

## Bridge Design Details 6.1 August 2022

### Abutment

The ABUTMENT LAYOUT and ABUTMENT DETAIL sheets provide specific details for the bridge abutment. Additional details such as abutment drainage, bearing pad layout, utility locations, retaining wall connections, and other abutment-related details may be shown on these sheets.

### Plan

- 1. Place at the top, left side of sheet, oriented with the front side facing down and the centerline of abutment horizontal. Alternatively, the PLAN view may be orientated the same direction as the PLAN view shown on the GENERAL PLAN sheet.
- 2. The minimum scale is <sup>1</sup>/<sub>4</sub>" = 1'-0". Use <sup>1</sup>/<sub>8</sub>" = 1'-0" on large structures but show less detail.
- 3. Show abutment, footing, pile spacing, bearing pad, and wingwall dimensions along the same layout lines used on the FOUNDATION PLAN (Note: Show the centerline of the abutment bearing for seat abutments and the centerline of the abutment for diaphragm abutments).
- 4. Do not repeat layout stations or bearings shown on the FOUNDATION PLAN.
- 5. Show wingwall or retaining wall lengths.
- 6. Show pile spacing (Do not dimension piles from edge of footing).
  - A FOOTING PLAN may be used to show pile spacing if it can't be shown clearly in the PLAN view. Additional DETAILS of footings should be shown in the same orientation as the PLAN view. Show the centerline of bearing.
- 7. Show North arrow.
- 8. Show bearing pads and limits of level bearing area. A portion of the expanded polystyrene or expansion joint filler material may be added.
- 9. Show the centerline of utility and future utility openings. Identify the size of opening and details for buried pipe for bridges with approach slabs, see *Standard Plan*: B6-10 Utility Openings T-Beam and *Standard Plan*: B7-10 Utility Openings Box Girder.
- 10. Avoid showing portions of approach slabs or reinforcement.



### **Elevation**

- 1. Place below PLAN view, projected from face of abutment. If PLAN is orientated the same as the GENERAL PLAN, place ELEVATION in front of PLAN, looking normal to face of abutment.
- 2. Use solid lines for portions below grade. Rear elevations should be avoided. ELEVATION should be a depiction of abutment stem, backwall, and footing. Avoid showing the superstructure on seat type abutments, but if it is shown use dashed lines.
- 3. Use the same scale as PLAN view.
- 4. Show location of weep holes if Structure Approach Drainage is not required. For typical drainage details, see *Standard Plan B0-3*: Bridge Detail 3-1.
- 5. Show the finished grade or slope paving in front of the abutment (FG should be parallel to the deck when the cross slope is constant and level for crowned slopes).
- 6. Do not attempt to show the entire skewed wingwalls.
- 7. Show bearing pads and utility opening information.
- 8. Do not show all piles (NOTE: All piles not shown).
- 9. Avoid showing barrier, approach slab, or other detail dimensions.

### **Wingwall Elevation**

- 1. Projection of PLAN view, if possible; otherwise locate by VIEW letters or simply call out as WINGWALL ELEVATION.
- 2. Always show looking normal to the wall.
- 3. Use the same scale as PLAN view unless reinforcement is to be shown. Usually, reinforcement should not be shown at a scale less than <sup>3</sup>/<sub>8</sub>" = 1'-0".
- 4. Do not show wingwall layout dimensions given on PLAN view. Call out Standard Plan references instead of re-detailing standard reinforcement.
- 5. Show SECTION of top of wall details for railings, sidewalks, overhangs, and architectural treatment. Section should show Structure Approach Drainage Details if applicable.
- 6. Show finished grade or slope paving.
- 7. Show all piles.
- 8. Railing need not be shown (NOTE: Barrier railing not shown).



### **Retaining Wall or Return Wall Elevation**

- 1. Do not show dimensions given on PLAN view or standard plan sheets. Call out Standard Plan references (e.g., footing steps, expansion joints, weakened planes, etc). Show all other layout information along the Retaining Wall Layout Line (RWLOL).
- 2. Long retaining walls adjacent to bridges may require separate sheets or plans showing PLAN and ELEVATION details.
- Show SECTION of top of wall details for railings, sidewalks, overhangs, and architectural treatment. Section should show Structure Approach Drainage Details if applicable.
- 4. Do not show all piles (NOTE: All piles not shown).
- 5. Distance between footing steps should be in multiples of 8 feet. Maximum height of steps should be held to 4 feet. For typical step details, see *Standard Plan B3-5*: Retaining Wall Details No. 1 Footing Step. Small steps less than 12 inches should be avoided unless distance between steps is 96 feet or more. If footing thickness changes between steps, the bottom of footing elevation should be adjusted so that the top of footing remains at the same elevation.
- 6. When sloping footings are used, form and joint lines are permitted to be perpendicular and parallel to the footing for ease of construction. Sloping footing grades shall be constant for the entire length of the wall. If breaks in footing grade (angle points) are deemed necessary, a level-stepped footing shall be used for the entire wall instead of a sloping footing (Maximum permissible slope for a reinforced concrete retaining wall footing is 3% and maximum permissible slope for masonry walls is 2%).
- 7. Weakened plane joints (*Standard Plan B0-3*: Bridge Detail 3-2) should be shown at nearly equal spaces between expansion joints.
- 8. Expansion Joints (*Standard Plan B0-3*: Bridge Detail 3-4) shall be shown at maximum intervals of 96 feet (shorter spaces should be in multiples of 8 feet). Expansion joints should not be placed at an angle point in the wall alignment. Waterstop in the expansion joint shall be shown to extend 1 foot below the finished grade. When concrete barriers or curbs are used on top of the retaining walls, the waterstop in the expansion joint shall be shown to extend 6 inches into the barrier or curb.



### **Sections and Details**

- 1. For general requirements, see *Bridge Design Details*: 1.1 General Detailing Detail Layout, Sections, and Views.
- SECTIONS and DETAILS showing reinforcement should not be less than <sup>3</sup>/<sub>8</sub>" = 1'-0" scale; the preferred scale is <sup>1</sup>/<sub>2</sub>" = 1'-0" minimum.
- 3. Do not repeat reinforcement shown in the Standard Plans.
- 4. Abutment SECTION should include the following:
  - a) Location of Beginning of Bridge (BB) and End of Bridge (EB), see *Bridge Design Details*: 6.8 BB and EB Locations.
  - b) Centerline Bearing for seat type abutment and Centerline Abutment for diaphragm type.
  - c) Stem and backwall reinforcement. For post tensioned girder bridges, backwall to be placed after bridge has been stressed.
  - d) Footing reinforcement and pile spacing.
  - e) Outline of end diaphragm or superstructure (Do not use drop out lines or include reinforcement details of superstructure beyond bars that extend from end diaphragm abutment into deck).
  - f) Joint seal type, movement range, and joint seal blockout details.
  - g) Waterstop or Structure Approach joint detail, see *Bridge Design Details*: 6.7 Sealed Joints.
  - h) Drainage details behind the abutment and "Weep Hole and Geocomposite Drain Detail" alternative when *Standard Plan B0-3*: Detail 3-1 is shown. For more information, see *Bridge Design Details*: 6.3 Abutment Drainage Details.
    - Edit the NOTES in the "Weep Hole and Geocomposite Drain Detail" to remove references to wall types or elements that are not specific to the project plans.
  - i) Dimension distance below the soffit and width of maintenance berm. For additional berm information, see *Bridge Design Details*: 2.1 Bridge Layout and *Bridge Design Details*: 6.2 Seat & End Diaphragm Abutments.
- 5. SHEAR KEY DETAIL should include the following:
  - a) Expanded polystyrene and expansion joint filler details.
  - b) Shear Key, stem, and wingwall reinforcement.



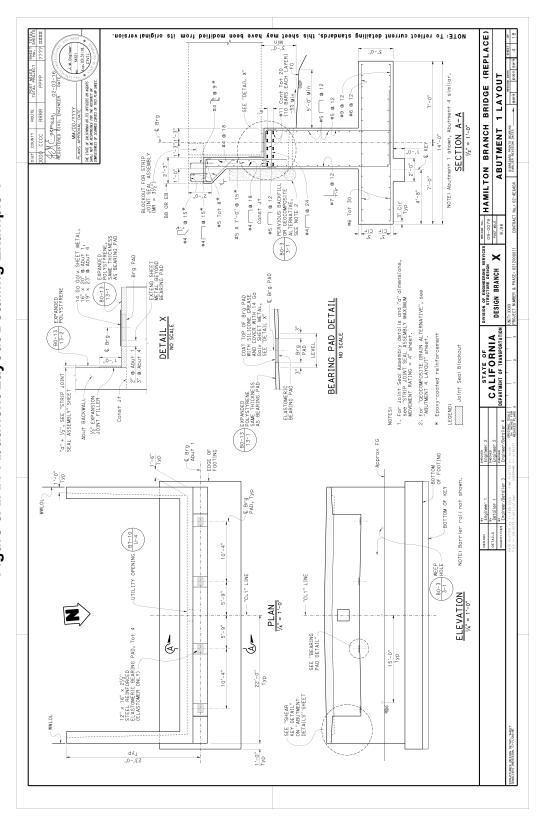
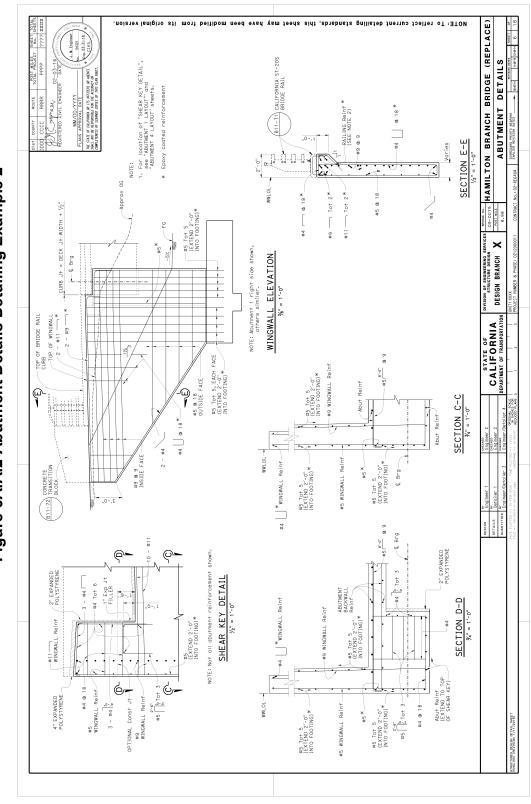


Figure 6A.A.1 Abutment Layout Detailing Example 1





## Figure 6A.A.2 Abutment Details Detailing Example 2

ABUTMENT DETAILING EXAMPLES – ATTACHMENT A



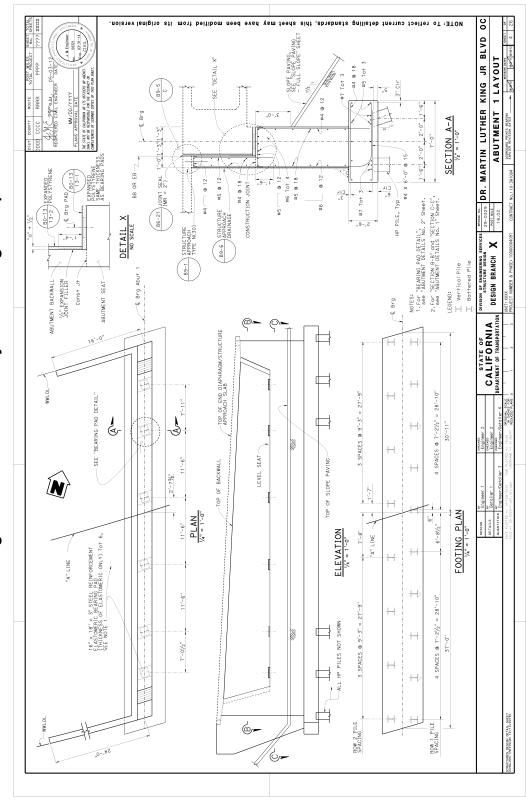


Figure 6A.A.3 Abutment Layout Detailing Example 3



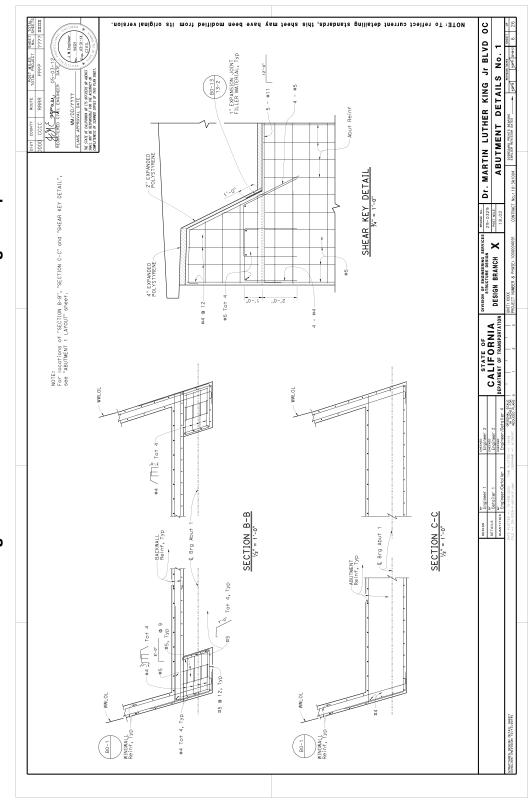
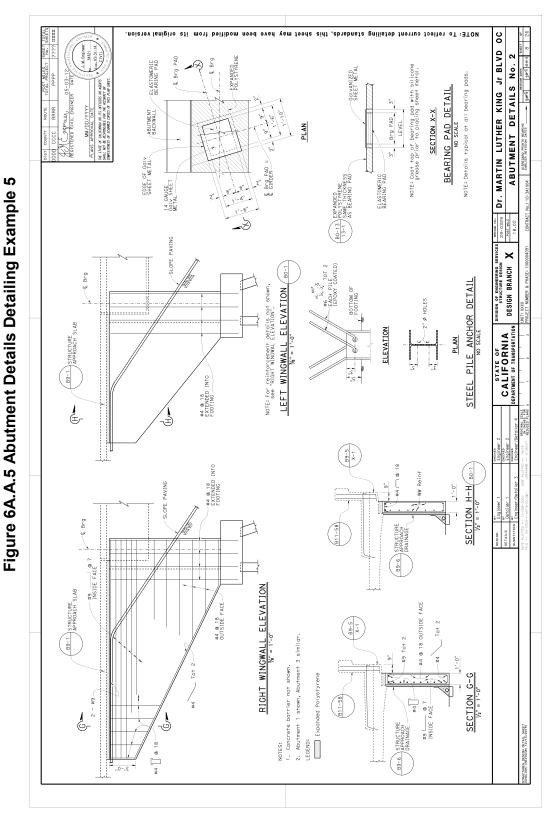


