PRECAST CONCRETE SUBSTRUCTURES NOTES

GUIDELINES

THESE GUIDELINE DRAWINGS REPRESENT TYPICAL DETAILS FOR THE DESIGN AND DETAILING OF PRECAST CONCRETE SUBSTRUCTURES.

THESE SHEETS ARE INCLUDED TO 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. DESIGN AND DETAIL EACH SUBSTRUCTURE ACCORDING TO THE SPECIFIC REQUIREMENTS OF EACH BRIDGE.

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.

RECOMMENDED MAXIMUM SIZES OF ELEMENTS:

- WIDTH: THE MAXIMUM WIDTH OF THE ELEMENT INCLUDING ANY PROJECTING REINFORCING SHOULD BE KEPT BELOW 12FT FOR SHIPPING REASONS
- WEIGHT: THE MAXIMUM WEIGHT OF EACH ELEMENT SHOULD BE KEPT TO LESS THAN 100KIP.
- HEIGHT: THE MAXIMUM HEIGHT OF ANY ELEMENT INCLUDING PROJECTING REINFORCING SHOULD BE KEPT TO LESS THAN 10FT FOR SHIPPING REASONS.
- LENGTH: THE MAXIMUM LENGTH OF ANY ELEMENT SHOULD BE KEPT TO LESS THAN 120 FEET

IMPLEMENTATION

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 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.

ENSURE SUFFICIENT DETAIL IS ADDED TO THE DESIGN PLANS TO ENSURE PROPER FIT UP OF PRECAST ELEMENTS IN THE FIELD. TOLERANCE DETAIL SHEETS DEPICT A WORKING METHOD FOR ACHIEVING PROPER FIT UP.

SPECIAL MATERIALS AND DEVICES

THE DETAILS CONTAINED HEREIN SHOW STANDARD 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:

1. 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.
2. 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 BRIDGE DESIGN SPECIFICATIONS. THESE DEVICES ARE PROPRIETARY; HOWEVER, THERE ARE MULTIPLE COMPANIES THAT CAN SUPPLY THESE PRODUCTS.
3. LEVELING BOLTS: 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.

GENERAL NOTES

DESIGN PRECAST CONCRETE SUBSTRUCTURE ELEMENTS IN ACCORDANCE WITH THE LATEST EDITION OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS EXCEPT AS NOTED OTHERWISE.

PROVIDE CLEAR COVER FOR REINFORCING AND GROUTED SPLICE COUPLERS AS PER STATE STANDARDS IN ALL SUBSTRUCTURE ELEMENTS UNLESS OTHERWISE NOTED.

CONTRACTOR TO PROVIDE TEMPORARY BRACING FOR ALL ELEMENTS UNTIL CONNECTIONS HAVE ACHIEVED ADEQUATE STRENGTH.

THE CONTRACTOR MAY SUBSTITUTE ALTERNATE LEVELING DEVICES PROVIDED THEY CAN PRODUCE A STRUCTURE WITHIN THE SPECIFIED ERECTION TOLERANCES.

CHAMFER ALL EXPOSED EDGES AND CORNERS $^{3}/_{4}$".

SHOW ESTIMATED SHIPPING WEIGHTS FOR ALL PRECAST ELEMENTS ON CONTRACT DRAWINGS.

PROVIDE MILD REINFORCEMENT AS PER STATE SPECIFICATIONS UNLESS OTHERWISE NOTED.

TOLERANCES

ALL PRECAST CONCRETE ELEMENTS TO BE FABRICATED TO THE SPECIFIED DIMENSIONS WITHIN ACCEPTABLE INDUSTRY TOLERANCES. THE DETAILING AND LAYOUT OF PRECAST ELEMENTS SHOULD ACCOUNT FOR THE FABRICATION AND ERECTION TOLERANCES.

THE DESIGNER SHOULD SPECIFY AND DETAIL ELEMENT FABRICATION TOLERANCES, ELEMENT ERECTION AND INSTALLATION TOLERANCES (BOTH HORIZONTAL AND VERTICAL), AND PILE DRIVING TOLERANCES (IF APPLICABLE).

RECOMMENDED ELEMENT FABRICATION TOLERANCES ARE SHOWN ON SHEETS 11 AND 12. 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 ERECTION ERRORS.

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.

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.

SEVERAL OF THE GUIDE DETAILS MAKE USE OF GROUTED SPLICE COUPLERS. CONTRACTORS MAY CHOOSE TO EXTEND REINFORCING BARS FROM ADJACENT ELEMENTS WITH EXTRA LENGTH. THE BAR EXTENSIONS CAN THEN BE CUT TO THE COUPLER MANUFACTURER'S RECOMMENDED LENGTH BASED ON REQUIRED ELEMENT ERECTION TOLERANCES.

DETAILS FOR FOUNDATION VOIDS ARE BASED ON A LATERAL INSTALLATION TOLERANCE OF ±3 INCHES IN PLAN FOR DRILLED SHAFTS AND DRIVEN PILES. IF THIS CANNOT BE ACCOMPLISHED THE DETAILS SHOWN HEREIN SHOULD BE ADJUSTED IN ORDER TO ACCOMMODATE THE ANTICIPATED TOLERANCES. FOR DETERMINING THE MINIMUM SIZE OF THE CORRUGATED METAL PIPE FOR USE WITH THE SUBSTRUCTURE ELEMENTS USE THE FOLLOWING:

PIPE PILE: O.D. + 8"
H-PILE OR PRECAST PILE: PILE DIA. + 8" (MEASURED DIAGONALLY FROM CORNERS)
DRILLED SHAFT: O.D. OF SPIRAL + 8"

THIS IS BASED ON PROVIDING A 1" MINIMUM GAP BETWEEN THE PILE AND THE SIDE OF THE VOID WITH THE MAXIMUM OFFSET TOLERANCE. NOTE THAT CORRUGATED METAL PIPE SIZES ARE BASED ON INSIDE DIAMETER.

CONCRETE 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 2000 PSI 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 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
- NORMAL CONCRETE: CONCRETE THAT WILL GAIN THE DESIGN STRENGTH IN LESS THAN 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. CONTROLLED DENSITY FILLS ARE FLOWABLE AND ARE LESS EXPENSIVE THAN FLOWABLE GROUTS. 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.

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 BEAM HAUNCHES AND 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.

INDEX OF SHEETS

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PRECAST/PRESTRESSED CONCRETE INSTITUTE NORTHEAST

SUGGESTED GUIDE DETAILS PRECAST SUBSTRUCTURES

PRECAST CONCRETE SUBSTRUCTURE NOTES

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SHEET: SUB-1

ISSUE DATE: 06-05-12

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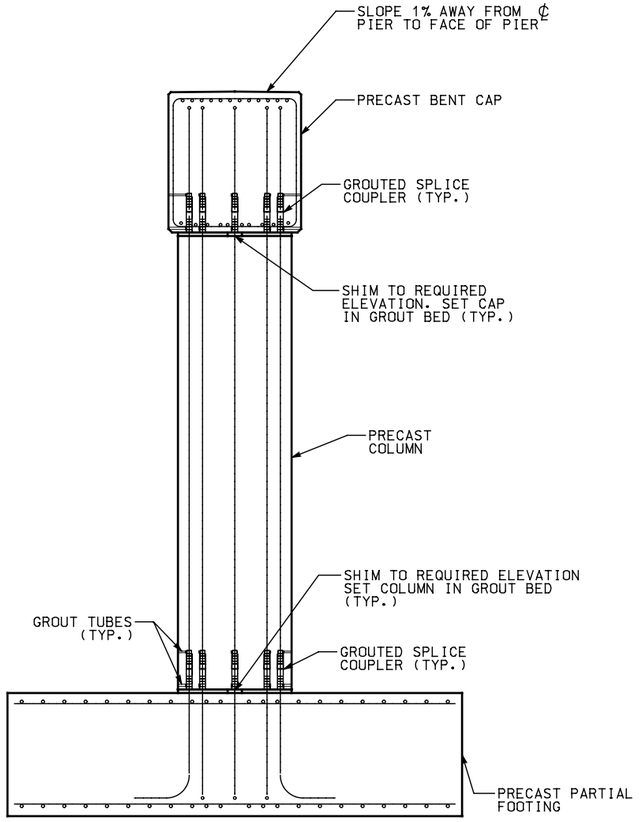
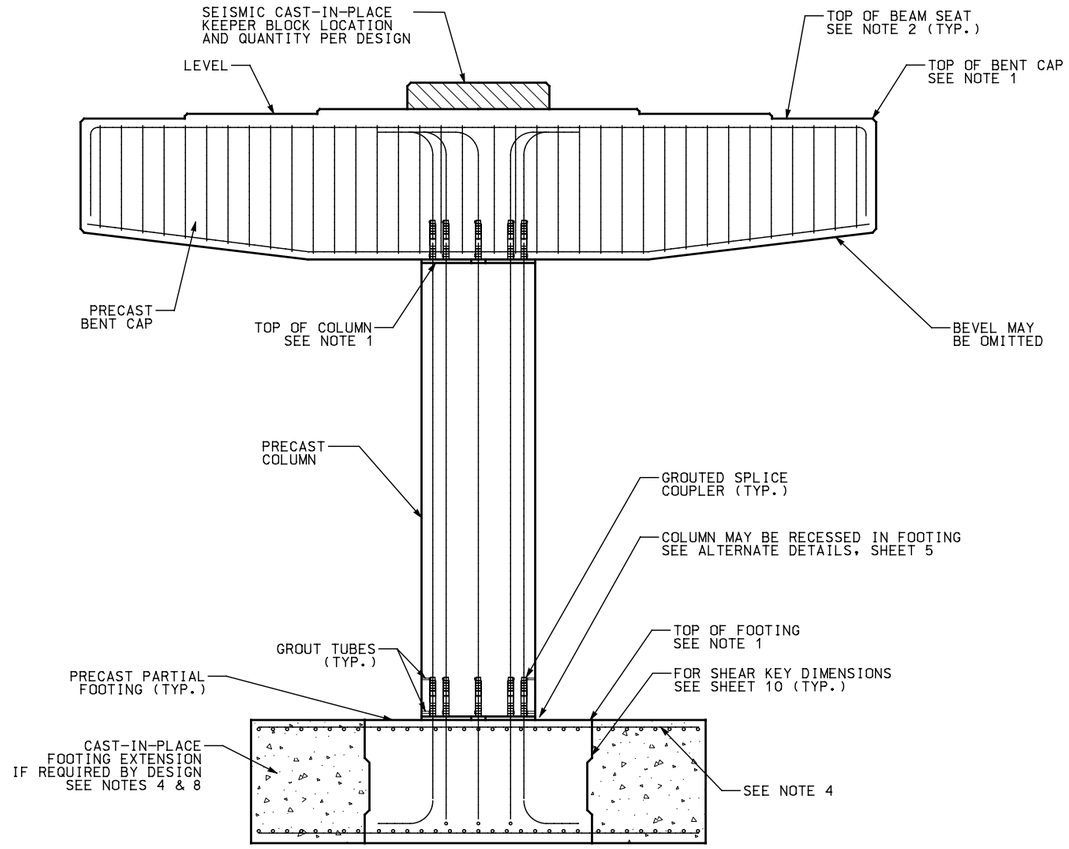
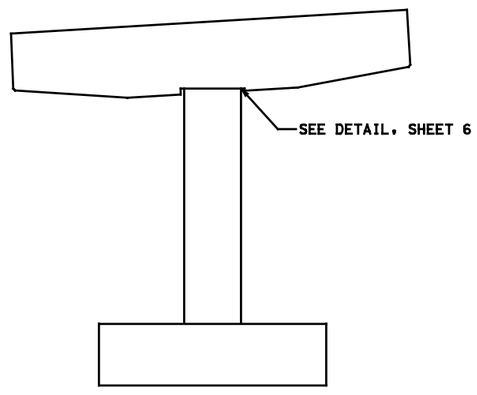


PRECAST SINGLE COLUMN BENT SIDE VIEW



PRECAST SINGLE COLUMN BENT ELEVATION

NOTE: PIER CAP TOP CAN BE MODIFIED TO STATE STANDARDS.



