



Client: ODOT/District 6  
Project: FRA-70 Project 4H  
Subject: Bridge No. FRA-70-1405C (High Street Bridge)  
East Cap Pier Footing Bearing Pressure Calculations

Job No.: 2012048  
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### Pier Footing Bearing Pressure Calculations

Based on AASHTO LRFD Bridge Design Specifications (9th edition) and the 2020 ODOT BDM.

Note: It appears that RC Pier does not correctly calculate the bearing pressure under an eccentrically loaded spread footing.  
In accordance with LRFD 10.6.1.3, the load shall be resisted by a reduced effective area equal to:

$$\sigma_v = B' \times L' = (B - 2e_B)(L - 2e_L)$$

Footing resting on = Soil  
B = 15.00 ft  
L = 60.08 ft

#### Service I Calculations:

$\Sigma V = 5,653$  kips From RC Pier.  
 $\Sigma M_z = 8,471$  k-ft From RC Pier.  
 $\Sigma M_x = 341$  k-ft From RC Pier.  
 $e_B = 0.06$  ft  
 $e_L = 1.50$  ft  
 $B' = 14.88$  ft LRFD 10.6.1.3.  
 $L' = 57.09$  ft LRFD 10.6.1.3.  
 $\sigma_v = 6.66$  ksf Service I load combination.

#### Strength I Calculations:

$\Sigma V = 7,713$  kips From RC Pier.  
 $\Sigma M_z = 11,888$  k-ft From RC Pier.  
 $\Sigma M_x = 512$  k-ft From RC Pier.  
 $e_B = 0.07$  ft  
 $e_L = 1.54$  ft  
 $B' = 14.87$  ft LRFD 10.6.1.3.  
 $L' = 57.00$  ft LRFD 10.6.1.3.  
 $\sigma_v = 9.10$  ksf Strength I load combination.

### Pier Footing Factored Bearing Resistance Calculations

Table From FRA-70-1405 Foundation Exploration Report, Dated July 2022:

| Effective Footing Width (ft) | Service Limit Bearing Pressure (ksf) for Specified Settlement (in) |      |      | Bearing Resistance at Strength Limit (ksf) |          |
|------------------------------|--|------|------|--|----------|
|                              | 0.5"   | 1.0" | 1.5" | Nominal                                    | Factored |
| 10                           | 2.34   | 4.93 | 8.94 | 32.73                                      | 16.36    |
| 12                           | 2.19   | 4.43 | 7.87 | 32.78                                      | 16.39    |
| 14                           | 2.08   | 4.08 | 7.11 | 32.84                                      | 16.42    |
| 16                           | 2.00   | 3.81 | 6.54 | 32.89                                      | 16.45    |
| 18                           | 1.94   | 3.61 | 6.10 | 32.95                                      | 16.48    |
| 20                           | 1.89   | 3.44 | 5.75 | 33.01                                      | 16.50    |
| 22                           | 1.85   | 3.31 | 5.46 | 33.06                                      | 16.53    |
| 24                           | 1.82   | 3.19 | 5.22 | 33.12                                      | 16.56    |
| 26                           | 1.79   | 3.10 | 5.02 | 33.17                                      | 16.59    |
| 28                           | 1.76   | 3.02 | 4.85 | 33.23                                      | 16.61    |
| 30                           | 1.74   | 2.95 | 4.70 | 33.28                                      | 16.64    |

$B' = 14.87$  ft For STRENGTH I maximum bearing pressure value.  
Nominal Bearing Resistance = 32.86 ksf  
Factored Bearing Resistance = 16.43 ksf  
Max. Bearing Pressure = 6.66 ksf For SERVICE.  
 $B' = 14.88$  ft For SERVICE maximum bearing pressure value.  
Service Bearing Pressure = 2.04 ksf For 0.5" of Settlement.  
Service Bearing Pressure = 3.96 ksf For 1.0" of Settlement.  
Service Bearing Pressure = 6.86 ksf For 1.5" of Settlement.  
Actual Settlement = #N/A in Calculation assumes up to 1.0" of settlement.  
Actual Settlement = 1.46 in Calculation assumes greater than 1.0" of settlement.