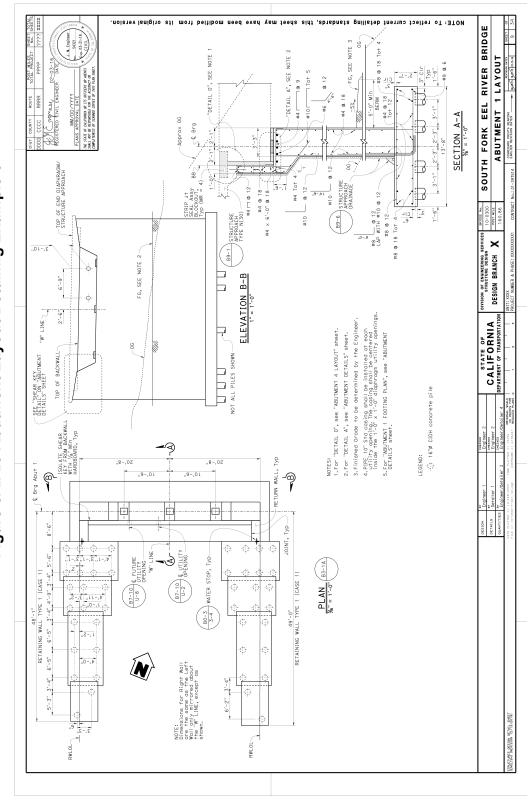
Figure 6A.A.4 Abutment Details Detailing Example 4

ABUTMENT DETAILING EXAMPLES – ATTACHMENT A





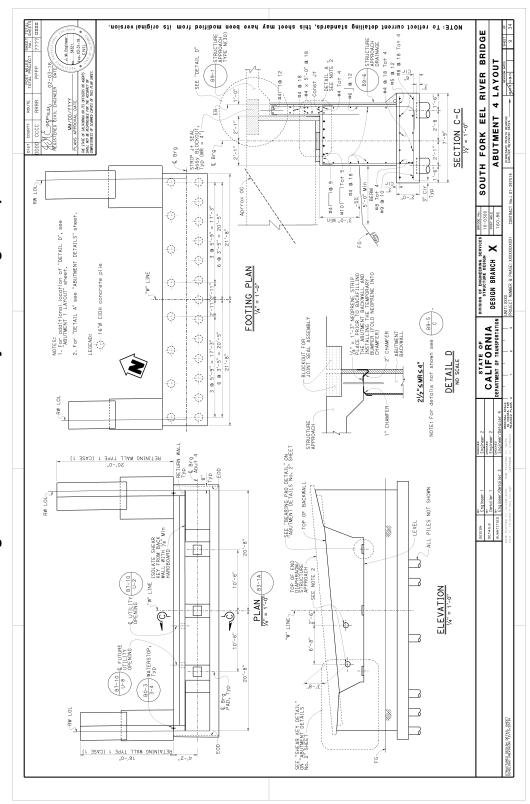




## Figure 6A.A.6 Abutment Layout Detailing Example 6

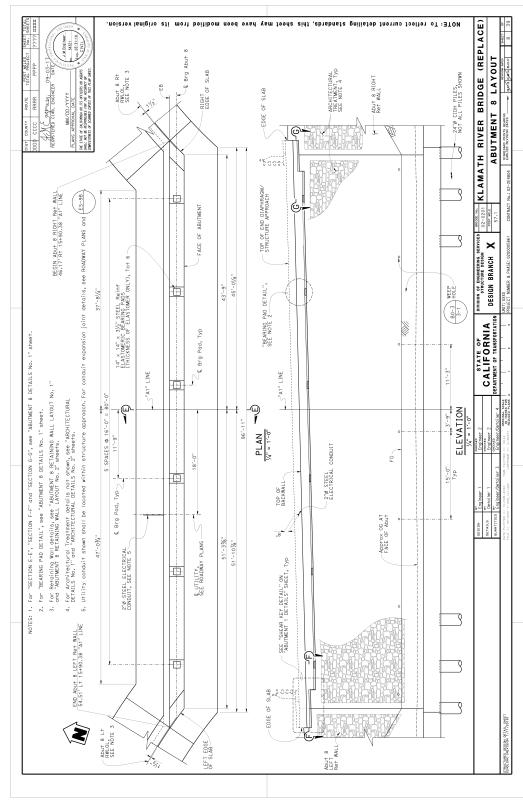
ABUTMENT DETAILING EXAMPLES – ATTACHMENT A





## Figure 6A.A.7 Abutment Layout Detailing Example 7





## Figure 6A.A.8 Abutment Layout Detailing Example 8

6A.A.8

ABUTMENT DETAILING EXAMPLES – ATTACHMENT A



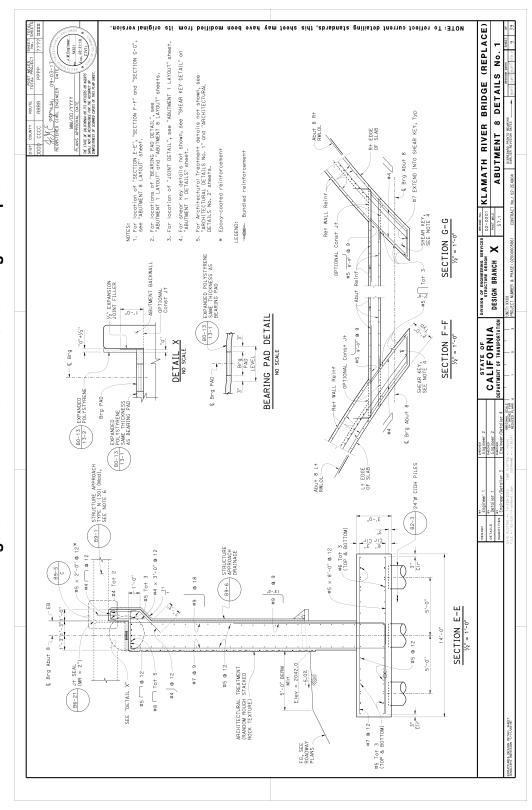
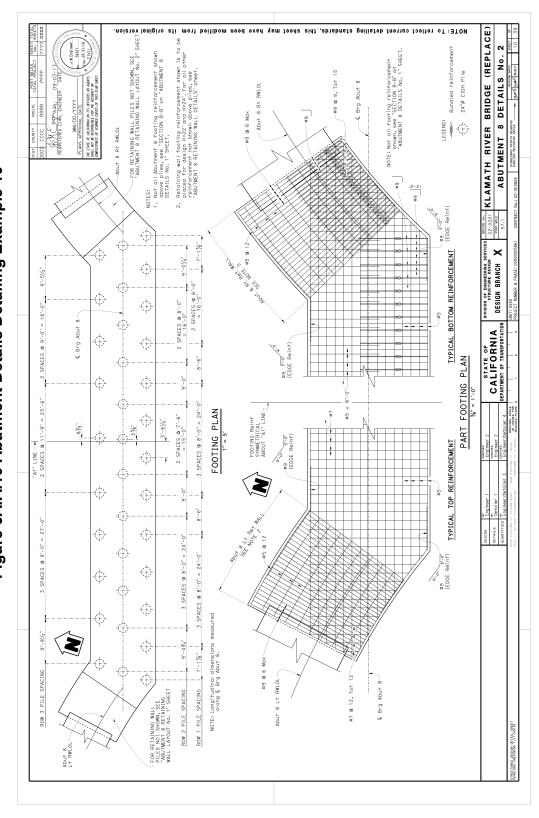