SCHEMATIC SLOPED PIER CAP DETAIL

NOTES

1. ERECTION TOLERANCE ON ELEVATION ±1/4".
2. ERECTION TOLERANCE ON BEAM SEAT ELEVATION ±1/8". MAY BE SET HIGH AND GROUND TO SPECIFIED ELEVATION.
3. COLUMN SHEAR REINFORCEMENT NOT SHOWN FOR CLARITY.
4. 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 (IF REQUIRED).
5. A LEVEL PIER CAP IS PREFERRED TO REDUCE FABRICATION COSTS. SLOPED CAPS ARE PERMITTED AS SHOWN IN THE SCHEMATIC DETAIL.
6. SEISMIC KEEPER BLOCK MAY BE PLACED BETWEEN OTHER BEAMS IF REINFORCING CONFLICTS ARISE.
7. FOOTING TO BE SET TO A TOLERANCE OF ±1/4" IN 4 FEET.
8. USE CAST IN PLACE EXTENSIONS TO KEEP SIZE AND WEIGHT OF FOOTING WITHIN RECOMMENDED MAXIMUM SIZE LIMITS.

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SUGGESTED GUIDE DETAILS PRECAST SUBSTRUCTURES

SINGLE COLUMN BENT

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SHEET: SUB-2

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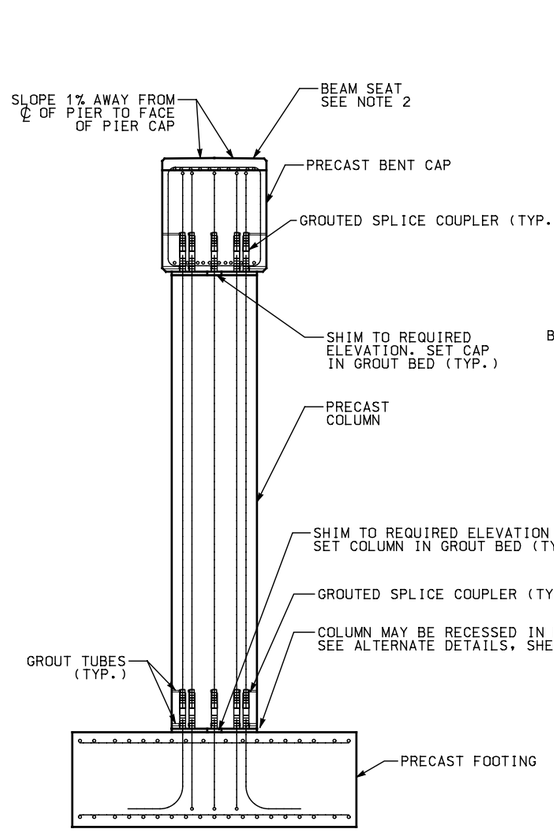
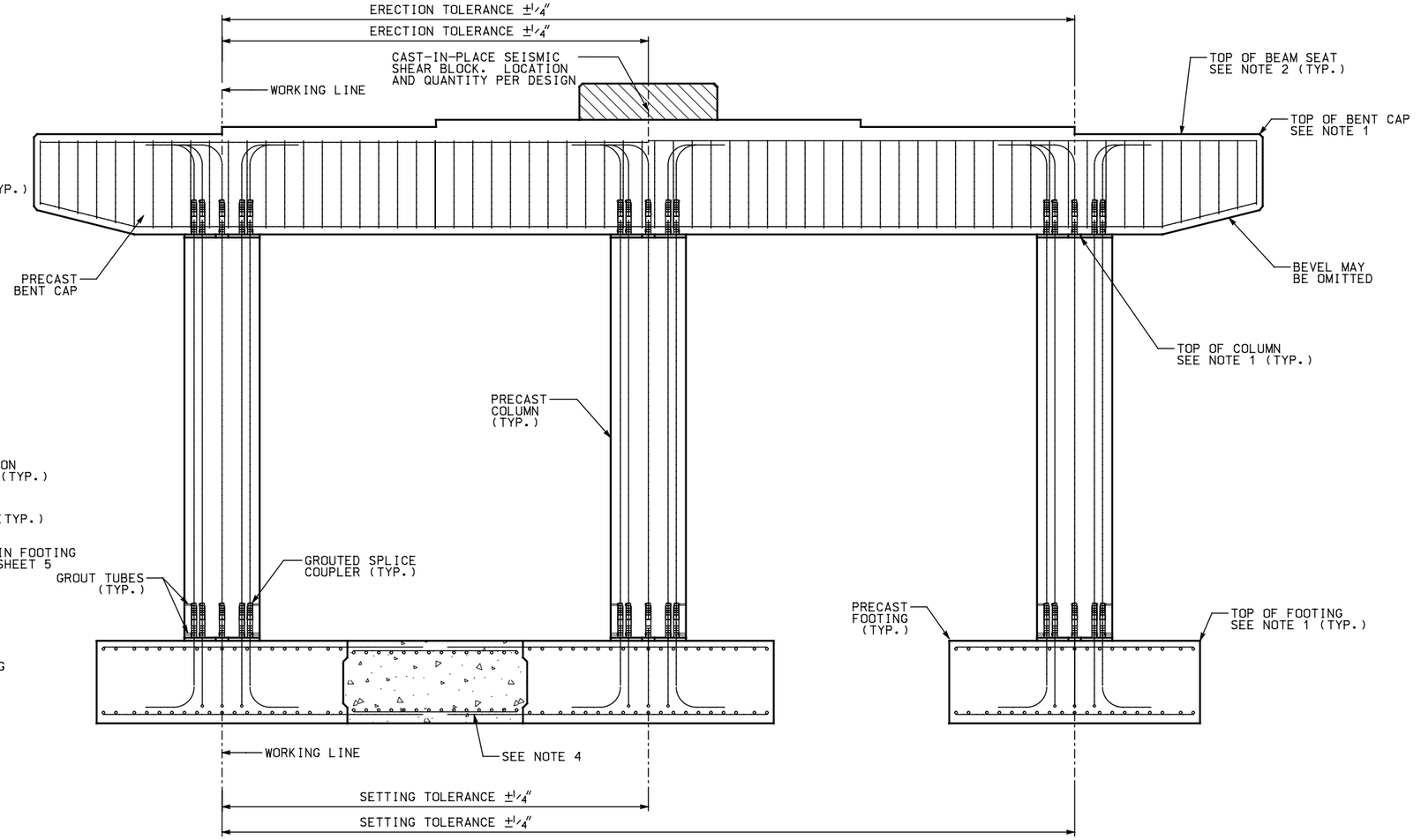
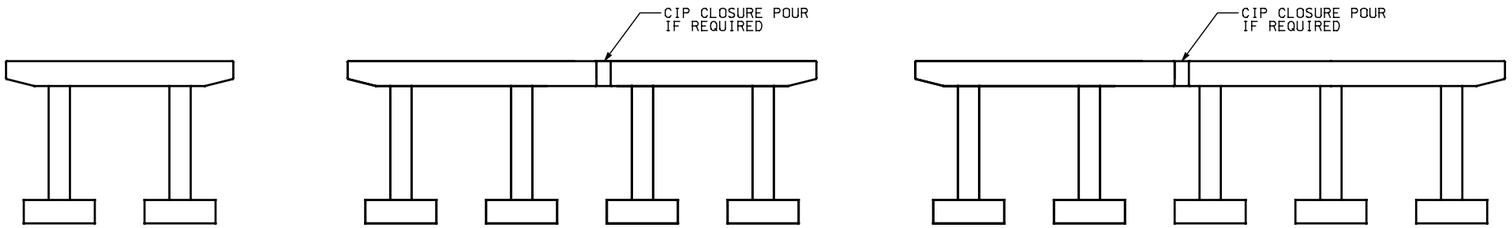


PRECAST TRIPLE COLUMN BENT
SIDE VIEW



PRECAST TRIPLE COLUMN BENT
ELEVATION



SCHEMATIC
PIER BENT DETAILS

NOTES

1. ERECTION TOLERANCE ON ELEVATION ±1/4".
2. ERECTION TOLERANCE ON BEAM SEAT ELEVATION ±1/8". MAY BE SET HIGH AND GROUND TO SPECIFIED ELEVATION.
3. COLUMN SHEAR REINFORCEMENT NOT SHOWN FOR CLARITY.
4. FOOTINGS MAY BE MADE CONTINUOUS BY EXTENDING REINFORCEMENT AND CASTING A CLOSURE POUR, SIMILAR TO DETAILS ON SHEET 7.
5. SEISMIC KEEPER BLOCK MAY BE PLACED BETWEEN OTHER BEAMS IF REINFORCING CONFLICTS ARISE.
6. FOOTING TO BE SET TO A TOLERANCE OF ±1/4" IN 4 FEET.
7. USE CAST IN PLACE EXTENSIONS TO KEEP SIZE AND WEIGHT OF FOOTING WITHIN THE RECOMMENDED MAXIMUM SIZE LIMITS AND TO CONNECT INDIVIDUAL FOOTINGS TO FORM A COMMON FOOTING.
8. A LEVEL PIER CAP IS PREFERRED TO REDUCE FABRICATION COSTS. SLOPED CAPS ARE PERMITTED. SEE DETAILS ON SHEET 6.

