

**LATERAL LOAD ANALYSIS - Abutment No. 1 (No Scour)**  
**Kamehameha Highway Drainage and Safety Improvements**  
**Vicinity of MP 3.06 to MP 3.54**  
**Waialua, Oahu, Hawaii**

| 1 feet |               | 5 feet |               | 15 feet |               | 20 feet |               | 30 feet |               |
|--------|---------------|--------|---------------|---------|---------------|---------|---------------|---------|---------------|
| y      | p             | y      | p             | y       | p             | y       | p             | y       | p             |
| (inch) | (pounds/inch) | (inch) | (pounds/inch) | (inch)  | (pounds/inch) | (inch)  | (pounds/inch) | (inch)  | (pounds/inch) |
| 0.000  | 0.0           | 0.000  | 0.0           | 0.000   | 0.0           | 0.000   | 0.000         | 0.000   | 0.000         |
| 0.054  | 514.2         | 0.093  | 805.5         | 0.001   | 72.0          | 0.014   | 11520.000     | 0.286   | 13740.658     |
| 0.104  | 674.9         | 0.139  | 976.7         | 0.010   | 144.0         | 0.019   | 11712.000     | 0.315   | 14381.579     |
| 0.153  | 794.6         | 0.185  | 1120.3        | 0.051   | 216.0         | 0.024   | 11904.000     | 0.343   | 14992.953     |
| 0.203  | 893.4         | 0.231  | 1246.2        | 0.160   | 288.0         | 0.029   | 12096.000     | 0.372   | 15578.441     |
| 0.253  | 978.8         | 0.278  | 1359.7        | 0.391   | 360.0         | 0.034   | 12288.000     | 0.400   | 16141.007     |
| 0.302  | 1055.0        | 0.324  | 1463.7        | 0.811   | 432.0         | 0.038   | 12480.000     | 0.429   | 16683.093     |
| 0.352  | 1124.2        | 0.370  | 1560.3        | 1.502   | 504.0         | 0.043   | 12672.000     | 0.457   | 17206.736     |
| 0.401  | 1187.9        | 0.416  | 1650.8        | 2.563   | 576.0         | 0.048   | 12864.000     | 0.486   | 17713.658     |
| 0.451  | 1247.2        | 0.462  | 1736.2        | 4.106   | 648.0         | 0.053   | 13056.000     | 0.514   | 18205.331     |
| 0.501  | 1302.8        | 0.508  | 1817.3        | 6.258   | 720.0         | 0.058   | 13248.000     | 0.543   | 18683.022     |
| 0.550  | 1355.2        | 0.554  | 1894.7        | 9.162   | 792.0         | 0.062   | 13440.000     | 0.571   | 19147.835     |
| 0.600  | 1405.0        | 0.600  | 1968.7        | 12.976  | 864.0         | 0.067   | 13632.000     | 0.600   | 19600.733     |
| 0.975  | 1771.9        | 0.975  | 2559.4        | 17.873  | 936.0         | 0.072   | 13824.000     | 0.975   | 25480.953     |
| 1.350  | 2138.7        | 1.350  | 3150.0        | 24.040  | 1008.0        | 0.077   | 14016.000     | 1.350   | 31361.173     |
| 1.620  | 2138.7        | 1.620  | 3150.0        | 31.680  | 1080.0        | 0.082   | 14208.000     | 1.620   | 31361.173     |
| 1.890  | 2138.7        | 1.890  | 3150.0        | 39.600  | 1080.0        | 0.086   | 14400.000     | 1.890   | 31361.173     |

| 40 feet |               | 52 feet |               |
|---------|---------------|---------|---------------|
| y       | p             | y       | p             |
| (inch)  | (pounds/inch) | (inch)  | (pounds/inch) |
| 0.000   | 0.0           | 0.000   | 0.0           |
| 0.381   | 22875.2       | 0.014   | 11520.0       |
| 0.401   | 23440.3       | 0.019   | 11712.0       |
| 0.421   | 23991.1       | 0.024   | 11904.0       |
| 0.441   | 24528.5       | 0.029   | 12096.0       |
| 0.461   | 25053.4       | 0.034   | 12288.0       |
| 0.481   | 25566.7       | 0.038   | 12480.0       |
| 0.501   | 26069.0       | 0.043   | 12672.0       |
| 0.520   | 26561.1       | 0.048   | 12864.0       |
| 0.540   | 27043.5       | 0.053   | 13056.0       |
| 0.560   | 27516.8       | 0.058   | 13248.0       |
| 0.580   | 27981.3       | 0.062   | 13440.0       |
| 0.600   | 28437.7       | 0.067   | 13632.0       |
| 0.975   | 36969.0       | 0.072   | 13824.0       |
| 1.350   | 45500.4       | 0.077   | 14016.0       |
| 1.620   | 45500.4       | 0.082   | 14208.0       |
| 1.890   | 45500.4       | 0.086   | 14400.0       |

