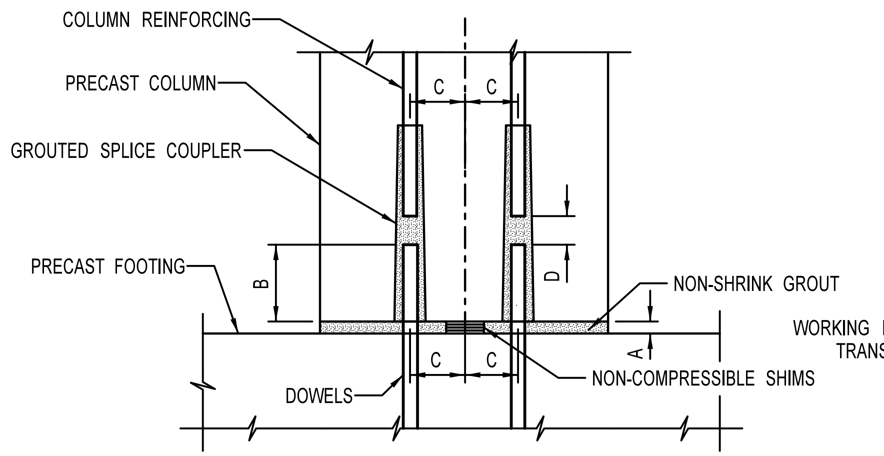
PCI®

PRECAST/PRESTRESSED CONCRETE INSTITUTE NORTHEAST

GUIDELINES FOR PRECAST SUBSTRUCTURES

REVISIONS

NO.	DATE	DESCRIPTION

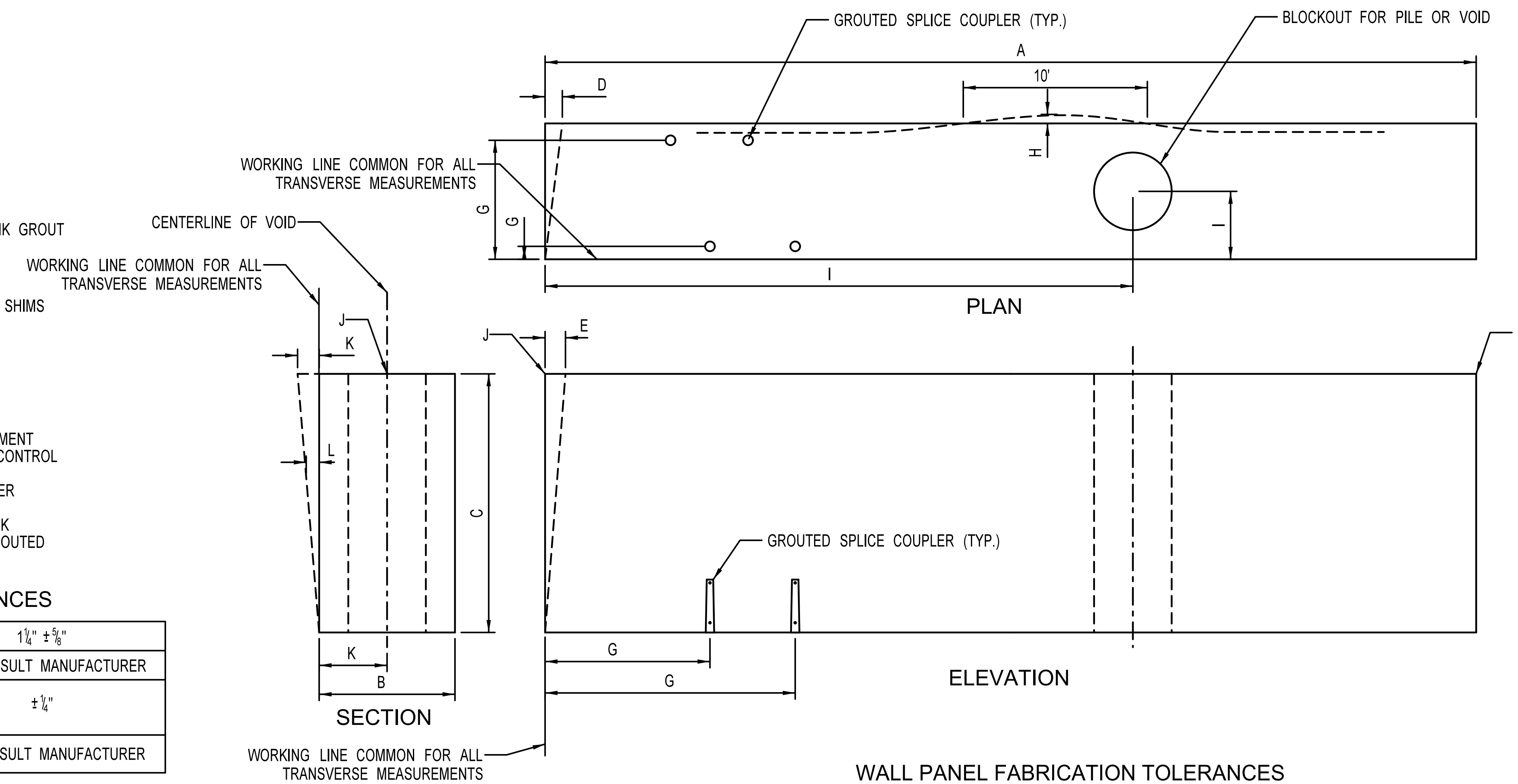


GROUTED SPLICE COUPLER DETAILS

NOTES:
1. USE MATCHING TEMPLATES AND JIGS FOR THE LOCATION OF REINFORCEMENT AND GROUTED SPLICE COUPLER PLACEMENT WITHIN THE ELEMENTS TO CONTROL CRITICAL DIMENSION "C".
2. CONSULT MANUFACTURER OF THE GROUTED SPLICE COUPLER FOR PROPER DIMENSIONS "B" AND "D" AND FOR TOLERANCE ON THESE DIMENSIONS.
3. BEFORE EXECUTING GROUTED SPLICE COUPLER ASSEMBLIES, ALWAYS SEEK INSTALLATION RECOMMENDATIONS FROM THE MANUFACTURER OF THE GROUTED SPLICE COUPLER USED.

GROUTED SPLICE COUPLER TOLERANCES

A	SHIM PACK HEIGHT	1¼" ± ⅝"
B	DOWEL HEIGHT	CONSULT MANUFACTURER
C	LOCATION OF COLUMN REINFORCING, GROUTED SPLICE COUPLER, AND FOOTING DOWELS MEASURED FROM A COMMON REFERENCE POINT	± ¼"
D	GAP BETWEEN DOWELS AND COLUMN REINFORCING	CONSULT MANUFACTURER



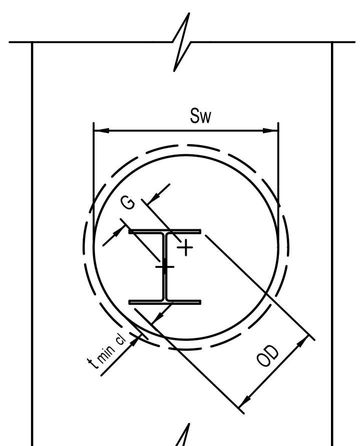
NOTE: THESE TOLERANCES APPLY TO THE FOLLOWING ELEMENTS
INTEGRAL ABUTMENT STEMS
CANTILEVER ABUTMENT STEMS
ABUTMENT BACKWALLS
CANTILEVER RETAINING WALLS

WALL PANEL FABRICATION TOLERANCES

A	LENGTH	± ⅜"
B	WIDTH (OVERALL)	± ¼"