Figure 6A.A.9 Abutment Details Detailing Example 9



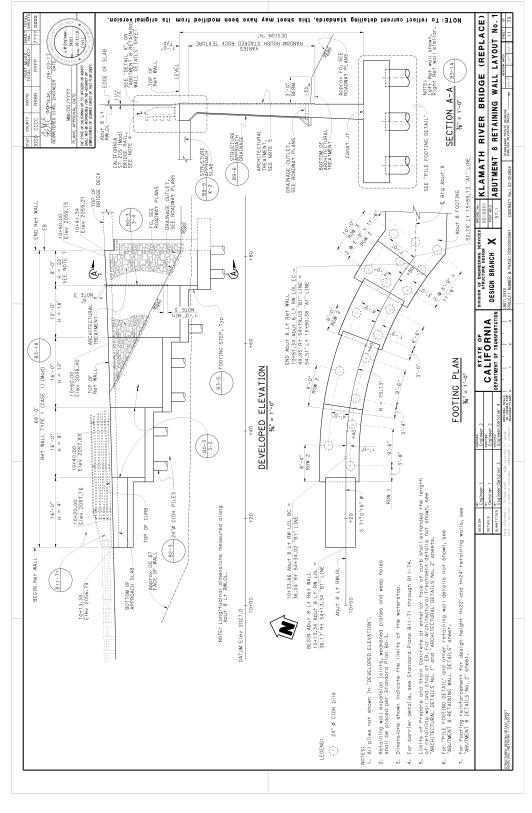


# Figure 6A.A.10 Abutment Details Detailing Example 10

6A.A.10







ABUTMENT DETAILING EXAMPLES – ATTACHMENT A

6A.A.11



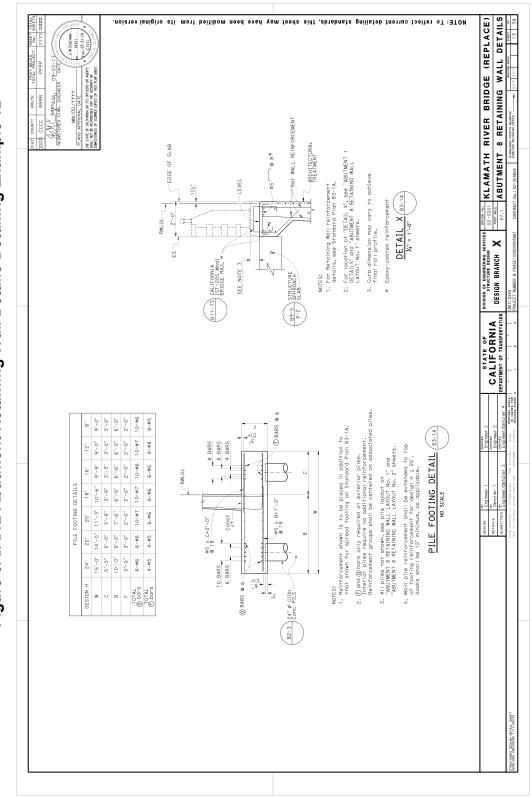


Figure 6A.A.12 Abutment Retaining Wall Details Detailing Example 12



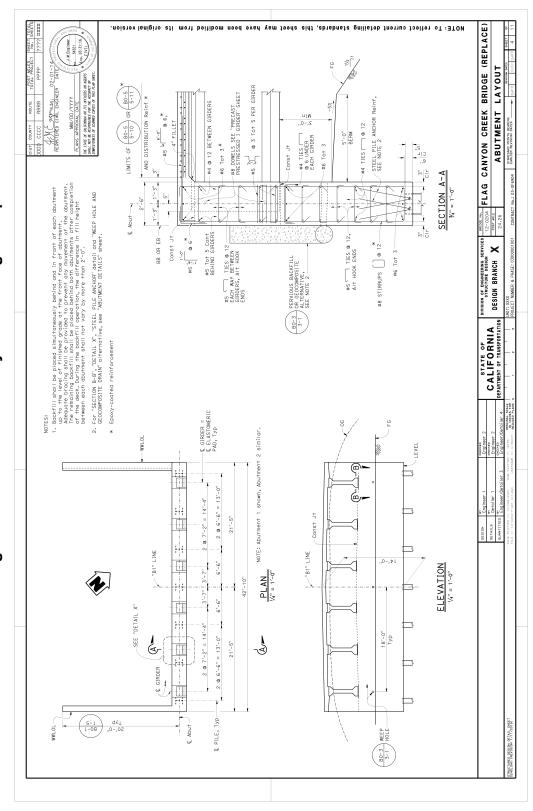


Figure 6A.A.13 Abutment Layout Detailing Example 13



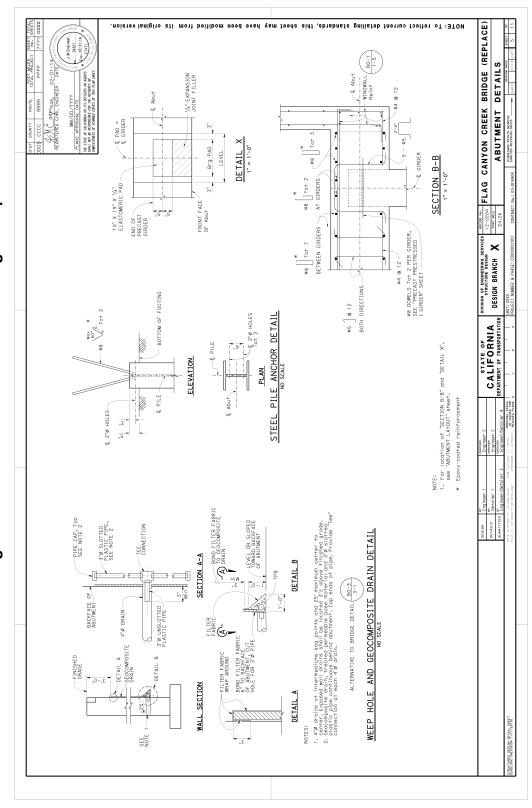


Figure 6A.A.14 Abutment Details Detailing Example 14

ABUTMENT DETAILING EXAMPLES – ATTACHMENT A



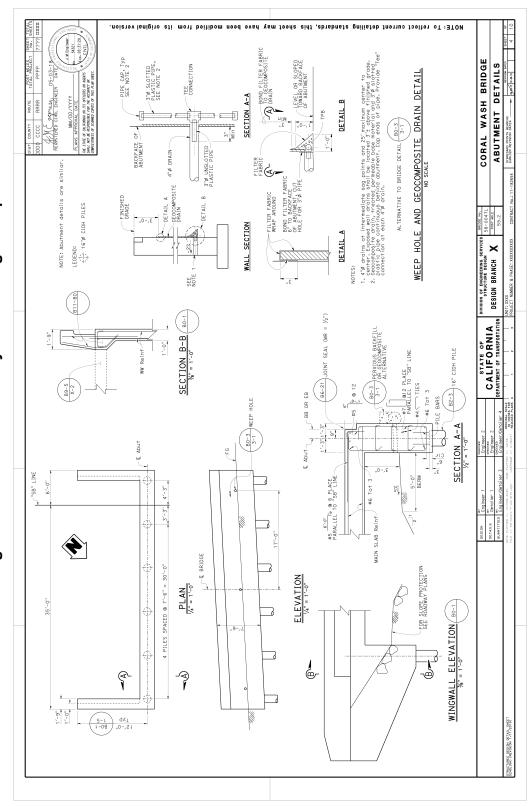


Figure 6A.A.15 Abutment Layout Detailing Example 15



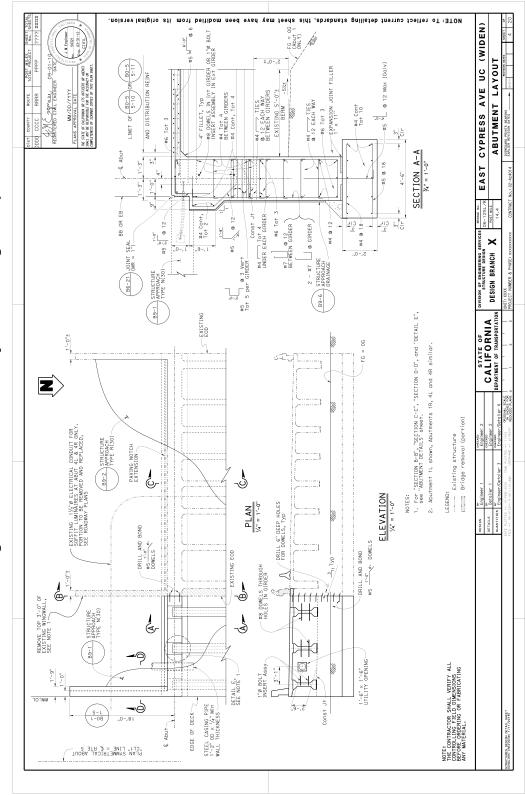


Figure 6A.A.16 Abutment Layout Detailing Example 16

ABUTMENT DETAILING EXAMPLES – ATTACHMENT A



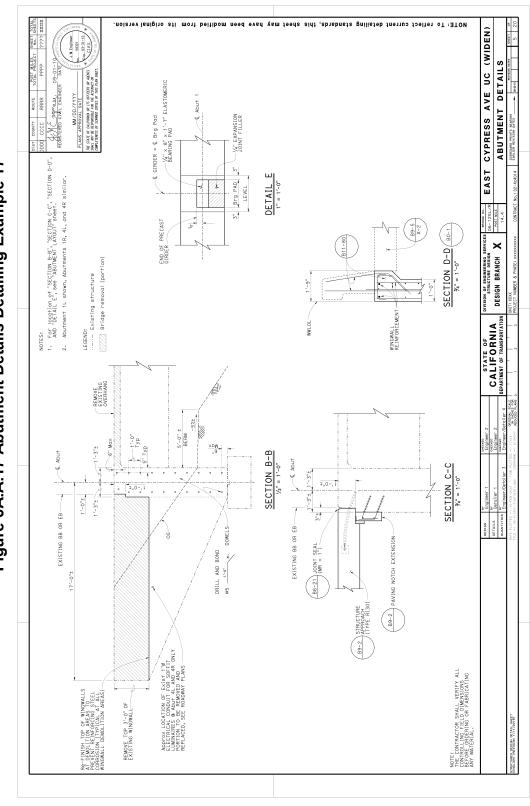


Figure 6A.A.17 Abutment Details Detailing Example 17



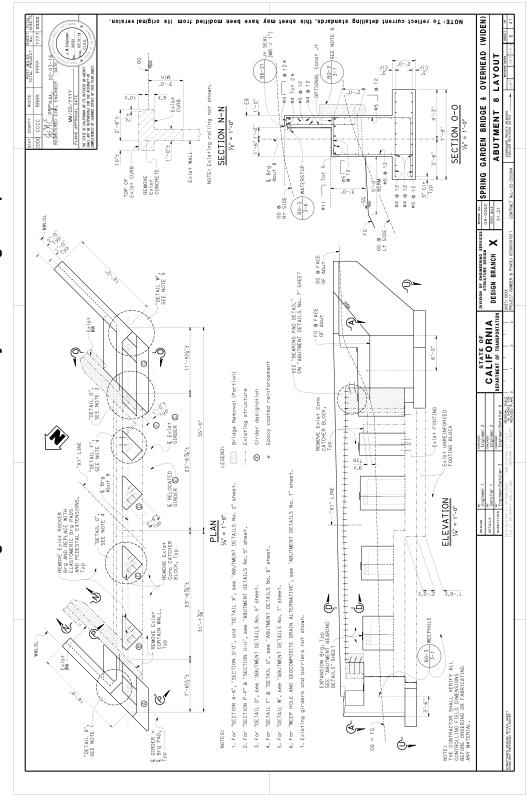
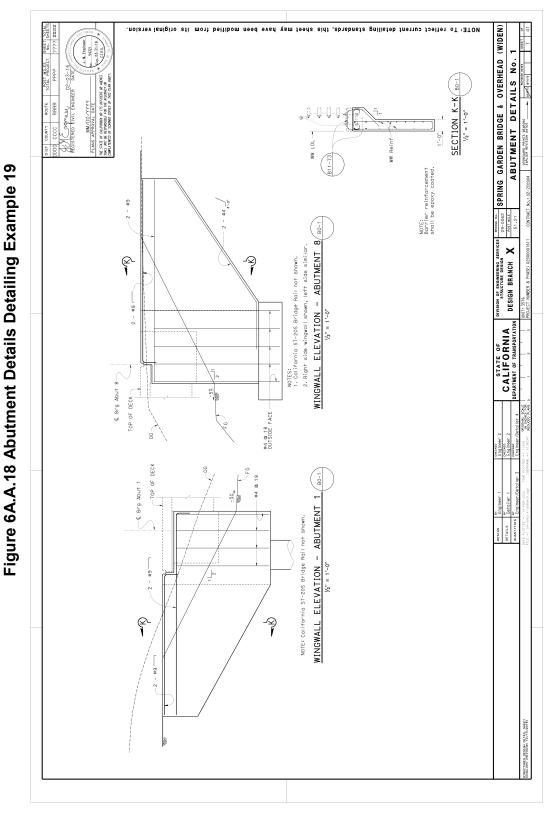


Figure 6A.A.18 Abutment Layout Detailing Example 18

6A.A.18

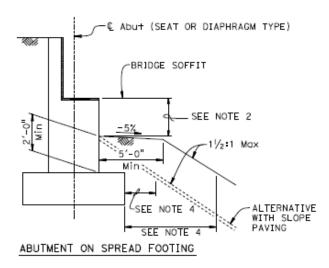


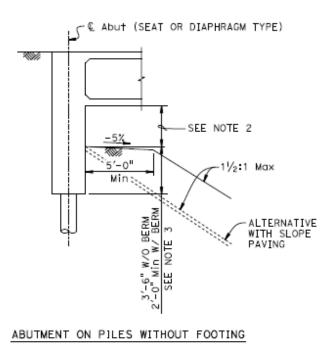




## Bridge Design Details 6.2 February 2020

### Seat & End Diaphragm Abutments





### Figure 6.2.1 Abutment Foundation Embedment and Berm



Notes:

- 1. For Abutment reinforcement, see Bridge Design Aids: Section 1 Abutments.
- 2. The clearance between the top of finish grade slope and the soffit of the bridge should be 3'-0" minimum for abutments with a berm. This clearance allows room for compaction of the berm and for future maintenance inspections. If, for some reason, the berm is wider than 6'-0", the minimum vertical clearance provided should be increased to provide the necessary room for construction. The clearance may be as little as 2'-0" for abutments without a berm (with slope paving); whereas the clearance can be as much as 4'-0" for typical bridges, depending upon individual project circumstances. Bridges with structure depths greater than 7'-0" would typically have more clearance, than the typical dimensions shown above, to provide a similar appearance as the shallower structures. The clearance is parallel to the deck when the cross slope is constant and level for crown slopes. The dimension shall be shown on the plans.
- 3. The bottom portion of abutments on piles without footings, shall be embedded a minimum of 3'-6" at the face of abutment when there is no berm (with slope paving). If the slope is flatter than  $1\frac{1}{2}$ :1 (horizontal:vertical), the embedment can be decreased to as little as 2'-0".
- 4. For abutments on spread footings, the horizontal clearance from the top of footing to the face of slope should be 5'-0" minimum, with a 2'-0" minimum cover at the edges of footing.
- 5. Front face slopes at abutments should be 1½ to 1 or flatter, except under very unusual circumstances.



## Bridge Design Details 6.3 February 2020

### **Abutment Drainage Details**

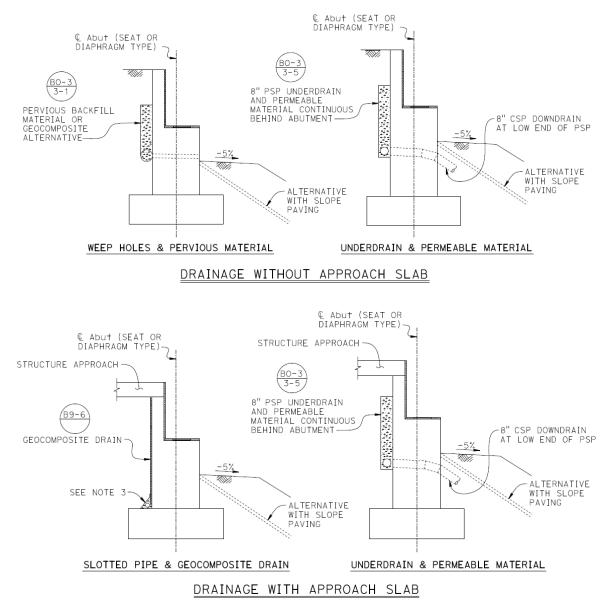
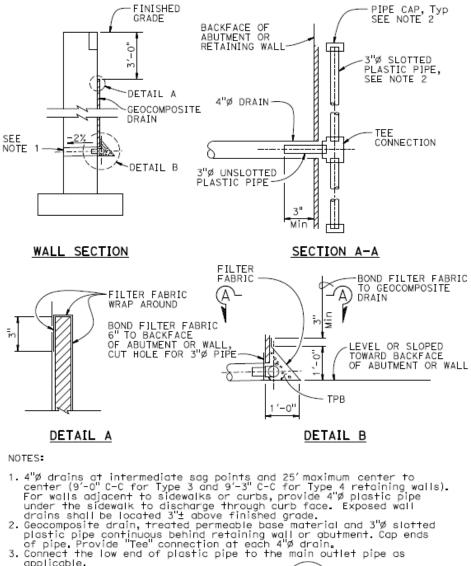


Figure 6.3.1 Abutment Drainage





- applicable.



Figure 6.3.2 Weep Hole and Geocomposite Drain Alternative



Notes:

- Continuous pervious backfill material (*Standard Plan B0-3*: Bridge Detail 3-1), structure approach drainage (*Standard Plan B9-6*: Structure Approach Drainage Details), or perforated pipe with permeable material (*Standard Plan B0-3*: Bridge Detail 3-5) should be placed in accordance with the instructions in *Memo to Designers:* 5-2 Diaphragm Abutments. Permeable material (*Standard Plan B0-3*: Bridge Detail 3-5), is only specified when known water bearing material is present behind the abutment as identified in the Foundation Report.
- 2. For all abutments (without structure approaches) and for retaining walls, the "Weep Hole and Geocomposite Drain Detail", shown in Figure 6.3.2, shall be added to the plans. This detail provides an alternative detail to the pervious backfill specified in *Standard Plan B0-3*: Bridge Detail 3-1. The plans should show the pervious material and not the alternative geocomposite drain in the abutment or retaining wall sections. Edit the NOTES in the "Weep Hole and Geocomposite Drain Detail" to remove references to wall types or elements that are not specific to the project plans.
- 3. Reference ROADWAY PLANS or show drainage outlet details behind the abutment whenever possible.



