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 exterior pile to EOD) = (0.2-0.4) pile spacing or 1.6' to 3.2'
Assume 2.75' (2'-9"

Number of Piles = \[ \frac{W - 2 \times \text{edge distance}}{\text{pile spacing}} + 1 \]
\[ = \frac{35.5 - 2(2.75)}{8} + 1 = 3.75 + 1 = 4.75 \]

USE 5 PILES

Pile Spacing = \[ \frac{35.5 - 2(2.75)}{4} = 7.5' \]
Service Load per Pile

Dead Load

- Slab self weight reaction (for L=32') = 1.91 k/ft
  Slab self weight per pile = 1.91 × 7.5 = 14.32 kips
- Dead load of overlay = 35 lb/ft²
  Dead load from overlay per pile spacing = 35 × 7.5 = 262.5 lb/ft
  Uniform load coefficient (for L=32') = 8.98
  Dead load from overlay per pile = \(\frac{262.5 \times 8.98}{1000} = 2.36\) 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 × 7.5 = 14.1 kips

Total DL = 14.32 + 2.36 + 1.67 + 14.1 = 32.45 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 = \(\frac{(44.91 + 7.35) \times 7.5}{11.04} = 35.5\) kips

Total Service Load = 32.45 + 35.5 = 67.95 kips Say 68 kips (can round off to 70 kips)
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:**
- Pile cap length = \( \frac{35.5}{\cos 46°} = 51.1' \)
- For L = 42', Type V support, pile spacing = 4.75'
- Skewed pile spacing = \( \frac{4.75}{\cos 46°} = 6.84' \)
- Max-edge distance = 0.4 (pile spacing) = 0.4 \times 6.84 = 2.736'
- Number of piles = \( \frac{\text{Support length} - 2 \times \text{edge distance}}{\text{Skewed pile spacing}} + 1 \)
  \[ = \frac{51.1 - 2(2.736)}{6.84} + 1 = 7.67 \]

**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:_

Abutment support length \(= \frac{35.5}{\cos 39°} = 45.68'\)

From “Substructure Design Table”, pile spacing = 7.5'

Skewed pile spacing \(= \frac{7.5}{\cos 39°} = 9.65'\)

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

Assume 3.5'

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 \(= 5 \times 0.4 = 2.0\)
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:*

Bent Support length = \( \frac{55.5}{\cos 18.5°} = 58.52' \)
For L= 24', Type VI support
Pile spacing (70T) = 11.5'
Skewed pile spacing = \( \frac{11.5}{\cos 18.5°} = 12.13' \)
Max. edge distance = 0.4 × 12.13 = 4.85'
Min. edge distance = 0.2 × 12.13 = 2.43'

Try 3 ft edge distance

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"