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MULTI-COLUMN BENT

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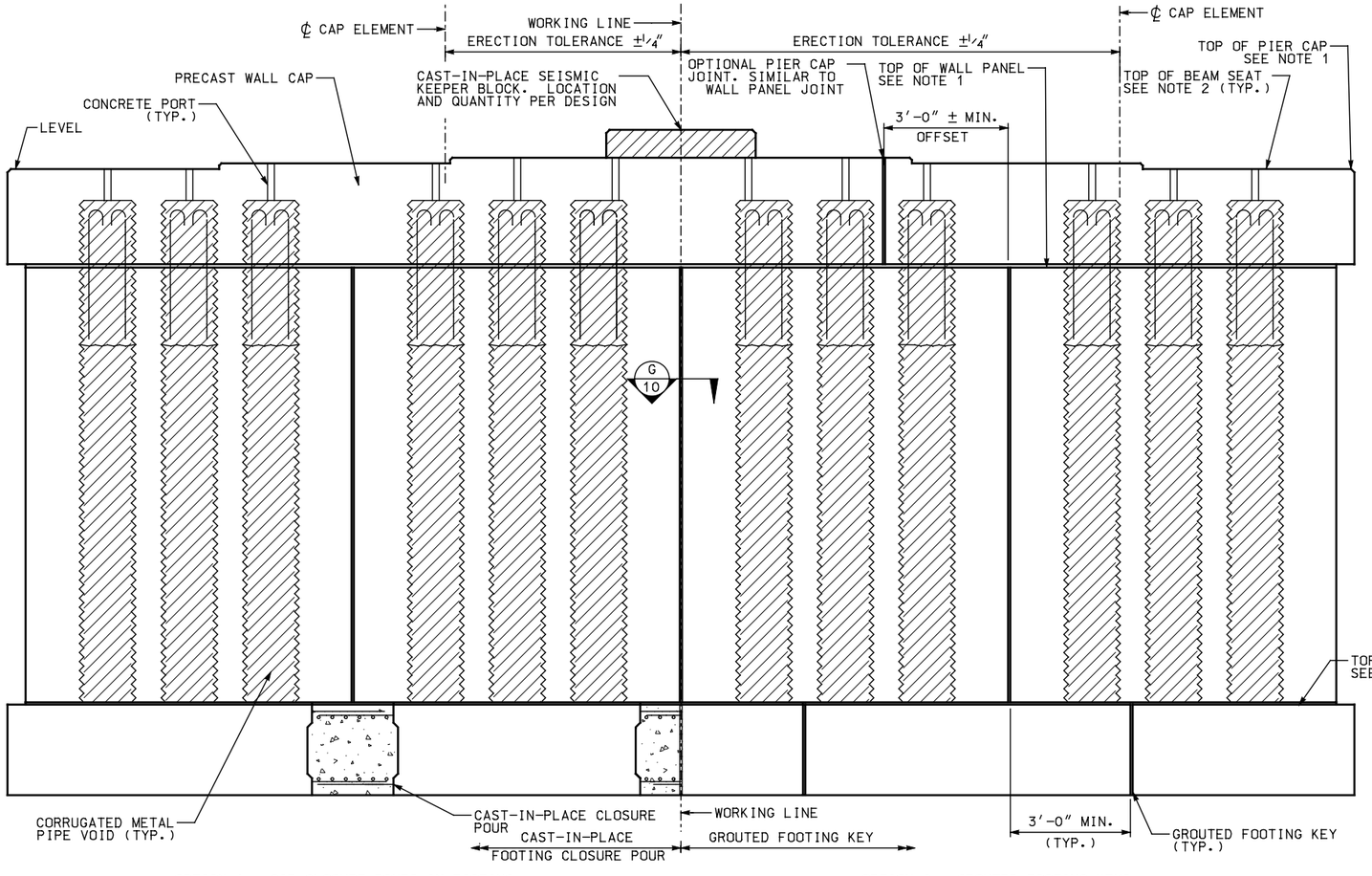
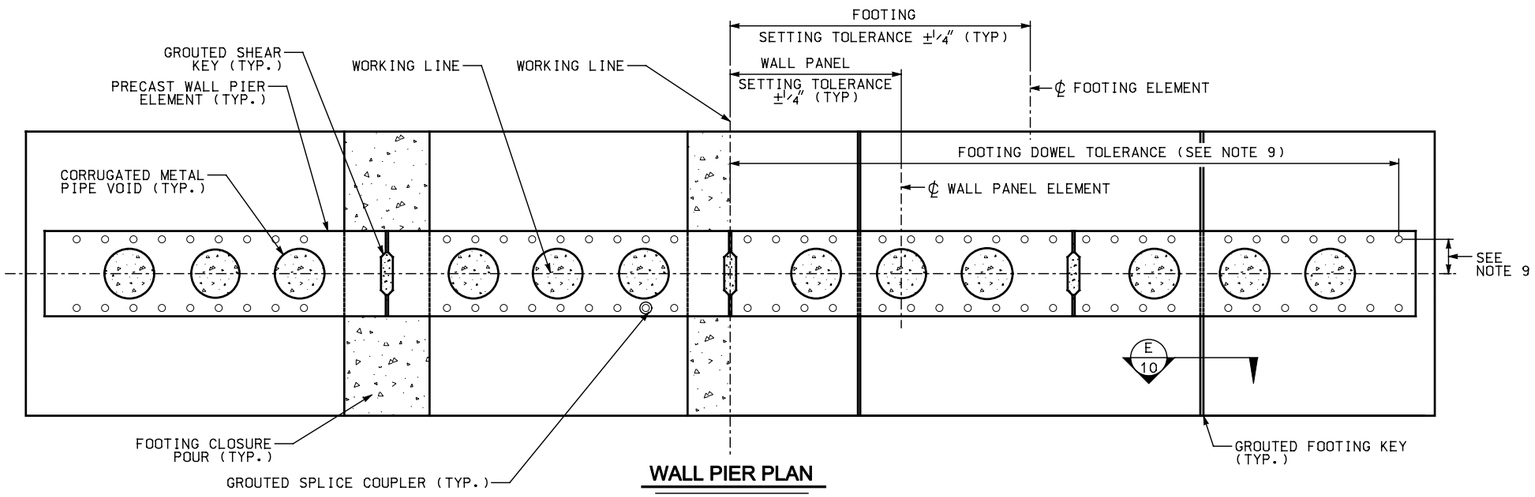


OPTION 1: CIP CLOSURE POURS IN FOOTING

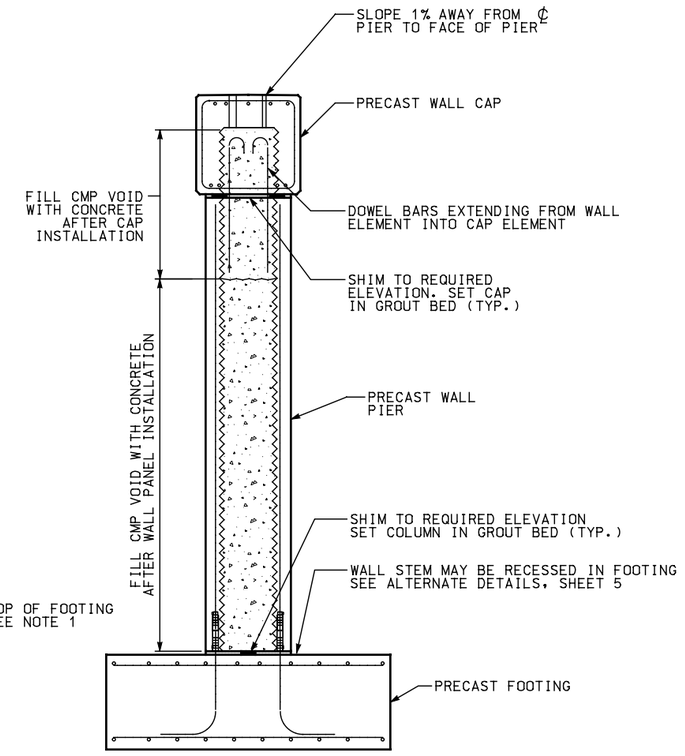
OPTION 2: GROUTED FOOTING KEYS

WALL PIER ELEVATION

NOTE: GROUTED SPLICE COUPLERS AND WALL REINFORCING NOT SHOWN.



WALL PIER PLAN



TYPICAL PRECAST WALL PIER SECTION

NOTES

1. ERECTION TOLERANCE ON ELEVATION ±1/4" MEASURED AT THE CENTERLINE OF THE WALL PANEL.
2. ERECTION TOLERANCE ON BEAM SEAT ELEVATION ±1/8". MAY BE SET HIGH AND GROUND TO SPECIFIED ELEVATION.
3. CAP AND WALL SHEAR REINFORCEMENT NOT SHOWN FOR CLARITY.
4. SEISMIC KEEPER BLOCK MAY BE PLACED BETWEEN OTHER BEAMS IF REINFORCING CONFLICTS ARISE.
5. FOOTING TO BE SET TO AN ELEVATION TOLERANCE OF ±1/4".
6. THE CMP VOIDS SERVE TWO PURPOSES:
   - -THEY REDUCE THE SHIPPING AND HANDLING WEIGHT OF THE PANEL.
   - -THEY PROVIDE FOR A SIMPLE CONNECTION FOR THE PIER CAP ELEMENT.
7. THE DOWELS BETWEEN THE PIER CAP AND THE WALL PANEL SHALL BE DESIGNED TO RESIST ALL ANTICIPATED FORCES.
8. FOOTINGS CAN BE DETAILED WITH EITHER GROUTED KEYS OR CLOSURE POURS. IF 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.
9. LOCATION OF GROUTED SPLICE COUPLER TO BE ACCORDING TO TOLERANCES NOTED ON SHEET 11. TOLERANCE FOR ALL COUPLERS IN FOOTINGS SHALL BE BASED ON A COMMON WORKING LINE.

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SUGGESTED GUIDE DETAILS PRECAST SUBSTRUCTURES

WALL PIER

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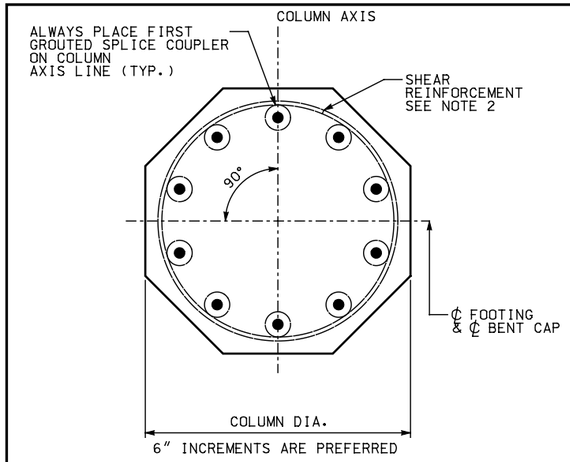
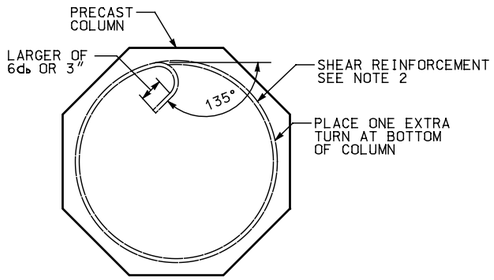
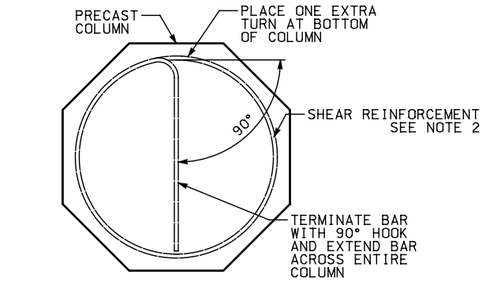


TYPICAL OCTAGONAL COLUMN SECTION



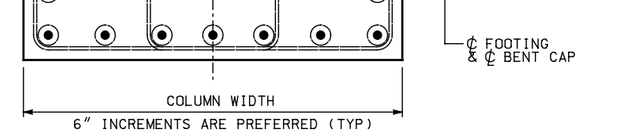
SHEAR REINFORCEMENT SPIRAL REINFORCEMENT TERMINATION PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS

NOTE: COLUMN VERTICAL REINFORCEMENT NOT SHOWN FOR CLARITY.

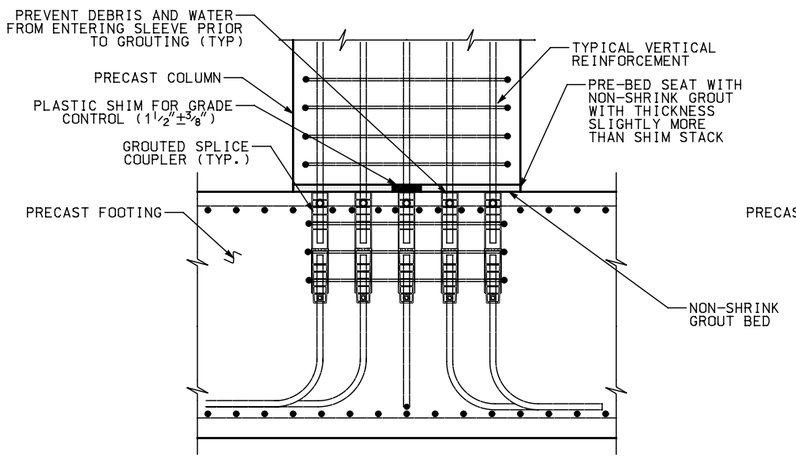


SHEAR REINFORCEMENT SPIRAL REINFORCEMENT TERMINATION PER AASHTO SEISMIC GUIDE SPECIFICATIONS

NOTE: COLUMN VERTICAL REINFORCEMENT NOT SHOWN FOR CLARITY.