## Bridge Design Details 6.4 February 2020 Pile Footings

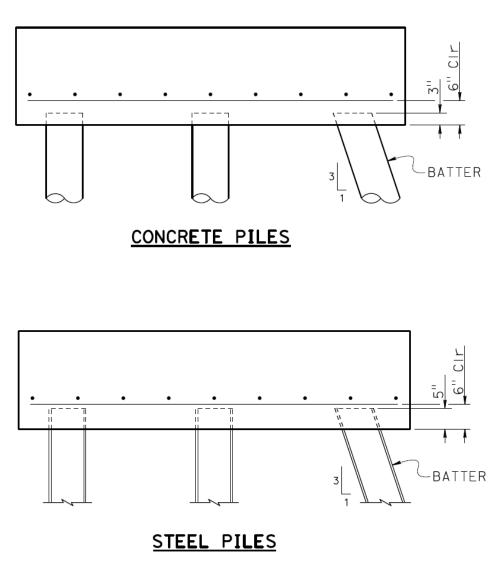


Figure 6.4.1 Pile Footings



## Bridge Design Details 6.5 February 2020

### **Piles at Abutment Corners**

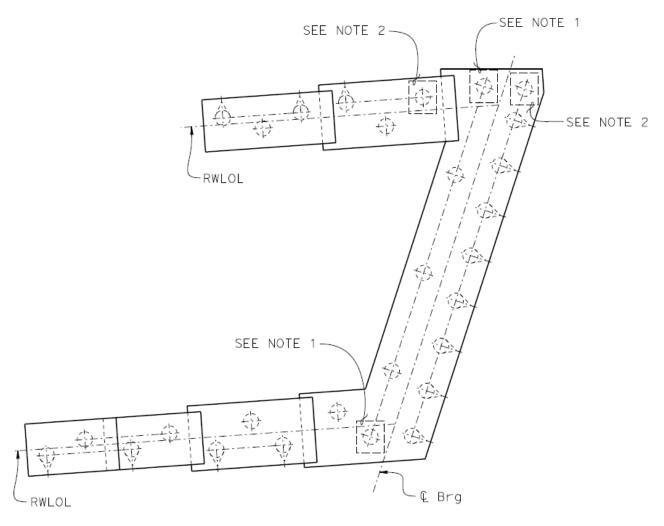


Figure 6.5.1 Piles at Abutment Corners

Notes:

- 1. Battered pile at this location is unnecessary. Pile should be vertical.
- 2. Use vertical pile rather than battered piles at sharp acute corners where it may be difficult to drive battered piles.



## Bridge Design Details 6.6 February 2020

### **Bearing Pad Location at Anchorage Blockout**

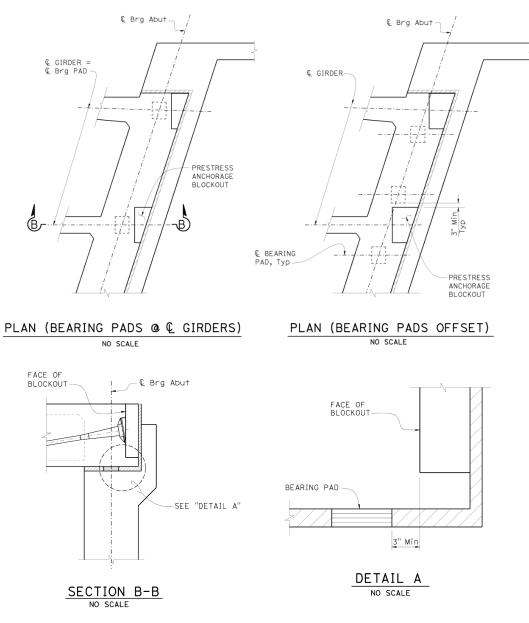
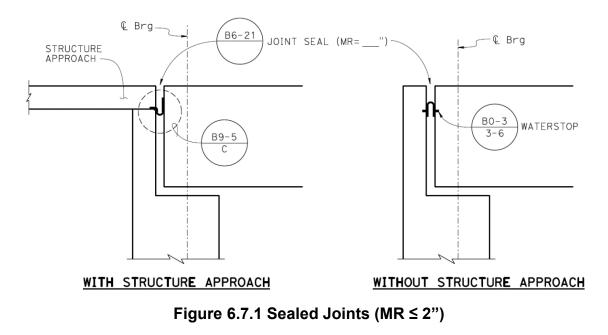


Figure 6.6.1 Bearing Pad Location at Anchorage Blockout



## Bridge Design Details 6.7 February 2020

### **Sealed Joints**



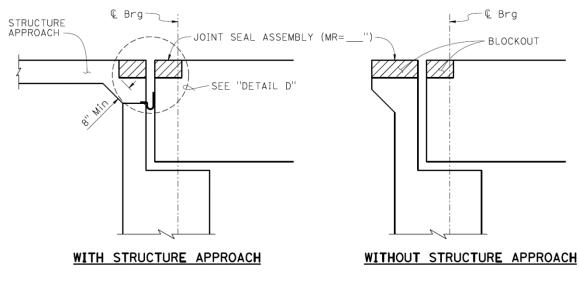


Figure 6.7.2 Joint Seal Assemblies (MR > 21/2")

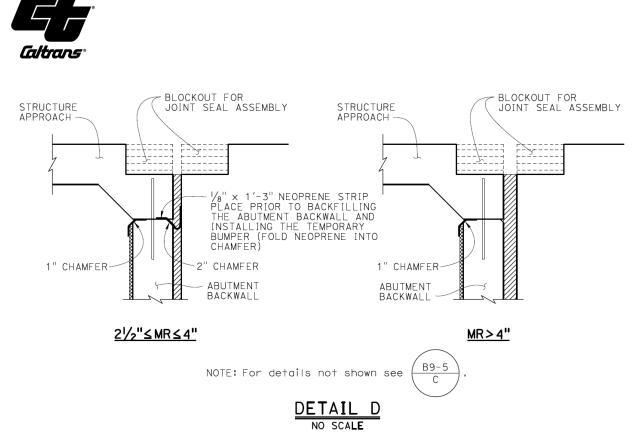


Figure 6.7.3 Joint Seal Protection Detail (MR > 21/2")

Note: "DETAIL D" must be shown in the plans for bridges with Standard Plan structure approach slabs with joint MR > 2". Show only the applicable portion of the detail that covers the actual joint MR range of the bridge.



## Bridge Design Details 6.8 February 2020

### **BB** and **EB** Locations

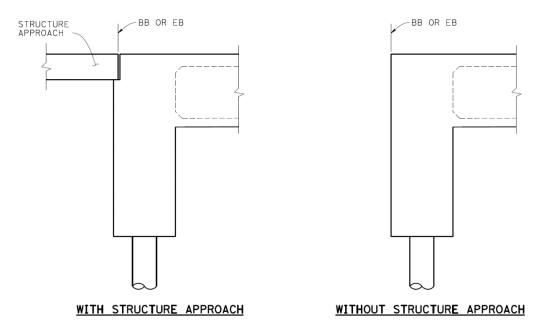


Figure 6.8.1 Diaphragm Abutment BB and EB Locations

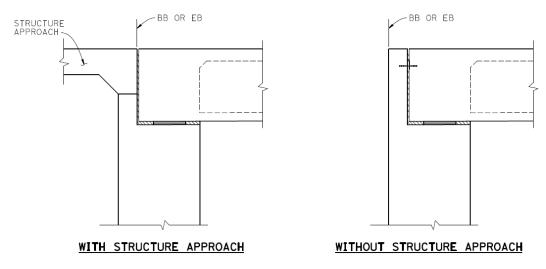
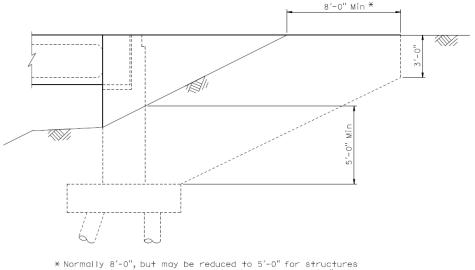


Figure 6.8.2 Seat Abutment BB and EB Locations



## Bridge Design Details 6.9 February 2020

### **Cantilever Wingwalls**



\* Normally 8'-0", but may be reduced to 5'-0" for structures in a cut or minor structure which is less than 50'-0" long, see Bridge Design Aids: 10-33 Slopes at Abutments.





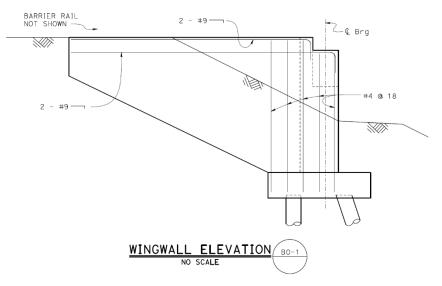


Figure 6.9.2 Seat Abutment with Standard Plan Wingwall



## Bridge Design Details 6.10 February 2020

### **Retaining Wall Wingwalls**

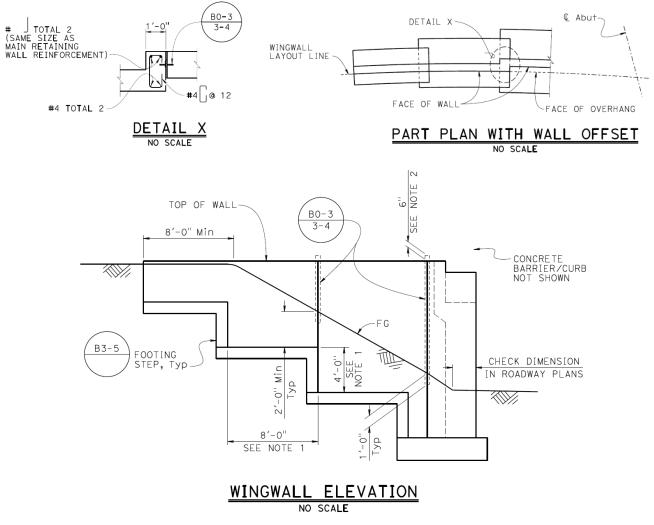


Figure 6.10.1 Retaining Wall Wingwalls

Notes:

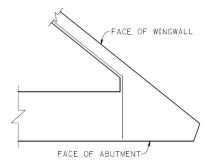
- 1. Preferred step dimensions shown, may vary to fit slope conditions or pile spacings. For additional information refer to *Standard Plan*: B3-5 Retaining Wall Details No. 1.
- 2. Extend waterstop 6 inches into concrete barrier or curb.



# Bridge Design Details 6.11 February 2020

## **Abutment Wingwall Corners**

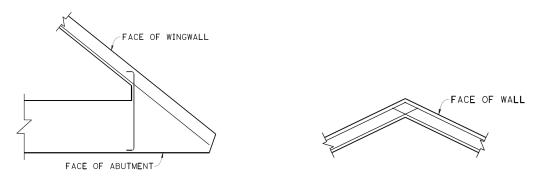
Tension reinforcement shall not be bent around a re-entrant corner of an acute abutment. The small amount of concrete cover is not sufficient to keep the reinforcing from straightening.



#### **INCORRECT**

#### Figure 6.11.1 Abutment Wingwall Corners

Reinforcement in each face should be straight and extend the required development length after it crosses the bar from the other direction. Standard practice for detailing reinforcement in all corners and angle changes in members is shown below.



#### CORRECT

#### Figure 6.11.2 Abutment Wingwall Corners



# Bridge Design Details 6.12 February 2020

## **Barriers on Walls**

When a barrier or bridge railing is to be placed on a wingwall or retaining wall, the wall must be detailed to alert the contractor of the additional work to be performed. This information is shown on the barrier Standard Plan or on the specific XS-SHEET details and must be referenced in the plans. The details below illustrate the minimum additional detail required for a standard plan concrete barrier. Details for Standard Plan barriers with a curb are similar.

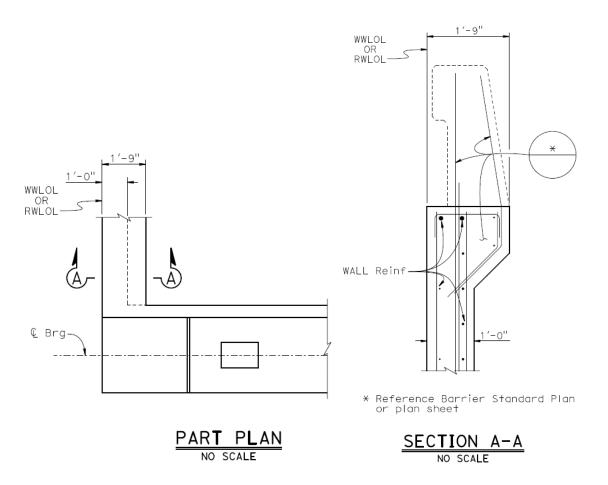
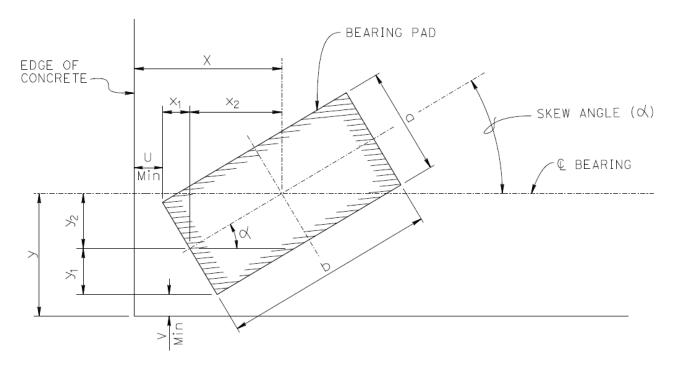