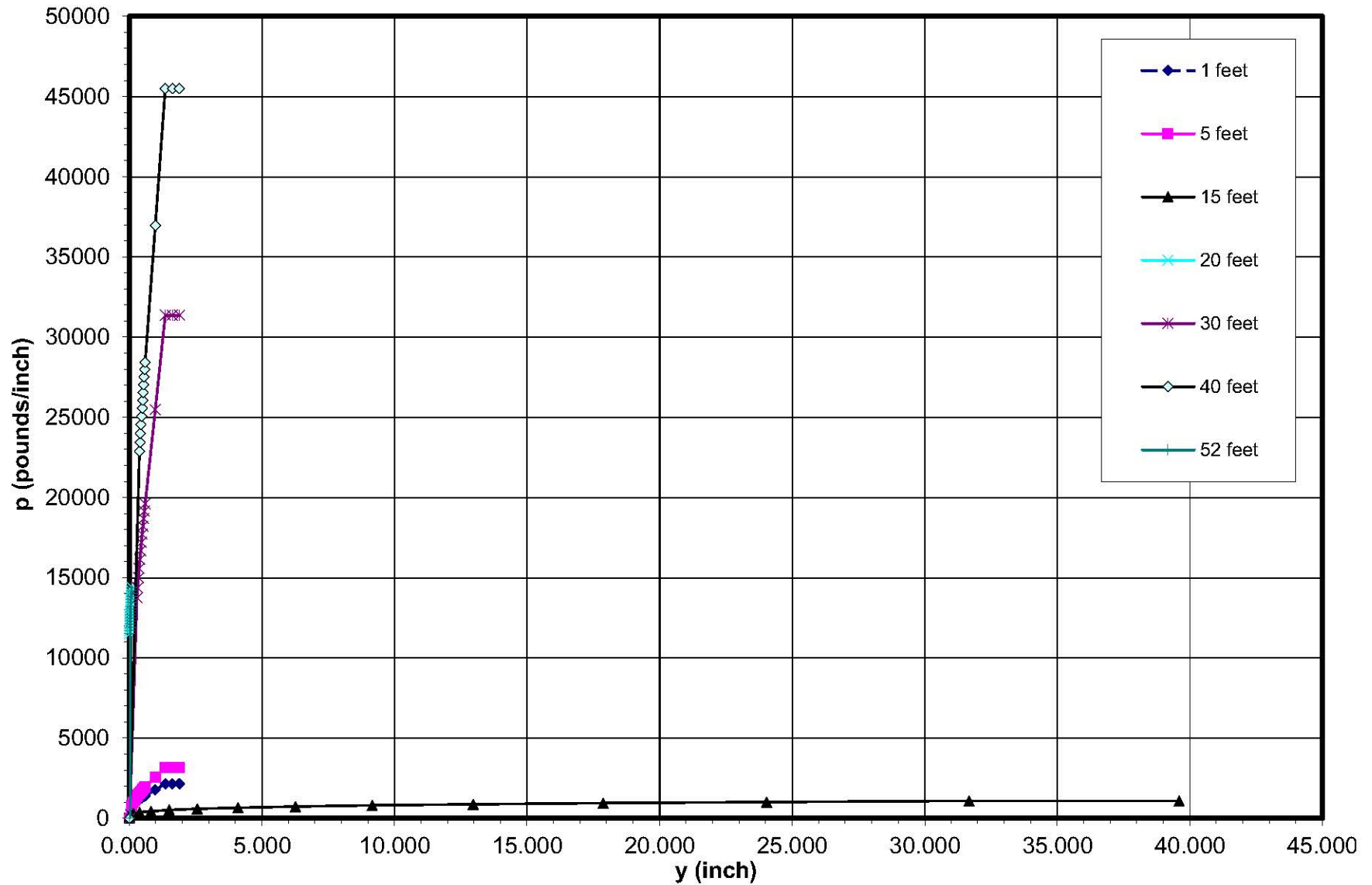
**Soil Profile at Abutment No. 1 (B-3)**