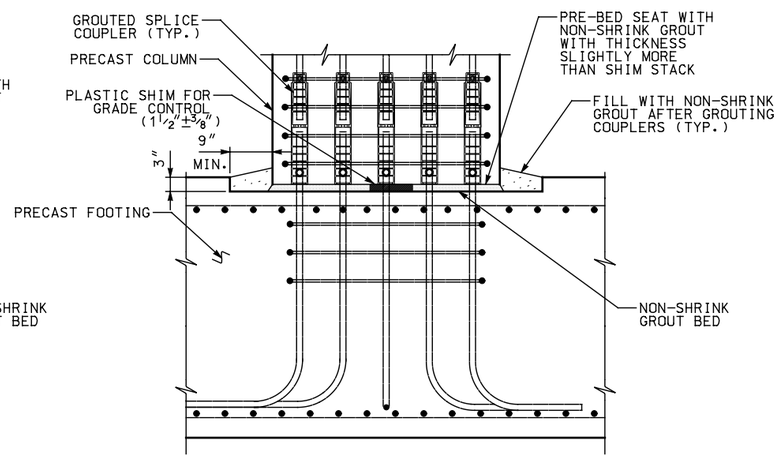


TYPICAL RECTANGULAR COLUMN SECTION



OPTIONAL PRECAST COLUMN TO FOOTING CONNECTION

NOTE: THE GROUTED SPLICE COUPLERS MAY BE INSTALLED IN THE PRECAST COLUMN, RATHER THAN THE FOOTING.



OPTIONAL RECESSED FOOTING - PREFERRED

NOTE: COLUMN SHOWN, WALL PANEL SIMILAR.

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.
3. IT IS RECOMMENDED TO PLACE THE FIRST GROUTED SPLICE COUPLER ON THE COLUMN AXIS LINE TO FACILITATE EASE OF CONSTRUCTION.
4. 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.

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

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)

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.
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. 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.

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COLUMN DETAILS

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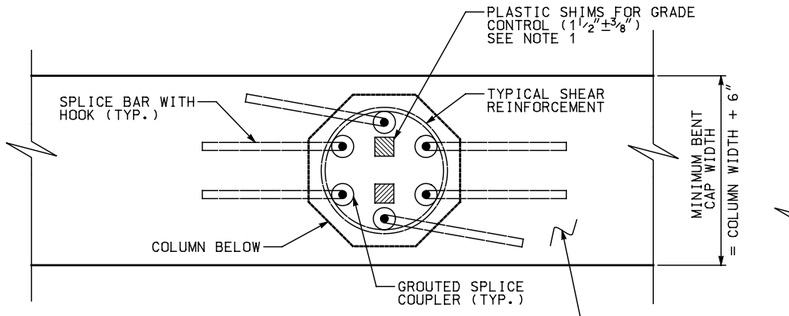
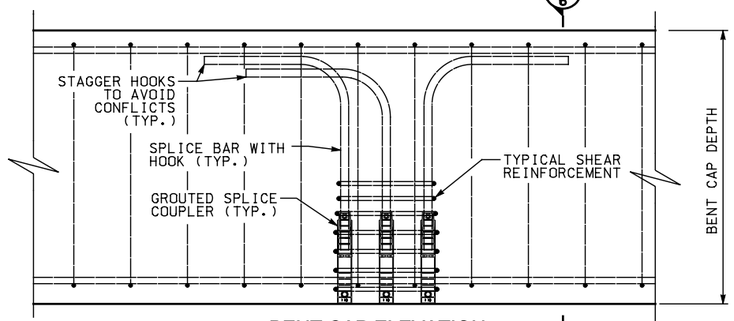
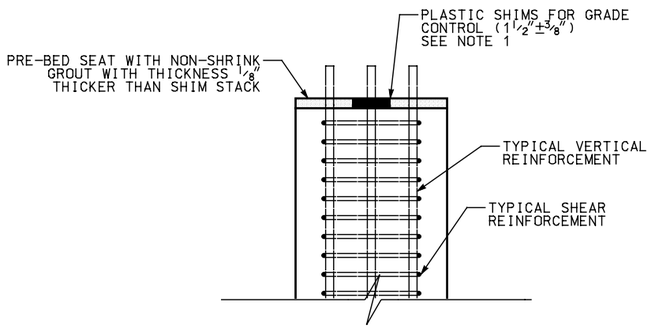


BENT CAP PLAN



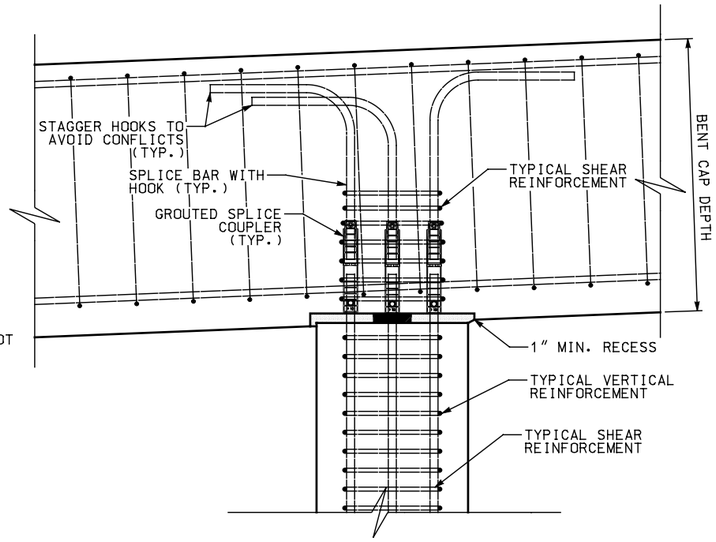
BENT CAP ELEVATION



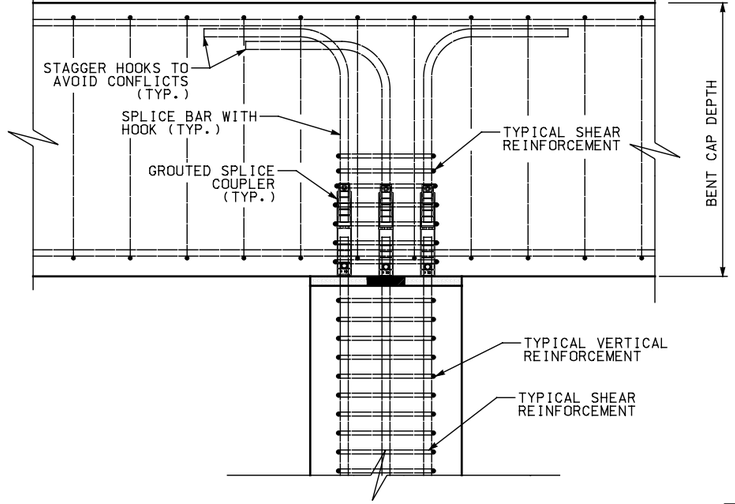
COLUMN ELEVATION

COLUMN TO BENT CAP CONNECTION PRIOR TO CONNECTION

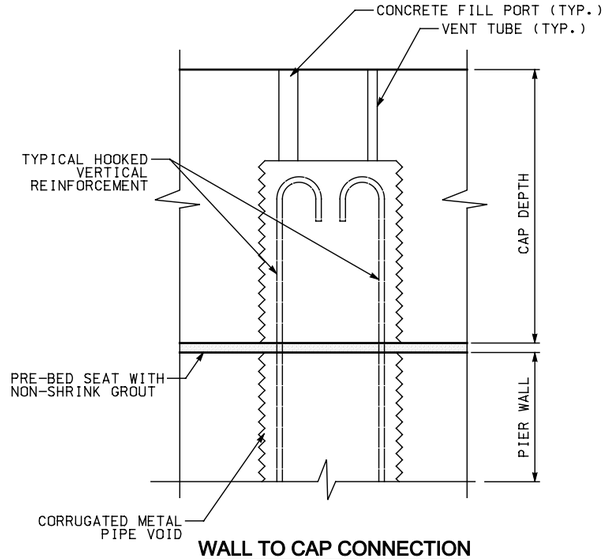
NOTES:
1. THIS DETAIL CAN BE USED FOR A COLUMN-TO-COLUMN SPLICE ALSO.



COLUMN TO SLOPED BENT CAP CONNECTION AFTER CONNECTION

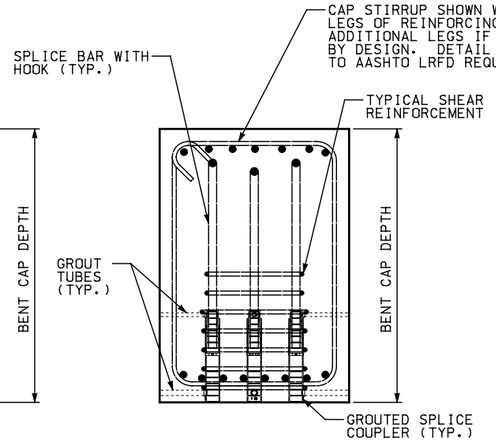


COLUMN TO BENT CAP CONNECTION AFTER CONNECTION



WALL TO CAP CONNECTION

NOTE: WALL AND CAP REINFROCING NOT SHOWN FOR CLARITY



SECTION A BENT CAP SECTION

NOTES

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

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TYPICAL PIER CONNECTION DETAILS

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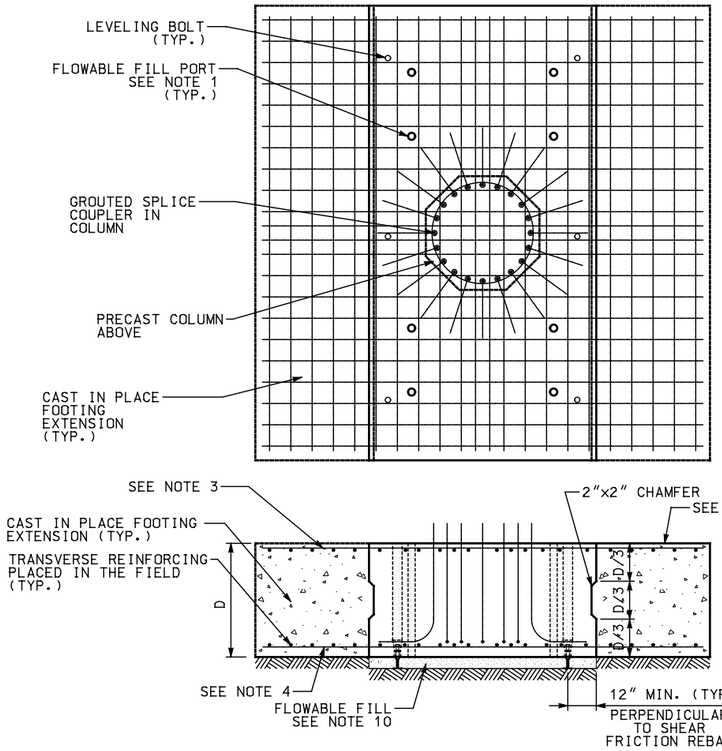
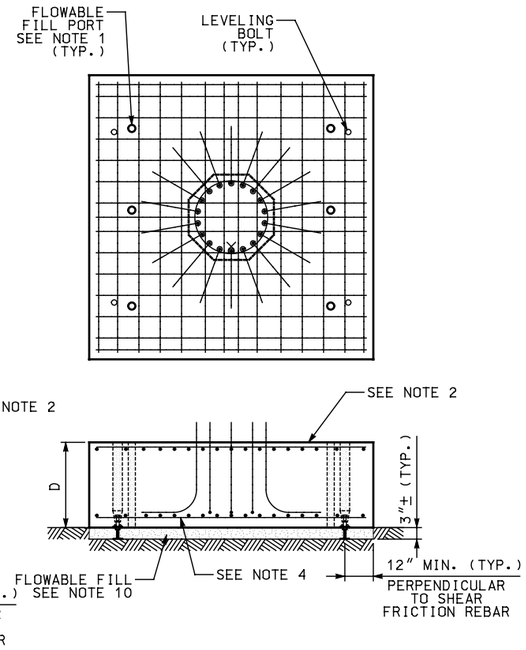


