GUIDELINES

These guidelines drawings represent typical details for the design and detailing of a typical concrete substructure. The drawings are intended to provide a basis for the design of typical concrete substructures. Several different substructure types are shown, and the designer is encouraged to vary the elements used in the drawings to meet the specific requirements of each project.

Details and reinforcement shown are schematic. Designers should use these drawings as a starting point and modify them to meet the specific requirements of each project.

1. General Notes

PREFACE CONCRETE SUBSTRUCTURE NOTES

2. Tolerances

All precast concrete elements are fabricated to the specified tolerances with a minimum error margin. The maximum tolerances for all precast concrete elements unless otherwise noted. The concreter shall specify the tolerances for each element in accordance with the specific design requirements.

3. Special Materials and Details

The details contained herein represent standard precast concrete elements. Some of the details shown may not be exactly those used on a given project. The following is a list of special materials and details that are shown in these guidelines:

- Corrugated metal pipe
- Reinforcement
- Seals
- Shotcrete

4. Implementation

It is the designer's responsibility to:

- Design and detail all substructure elements, including external and internal elements.
- Design and detail the substructure elements for all anticipated loads.
- Detail all elements, including internal elements, so that the final product is not compromised.
- 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. Element locations shall be kept below 2% LFT for reasons of safety.
- Determine the geometric requirements of the site and place the applicable information on the plans.
- Place and detail all elements. Ensure sufficient detail is added to the design plans to ensure proper fit up of all elements in the field.

5. Special Materials and Details

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- Reinforcement
- Seals
- Shotcrete

6. Index of Sheets

1. Precast Concrete Substructure Notes
2. Column Details
3. Multi-column Detail
4. Wall Details
5. Column Details
6. Wall-to-wall Connection Details
7. Footing Details
8. Reinforcement Details
9. Precast Abutment Details
10. Miscellaneous Details

7. Recommended Substructure Notes

For shipping reasons, the maximum weight of each element should be kept under 500 kg. The maximum width of the element including any corrugated metal pipe, reinforcing steel bars, or other components should be kept as low as possible to ensure easy handling.

8. Recommended Substructure Notes

For fast and accurate adjustment of the vertical elevation of the element, leveling bolts should be provided. These bolts shall be provided at each end of the element and shall be capable of adjusting the vertical elevation of the element to within ±1.5 cm. The leveling bolts shall be designed to provide a minimum load of 200 kg per bolt.

9. Recommended Substructure Notes

Precast concrete substructures are shown on sheets 1 and 2 of the drawing set. The design parameters for these substructures may be adjusted to meet the requirements of the site and the specific project.
PRECAST TRIPLE COLUMN BENT

1. ERECTION TOLERANCE ON ELEVATION ±1/2".
2. ERECTION TOLERANCE ON BEAM SEAT ELEVATION ±1/4". PRECAST 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 COLUMN SHEAR reinforcements, similar to footing details shown.
5. SKIRTED FOOTING BLOCK MAY BE PLACED BETWEEN OTHER BEAMS TO MINIMIZE CONFLICTS ABOVE.
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 RANGE SPECIFIED.
8. A LEVEL PIED CAP IS USED TO REDUCE CONSTRUCTION COSTS. SPECIFIED CAPS ARE IDENTICAL. SEE DETAILS ON SHEET 6.
OPTION 1: CUT (CLOSED) HOLES IN FOOTING

WALL PIER ELEVATION.

NOTES:
- Grounded splices are shown on wall reinforcing not shown.

1. Erection Tolerance on elevation ±1/2" measured at the centerline of the wall panel.
2. Erection Tolerance on beam seat elevation ±1/2" may be set high and ground to specified elevation.
3. Cap and wall shear reinforcement not shown for clarity.
4. Design depth above may be placed between other rebar or prestressing supports above.
5. Footings to be set to an elevation tolerance of ±1/2".
6. The cap voids serve two purposes:
   - Helps distribute the 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 grouted footing keys should be designed to transmit the dead load of the entire structure. The entire footing should be designed to support all loads.
9. Location of grouted splices is according to be on sheet 1 tolerance for all details. Footings shall be based on a common working dimension.
1. Adjust shoe stack height to control elevation. 
2. Bed crown dots loosely 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 duty values. 
5. See sheet 5 for grouted splice coupler connection sequence.
INTEGRAL ABUTMENT PLAN

1. ABUTMENT DIAGRAMS NOT SHOWN FOR CLARITY.
2. DIFFERENT FOUNDATIONS ARE SHOWN TO DETECT DIFFERENT DESIGNS. DO NOT CONSTRUCT DIFFERENT FOUNDATIONS ON ANY ONE SUBSTRUCTURE ELEMENT UNLESS REQUIRED BY DESIGN.
3. LARGER Voids MAY BE USED WITH SMALLER PIECES TO REDUCE WEIGHT.
4. PILE NOT REQUIRED UNDER EACH BEAM.
5. USE TWO PIECES PER ABUTMENT CAP ELEMENT. IF THIS IS NOT POSSIBLE, CONSIDER CLOSING THE SECOND CONNECTION BETWEEN ABUTMENT CAP ELEMENT AND ADJACENT MULTI-PILE CAP ELEMENT.
6. DESIGN REINFORCEMENTS IN STEEL ASSUMING A Pinned JOINT AT THE VERTICAL SHEAR KEY. VERTICAL BARS SHOULD BE USED AS THE MAIN REINFORCEMENTS AND SHOULD BE DESIGNED TO RESIST THE LOAD ACCORDING TO THE ABUTMENT LEVEL AND THE SUPERSTRUCTURE CONNECTION.
7. TRANSVERSE POST-TENSIONING MAY BE USED IN LIES OF THE VERTICAL SHEAR KEY. WIDE CASTINGS OF STEEL ELEMENTS SHOULD BE USED FOR TWO OPTION.