Figure 6.12.1 Concrete Barrier on Walls

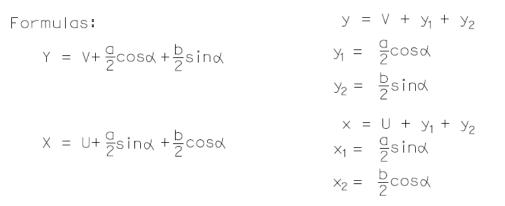


# Bridge Design Details 6.13 February 2020

## **Edge Distance Calculation for Bearing Pad**









- Example: 10" x 22" Bearing Pad (a = 10", b = 22") Minimum Skew Angle ( $\alpha$ ) = 27° 10' 30" Clearance (U = 3", V = 3")
- Calculate:  $Y = 3" + \frac{10"}{2} (0.8896) + \frac{22"}{2} (0.4567)$  Y = 3" + 4.45" + 5.02" = 12.47", use  $12\frac{1}{2}"$  minimum  $X = 3" + \frac{10"}{2} (0.4567) + \frac{22"}{2} (0.8896)$ X = 3" + 2.28" + 9.78" = 15.06", use 15" minimum



# **Abutment - Checklist**

Structure:	Structure Number:
Contract Number:	Project Number & Phase:
Detailer:	Date:
Designer:	Date:
Checker:	Date

## Plan

- 1. Place at the top, left side of sheet, oriented with the front side facing down and the centerline of abutment horizontal. Alternatively, the PLAN view may be orientated the same direction as the PLAN view shown on the GENERAL PLAN sheet.
- 2. The minimum scale is  $\frac{1}{4}$ " = 1'-0". Use  $\frac{1}{8}$ " = 1'-0" on large structures, but show less detail.
- 3. Show abutment, footing, pile spacing, bearing pad, and wingwall dimensions along the same layout lines used on the FOUNDATION PLAN (Note: Show the centerline of the abutment bearing for seat abutments and the centerline of the abutment for diaphragm abutments).
- 4. Do not repeat layout stations or bearings shown on the FOUNDATION PLAN.
  - 5. Show wingwall or retaining wall lengths.
- 6. Show pile spacing (Do not dimension piles from edge of footing).
  - A FOOTING PLAN may be used to show pile spacing if it can't be shown clearly in the PLAN view. Additional DETAILS of footings should be shown in the same orientation as the PLAN view. Show the centerline of bearing.
- 7. Show North arrow.
- 8. Show bearing pads and limits of level bearing area. A portion of the expanded polystyrene or expansion joint filler material may be added.
- 9. Show the centerline of utility and future utility openings. Identify the size of opening and details for buried pipe for bridges with approach slabs, see *Standard Plan*: B6-10 Utility Openings T-Beam and *Standard Plan*: B7-10 Utility Openings Box Girder.
- 10. Avoid showing portions of approach slabs or reinforcement.



## Elevation

- Place below PLAN view, projected from face of abutment. If PLAN is orientated the same as the GENERAL PLAN, place ELEVATION in front of PLAN, looking normal to face of abutment
  - Use solid lines for portions below grade. Rear elevations should be avoided. ELEVATION should be a depiction of abutment stem, backwall, and footing. Avoid showing the superstructure on seat type abutments, but if it shown – use dashed lines.
- 3. Use the same scale as PLAN view.
- 4. Show location of weep holes if Structure Approach Drainage is not required. For typical drainage details, see *Standard Plan B0-3*: Bridge Detail 3-1.
- 5. Show the finished grade or slope paving in front of the abutment (FG should be parallel to the deck when the cross slope is constant and level for crowned slopes).
- 6. Do not attempt to show the entire skewed wingwalls.
- 7. Show bearing pads and utility opening information.
- 8. Do not show all piles (NOTE: All piles not shown).
- 9. Avoid showing barrier, approach slab, or other detail dimensions.

# **Wingwall Elevation**

- 1. Projection of PLAN view, if possible; otherwise locate by VIEW letters or simply call out as WINGWALL ELEVATION.
- 2. Always show looking normal to the wall.
- 3. Use the same scale as PLAN view unless reinforcement is to be shown. Usually reinforcement should not be shown at a scale less than  $\frac{3}{8}$  = 1'-0".
- 4. Do not show wingwall layout dimensions given on PLAN view. Call out Standard Plan references.
- Show SECTION of top of wall details for railings, sidewalks, overhangs, and architectural treatment. Section should show Structure Approach Drainage Details if applicable.
- 6. Show finished grade or slope paving.
- 7. Show all piles.
- 8. Railing need not be shown (NOTE: Barrier railing not shown).



# **Retaining Wall or Return Wall Elevation**

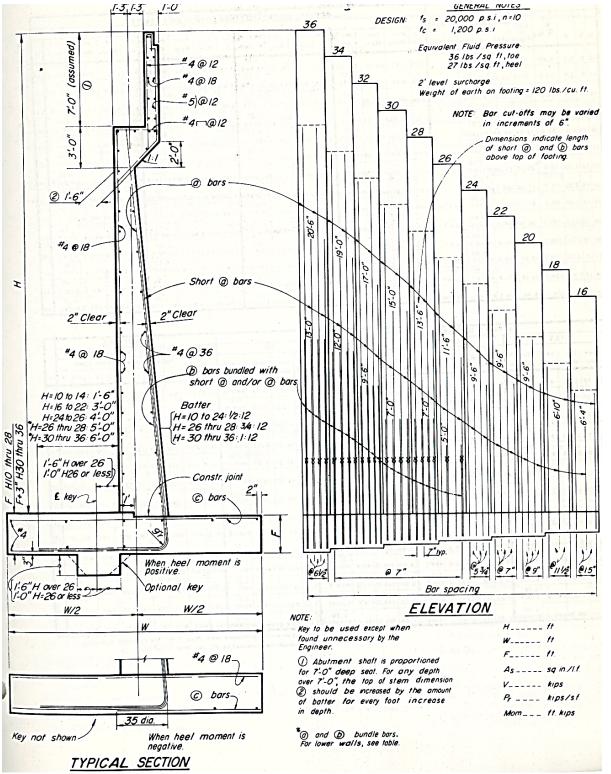
- Do not show dimensions given on PLAN view or standard plan sheets. Call out Standard Plan references (i.e. footing steps, expansion joints, weakened planes, etc). Show all other layout information along the Retaining Wall Layout Line (RWLOL).
  - 2. Long retaining walls adjacent to bridges may require separate sheets or plans showing PLAN and ELEVATION details.
  - 3. Show SECTION of top of wall details for railings, sidewalks, overhangs, and architectural treatment. Section should show Structure Approach Drainage Details if applicable.
  - 4. Do not show all piles (NOTE: All piles not shown).
  - 5. Distance between footing steps should be in multiples of 8 feet. Maximum height of steps should be held to 4 feet. For typical step details, see *Standard Plan B3-5*: Retaining Wall Details No. 1 Footing Step. Small steps less than 12 inches should be avoided unless distance between steps is 96 feet or more. If footing thickness changes between steps, the bottom of footing elevation should be adjusted so that the top of footing remains at the same elevation.
- 6. When sloping footings are used, form and joint lines are permitted to be perpendicular and parallel to the footing for ease of construction. Sloping footing grades shall be constant for the entire length of the wall. If breaks in footing grade (angle points) are deemed necessary, a level-stepped footing shall be used for the entire wall instead of a sloping footing (Maximum permissible slope for a reinforced concrete retaining wall footing is 3% and maximum permissible slope for masonry walls is 2%).
- 7. Weakened plane joints (*Standard Plan B0-3*: Bridge Detail 3-2) should be shown at nearly equal spaces between expansion joints.
- 8. Expansion Joints (*Standard Plan B0-3*: Bridge Detail 3-4) shall be shown at maximum intervals of 96 feet (shorter spaces should be in multiples of 8 feet). Expansion joints should not be placed at an angle point in the wall alignment. Waterstop in the expansion joint shall be shown to extend 1 foot below the finished grade. When concrete barriers or curbs are used on top of the retaining walls, the waterstop in the expansion joint shall be shown to extend 6 inches into the barrier or curb.



## **Sections and Details**

- 1. For general requirements, see *Bridge Design Details*: 1.1 General Detailing Detail Layout, Sections, and Views.
  - SECTIONS and DETAILS showing reinforcement should not be less than <sup>3</sup>/<sub>8</sub>" = 1'-0" scale; the preferred scale is <sup>1</sup>/<sub>2</sub>" = 1'-0" minimum.
  - 3. Do not repeat reinforcement shown in the Standard Plans.
  - 4. Abutment SECTION should include the following:
    - ] a) Location of Beginning of Bridge (BB) and End of Bridge (EB), see *Bridge Design Details*: 6.8 BB and EB Locations.
  - b) Centerline Bearing for seat type abutment and Centerline Abutment for diaphragm type.
  - c) Stem and backwall reinforcement. For post tensioned girder bridges, backwall to be placed after bridge has been stressed.
  - d) Footing reinforcement and pile spacing.
  - e) Outline of end diaphragm or superstructure (Do not use drop out lines or include reinforcement details of superstructure beyond bars that extend from end diaphragm abutment into deck).
  - f) Joint seal type, movement range, and joint seal blockout details.
  - g) Waterstop or Structure Approach joint detail, see *Bridge Design Details*: 6.7 Sealed Joints.
  - h) Drainage details behind the abutment and "Weep Hole and Geocomposite Drain Detail" alternative when *Standard Plan B0-3:* Detail 3-1 is shown. For more information, see *Bridge Design Details*: 6.3 Abutment Drainage Details.
    - Edit the NOTES in the "Weep Hole and Geocomposite Drain Detail" to remove references to wall types or elements that are not specific to the project plans.
  - i) Dimension distance below the soffit and width of maintenance berm. For additional berm information, see *Bridge Design Details*: 2.1 Bridge Layout and *Bridge Design Details*: 6.2 Seat & End Diaphragm Abutments.
  - 5. SHEAR KEY DETAIL should include the following:
    - a) Expanded polystyrene and expansion joint filler details.
    - b) Shear Key, stem, and wingwall reinforcement.