| Depths*                     |              |
|-----------------------------|--------------|
| Beach Deposit (above water) | 0 - 2 feet   |
| Beach Deposit (below water) | 2 - 10 feet  |
| Alluvium                    | 10 - 18 feet |
| Basalt Formation            | 18 - 28 feet |
| Clinker                     | 28 - 50 feet |
| Basalt Formation            | 50 - 62 feet |

\*Depths below top of drilled shaft at Elevation +3 feet MSL

**LATERAL LOAD ANALYSIS - Abutment No. 1 (No Scour)**  
**Kamehemeha Highway Drainage and Safety Improvements**  
**Vicinity of MP 3.06 to MP 3.54**  
**Waialua, Oahu, Hawaii**

P-Y Curves



**LATERAL LOAD ANALYSIS - Abutment No. 2 (No Scour)**  
**Kamehameha Highway Drainage and Safety Improvements**  
**Vicinity of MP 3.06 to MP 3.54**  
**Waialua, Oahu, Hawaii**

| 3 feet |               | 5 feet |               | 10 feet |               | 15 feet |               | 20 feet |               |
|--------|---------------|--------|---------------|---------|---------------|---------|---------------|---------|---------------|
| y      | p             | y      | p             | y       | p             | y       | p             | y       | p             |
| (inch) | (pounds/inch) | (inch) | (pounds/inch) | (inch)  | (pounds/inch) | (inch)  | (pounds/inch) | (inch)  | (pounds/inch) |
| 0.000  | 0.0           | 0.000  | 0.0           | 0.000   | 0.0           | 0.000   | 0.000         | 0.000   | 0.000         |
| 0.062  | 425.9         | 0.001  | 72.0          | 0.001   | 72.0          | 0.014   | 11520.000     | 0.127   | 4435.725      |
| 0.111  | 573.6         | 0.010  | 144.0         | 0.010   | 144.0         | 0.019   | 11712.000     | 0.170   | 5099.306      |
| 0.160  | 691.2         | 0.051  | 216.0         | 0.051   | 216.0         | 0.024   | 11904.000     | 0.213   | 5680.317      |
| 0.208  | 792.1         | 0.160  | 288.0         | 0.160   | 288.0         | 0.029   | 12096.000     | 0.256   | 6203.104      |
| 0.257  | 881.9         | 0.391  | 360.0         | 0.391   | 360.0         | 0.034   | 12288.000     | 0.299   | 6682.013      |
| 0.306  | 963.6         | 0.811  | 432.0         | 0.811   | 432.0         | 0.038   | 12480.000     | 0.342   | 7126.334      |
| 0.355  | 1039.1        | 1.502  | 504.0         | 1.502   | 504.0         | 0.043   | 12672.000     | 0.385   | 7542.491      |
| 0.404  | 1109.7        | 2.563  | 576.0         | 2.563   | 576.0         | 0.048   | 12864.000     | 0.428   | 7935.142      |
| 0.453  | 1176.2        | 4.106  | 648.0         | 4.106   | 648.0         | 0.053   | 13056.000     | 0.471   | 8307.792      |
| 0.502  | 1239.2        | 6.258  | 720.0         | 6.258   | 720.0         | 0.058   | 13248.000     | 0.514   | 8663.155      |
| 0.551  | 1299.3        | 9.162  | 792.0         | 9.162   | 792.0         | 0.062   | 13440.000     | 0.557   | 9003.387      |
| 0.600  | 1356.8        | 12.976 | 864.0         | 12.976  | 864.0         | 0.067   | 13632.000     | 0.600   | 9330.228      |
| 0.975  | 1788.6        | 17.873 | 936.0         | 17.873  | 936.0         | 0.072   | 13824.000     | 0.975   | 12129.296     |
| 1.350  | 2220.3        | 24.040 | 1008.0        | 24.040  | 1008.0        | 0.077   | 14016.000     | 1.350   | 14928.364     |
| 1.620  | 2220.3        | 31.680 | 1080.0        | 31.680  | 1080.0        | 0.082   | 14208.000     | 1.620   | 14928.364     |
| 1.890  | 2220.3        | 39.600 | 1080.0        | 39.600  | 1080.0        | 0.086   | 14400.000     | 1.890   | 14928.364     |