INTEGRAL ABUTMENT ELEVATION

INTEGRAL ABUTMENT NOTES:

SECTION B: INTEGRAL ABUTMENT

SECTION B: SEMI-INTEGRAL ABUTMENT

NOTES:
1. THIS DETAIL IS BASED ON DETAILS FROM SEVERAL STATES.
2. ALL REINFORCEMENT NOT SHOWN FOR CLARITY.
3. BACKWALL MAY BE PRECAST INTEGRALLY WITH THE ABUTMENT CAP.
4. MECHANICAL BAR SPLICERS MAY BE USED FOR BARS OR TRANSVERSE POST-TENSIONING.
5. REINFORCEMENT STUDS SHOWN ON RIGHT SIDE OF BACKWALL SHALL BE BASED ON THE DESIGN SPECIFIED FILE DESIGN.
6. COUPLERS TO BE USED WITH PRECAST BACKWALLS ONLY.
NOTES:
1. USE WINDING TEMPLATES AND JOGS FOR THE LOCATION OF REINFORCEMENT AND GROUTED SPLICE COUPLER PLACEMENT WITHIN THE ELEMENTS TO CONTROL VERTICAL SPACING OF THE SPLICE COUPLER FOR PROPER ALIGNMENT.
2. CONSULT MANUFACTURER OF THE GROUTED SPLICE COUPLER FOR PROPER INSTALLATION RECOMMENDATIONS 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 PRIOR TO INSTALLATION.

**GROUTED SPLICE COUPLER DETAILS**

LOCATION OF GROUTED SPLICE COUPLER MEASURED FROM A COMMON REFERENCE POINT

**GROUTED SPLICE COUPLER TOLERANCES**

<table>
<thead>
<tr>
<th>A</th>
<th>GROUT PACK HEIGHT</th>
<th>± 1/4 &quot;</th>
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<tr>
<td>B</td>
<td>DOWEL HEIGHT</td>
<td>CONSULT MANUFACTURER</td>
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<tr>
<td>C</td>
<td>ELEVATION OF COLUMN REINFORCEMENT: GROUTED SPLICE COUPLER</td>
<td>± 1/4 &quot;</td>
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<tr>
<td>D</td>
<td>GAP BETWEEN DOWELS AND COLUMN REINFORCING</td>
<td>CONSULT MANUFACTURER</td>
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**COLUMN FABRICATION TOLERANCES**

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<td>WIDTH (OVERALL)</td>
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<td>C</td>
<td>DEPTH (OVERALL)</td>
<td>± 1/4 &quot;</td>
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<tr>
<td>D</td>
<td>VARIATION FROM SPECIFIED PLAN SQUARENESS</td>
<td>± 1/4 PER 10 INCH WIDTH OR WIDTH</td>
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<tr>
<td>E</td>
<td>VARIATION FROM SPECIFIED ELEVATION END SQUARENESS</td>
<td>± 1/4 IN 10 FEET</td>
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<td>F</td>
<td>VARIATION FROM SPECIFIED ELEVATION END SQUARENESS</td>
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<td>G</td>
<td>VARIATION FROM SPECIFIED CAMBER</td>
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<td>LOCAL SMOOTHNESS OF ANY SURFACE</td>
<td>± 1/4 IN 10 FEET</td>
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<tr>
<td>I</td>
<td>LOCAL SMOOTHNESS OF ANY SURFACE</td>
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**COLUMN ERECTION TOLERANCES**

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<th>MAXIMUM LOW</th>
<th>MAXIMUM HIGH</th>
<th>± 1/4 &quot;</th>
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<tr>
<td>B</td>
<td>MAXIMUM PLUMB VARIATION OVER HEIGHT OF COLUMN</td>
<td>± 1/4 &quot;</td>
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| C | PLUMB IN ANY 10 FEET OF COLUMN HEIGHT | ± 1/4 "
**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 "c" 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.

### 1. **GROUTED SPICE COUPLER DETAILS**

- **COLUMN REINFORCING**
- **GROUTED SPLICE COUPLER**
- **PLASTIC SHIM PACK**
- **NON-SHRINK GROUT**
- **GROUT SUPPLIED BY MANUFACTURER**

### 2. **GROUTED SPLICE COUPLER TOLERANCES**

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<tr>
<td><strong>SPLICE COUPLER HEIGHT</strong></td>
<td><strong>GAP BETWEEN DOWELS AND COLUMN REINFORCING</strong></td>
<td><strong>LOCATION OF COLUMN REINFORCING, GROUTED SPLICE COUPLER, AND FOOTING DOWELS</strong></td>
<td><strong>GROUTED SPLICE COUPLER TOLERANCES</strong></td>
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Consult manufacturer if applicable.

### 3. **WALL PANEL FABRICATION TOLERANCES**

- **LENGTH**
- **WIDTH (OVERALL)**
- **HEIGHT (OVERALL)**
- **VARIATION FROM SPECIFIED ELEVATION END TO PANEL**
- **VARIATION FROM SPECIFIED ELEVATION END TO PANEL**
- **LOCATION OF COLUMN REINFORCING**
- **LOCATION OF MOUNTING HOLES**
- **LOCAL SQUARENESS OF ANY SURFACE**
- **LOCATION OF HOLE FOR PANELS OR VOIDS**

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