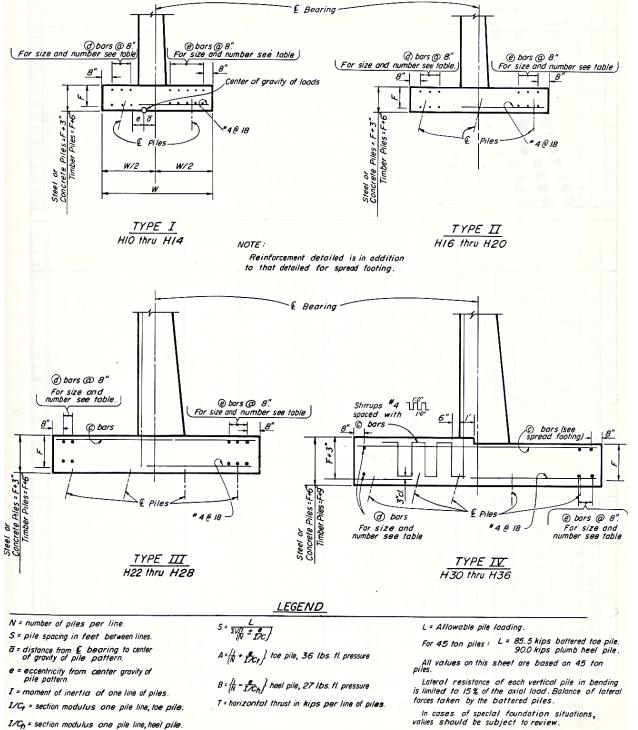


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6 19 tc I P 0 4. 2 4. 4 4. 6 4. 8 4. 0 5. 2 5. 4 5.	9 2. 7 56 - 57 - 62 - 72 - 84 - 13 - 31 - 64 -	1 toe Mom -5.80 -9.41 -14.2 20.00 27.00 -36.7 -47.1 -60.6	09.1 : 12.5 hee Mo: -4.9 -3.7 3 -1.9 0 +4.5 6 +9.5 6 +9.5 8 +16. 1+22. 7 +33.	1         het           m         c b           9         #68           0.1         9           4         #5 6           0.1         2           2         #5 6           0.2         2           5         0.4           2         #56           0.5         25           1.3         #106           3         #101	APP APP APP APP APP APP APP APP	<ul> <li>*11@6%</li> <li>LIED SU</li> <li>oe toe</li> <li>r. Mom</li> <li>97 -6.45</li> <li>.93 -10.3</li> <li>.94 -15.4</li> <li>00 -21.4</li> <li>09 -28.8</li> <li>.36 -38.8</li> <li>52 -49.5</li> <li>83 -63.21</li> </ul>	PERST 15 heel Mom. -6.61 1-5.55 4-4.05 7+2.68 4+7.10 9+13.00 3+20.49 1+30.19	RUCT heel c ba 0.31 #7@ 0.26 #6@ 0.12 #4@ 0.31 #5@ 0.12 #4@ 0.31 0.48 #5@ 0.75 #9@ 1.23	URE A, to Pr Pr 18 5.3 18 5.2 5 5.2 11/5 5.3 5 5.5 11/5 6.0	<ul> <li>toe Mom</li> <li>toe 30</li> <li>toe 40.00</li> <li>toe 40.00</li></ul>	HI KIPS 17.5 heel Mom -8.17 1-7.32 0 -6.01 0 -3.98 4 +4.63 8 +10.92 9 +17.62 4 +27.21	heel A           c.bars           0.38           77 @18           0.34           #7@18           0.34           #7@18           0.17           #5@18           0.17           #5@15           0.20           #4@111           0.40           #5@9           0.64           #8@14           0.86           #9@11	FT. toes Pr. 5.83 5.56 5.55 5.55 5.83 5.84 5.94 6.21	105.1 # toe Mom -1-7.73 -12.12 -17.78 -24.400 -32.37 -42.97 -54.27 -68.65	20 hee1 Mom. -9.74 2-9.13 -8.01 -6.25 -3.80 +14.69 +14.69	heel A c bars 0.45 # 8@ 18 0.47 # 7@ 18 0.37 # 7@ 18 0.37 # 7@ 18 0.37 # 7@ 18 0.37 # 7@ 18 0.34 # 4@ 11 0.30 \$ 5@ 9 0.54 # 8@ 14 0.54 # 8@ 14 0.54 # 8@ 14 0.54 # 8@ 14 0.54 # 8@ 14 0.54 # 8@ 16 10 10 10 10 10 10 10 10 10 10 10 10 10	Conx cf/ft 24.5 29.1 33.8 9 43.8 51.7 57.4 66.5	Bar 0 57 74 102 129 172 231 307 366	#11@ Reint App 5 55 69 99 124 164 220 291 366	QU forcin lied 2 7.5 57 68 96 119 158 2111 291 353	AN T ng St Supe 10 58 70 93 115 158 211 281 353	ITIE ool ( rstruct 12.5 59 71 94 112 152 203 271 353	5 1bs.// 15 61 72 95 109 147 203 271 341	<ul> <li>(4.)</li> <li>(5.0)</li> <li>(61)</li> <li>(74)</li> <li>(96)</li> <li>(113)</li> <li>(143)</li> <li>(</li></ul>	@61/2 20 63 76 98 115 145 196 264 331
6 19 tc I P 0 4. 2 4. 4 4. 6 4. 8 4. 0 5. 2 5. 4 5.	9 2. 7 56 - 57 - 62 - 72 - 84 - 13 - 31 - 64 -	1 toe Mom -5.80 -9.41 -14.2 20.00 27.00 -36.7 -47.1 -60.6	09.1 : 12.5 hee Mo: -4.9 -3.7 33 -1.9 0 +4.5 6 +9.5 8+16. 1 +22.	1         het           m         c b           9         #66           0.1         #56           0.8         #44           0.2         #56           0.3         #44           2         #56           0.3         #11	APP APP APP APP APP APP APP APP	<ul> <li>*11@6%</li> <li>LIED SU</li> <li>oe toe</li> <li>Pr. Mom</li> <li>97 -6.45</li> <li>.93 -10.3</li> <li>.94 -15.4</li> <li>00 -21.4</li> <li>09 -28.8</li> <li>.36 -38.8</li> <li>52 -49.5</li> </ul>	PERST 15 heel Mom. -6.61 1-5.55 4-4.05 7+2.68 4+7.10 9+13.00 3+20.49 1+30.19	RUCT heel c ba 0.31 #7@ %5@ 0.12 #4@ 0.12 #4@ 0.12 #4@ 0.48 #5@ 0.48 #5@ 0.75 #9@ 1.23 #11@	URE A, to Pr Pr 18 5.3 18 5.2 5 5.2 11/5 5.3 5 5.5 11/5 6.0	<ul> <li>toe Mom</li> <li>toe 30</li> <li>toe 40.00</li> <li>toe 40.00</li></ul>	HI KIPS 17.5 heel Mom -8.17 1-7.32 0 -6.01 0 -3.98 4 +4.63 8 +10.92 9 +17.62 4 +27.21	heel A c, bars 0.38 #7 @ 18 0.34 #7 @ 18 0.34 #5 @ 18 0.17 #5 @ 15 0.20 #4@111 0.40 #5 @ 9 0.64 #8@ 14 0.86 #9@111 1.17 #11@1	FT. toes Pr. 5.83 5.56 5.55 5.55 5.83 5.84 5.94 6.21	105.1 # toe Mom -1-7.73 -12.12 -17.78 -24.400 -32.37 -42.97 -54.27 -68.65	20 hee1 Mom. -9.74 2-9.13 -8.01 -6.25 -3.80 +14.69 +14.69	heel A c bars 0.45 #8@18 0.37 #7@18 0.29 #6@15 0.18 #4@11/ 0.30 #5@9 0.54 #8@14 0.76 1 #8@14	Conx cf/ft 24.5 29.1 33.8 38.9 43.8 51.7 57.4	Bar 0 57 74 102 129 172 231 307 366	#11@ Rein App 5 55 69 99 124 164 220 291	QU forcin lied : 7.5 57 68 96 119 158 211 291	AN T 9 St 500000 10 58 70 93 1155 158 2111 281	ITIE           eel         (istruct)           12.5         59           71         94           112         152           2033         271	5 Ibs.// 1000 L 15 61 72 95 109 147 203 271	<ul> <li>(4.)</li> <li>(5.0)</li> <li>(61)</li> <li>(74)</li> <li>(96)</li> <li>(113)</li> <li>(143)</li> <li>(</li></ul>	e61/2 20 63 76 98 115 145 196 264
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6 19 t t t 1 P 0 4. 2 4. 4 4. 6 4. 8 4. 0 5. 2 5. 4 5. 6 5.	9 2.3 56 - 57 - 62 - 72 - 84 - 13 - 31 - 64 - 80 -	75.21 toe Mom -9.41 -14.2 20.00 27.00 -36.7 -47.1 -60.6 75.32	09.1 : 12.5 hee Mo: -4.9 -3.7 3 -1.9 0 +4.5 6 +9.5 6 +9.5 8 +16. 1+22. 7 +33.	1 het	APP APP Ara F 2 18 4. 5 5 18 4. 9 9 5. 5 114 5. 5 5 5 5 5 5 5 5 5 5 5 5 5	<ul> <li>*11@6%</li> <li>LIED SU</li> <li>oe toe</li> <li>r. Mom</li> <li>97 -6.45</li> <li>.93 -10.3</li> <li>.94 -15.4</li> <li>00 -21.4</li> <li>09 -28.8</li> <li>.36 -38.8</li> <li>52 -49.5</li> <li>83 -63.21</li> </ul>	PERST 15 hee1 Mom. -6.61 1 -5.55 4 -4.05 7 +2.68 4 +7.10 9 +13.06 3+20.49 +30.19 0 +36.9	RUCT heel c ba 0.31 77 @ 0.26 #5@ 0.19 #5@ 0.19 #5@ 0.19 #5@ 0.19 #5@ 0.11 0.48 #6@ 0.75 #9@ 1.23 #11@ 1.47 #11@	URE A, too Pr 18 5.3 18 5.2 18 5.2 18 5.2 18 5.2 14 5.3 0 5.5 14 5.7 15 6.0 14 6.1	<ul> <li>toe Mom</li> <li>toe 30</li> <li>toe 40.00</li> <li>toe 40.00</li></ul>	N KIPS IN KIPS I7.5 heel Mom 8.17 -7.32 0 -6.01 0 -3.98 4 +4.63 8 +10.92 9 +17.622 4 +27.21 9 +33.6	PER heel A c.bars 0.38 #7@18 0.34 #7@18 0.34 #5@18 0.17 #5@15 0.20 #4@111 0.40 #5@9 0.64 #8@14 0.64 #8@14 0.64 1.17 #11@14	FT. 100 5.81 5.81 5.55 5.55 5.81 5.94 5.94 6.21 4.6.34	105.1 # toe Mom -7.73 -17.78 -17.78 -24.40 -32.37 -54.27 -54.27 -68.65 -84.23	20 heel -9.74 2-9.13 -8.01 -6.25 -3.80 +8.29 +14.69 +14.69 +31.4	heel A c bars 0.45 #8 e18 0.37 #7 e18 0.29 #6 e15 0.30 #4 e11 0.30 #5 e9 0.54 #8 e14 0.54 #8 e14 1.05 #10e14	Conx cf/ft 24.5 29.1 33.8 38.9 43.8 51.7 57.4 66.5 77.8	Bar 0 57 74 102 129 172 231 307 366 400	#11@ Reint App 5 55 69 99 124 164 220 291 366	QU forcin lied 2 7.5 57 68 96 119 158 2111 291 353	AN T ng St Supe 10 58 70 93 115 158 211 281 353	ITIE ool ( rstruct 12.5 59 71 94 112 152 203 271 353	S Ibs.// 15 61 72 95 109 147 203 271 341 382	<ul> <li>(4.)</li> <li>(5.0)</li> <li>(61)</li> <li>(74)</li> <li>(96)</li> <li>(113)</li> <li>(143)</li> <li>(</li></ul>	@61 <sup>4</sup> 20 63 76 98 115 145 264 331 371
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6 19 1 tc 1 P 0 4. 2 4. 4 4. 6 4. 8 4. 0 5. 2 5. 4 5. 6 5. 8 6.	9 2.3 56 - 57 - 62 - 72 - 84 - 13 - 31 - 80 - 14 - 14 -	75.21 1 toe Mom -5.80 -9.41 -14.2 20.00 27.00 -36.7 -47.1 -60.6 75.32 93.30	12.5         hee         Mo:         -4.9         -3.7         3         -1.9         0         +4.5         6         +9.5         6         +9.5         7         2         +400         +53.	58.94 1 he(m c b 0.2 9 f66 0.4 4 #56 0.4 4 #56 0.4 2 #56 0.5 2 #66 0.5 2 #66 0.5 2 #66 1.3 # 10 1.5 1 #9 1.5 1 #9 1.6 1.5 1 #9 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5	APP 11 A t 12 A t 13 A t 13 A t 14 A t 13 4 4 12 13 5 4 11 14 5 13 5 11 14 5 13 5 14 5 15 5 14 5 15 7 7 6 7 6	<ul> <li>*11@6%</li> <li>*11@6%</li> <li>LIED SU</li> <li>oe toe</li> <li>7. Mom</li> <li>97 -6.45</li> <li>.93 -10.3</li> <li>.94 -15.4</li> <li>00 -21.4</li> <li>09 -28.8</li> <li>36 -38.8</li> <li>52 -49.5</li> <li>83 -63.21</li> <li>98 -78.30</li> <li>32 -96.60</li> </ul>	PERST 15 heel Mom. -6.61 1-5.55 4-4.05 7+2.68 4+7.10 9+13.00 3+20.49 +30.19 +36.9 5+50.2	RUCT heel cba cba cba cba cba cba cba cba cba cba	URE A. too Pr 18 5.3 18 5.3 18 5.3 18 5.2 5 5.2 11/5 6.0 14 6.1 17 6.4	LOAD toe Mom 9 -7.05 11.2 5 -16.6 5 -16.6 4 -30.2 2 -51.8 2 -55.9 6 -81.2 2 -65.9 8 -99.8	HI E C C C C C C C C C C C C C C C C C C	heel A c, bars 0.38 #7 @ 18 0.34 #7 @ 18 0.28 #6@ 18 0.17 #5@ 15 0.20 #4@11 0.40 #5@ 9 0.64 #8@ 14 0.86 #9@11 1.17 #11@14 1.37 #11@14 1.43	FT. 5.81 5.55 5.55 5.55 5.81 5.55 5.55 5.5	105.1 # toe Mom -24.40 -32.37 -54.27 -54.27 -54.23 -03.14	20 heel Mom. -9.74 2-9.13 -8.01 -6.25 7-3.80 +14.69 +14.69 +24.13 5+31.4 +43.9	heel A c bars 0.45 8 @ 18 0.37 7 @ 18 0.29 #6@ 15 0.18 #7 @ 18 0.29 #6@ 15 0.30 #5@ 9 0.54 #8@ 11 0.55 #10@ 14 1.38	Conc cf/ft 24.5 29.1 33.8 38.9 43.8 51.7 57.4 66.5 77.8 90.8	Bor 0 57 74 102 129 172 231 307 366 400 492	*11@ Reint App 5 55 69 99 124 164 220 291 3666 400 470	QU forcin forcin lied 3 7.5 57 68 96 119 158 211 291 353 400, 470	AN T rg St Super 10 58 70 93 115 158 211 281 353 400 470	ITIE           eel (           rstruct           12.5           59           71           94           112           152           203           271           353           382           470	S Ibs.// 15 61 72 95 109 147 203 271 341 382 470	it.)         -	e61/3 20 63 76 98 115 145 196 264 331 371 451
4 4. 4 4. 4 4. 4 4. 5. 6 5. 8 6. 0 6.	9 2 56 - 57 - .62 - .72 - .84	75.20 Mom -5.80 -9.41 -14.2 20.00 -36.7 -47.1 -60.6 75.32 93.30 112.0	12.5         hee         Mo:         -4.9         -3.7         3         -1.9         0         +4.5         6         +9.5         6         +9.5         7         2         +400         +53.	1         hee           m         c b           9         #66           0.2         9           8         4           2         #56           0.3         8           2         #56           0.5         5           9.5         6.4           2         #56           0.3         1.3           1.3         1.4           1.3         1.4           1.3         1.4           1.3         1.4           1.3         1.3           1.3         1.4           1.5         1.5           1.5         1.5           1.7         1.7	APP APP 1 A, t t 1 ars F 2 1 8 4. 2 1 8 4. 3 5 5 5 5 5 5 5 5 5 5 5 5 5	<ul> <li>*11@6%</li> <li>*11@6%</li> <li>LIED SU</li> <li>oe toe</li> <li>7. Mom</li> <li>97 -6.45</li> <li>.93 -10.3</li> <li>.94 -15.4</li> <li>00 -21.4</li> <li>09 -28.8</li> <li>36 -38.8</li> <li>52 -49.5</li> <li>83 -63.21</li> <li>98 -78.30</li> <li>32 -96.60</li> </ul>	PERST 15 heel Mom. -6.61 1 -5.55 4 -4.05 7 +2.68 4 +7.10 9 +13.06 3 +20.49 1 +30.19 0 +36.9 5 +50.2 9 +52.8	RUCT heel c ba c ba c ba c ba c ba d c ba c ba d c ba	URE A. too Pr 18 5.3 18 5.2 15 5.2 16 5.3 16 6.1 7 6.4 7 6.6	LOAD toe Mom 9 -7.05 18 -11.2 5 -16.6 7 -22.9 9 -40.9 2 -51.8 4 -30.2 2 -51.8 4 -30.2 2 -51.8 8 -99.81 5 119.2	HI E C C C C C C C C C C C C C C C C C C	PER         heel A         c.bars         0.38         7@18         0.34         #7@18         0.34         #7@18         0.28         #6@18         0.17         \$5@15         0.20         #4@11         0.40         #5@9         0.64         #8@14         0.86         #9@11         1.17         #10@14         1.37         #10@14         1.43         #9@7	FT. 5.8 5.5 5.55 5.55 5.8 5.55 5.55 5.8 5.55 5.8 5.94 6.21 6.34 6.34 6.34	105.1 # toe Mom -24.40 -32.37 -54.27 -54.27 -54.23 -03.14	20 heel Mom. -9.74 2-9.13 3-8.01 2-6.25 (-3.80 +8.29 +14.69 +24.13 3+31.4 +43.9 0+46.9	heel A c barr 0.45 *8 @ 18 0.42 *7 @ 18 0.37 *7 @ 18 0.37 *3 @ 19 0.37 *3 @ 19 0.37 *3 *3 @ 19 0.37 *3 *3 *3 *3 *3 *3 *3 *3 *3 *3 *3 *3 *3	Conx cf/ft 24.5 29.1 33.8 38.9 43.8 51.7 57.4 66.5 77.8 90.8 103.6	Bor 0 57 74 102 129 172 231 307 366 400 492	#11ee Reini App 5 55 69 99 124 164 220 291 366 400 470 543	QU forcin forcin lied 3 7.5 57 68 96 119 158 211 291 353 400, 470	AN T rg St Super 10 58 70 93 115 158 211 281 353 400 470	ITIE           eel (           rstruct           12.5           59           71           94           112           152           203           271           353           382           470	S Iba.// 1007 E 15 61 72 95 109 147 203 271 341 382 470 518	(4.) (4.) (5.1	e61/3 20 63 76 98 115 145 196 264 331 371 451
