

SLAB SUPPORT DESIGN EXAMPLES

Example 1: Abutment

Bridge Details:

Width (W) = 35'-6"

Span Length (L) = 32'

Support Type: Abutment, Type IV

No Skew

Pile Calculations:

For L = 32', Type IV support, pile spacing (45T) = 8' (From Table)

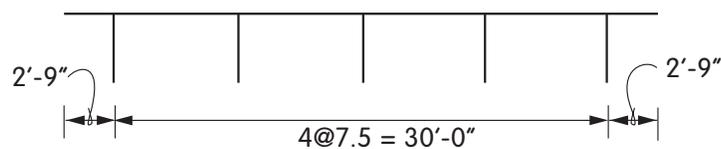
Edge distance (distance from \mathcal{C} exterior pile to EOD) = (0.2-0.4) pile spacing
or 1.6' to 3.2'

Assume 2.75' (2'-9"

$$\begin{aligned} \text{Number of Piles} &= \frac{W - 2 \times \text{edge distance}}{\text{pile spacing}} + 1 \\ &= \frac{35.5 - 2(2.75)}{8} + 1 = 3.75 + 1 = 4.75 \end{aligned}$$

USE 5 PILES

$$\text{Pile Spacing} = \frac{35.5 - 2(2.75)}{4} = 7.5'$$





ATTACHMENT G

Service Load per Pile

Dead Load

- Slab self weight reaction (for L=32') = 1.91 k/ft
Slab self weight per pile = $1.91 \times 7.5 = 14.32$ kips
- Dead load of overlay = 35 lb/ft²
Dead load from overlay per pile spacing = $35 \times 7.5 = 262.5$ lb/ft
Uniform load coefficient (for L=32') = 8.98
Dead load from overlay per pile = $262.5 \times \frac{8.98}{1000} = 2.36$ kips
- Dead load from 2 barrier rails at 0.465k/ft = 0.93k/ft
Assume barrier rail load to be distributed to all piles
Dead load from barrier rails per pile = $\frac{0.93 \times 8.98}{5} = 1.67$ kips
- Dead load from diaphragm at 1.88k/ft = $1.88 \times 7.5 = 14.1$ kips

$$\text{Total DL} = 14.32 + 2.36 + 1.67 + 14.1 = 32.45 \text{ kips}$$

Live Load

- HL 93 vehicle reaction per lane (L=32') = 44.91 kips
- HL 93 Lane load reaction per lane (L=32') = 7.35 kips
- Lane width (L=32', W=35.5') = 11.04'
Total HL 93 live load reaction per pile = $(44.91 + 7.35) \times \frac{7.5}{11.04} = 35.5$ kips

$$\text{Total Service Load} = 32.45 + 35.5 = 67.95 \text{ kips Say } 68 \text{ kips (can round off to } 70 \text{ kips)}$$

ATTACHMENT G

Example 2: Typical Bent with Skew

Bridge Details:

Width (W) = 35'-6"; Span Length (L) = 42'

Support Type: Bent, Type V

Skew Angle = 46°

Pile Type: 70T

Pile Calculations:

$$\text{Pile cap length} = \frac{35.5}{\cos 46^\circ} = 51.1'$$

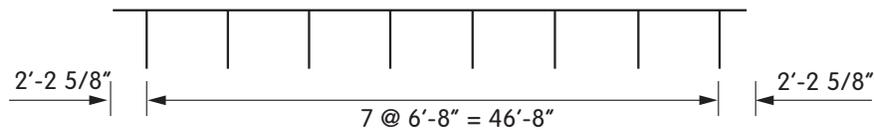
For L = 42', Type V support, pile spacing = 4.75'

$$\text{Skewed pile spacing} = \frac{4.75}{\cos 46^\circ} = 6.84'$$

Max-edge distance = 0.4 (pile spacing) = 0.4 × 6.84 = 2.736'

$$\begin{aligned} \text{Number of piles} &= \frac{\text{Support length} - 2 \times \text{edge distance}}{\text{Skewed pile spacing}} + 1 \\ &= \frac{51.1 - 2(2.736)}{6.84} + 1 = 7.67 \end{aligned}$$