| 30 feet |               | 45 feet |               |
|---------|---------------|---------|---------------|
| y       | p             | y       | p             |
| (inch)  | (pounds/inch) | (inch)  | (pounds/inch) |
| 0.000   | 0.0           | 0.000   | 0.0           |
| 0.195   | 9112.0        | 0.014   | 11520.0       |
| 0.232   | 9902.5        | 0.019   | 11712.0       |
| 0.268   | 10629.9       | 0.024   | 11904.0       |
| 0.305   | 11306.9       | 0.029   | 12096.0       |
| 0.342   | 11942.7       | 0.034   | 12288.0       |
| 0.379   | 12543.7       | 0.038   | 12480.0       |
| 0.416   | 13115.0       | 0.043   | 12672.0       |
| 0.453   | 13660.6       | 0.048   | 12864.0       |
| 0.489   | 14183.5       | 0.053   | 13056.0       |
| 0.526   | 14686.4       | 0.058   | 13248.0       |
| 0.563   | 15171.2       | 0.062   | 13440.0       |
| 0.600   | 15639.8       | 0.067   | 13632.0       |
| 0.975   | 20331.7       | 0.072   | 13824.0       |
| 1.350   | 25023.7       | 0.077   | 14016.0       |
| 1.620   | 25023.7       | 0.082   | 14208.0       |
| 1.890   | 25023.7       | 0.086   | 14400.0       |

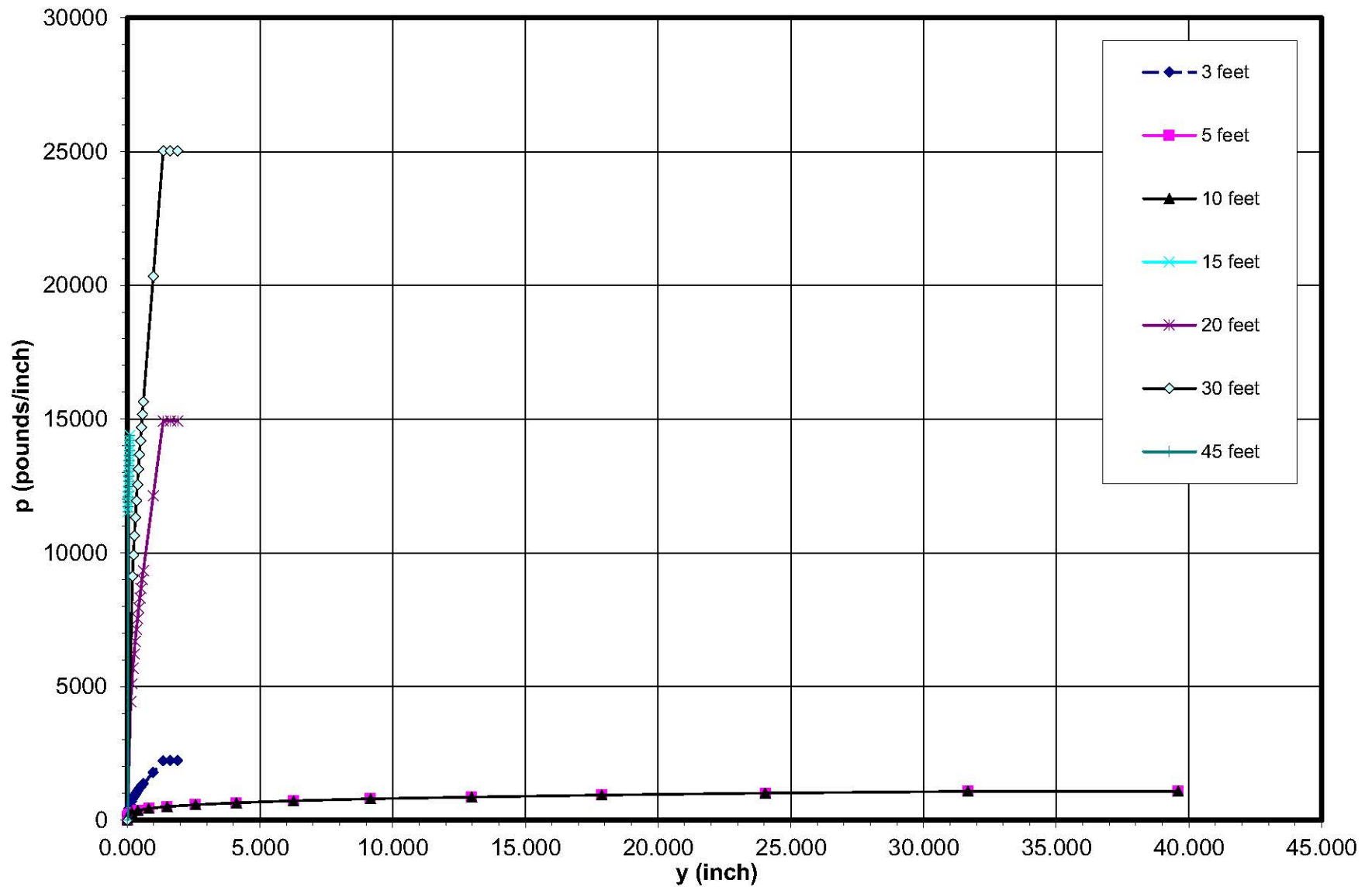
**Soil Profile at Abutment No. 2 (B-4)**