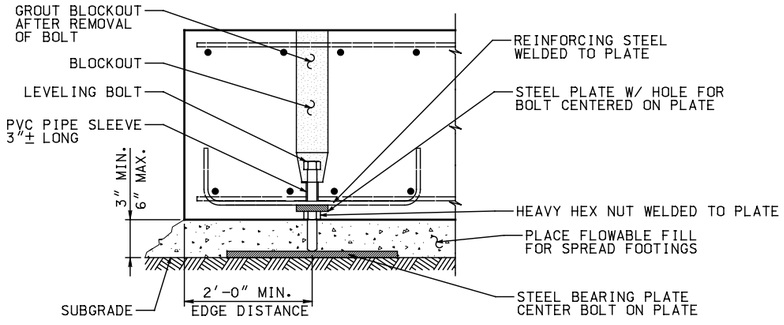
PARTIAL PRECAST SPREAD FOOTING



PRECAST SPREAD FOOTING

PRECAST FOOTING NOTES

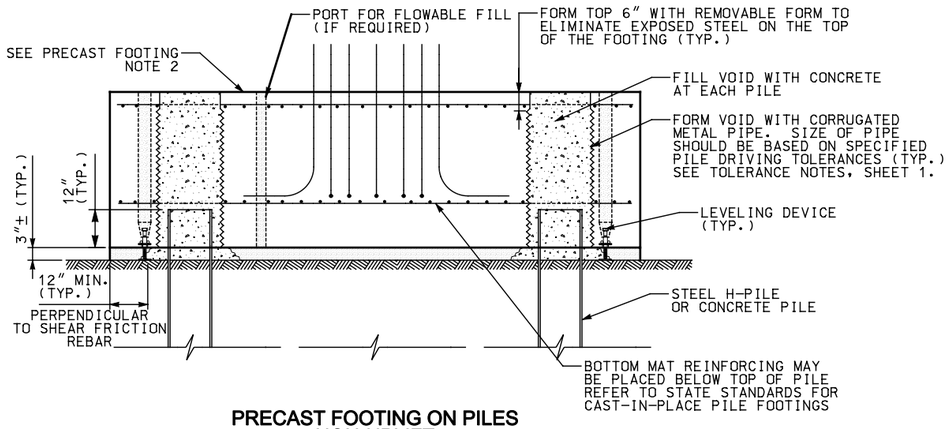
1. CONTRACTOR TO DETERMINE SIZE AND SPACING OF PORTS BASED ON MIX DESIGN AND FOOTING SIZE.
2. ERECTION TOLERANCE ON ELEVATION ±¼". THIS SHOULD BE SPECIFIED AND DETAILED ON THE CONTRACTOR'S ASSEMBLY PLAN.
3. DETAIL BAR EXTENSIONS TO THE LIMITS OF THE FOOTING IF POSSIBLE. IF TOTAL WIDTH OF FOOTING AND 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.



FOOTING INSTALLATION DETAIL

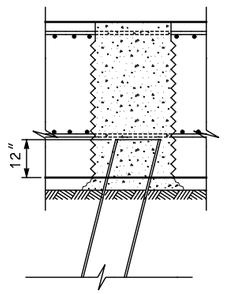
LEVELING BOLT NOTES

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 A325. 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.

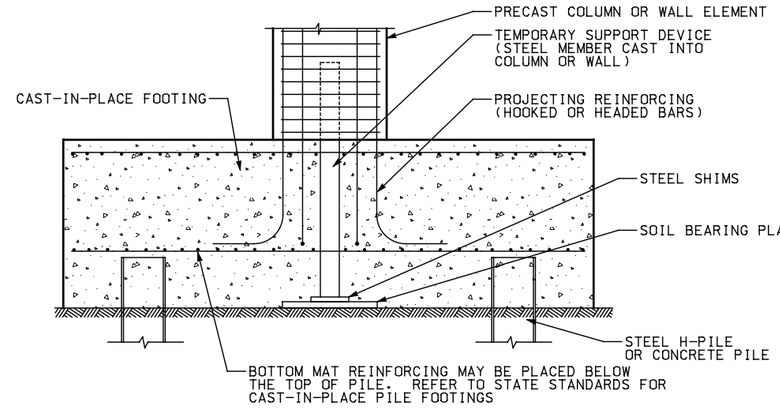


PRECAST FOOTING ON PILES NON-UPLIFT

NOTE: FLOWABLE FILL BETWEEN PILES IS NOT NECESSARILY REQUIRED SINCE SETTLEMENT OF SUB-SOIL IS POSSIBLE. IF FLOWABLE FILL IS USED, IT SHOULD BE PLACED AFTER PLACEMENT OF PILE POCKET CONCRETE.



PRECAST FOOTING ON BATTERED PILE



CAST-IN-PLACE FOOTINGS

NOTE: PILE FOOTING SHOWN, SPREAD FOOTING SIMILAR USE THIS OPTION FOR FOOTINGS WITH CLOSELY SPACED PILES

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.

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FOOTING DETAILS

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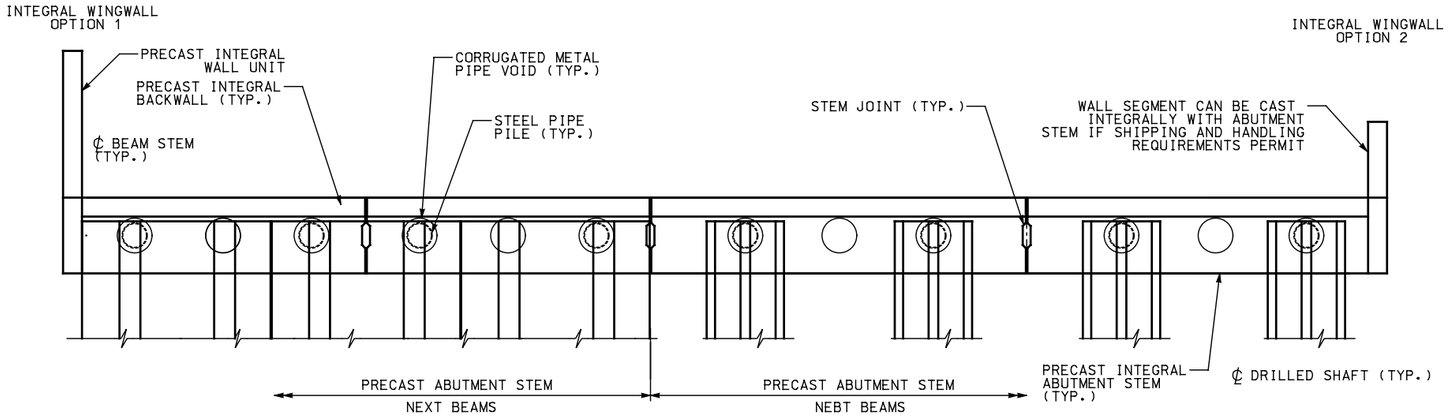
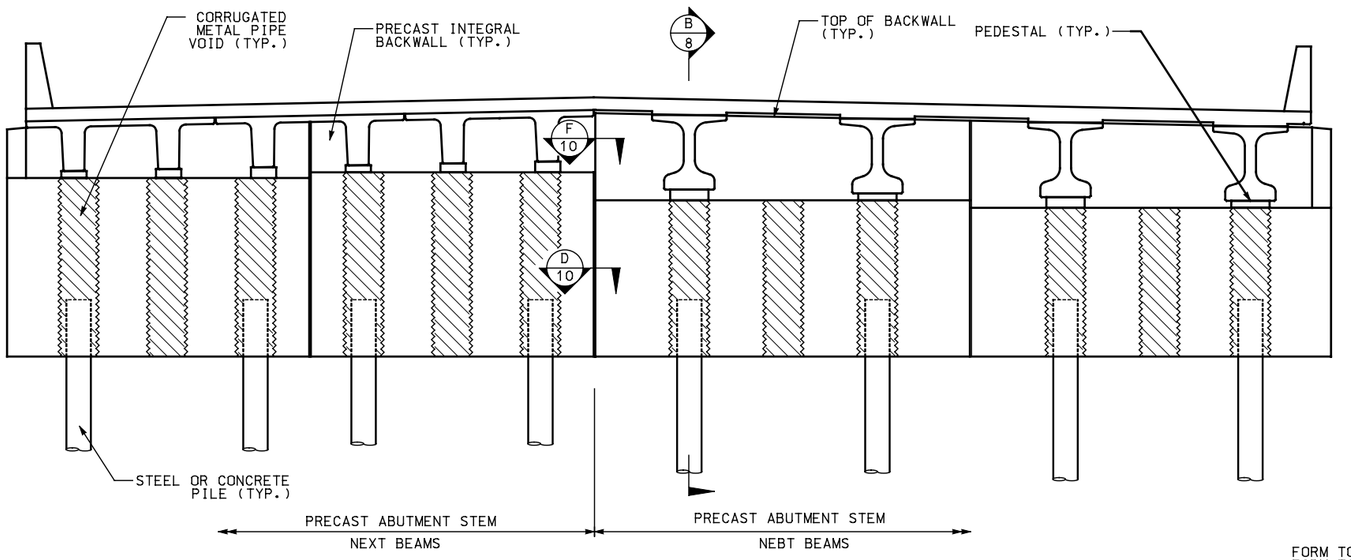


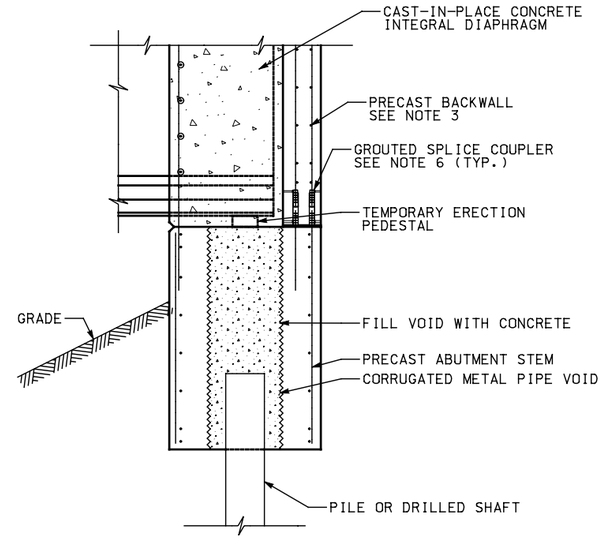
INTEGRAL ABUTMENT PLAN



INTEGRAL ABUTMENT ELEVATION

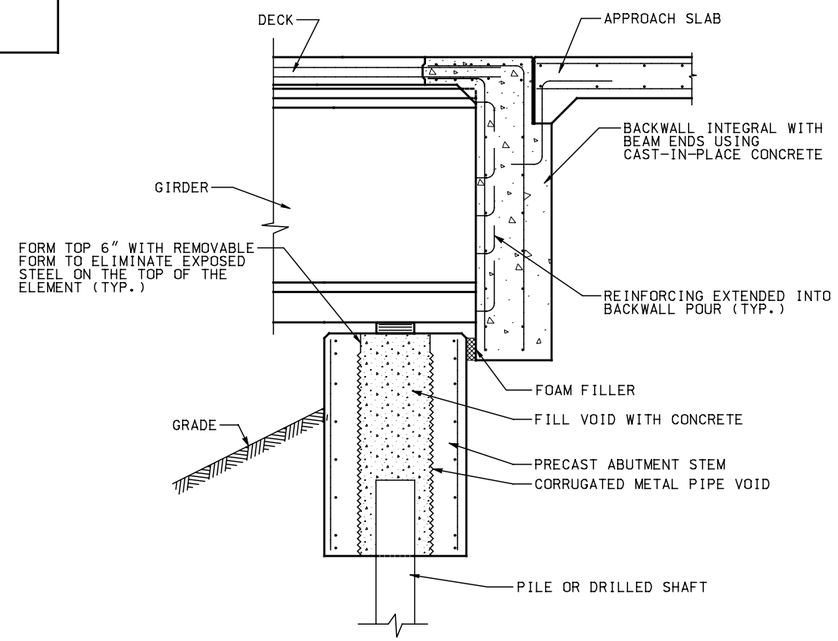
INTEGRAL ABUTMENT NOTES:

1. ABUTMENT DIAPHRAGMS NOT SHOWN FOR CLARITY.
2. DIFFERENT FOUNDATIONS ARE SHOWN TO DEPICT DIFFERENT DESIGNS. DO NOT COMBINE DIFFERENT FOUNDATIONS ON ANY ONE SUBSTRUCTURE ELEMENT UNLESS REQUIRED BY DESIGN.
3. LARGER VOIDS MAY BE USED WITH PIPE PILES TO REDUCE WEIGHT.
4. PILE NOT REQUIRED UNDER EACH BEAM.
5. USE TWO PILES PER ABUTMENT CAP ELEMENT. IF THIS IS NOT POSSIBLE, CONSIDER CLOSURE POUR MOMENT CONNECTION BETWEEN SINGLE PILE CAP ELEMENT AND ADJACENT MULTI PILE CAP ELEMENT. PER CAP ELEMENT.
6. DESIGN 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 SUPERSTRUCTURE CONNECTION.
7. TRANSVERSE POST TENSIONING MAY BE USED IN LIEU OF THE VERTICAL SHEAR KEYS. MATCH CASTING OF STEM ELEMENTS SHOULD BE USED FOR THIS OPTION.



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. MECHANICAL BAR SPLICERS MAY BE USED FOR BARS EXTENDING INTO CLOSURE POUR.
5. THE SIZE OF THE CORRUGATED PIPE VOID SHALL BE BASED ON THE SPECIFIED PILE DRIVING TOLERANCES.
6. COUPLERS TO BE USED WITH PRECAST BACKWALLS ONLY.



SECTION B: SEMI-INTEGRAL ABUTMENT

NOTE: BACKWALL CAN BE PRECAST INTEGRALLY WITH THE BEAM USING A SECONDARY POUR. SPECIAL DETAILING OF JOINTS BETWEEN BACKWALLS WILL BE REQUIRED.

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INTEGRAL ABUTMENT DETAILS

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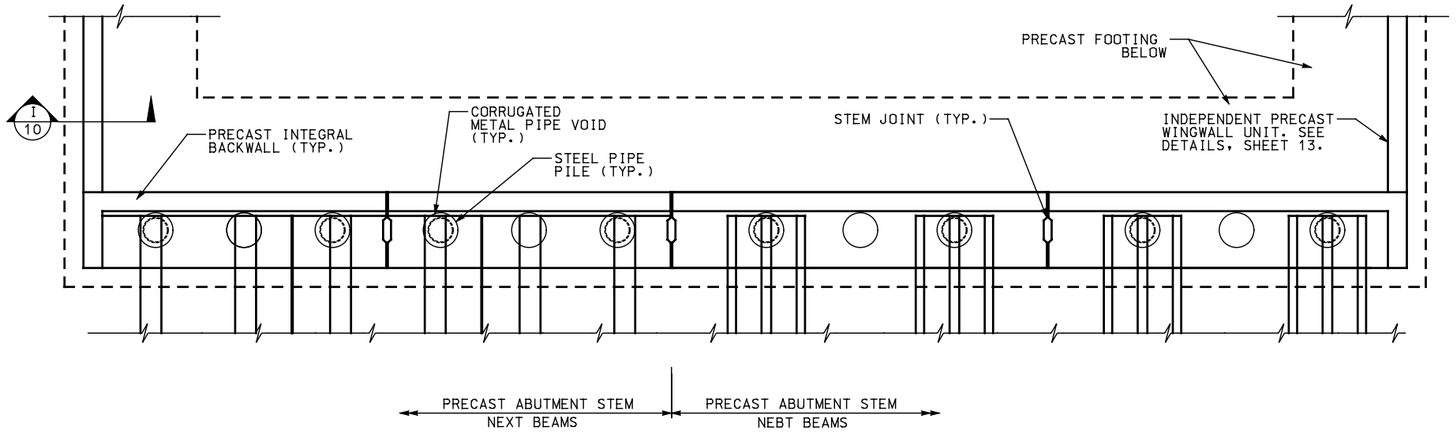
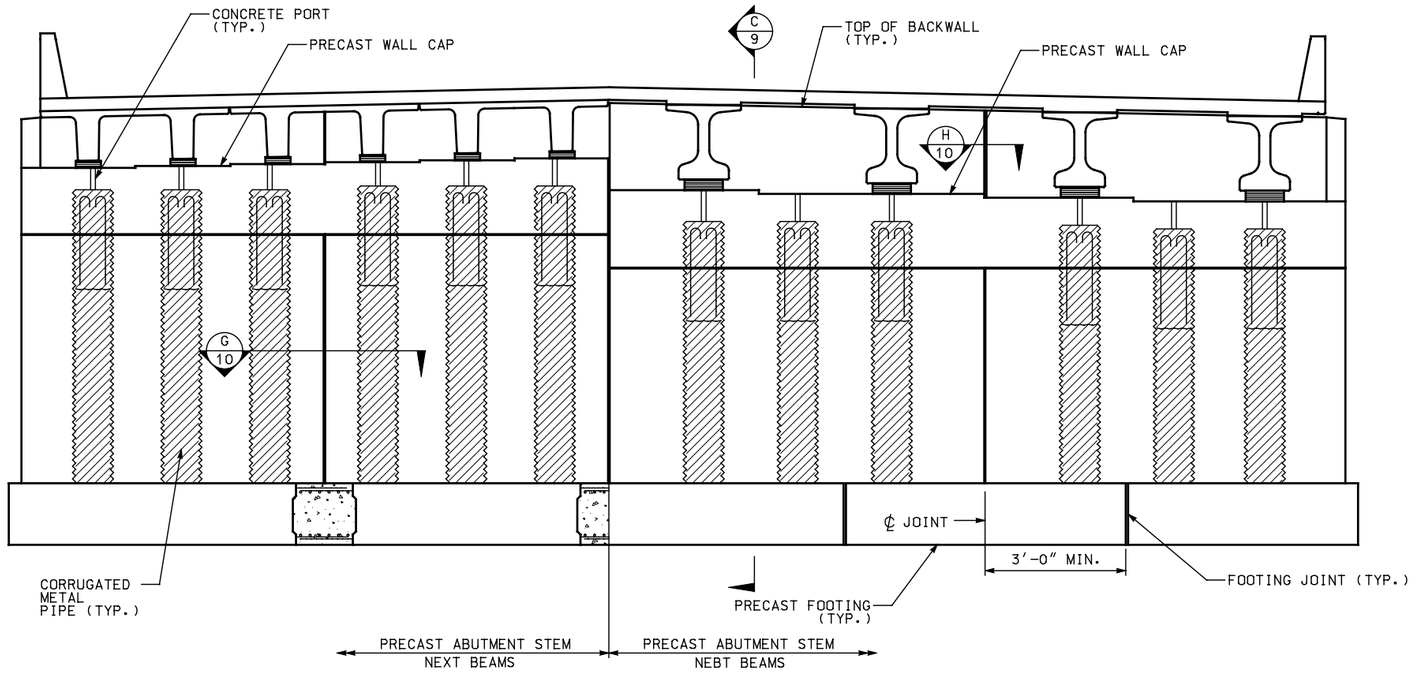


CANTILEVER ABUTMENT PLAN

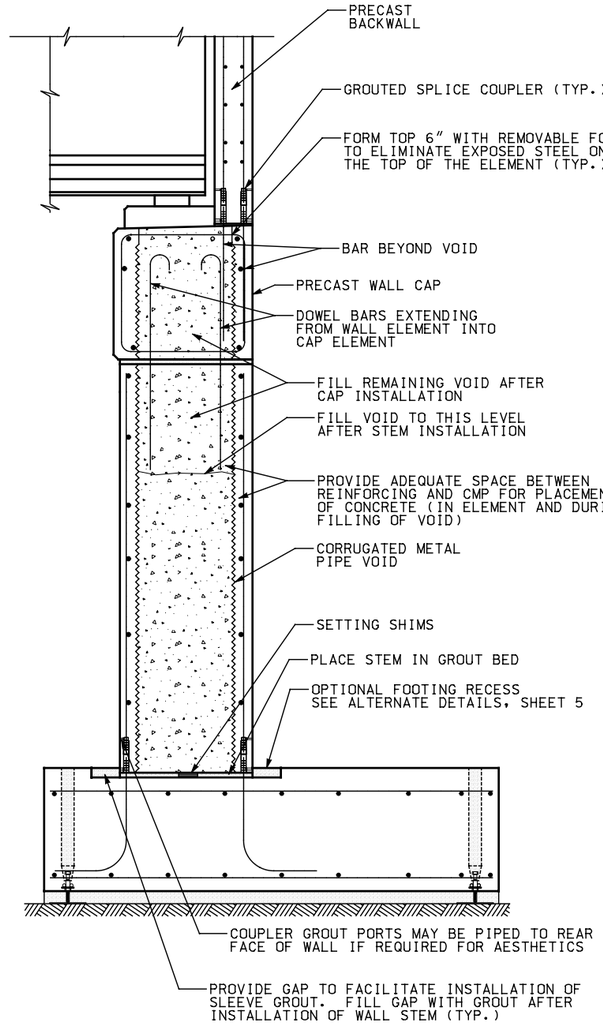


OPTION 1: CIP CLOSURE POURS IN FOOTING

OPTION 2: GROUTED FOOTING KEYS

CANTILEVER ABUTMENT ELEVATION

NOTES:
1. ABUTMENT DIAPHRAGMS NOT SHOWN FOR CLARITY.
2. DIFFERENT FOUNDATIONS ARE SHOWN TO DEPICT DIFFERENT DESIGNS. DO NOT COMBINE DIFFERENT FOUNDATIONS ON ANY ONE SUBSTRUCTURE ELEMENT UNLESS REQUIRED BY DESIGN.
3. LARGER VOIDS MAY BE USED WITH PIPE PILES TO REDUCE WEIGHT.
4. WALL PANELS CONNECTED TO FOOTING USING GROUTED SPLICE COUPLERS.
5. FOOTING LAYOUT AND DETAILING SIMILAR TO WALL PIER. SEE SHEET 4.



SECTION C: CANTILEVER ABUTMENT WITH PRESTRESSED CONCRETE GIRDER

NOTES: 1. BACKWALL MAY BE PRECAST INTEGRALLY WITH THE ABUTMENT CAP.
2. SEE SHEET 5 FOR GROUTED SPLICE COUPLER CONNECTION SEQUENCE.