USE 8 PILES @ 6'-8" SPACING



Bent Cap Details:

"a" bars → #8 (From Table)

Provide 6 - #8 @ top & 6 - #8 bottom (tot 12)

Stirrups #5 @ 9"

Example 3: Skewed Abutment

Bridge Details:

Width (W) = 35'-6"; Span Length (L) = 30'

Support Type: Abutment, Type I

Pile Type: 45T

Skew Angle: 39°

Pile Calculations:

$$\text{Abutment support length} = \frac{35.5}{\cos 39^\circ} = 45.68'$$

From "Substructure Design Table", pile spacing = 7.5'

$$\text{Skewed pile spacing} = \frac{7.5}{\cos 39^\circ} = 9.65'$$

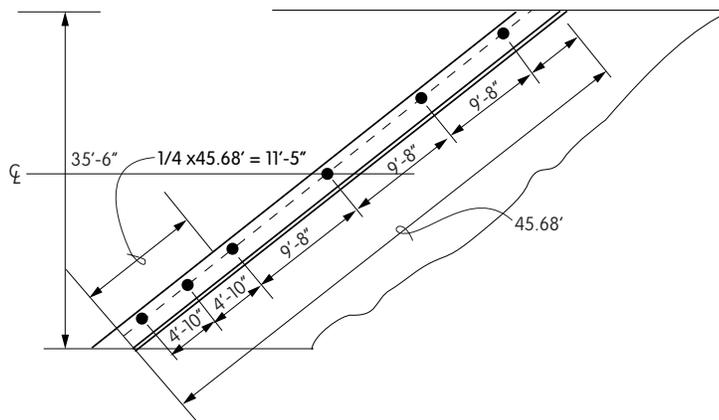
Max edge distance = 0.4 (pile spacing) = 0.4 × 9.65 = 3.86'

Assume 3.5'

$$\text{Number of Piles} = \frac{45.68 - 2(3.5)}{9.65} + 1 = 5$$

For skew angle of 39°, Reaction coefficient k = 0.4

Number of piles required at obtuse corner for 1/4 length = 5 × 0.4 = 2.0



Example 4: Expansion Bent

Bridge Details:

Width (W) = 55'-6"

Span (L) = 24'

Support Type: Expansion bent (Type VI)

Pile Type: 70T

Skew Angle: 18.5°

Pile Calculations:

$$\text{Bent Support length} = \frac{55.5}{\cos 18.5^\circ} = 58.52'$$

For L = 24', Type VI support

Pile spacing (70T) = 11.5'

$$\text{Skewed pile spacing} = \frac{11.5}{\cos 18.5^\circ} = 12.13'$$

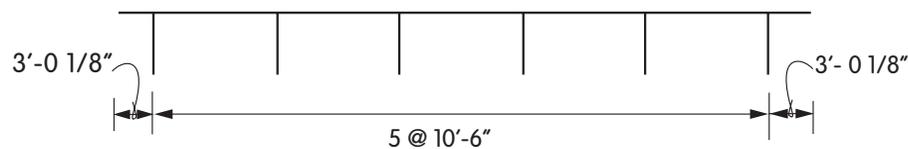
$$\text{Max. edge distance} = 0.4 \times 12.13 = 4.85'$$

$$\text{Min. edge distance} = 0.2 \times 12.13 = 2.43'$$

Try 3 ft edge distance

$$\text{Number of Piles} = \frac{58.52 - 2(3)}{12.13} + 1 = 5.3$$

USE 6 PILES



Bent Cap Reinforcement:

"a" bars - #8; (From Table)

Stirrups: - #5 @ 8"