|                             | Depths*      |
|-----------------------------|--------------|
| Beach Deposit (above water) | 0 - 1 feet   |
| Beach Deposit (below water) | 1 - 5 feet   |
| Alluvium                    | 5 - 14 feet  |
| Basalt Formation            | 14 - 17 feet |
| Clinker                     | 17 - 39 feet |
| Basalt Formation            | 39 - 56 feet |

\*Depths below top of drilled shaft at Elevation +3 feet MSL

**LATERAL LOAD ANALYSIS - Abutment No. 2 (No Scour)**  
**Kamehemeha Highway Drainage and Safety Improvements**  
**Vicinity of MP 3.06 to MP 3.54**  
**Waialua, Oahu, Hawaii**

P-Y Curves





**LATERAL LOAD ANALYSIS - Center Pier (No Scour)**  
**Kamehameha Highway Drainage and Safety Improvements**  
**Vicinity of MP 3.06 to MP 3.54**  
**Waialua, Oahu, Hawaii**

| 1 foot |               | 5 feet |               | 15 feet |               | 19 feet |               | 30 feet |               |
|--------|---------------|--------|---------------|---------|---------------|---------|---------------|---------|---------------|
| y      | p             | y      | p             | y       | p             | y       | p             | y       | p             |
| (inch) | (pounds/inch) | (inch) | (pounds/inch) | (inch)  | (pounds/inch) | (inch)  | (pounds/inch) | (inch)  | (pounds/inch) |
| 0.000  | 0.0           | 0.000  | 0.0           | 0.000   | 0.0           | 0.000   | 0.000         | 0.000   | 0.000         |
| 0.068  | 235.4         | 0.133  | 615.1         | 0.001   | 69.2          | 0.014   | 11520.000     | 0.148   | 5851.740      |
| 0.116  | 266.6         | 0.176  | 656.4         | 0.010   | 138.5         | 0.019   | 11712.000     | 0.189   | 6583.463      |
| 0.165  | 289.0         | 0.218  | 690.7         | 0.051   | 207.7         | 0.024   | 11904.000     | 0.230   | 7236.131      |
| 0.213  | 306.8         | 0.261  | 720.2         | 0.160   | 277.0         | 0.029   | 12096.000     | 0.271   | 7830.490      |
| 0.262  | 321.7         | 0.303  | 746.3         | 0.391   | 346.2         | 0.034   | 12288.000     | 0.312   | 8379.570      |
| 0.310  | 334.6         | 0.346  | 769.7         | 0.811   | 415.5         | 0.038   | 12480.000     | 0.353   | 8892.183      |
| 0.358  | 346.1         | 0.388  | 791.0         | 1.502   | 484.7         | 0.043   | 12672.000     | 0.394   | 9374.617      |
| 0.407  | 356.4         | 0.430  | 810.5         | 2.563   | 554.0         | 0.048   | 12864.000     | 0.436   | 9831.543      |
| 0.455  | 365.8         | 0.473  | 828.7         | 4.106   | 623.2         | 0.053   | 13056.000     | 0.477   | 10266.543     |
| 0.503  | 374.5         | 0.515  | 845.6         | 6.258   | 692.5         | 0.058   | 13248.000     | 0.518   | 10682.435     |
| 0.552  | 382.6         | 0.558  | 861.6         | 9.162   | 761.7         | 0.062   | 13440.000     | 0.559   | 11081.484     |
| 0.600  | 390.1         | 0.600  | 876.6         | 12.976  | 831.0         | 0.067   | 13632.000     | 0.600   | 11465.540     |
| 0.975  | 446.7         | 0.975  | 1005.7        | 17.873  | 900.2         | 0.072   | 13824.000     | 0.975   | 14905.202     |
| 1.350  | 503.3         | 1.350  | 1134.9        | 24.040  | 969.5         | 0.077   | 14016.000     | 1.350   | 18344.864     |
| 1.620  | 503.3         | 1.620  | 1134.9        | 31.680  | 1038.7        | 0.082   | 14208.000     | 1.620   | 18344.864     |
| 1.890  | 503.3         | 1.890  | 1134.9        | 39.600  | 1038.7        | 0.086   | 14400.000     | 1.890   | 18344.864     |