16       11         1       10         1       10         2       4         4       4         6       4         6       4         8       4         0       5         2       5         4       5         6       5         8       6         0       6         2       5         8       6         0       6         2       5         8       6         0       6         2       6	9 2 9 2	75.20 1 toe Mom -5.80 9.41 -14.2 20.00 27.00 27.00 -36.7 -47.1 -60.6 -60.6 112.0 112.0 1135.31	12.5         hee         Mo:         -4.9         -3.7         3 -1.9         0 +4.5         8 +16.         1 +22.         7 +33.         2 +40.         0 +53.         4 +56.         1 +68.	58.94 1 he(m m c b 0.2 9 k66 0.4 4 #56 0.4 2 #56 0.5 2 #66 0.5 2 #66 1.3 3 #110 1.5 1 #96 0 #9 © 1.7 3 #100 2.0 0 # 6 b 1.5 1 #9.6 0 # 6 b 1.5 1 # 2 # 6 b 1.5 1 # 5 # 6 b 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5	APP 11 A, t 12 A, t 13 A, t 14 A, t 14 A, t 14 A, t 18 4 18 4 18 4 18 4 18 4 18 4 19 9 18 4 18 4 19 9 18 4 19 9 18 4 19 9 18 4 19 9 18 4 19 5 18 4 19 5 18 4 19 5 18 4 19 5 18 4 19 5 18 5 11 1/4 5 5 5 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 7 6 7 7 6 7 7 7 6 7 7 7 6 7 7 7 6 7 7 7 6 7 7 7 6 7 7 7 6 7 7 7 6 7 7 7 6 7 7 7 6 7 7 7 6 7 7 7 6 7 7 7 7 6 7 7 7 7 7 7 7 7 7 7 7 7 7	LIED SU oe toe r. Mom 97 -6.45 .93 -10.3 .94 -15.4 00 -21.4 09 -28.8 36 -38.8 52 -49.5 83 -63.2 98 -78.3( 32 -96.60 49 -115.6	PERST 15 heel Mom. -6.61 1-5.55 4-4.05 7+2.68 4+7.10 9+13.06 3+20.49 +30.19 0+36.9 5+50.2 9+52.8 1+65.4	RUCT c bai 0.31 #760 0.26 #560 0.19 #560 0.19 #560 0.31 #560 0.31 #560 0.31 #560 0.35 #990 1.23 #110 1.23 #110 1.54 #997 1.54 #997 2.000	URE A tor Pr 18 5.3 18 5.2 5 5.2 15 5.2 15 5.2 15 6.0 14 5.7 15 6.0 14 6.1 7 6.6 6.9	LOAD 100 Mom 9 -7.05 18 -11.2 5 -16.6 7 -22.9 4 -30.2 2 -51.8 9 -40.9 9 -40.9 9 -40.9 9 -40.9 9 -55.9 6 -81.2 2 -55.8 8 -99.8 5 -119.2 7 -143.2	N KIPS 17.5 heel Mom 8.17 8.17 8.17 3.98 4 +4.63 8 +10.92 9 +17.62 4 +27.21 9 +33.6 5 +46.8 9 +49.9 3 +62.2	heel A         c.bars         0.38         #7@18         0.34         #7@18         0.34         #7@18         0.34         #7@18         0.34         #7@18         0.34         #6@18         0.17         #5@18         0.17         #4@111         0.40         #5@9         0.64         #8@14         0.86         #9@911         1.17         #11@14         1.37         #11@14         1.43         #9@7         1.91	FT. 5.81 5.55 5.55 5.55 5.55 5.55 5.55 5.5	105.1 # toe Mom -7.73 -17.78 -17.78 -24.40 -32.37 -42.97 -54.27 -54.27 -68.65 -84.23 -103.14 -122.80 -147.00	20 heel Mom. -9.74 2-9.13 -8.01 -6.25 -3.80 +8.29 +14.69 +443.9 +443.9 +59.3	heel A c barr 0.45 *8 @ 18 0.42 *7 @ 18 0.37 *7 @ 18 *5 @ 9 0.54 *8 @ 11 1.05 * *8 @ 11 1.05 * *8 @ 11 1.05 * * 1.05 * * 1.05 * * * * * * * * * * * * * * * * * * *	Conx cf/ft 24.5 29.1 33.8 38.9 43.8 51.7 57.4 66.5 77.8 90.8 103.6 117.3	Bar 0 57 74 102 129 172 231 307 366 400 492 543 620	*11ee Reinin App 5 5 55 69 99 124 164 220 291 366 400 470 543 620	QU           forcin           forcin           forcin           11ed           7.5           57           68           96           119           158           211           353           4000,           4700           543           620	AN T ng St Supe 10 58 70 93 115 158 211 281 353 400 470 543 620	ITTLE           sel         (           ratruct         12.5           59         71           94         112           152         203           271         353           382         470           518         620	S bbs.// for L 15 61 72 95 109 147 203 271 341 382 470 518 594	<ul> <li>it.)</li> <li>ood</li> <li>17.5</li> <li>61</li> <li>74</li> <li>96</li> <li>113</li> <li>143</li> <li>196</li> <li>264</li> <li>341</li> <li>382</li> <li>451</li> <li>518</li> <li>594</li> </ul>	20 63 76 98 115 145 264 331 371 451 518 594
6 19 t ( P 0 4. 2 4. 4 4. 6 4. 8 4. 0 5. 2 5. 8 6. 0 6. 8 6.	9 2 9 2	75.20 1 toe Mom -5.80 9.41 -14.2 20.00 27.00 27.00 -36.7 -47.1 -60.6 -60.6 112.0 112.0 1135.31	12.5         here         Mov         -4.9         -3.7         33 -1.9         0 + 4.5         6 + 9.5         8 + 16.         1 + 22.         7 + 33.         2 + 40.         0 + 53.         4 + 56.	58.94 1 he(m m c b 0.2 9 k66 0.4 4 #56 0.4 2 #56 0.5 2 #66 0.5 2 #66 1.3 3 #110 1.5 1 #96 0 #9 © 1.7 3 #100 2.0 0 # 6 b 1.5 1 #9.6 0 # 6 b 1.5 1 # 2 # 6 b 1.5 1 # 5 # 6 b 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5	APP 11 A, t 12 A, t 13 A, t 14 A, t 14 A, t 14 A, t 18 4 18 4 18 4 18 4 18 4 18 4 19 9 18 4 18 4 19 9 18 4 19 9 18 4 19 9 18 4 19 9 18 4 19 5 18 4 19 5 18 4 19 5 18 4 19 5 18 4 19 5 18 5 11 1/4 5 5 5 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 7 6 7 7 6 7 7 7 6 7 7 7 6 7 7 7 6 7 7 7 6 7 7 7 6 7 7 7 6 7 7 7 6 7 7 7 6 7 7 7 6 7 7 7 6 7 7 7 6 7 7 7 7 6 7 7 7 7 7 7 7 7 7 7 7 7 7	LIED SU oe toe r. Mom 97 -6.45 .93 -10.3 .94 -15.4 00 -21.4 00 -21.4 09 -28.8 .36 -38.8 52 -49.5 .83 -63.21 98 -78.30 .32 -96.66 49 -115.6	PERST 15 heel Mom. -6.61 1-5.55 4-4.05 7+2.68 4+7.10 9+13.06 3+20.49 +30.19 0+36.9 5+50.2 9+52.8 1+65.4	RUCT c ba 0.31 #7@1 0.26 #6@3 0.19 #5@3 0.19 #5@1 0.31 #5@1 0.31 #5@1 0.31 #5@1 0.33 #10 0.47 #9@1 1.23 #11@ 1.54 #9@1 1.54	URE A tor Pr 18 5.3 18 5.2 5 5.2 5 5.2 15 5.2 15 6.0 14 5.7 15 6.0 14 6.1 7 6.6 6.9	LOAD toe Mom 9 -7.05 18 -11.2 5 -16.6 7 -22.9 9 -40.9 2 -51.8 4 -30.2 2 -51.8 4 -30.2 2 -51.8 8 -99.81 5 119.2	N KIPS 17.5 heel Mom 8.17 8.17 8.17 3.98 4 +4.63 8 +10.92 9 +17.62 4 +27.21 9 +33.6 5 +46.8 9 +49.9 3 +62.2	PER heel A c.bars 0.38 *7 @18 0.34 *7 @18 0.34 *6 @18 0.17 *5@15 0.20 *4@11 0.40 *5@15 0.40 *3@11 1.17 *11@14 1.43 *9@7 1.60 *9@7	FT. 5.81 5.55 5.55 5.55 5.55 5.55 5.55 5.5	105.1 # toe Mom -7.73 -17.78 -12.12 -17.78 -24.40 -32.37 -42.97 -54.27 -68.65 -84.23 -103.14 -122.86	20 heel Mom. -9.74 2-9.13 3-8.01 2-6.25 (-3.80 +8.29 +14.69 +24.13 3+31.4 +43.9 0+46.9	heel A c bars 0.45 #8 e18 0.37 #7 e18 0.29 #6 e15 0.38 #4 e11 0.30 #5 e9 0.54 #8 e14 0.54 #8 e14 1.25 1.52 #9 e7	Conx cf/ft 24.5 29.1 33.8 38.9 43.8 51.7 57.4 66.5 77.8 90.8 103.6 117.3	Bar 0 57 74 102 129 172 231 307 366 400 492 543	*11ee Reinin App 5 5 55 69 99 124 164 220 291 366 400 470 543 620	QU           Gev           forein           forein <td>AN T ng St Super 10 58 70 93 115 158 211 281 353 400 470 543</td> <td>ITIE           ool         (           ratruct         12.5           59         71           94         112           152         203           271         353           382         470           518         620</td> <td>S bbs.// for L 15 61 72 95 109 147 203 271 341 382 470 518 594</td> <td><ul> <li>it.)</li> <li>ood</li> <li>17.5</li> <li>61</li> <li>74</li> <li>96</li> <li>113</li> <li>143</li> <li>196</li> <li>264</li> <li>341</li> <li>382</li> <li>451</li> <li>518</li> <li>594</li> </ul></td> <td>e61/3 20 63 76 98 1115 1455 196 264 3311 371 451 518</td>	AN T ng St Super 10 58 70 93 115 158 211 281 353 400 470 543	ITIE           ool         (           ratruct         12.5           59         71           94         112           152         203           271         353           382         470           518         620	S bbs.// for L 15 61 72 95 109 147 203 271 341 382 470 518 594	<ul> <li>it.)</li> <li>ood</li> <li>17.5</li> <li>61</li> <li>74</li> <li>96</li> <li>113</li> <li>143</li> <li>196</li> <li>264</li> <li>341</li> <li>382</li> <li>451</li> <li>518</li> <li>594</li> </ul>	e61/3 20 63 76 98 1115 1455 196 264 3311 371 451 518
5 19 tc P 0 4. 4. 4. 4. 5 4. 5 4. 5 4. 5 5. 5 5. 5	9 2 56 - 57 - 57 - 62 - 72 - 84 - 80 - 14 - 80 - 14 - 80 - 14 - 80 - 14 - 80 -	I           toe           Mom           -5.80           -9.41           14.2           20.00           -36.7           -47.1           -60.6           75.32           93.30           112.0           135.31           160.11	12.5         hee         Mo:         -4.9         -3.7         3 -1.9         0 +4.5         8 +16.         1 +22.         7 +33.         2 +40.         0 +53.         4 +56.         1 +68.	1         he           m         c b           9         #66           0.2         #66           0.1         4           4         #56           0.1         4           2         #56           0.1         3           1.3         #100           1.3         #100           1.3         3           1.7         3           3         #11           .96         1.6           .1.7         3           3         #100           .1.7         3           .1.7         3           .1.7         3           .1.7         3	APP APP APP Ara 1 1 2 1 4 4 2 1 4 4 5 5 1 1 4 4 2 1 5 5 1 1 4 4 2 1 5 5 5 5 5 5 5 5 5 5 5 5 5	LIED SU oe toe r. Mom 97 -6.45 .93 -10.3 .94 -15.4 00 -21.4 09 -28.8 36 -38.8 52 -49.5 83 -63.2 98 -78.3( 32 -96.60 49 -115.6	PERST 15 heel Mom. -6.61 1 -5.55 4 -4.05 7 +2.68 4 +7.10 9 +13.06 3 +20.49 4 +30.19 0 +36.9 5 +50.2 9 +52.8 1 +65.4 3 +77.1	RUCT c bai 0.31 #760 0.26 #560 0.19 #560 0.19 #560 0.31 #560 0.31 #560 0.31 #560 0.35 #990 1.23 #110 1.23 #110 1.54 #997 1.54 #997 2.000	URE A. tor Pr 18 5.3 18 5.2 15 5.2 16 5.3 16 5.3 17 6.6 6.9 7.1	LOAD toe Mom 9 -7.05 5 -16.6 5 -16.6 7 -22.9 9 -40.9 2 -51.8 8 -99.8 2 -51.8 8 -99.8 5 -119.2 7 -143.2 5 -168.3	N KIPS 17.5 heel Mom -8.17 -8.17 -7.32 0 -6.01 0 -3.98 4 +4.63 8 +10.92 9 +17.62 4 +27.21 9 +17.62 4 +27.21 9 +33.6 5 +46.8 9 +49.9 3 +62.2 2 +74.0	heel A         c.bars         0.38         #7@18         0.34         #7@18         0.34         #7@18         0.34         #7@18         0.34         #7@18         0.34         #6@18         0.17         #5@18         0.17         #4@111         0.40         #5@9         0.64         #8@14         0.86         #9@911         1.17         #11@14         1.37         #11@14         1.43         #9@7         1.91	FT. 5.83 5.56 5.55 5.55 5.81 5.94 6.21 6.34 6.34 6.34 6.34 7.11 7.30	105.1 # toe Mom -7.73 -17.78 -12.12 -17.78 -24.40 -32.37 -42.97 -54.27 -68.65 -84.23 -103.14 -122.86 -147.00 -17253	20 heel Mom. -9.74 2-9.13 -8.01 -6.25 -3.80 +8.29 +14.69 +443.9 +443.9 +59.3	heel A c bars 0.45 #8 e 18 0.29 #6 e 15 0.37 #7 e 18 0.29 #6 e 15 0.30 #4 e 11 0.30 #5 e 9 0.54 #8 e 14 0.54 #8 e 14 0.54 #8 e 14 1.28 #10e 14 1.52 #9 e 7 1.83 #10e 7 2.00	Conx cf/ft 24.5 29.1 33.8 38.9 43.8 51.7 57.4 66.5 77.8 90.8 103.6 117.3 126.7	Bar 0 57 74 102 129 172 231 307 366 400 492 543 620	#11ee           Reining           5           55           69           99           124           164           220           291           366           400           470           543           620           776	QU           forcin           forcin           forcin           11ed           7.5           57           68           96           119           158           211           353           4000,           4700           543           620	AN T 9 St Supe 10 58 70 93 115 158 211 353 400 470 543 620 745	ITTLE           eel         (           rstruct         12.5           59         71           94         112           152         203           271         353           382         470           518         620           745	S  bs.// 109 147 203 271 341 382 470 518 594 745	it.)	20 63 76 98 115 145 264 331 371 451 518 594