C	DEPTH (OVERALL)	± ⅜"
D	VARIATION FROM SPECIFIED PLAN END SQUARENESS OR SKEW	± ⅛" PER 12 INCH WIDTH ± ½" MAXIMUM
E	VARIATION FROM SPECIFIED ELEVATION END SQUARENESS OR SKEW	± ⅛" PER 12 INCH WIDTH ± ½" MAXIMUM
G	LOCATION OF GROUTED SPLICE COUPLER MEASURED FROM A COMMON REFERENCE POINT	± ¼"
H	LOCAL SMOOTHNESS OF ANY SURFACE	± ¼" IN 10 FEET
I	LOCATION OF BLOCKOUT FOR PILES OR VOIDS	± 1"

WALL PANEL ERECTION TOLERANCES

J	TOP ELEVATION FROM NOMINAL TOP ELEVATION MAXIMUM LOW MAXIMUM HIGH	 ¼" ¼"
K	MAXIMUM PLUMB VARIATION OVER HEIGHT OF COLUMN	½"
L	PLUMB IN ANY 10 FEET OF COLUMN HEIGHT	¼"



CORRUGATED METAL PIPE POCKET TOLERANCES

RECOMMENDED PIPE SIZE = $Sw = 2t_{min\ cl} + OD + 2Tw$

WHERE:
$t_{min\ cl}$ = MINIMUM ALLOWABLE SPACE BETWEEN PILE AND CMP FOR MATERIAL PLACEMENT
OD = MAXIMUM OUTSIDE PLAN DIMENSION OF PILE
Tw = PILE POCKET WIDTH TOLERANCE FACTOR (SEE TABLE BELOW)

PILE INSTALLATION SPECIFICATION TOLERANCE (G)	Tw
3"	3.25"
6"	6.125"
9"	9.125"

Note: Highlighted notes represent hyperlinks

RETURN TO DETAIL USAGE TABLE

ISSUE DATE: 5/13/2022 | SHEET SUB 16

ABUTMENT AND WALL ELEMENT TOLERANCES

WWW.PCINE.ORG

PCI®
PRECAST/PRESTRESSED CONCRETE INSTITUTE NORTHEAST

GUIDELINES FOR PRECAST SUBSTRUCTURES

REVISIONS
NO.	DATE	DESCRIPTION