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CANTILEVER ABUTMENT DETAILS

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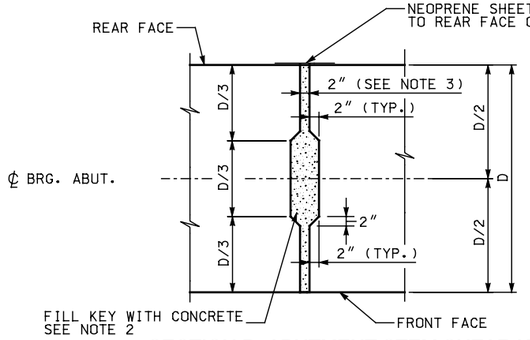
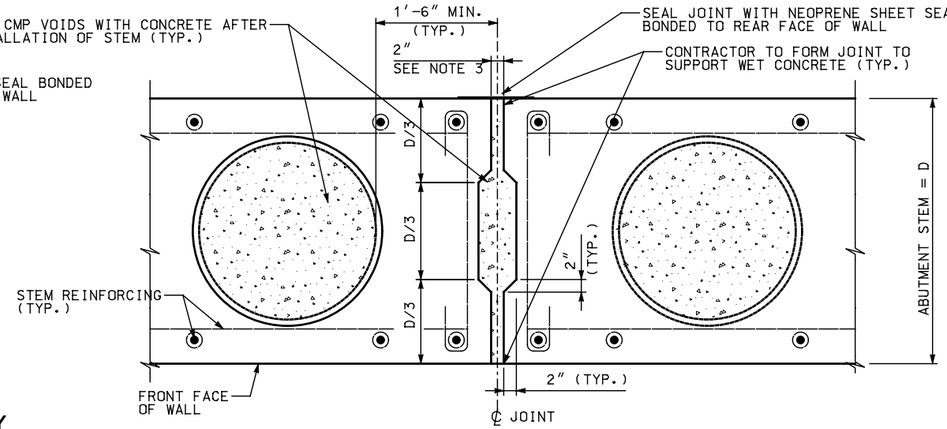
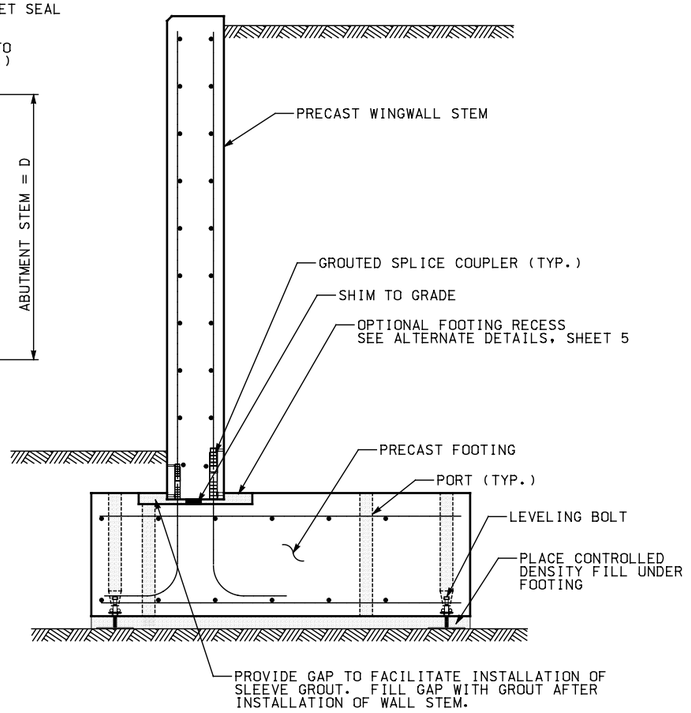


SECTION D: ABUTMENT STEM SHEAR KEY



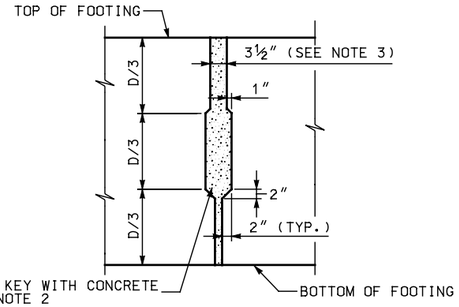
SECTION G: TYPICAL CANTILEVER ABUTMENT STEM SHEAR KEY



SECTION I: PRECAST WINGWALL

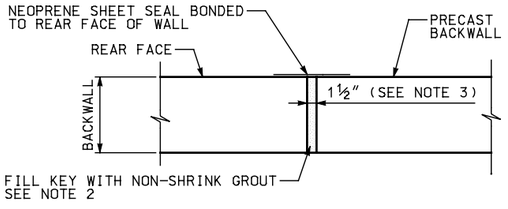
ELEMENT JOINT NOTES

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 ELEMENT AND ERECTION TOLERANCES.

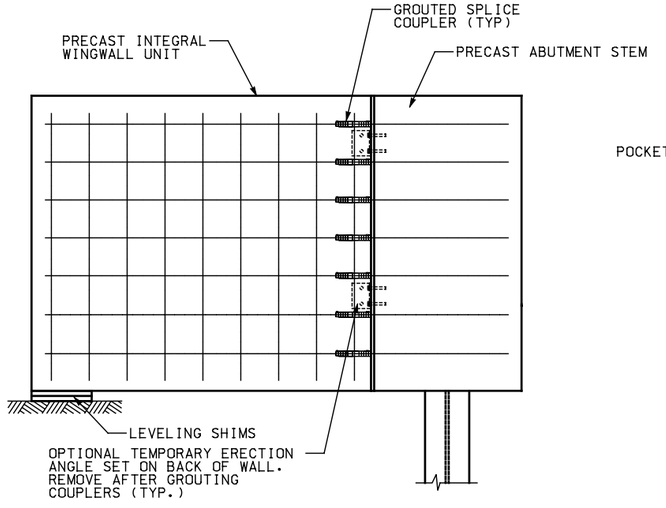


SECTION E: FOOTING SHEAR KEY

NOTES: 1. APPROACH SLAB NOT SHOWN.
2. SEE SHEET 5 FOR GROUTED SPLICE COUPLER CONNECTION SEQUENCE.

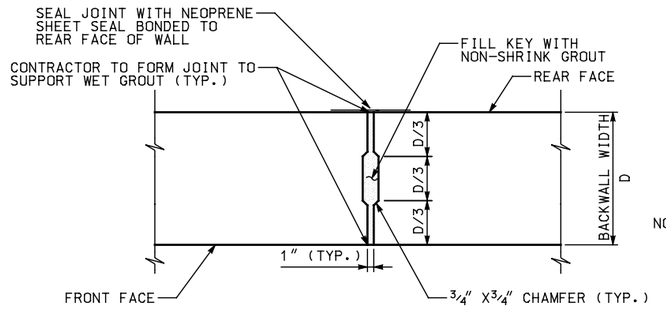


SECTION F: ABUTMENT BACKWALL JOINTS

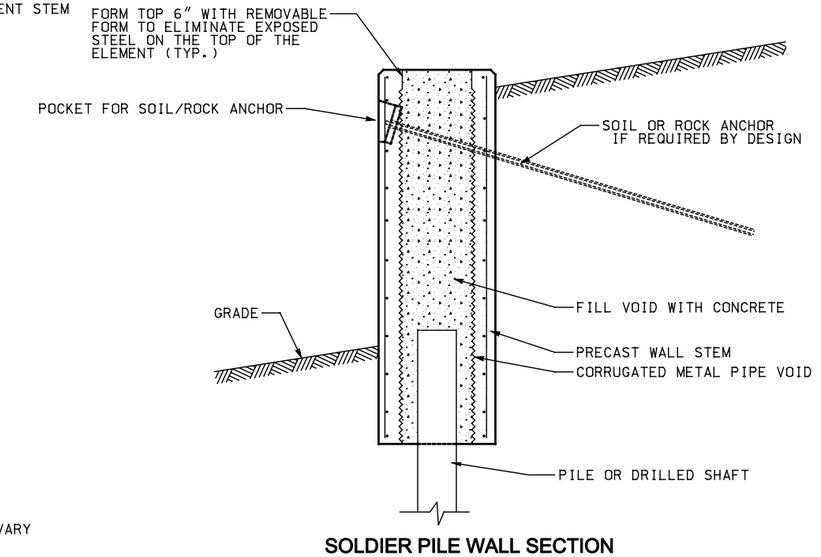


PRECAST INTEGRAL WINGWALL ELEVATION

NOTES: 1. THIS DETAIL IS SCHEMATIC. DIMENSIONS AND DETAILS WILL VARY BASED ON THE ABUTMENT DETAILS.
2. ALL REINFORCEMENT NOT SHOWN.
3. SEE SHEET 5 FOR GROUTED SPLICE COUPLER CONNECTION SEQUENCE.



SECTION H: CANTILEVER ABUTMENT BACKWALL KEY



SOLDIER PILE WALL SECTION

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MISCELLANEOUS ABUTMENT DETAILS

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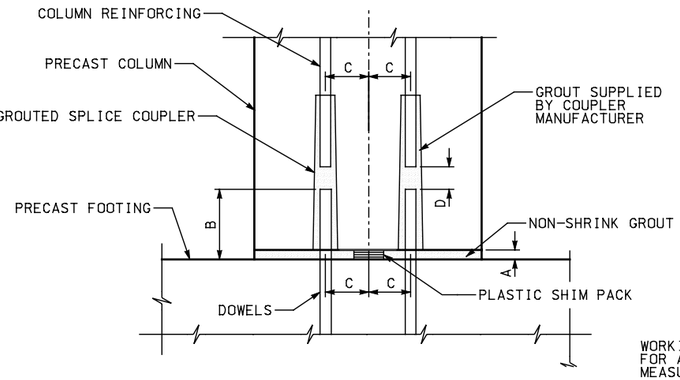
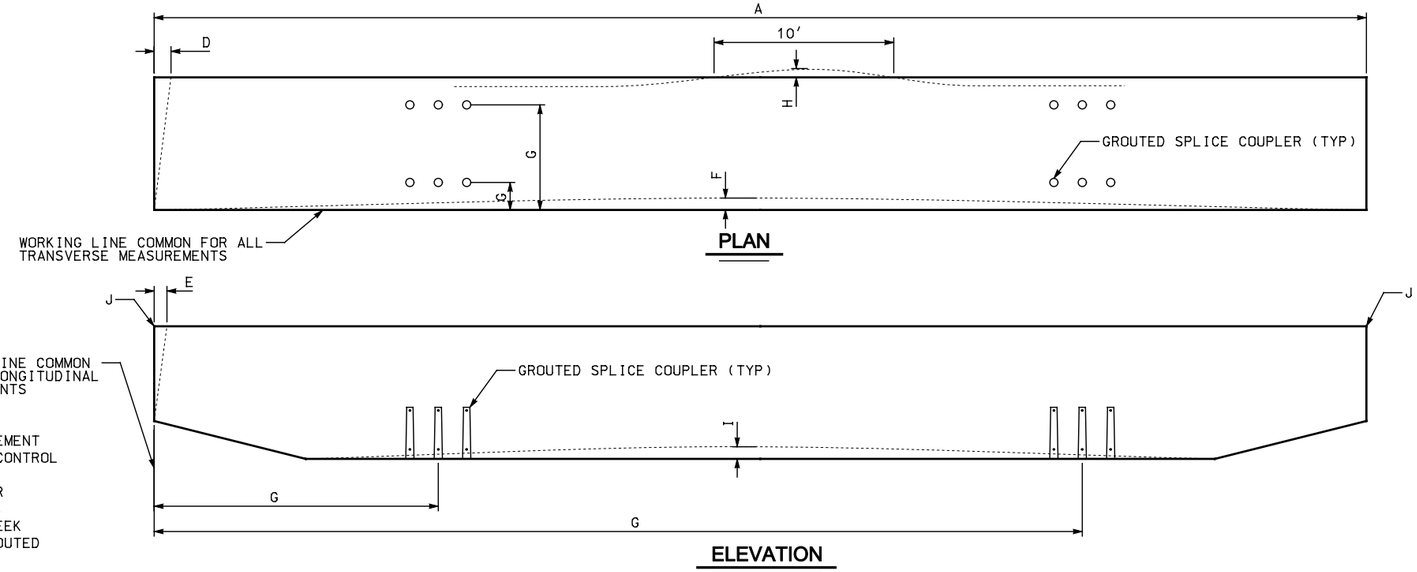