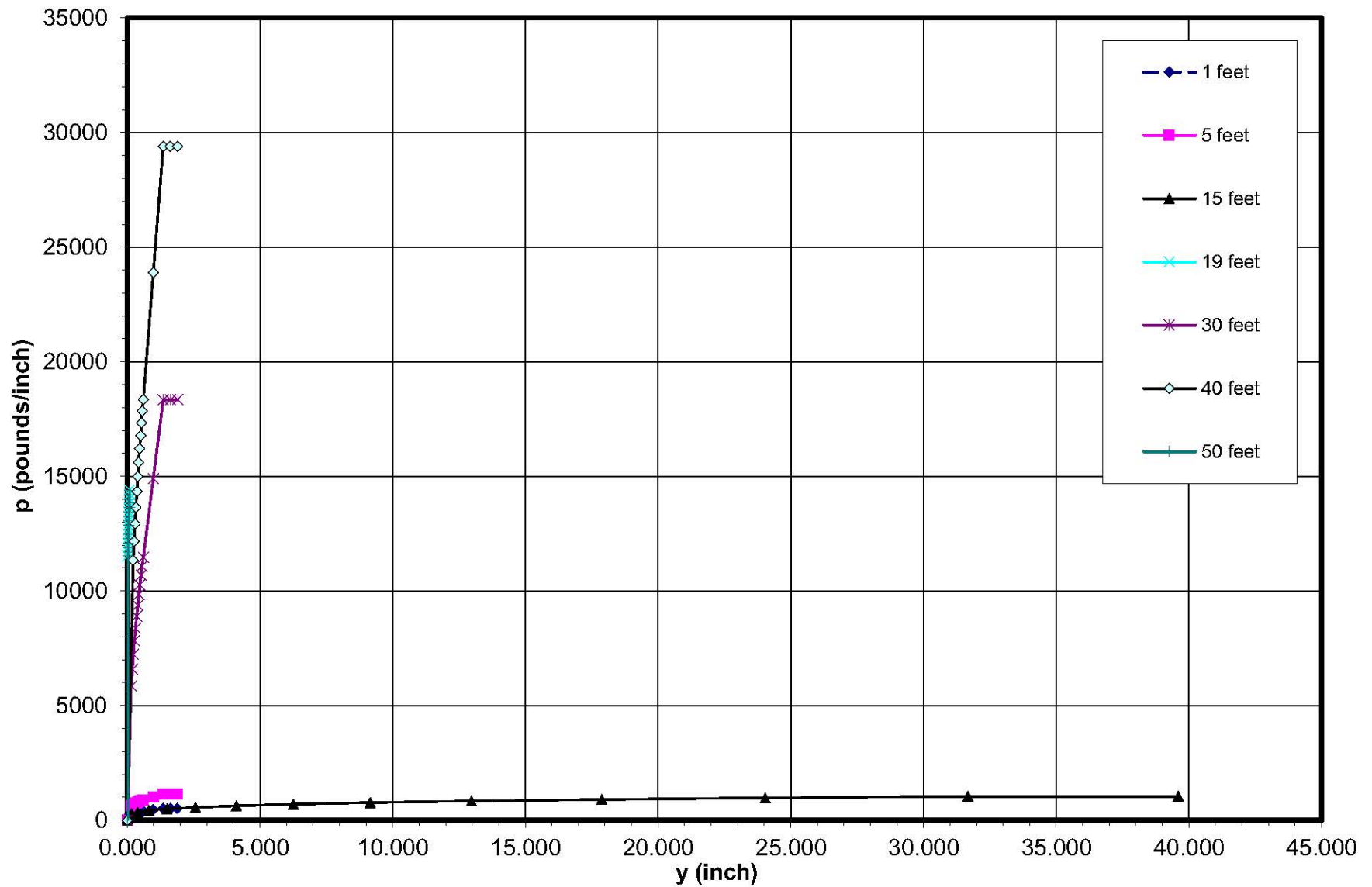
| 40 feet |               | 50 feet |               |
|---------|---------------|---------|---------------|
| y       | p             | y       | p             |
| (inch)  | (pounds/inch) | (inch)  | (pounds/inch) |
| 0.000   | 0.0           | 0.000   | 0.0           |
| 0.220   | 11344.7       | 0.014   | 11520.0       |
| 0.254   | 12168.2       | 0.019   | 11712.0       |
| 0.289   | 12935.3       | 0.024   | 11904.0       |
| 0.324   | 13656.0       | 0.029   | 12096.0       |
| 0.358   | 14337.7       | 0.034   | 12288.0       |
| 0.393   | 14986.0       | 0.038   | 12480.0       |
| 0.427   | 15605.2       | 0.043   | 12672.0       |
| 0.462   | 16198.9       | 0.048   | 12864.0       |
| 0.496   | 16769.9       | 0.053   | 13056.0       |
| 0.531   | 17320.6       | 0.058   | 13248.0       |
| 0.565   | 17852.9       | 0.062   | 13440.0       |
| 0.600   | 18368.6       | 0.067   | 13632.0       |
| 0.975   | 23879.2       | 0.072   | 13824.0       |
| 1.350   | 29389.8       | 0.077   | 14016.0       |
| 1.620   | 29389.8       | 0.082   | 14208.0       |
| 1.890   | 29389.8       | 0.086   | 14400.0       |

| Soil Profile at Center Pier (B-3 and B-4) |              |
|-------------------------------------------|--------------|
|                                           | Depths*      |
| Beach Deposit (above water)               | 0 - 3 feet   |
| Beach Deposit (below water)               | 3 - 7 feet   |
| Alluvium                                  | 7 - 16 feet  |
| Basalt Formation                          | 16 - 20 feet |
| Clinker                                   | 20 - 45 feet |
| Basalt Formation                          | 45 - 62 feet |

\*Depths below top of drilled shaft at Elevation +3 feet MSL

**LATERAL LOAD ANALYSIS - Center Pier (No Scour)**  
**Kamehameha Highway Drainage and Safety Improvements**  
**Vicinity of MP 3.06 to MP 3.54**  
**Waialua, Oahu, Hawaii**