NOTE: For walls with seats less than 7'-0", the concrete quantity shall be increased by 2% per foot of variation.

## Figure 6A.B.2 High Cantilever Abutment on Spread Footing Information





## Figure 6A.B.3 High Cantilever Abutment on Pile Footing Details



_									PIL	EL	DADI	NGS	FOR	ABU	TMEN	r Pil	EF	00Т	INGS												
-					<u></u>					PILE	PA	TTE	RNF	ROF	PERTI	ES	T	QUA	NTIT	IES		BAR REINFORCING STEEL (LBS/FT)									
3.1	Y PE	-		PILE PATTERN LAYOUT				-						I/ct	I/c	đ		e	-		APPL	IED S	UPER	STRU	CTUR	E LO	AD.	Π			
н	V >	🗢 sı	NGLE SPA	CING	~		LE SPA	CING	Ν	1/N		а		I	°t	Ŭ	<sup>h</sup> в	ars	Bars	conc cf/f	0	5	7.5	10	12.5	15	17.5	20	н		
10	5 1	то	E		1-61-6	2	HE	EEL	1.5	0.667		0.50		3.00	3.00	1.5	6 6-	#10 1	0-#11	26.0	139	137	136	137	138	140	140	142	10		
12	7 1			<b>()</b>	z-0 z-0	0			1.5	0.667		0.67	<u> </u>	5.33	4.00	2.0	6-	#9	0-#11	30.8	140	13,5	134	133	134	135	137	139	12		
14 8	3 1	hallow		🏈 2'-	6" 2'-	6" 🔶			1.5	0.667		0.83	$(a,b) \in \mathcal{A}$	8.34	5.00	2.5	1 6-	# 8	6-#11	35.8	154	151	148	145	142	143	144	146	14:		
16 9	9 11	8	4	3'-0"	<b>()</b> 3'	-0" 🔾			2.0	0.500		0.75	1	2.37	5.50	3.3	0 6-	#8	6-# 11	41.1	181	176	171	167	164	161	161	163	16		
18 1	0 11		*	3'-6"	<b>* • •</b>	-6"			2.0	0.500	-	0.87		16.85	6.41	3.8	6 4-	# 9	6-# 10	46.3	216	208	202	202	196	191	187	185	18		
20 1	1 11			4'-0"			0		2.0	0.500		1.00		22.00	7.33	4.4	0 2-	#10	4-#10	54.5	262	251	242	242	234	234	227	227	20		
_	2 111			0					3.0	0.333	3	1.00		30.7	8.76	5.5	8 4-	# 8	6-#10	60.4	349	333	333	323	313	313	306	306	22		
24 1	3 111		-			-			3.0	0.333	3	1.11	;	38.0	9.78	6.2	2 2-	#10	6-#8	69.7	397	397	384	384	384	372	372	362	24		
26 1	4 111						- 8" 🗲		3.0	0.333	2	1.22		45.9	10.72	6.8	2 2-	#9	4-# 9	77.8	400	400	400	400	382	382	382	371	26		
	5 111						4'-0"		3.0	0.333	3	1.33		54.6	11.70	7.4	5 2-	# 8	4-#8	90.8	492	470	470	470	470	470	451	451	28		
_	6 IV					. <b>T</b> .	3'-6"		3.5	0.286	5	1.57		71.6	14.52	8.8	8 2-	# 8	4-# 8	103.6	543	543	543	543	518	518	518	518	30		
	7 17						4'-0"		3.5	0.286	-	1.86		82.4	16.02	9.3	0 2-	# 8	2-#10	117.3	620	620	620	620	620	594	594	594	32		
	_	<b>3</b> -0					5'-0"	-		0.286		2.21		91.6	17.30				2-#10	126.7			776		745	745	745	745	+		
36 1	9 IV <del>(</del>	3'-0"	3-0	2	-0- 2-0		6'-0"		3.5	0.286	3	2.57	ł	101.6	18.70	9.6	2 2	# 7	2-#10	141.4	854	854	854	820	820	820	820	820	36		
	-				-		- C	BEAF		;																			_		
115										AF	PLI	ED SI	JPER	STR	JCTUR	ELO	AD (	K/F	T.)												
	(1) (1) (1)	0 *******									5							7.5			T				10						
н Н	Σv	e 36#	e 27#	Å	в	s	т	Σv	e 36≉	e 27#	A	в	s	T	Σv	e 36#	e 27#	A	в	s	т	Σv	е 36#	e 27#	А	в	s	т	С. Н		
10	5.64	1.17	.56	1.058		12.0	46.0	10.64	.38	.06	.794		10.1	32.4	13.14	.22	04	.740		8.80 2	8.2	15.64	.10	12		.744	7.74	24.8	10		
12	7.98	1.05	.37	.930		11.5	49.1	12.98	.39	03	.765		8.61	36.6	15.48	.21	13	.719		7.68 3	2.6	17.98	.09	.21		.772	6.48	27.5	12		
14	10.55	.97	.23	.861		9.41	51.2	15.55	.39	- 11	.745	17	7.38	40.2	18.05	.22	21		.751	6.65 3	6.2	20.55	.09	28	_	.779	5.62	30.6	14		
16	13.39	1.14	.34	.709		9.02	61.2	18.39	.63	.04	.616		7.55	51.1	20.89	.46	.05	.584		6.99 4	7.3	23.39	.34	13	.562	_	6.50	44.0	16		
18	16.45	1.13	.25	.676	0.07	7.68	63.3	21.45	.66	- 0.0 1	.603	-	6.60	54.4	23.95	0.50	10	.578		6.17 5	1.0	26.45	.37	17	.558	10.0	5.79	47.7	18		
20	20.17	1.20	.23	.664	and the	6.40	64.4	25.17	.76	01	.604	144	5.63	56.9	27.67	.61	. 10	.583		5.30 5	3.5	30.17	.47	18	.564		5.03	50.8	20		
22	23.78	1.35	.28	.487		7.39	88.1	28.78	.94	.05	.440	1	6.75	80.4	31.28	.78	03	.422		6.47 7	7.0 3	33.78	.65	10	.407	0.00	6.21	73.8	22		
24	28.11	1.44	.27	.480	10 Ş.	6.34	89.0	33.11	1.05	5 .07	.440		5.86	82.3	35.61	.91	02	.426	1.4	5.63	9.03	38.11	.77	.09	.412	_	5.45	76.4	24		
26	32.29	1.45	.21	.468		5.66	91.8	37.29	1.09	.02	.435	_	5.26	85.2	39.79	.94	06	.421		5.108	2.6	12.29	.82	13	.409	44	4.95	80.2	26		
28	37.30	1.55	.21	.466		4.91	91.8	42.30	1.2	1.03	.436		4.63	86.5	44.80	1.07	05	.425		4.50	34. 1	47.30	.94	12	.413	$< c_{\rm e}$	4.38	81.9	. 28		
30.	42.08	1.42	.01	.384	ops.	5.29	111.5	47.08	1.1	116	.362		5.01	105.0	49.58	.97	.23	.353	030	4.88 1	02.0	52.08	.85	.29	.345		4.76	00.0	<b>;30</b>		
32	47.85	1.33	. 18	.369	1	4.83	115.7	52.85	1.03	35	.350	alta.	4.62	1 10. 5	55.35	.90	41	.342		4.52	08.0	57.85	.78	47	.335		4.41	105.0	32		
	53.25	1.11	.49	.350	100	4.58	122.1	58.25	.82	64	.333		4.41	117.5	60.75		.71	10	.361	4.101	09.0	63.25	.58	76	$=2^{\circ}$	.367	3.87	103.0	34		
36	59.65	.93	72	.336		4.26	127.0	64.65	.66	89		.379	3.68	110.0	67.15		.95		.385	3.48 1	04.0	59.65	.43	-1.01		.391	3.30	98.4	36		
											PPL	IED S	SUPE	RSTR	UCTU	REL	OAD	(K/F	т.)												
· —	200		12.	5				10.00			15						17.5										-	1 - 1			
Ĥ	Σν	e 36#	e 27#	A	в	s	т	Σv	e 36#	e 27#	A	в	s	Т	Σν	е 36#	e 27#	A	в	s	-	Σν	e 36#	e 27#	A	в	s	т	н.		
_	18.14	.02	17		.776	6.39		20.64	.05	.21	2		5.44		23.14	.09	.24	-	.821			25.64	13	27		-	4.18				
12	20.48	0.00	27		.802	5.48	23.3	22.98	07	31	111	.822	4.76	20.2	25.48	.13	34	00				27.98		37			3.78		-		
14	23.05	01	34	100				25.55	09	+	95			23.4		.15	43	<u> </u>		3.82		30.55		46		.850	3.47		1		
• 16	25.89	.23	19		. 588			28.39	.14	424	100				30.89	.07	28					33.39		31		.594	4.53		-		
18	28.95	.27	23		.560	5.44	44.8	31.45	.18	28		.573	4.99	41.1	33.95	.07	32					36.45					4.16				
20	32.67	.36	24		. 555	4.76	48.3	35.17	.26			.566	4.52	45.6	37.67	.18	34					40.17					3.82		1		
22	36.28	.54	17	.395	202	5.96	71.0	38.78	.44	22	.383		5.76	68.6	41.28	.35	.27					43.78					5.28		1		
24	40.61	.66	15	.400	149.6	5.26	73.6	43.11	.5	520	.389		5.09	71.2	45.61	.46	26	.380				48.11					4.77				
26	44.79	.70	19	.398		4.79	77.6	47.29	.60	26	.388		4.65	75.3	49.79	.51	.29	.381		4.51	3.0	52.29	.43	34		.383	4.37	70.8	26		
28	49.80	.83	18	.404	4444	4.26	79.5	52.30	.73	23	.395		4.14	77.4	54.80	.63	28	.387	-	4.04	5.5	57.30	.54	33	3.79		3.94	73.6	28		
30	54.58	.74	35	.337	2020	4.64	97.4	57.08	.63	40	-	.331	4.53	95.2	59.58	.54	.45	100	.337	4.42	3.0	52.08	.46	51		.343	4. 23	88.9	30		
	60.35	.67	53	205	.343	4.33	103.0	62.85	.57	58		.348	4.10	98.0	65.35	.48	63		.354	3.89	3.1	57.85	.39	.67		.358	3.71	88.8	32		
									1		1		1	1						E							T		1 a . 1		
34	65.75 72.15	.47	82					68.25 74.65	+			.378			70.75 77.15			11	_		_	73.25				.388	3.17	84.3	34		

NOTES: The values of "S" given are maximum allowable. Where only values of "A" are listed the toe pile govarns. When "B" values only are listed the heel pile governs. For other pile loadings obtain the required spacing by proportion, for example: allowable pile loading - 60 tons, multiply values of "S" in the table by 60/45.

BAR REINFORCING QUANTITIES ARE Total quantities including stee In Abutment and footing.

## Figure 6A.B.4 High Cantilever Abutment on Pile Footing Information