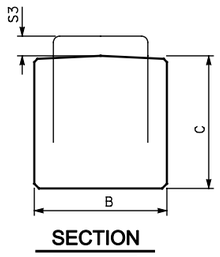
GROUTED SPLICE COUPLER DETAILS

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	$1\frac{1}{2}'' \pm \frac{3}{8}''$
B	DOWEL HEIGHT	CONSULT MANUFACTURER
C	LOCATION OF COLUMN REINFORCING, GROUTED SPLICE COUPLER, AND FOOTING DOWELS MEASURED FROM A COMMON REFERENCE POINT	$\pm \frac{1}{4}''$
D	GAP BETWEEN DOWELS AND COLUMN REINFORCING	CONSULT MANUFACTURER



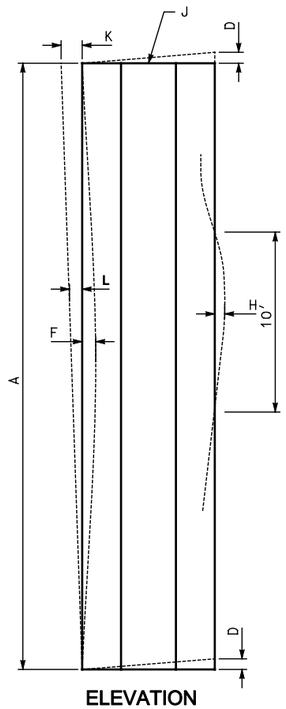


BENT CAP FABRICATION TOLERANCES

A	LENGTH	$+ \frac{3}{4}''$
B	WIDTH (OVERALL)	$\pm \frac{1}{4}''$
C	DEPTH (OVERALL)	$\pm \frac{1}{4}''$
D	VARIATION FROM SPECIFIED PLAN END SQUARENESS OR SKEW	$\pm \frac{1}{8}''$ PER 12 INCH WIDTH $\pm \frac{1}{2}''$ MAXIMUM
E	VARIATION FROM SPECIFIED ELEVATION END SQUARENESS OR SKEW	$\pm \frac{1}{8}''$ PER 12 INCH WIDTH $\pm \frac{1}{2}''$ MAXIMUM
F	SWEEP, FOR MEMBER LENGTH (IF PRESTRESSED): UP TO 40 FEET 40 FEET TO 60 FEET OVER 60 FEET	$\pm \frac{1}{4}''$ $\pm \frac{1}{2}''$ $\pm 5\frac{5}{8}''$
G	LOCATION OF GROUTED SPLICE COUPLER MEASURED FROM A COMMON REFERENCE POINT	$\pm \frac{1}{4}''$
H	LOCAL SMOOTHNESS OF ANY SURFACE	$\pm \frac{1}{4}''$ IN 10 FEET
I	VARIATION FROM SPECIFIED CAMBER (IF PRESTRESSED)	$+ \frac{1}{8}''$ PER 10 FEET $+ \frac{1}{2}''$ MAXIMUM
J	ERECTION ELEVATION TOLERANCE	$\pm \frac{1}{4}''$
S3	STIRRUP PROJECTION FROM CAP SURFACE	$+ \frac{1}{4}'', - \frac{1}{2}''$

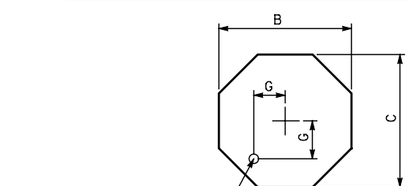
COLUMN FABRICATION TOLERANCES

A	LENGTH	$\pm \frac{1}{2}''$
B	WIDTH (OVERALL)	$\pm \frac{1}{4}''$
C	DEPTH (OVERALL)	$\pm \frac{1}{4}''$
D	VARIATION FROM SPECIFIED END SQUARENESS OR SKEW	$\pm \frac{1}{8}''$ PER 12 INCH WIDTH $\pm \frac{3}{8}''$ MAXIMUM
F	SWEEP, FOR MEMBER LENGTH:	$\pm \frac{1}{8}''$ PER 10 FEET $\pm \frac{1}{2}''$ MAXIMUM
G	LOCATION OF GROUTED SPLICE COUPLER MEASURED FROM A COMMON REFERENCE POINT	$\pm \frac{1}{4}''$
H	LOCAL SMOOTHNESS OF ANY SURFACE	$\pm \frac{1}{4}''$ IN 10 FEET



COLUMN ERECTION TOLERANCES

J	TOP ELEVATION FROM NOMINAL TOP ELEVATION MAXIMUM LOW MAXIMUM HIGH	 $\frac{1}{2}''$ $\frac{1}{4}''$
K	MAXIMUM PLUMB VARIATION OVER HEIGHT OF COLUMN	$\frac{1}{2}''$
L	PLUMB IN ANY 10 FEET OF COLUMN HEIGHT	$\frac{1}{4}''$



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SUGGESTED GUIDE DETAILS PRECAST SUBSTRUCTURES

PIER ELEMENT TOLERANCES

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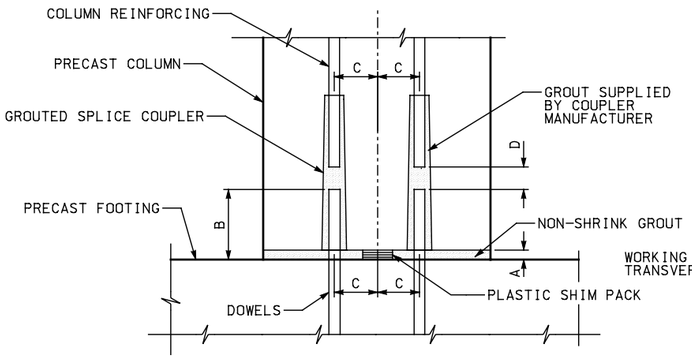
SHEET: SUB-11

ISSUE DATE: 06-05-12

REVISIONS

NO.	DATE	DESCRIPTION

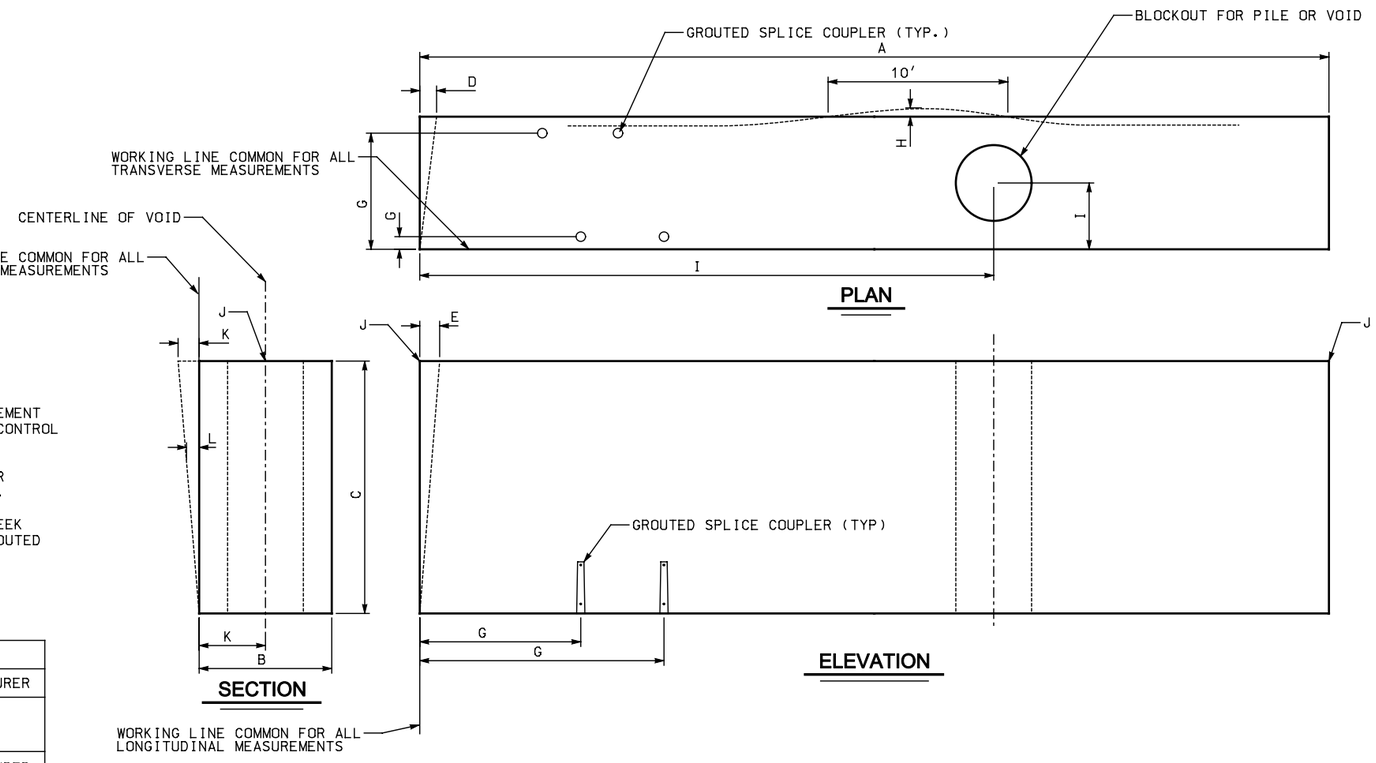


GROUTED SPLICE COUPLER DETAILS

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	$1\frac{1}{2}" \pm \frac{3}{8}"$
B	DOWEL HEIGHT	CONSULT MANUFACTURER
C	LOCATION OF COLUMN REINFORCING, GROUTED SPLICE COUPLER, AND FOOTING DOWELS MEASURED FROM A COMMON REFERENCE POINT	$\pm \frac{1}{4}"$
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 ERECTION TOLERANCES

J	TOP ELEVATION FROM NOMINAL TOP ELEVATION MAXIMUM LOW MAXIMUM HIGH	 $\frac{1}{2}"$ $\frac{1}{4}"$
K	MAXIMUM PLUMB VARIATION OVER HEIGHT OF PANEL	$\frac{1}{2}"$
L	PLUMB IN ANY 10 FEET OF PANEL HEIGHT	$\frac{1}{4}"$

WALL PANEL FABRICATION TOLERANCES

A	LENGTH	$\pm \frac{1}{4}"$
B	WIDTH (OVERALL)	$\pm \frac{1}{4}"$
C	DEPTH (OVERALL)	$\pm \frac{1}{4}"$
D	VARIATION FROM SPECIFIED PLAN END SQUARENESS OR SKEW	$\pm \frac{1}{8}"$ PER 12 INCH WIDTH $\pm \frac{1}{2}"$ MAXIMUM
E	VARIATION FROM SPECIFIED ELEVATION END SQUARENESS OR SKEW	$\pm \frac{1}{8}"$ PER 12 INCH WIDTH $\pm \frac{1}{2}"$ MAXIMUM
G	LOCATION OF GROUTED SPLICE COUPLER MEASURED FROM A COMMON REFERENCE POINT	$\pm \frac{1}{4}"$
H	LOCAL SMOOTHNESS OF ANY SURFACE	$\pm \frac{1}{4}"$ IN 10 FEET
I	LOCATION OF BLOCKOUT FOR PILES OR VOIDS	$\pm 1"$

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ABUTMENT AND WALL ELEMENT TOLERANCES

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