P-Y Curves



# **LATERAL LOAD ANALYSIS - Abutment No. 1 (Scour to Elev. -2.0 ft)**

## **Kamehemeha Highway Drainage and Safety Improvements**

### **Vicinity of MP 3.06 to MP 3.54**

### **Waialua, Oahu, Hawaii**

| 7 feet |               | 15 feet |               | 20 feet |               | 30 feet |               | 40 feet |               |
|--------|---------------|---------|---------------|---------|---------------|---------|---------------|---------|---------------|
| y      | p             | y       | p             | y       | p             | y       | p             | y       | p             |
| (inch) | (pounds/inch) | (inch)  | (pounds/inch) | (inch)  | (pounds/inch) | (inch)  | (pounds/inch) | (inch)  | (pounds/inch) |
| 0.000  | 0.0           | 0.000   | 0.0           | 0.000   | 0.0           | 0.000   | 0.000         | 0.000   | 0.000         |
| 0.023  | 26.9          | 0.001   | 37.4          | 0.014   | 11520.0       | 0.123   | 3678.255      | 0.188   | 7876.961      |
| 0.076  | 35.4          | 0.010   | 74.7          | 0.019   | 11712.0       | 0.166   | 4254.157      | 0.225   | 8597.122      |
| 0.128  | 40.0          | 0.051   | 112.1         | 0.024   | 11904.0       | 0.209   | 4755.845      | 0.263   | 9257.177      |
| 0.181  | 43.3          | 0.160   | 149.4         | 0.029   | 12096.0       | 0.253   | 5205.831      | 0.300   | 9869.791      |
| 0.233  | 46.0          | 0.391   | 186.8         | 0.034   | 12288.0       | 0.296   | 5617.157      | 0.338   | 10443.737     |
| 0.285  | 48.2          | 0.811   | 224.2         | 0.038   | 12480.0       | 0.340   | 5998.177      | 0.375   | 10985.386     |
| 0.338  | 50.1          | 1.502   | 261.5         | 0.043   | 12672.0       | 0.383   | 6354.618      | 0.413   | 11499.538     |
| 0.390  | 51.8          | 2.563   | 298.9         | 0.048   | 12864.0       | 0.426   | 6690.610      | 0.450   | 11989.913     |
| 0.443  | 53.3          | 4.106   | 336.3         | 0.053   | 13056.0       | 0.470   | 7009.245      | 0.488   | 12459.466     |
| 0.495  | 54.8          | 6.258   | 373.6         | 0.058   | 13248.0       | 0.513   | 7312.909      | 0.525   | 12910.588     |
| 0.548  | 56.1          | 9.162   | 411.0         | 0.062   | 13440.0       | 0.557   | 7603.490      | 0.563   | 13345.245     |
| 0.600  | 57.3          | 12.976  | 448.3         | 0.067   | 13632.0       | 0.600   | 7882.510      | 0.600   | 13765.081     |
| 0.975  | 65.6          | 17.873  | 485.7         | 0.072   | 13824.0       | 0.975   | 10247.263     | 0.975   | 17894.605     |
| 1.350  | 73.9          | 24.040  | 523.1         | 0.077   | 14016.0       | 1.350   | 12612.016     | 1.350   | 22024.130     |
| 1.620  | 73.9          | 31.680  | 560.4         | 0.082   | 14208.0       | 1.620   | 12612.016     | 1.620   | 22024.130     |
| 1.890  | 73.9          | 39.600  | 560.4         | 0.086   | 14400.0       | 1.890   | 12612.016     | 1.890   | 22024.130     |

| 45 feet |               | 52 feet |               |
|---------|---------------|---------|---------------|
| y       | p             | y       | p             |
| (inch)  | (pounds/inch) | (inch)  | (pounds/inch) |
| 0.000   | 0.0           | 0.000   | 0.0           |
| 0.225   | 10823.1       | 0.014   | 11520.0       |
| 0.260   | 11578.9       | 0.019   | 11712.0       |
| 0.294   | 12284.7       | 0.024   | 11904.0       |
| 0.328   | 12949.1       | 0.029   | 12096.0       |
| 0.362   | 13578.4       | 0.034   | 12288.0       |
| 0.396   | 14177.6       | 0.038   | 12480.0       |
| 0.430   | 14750.6       | 0.043   | 12672.0       |
| 0.464   | 15300.4       | 0.048   | 12864.0       |
| 0.498   | 15829.6       | 0.053   | 13056.0       |
| 0.532   | 16340.3       | 0.058   | 13248.0       |
| 0.566   | 16834.2       | 0.062   | 13440.0       |
| 0.600   | 17313.0       | 0.067   | 13632.0       |
| 0.975   | 22506.8       | 0.072   | 13824.0       |
| 1.350   | 27700.7       | 0.077   | 14016.0       |
| 1.620   | 27700.7       | 0.082   | 14208.0       |
| 1.890   | 27700.7       | 0.086   | 14400.0       |

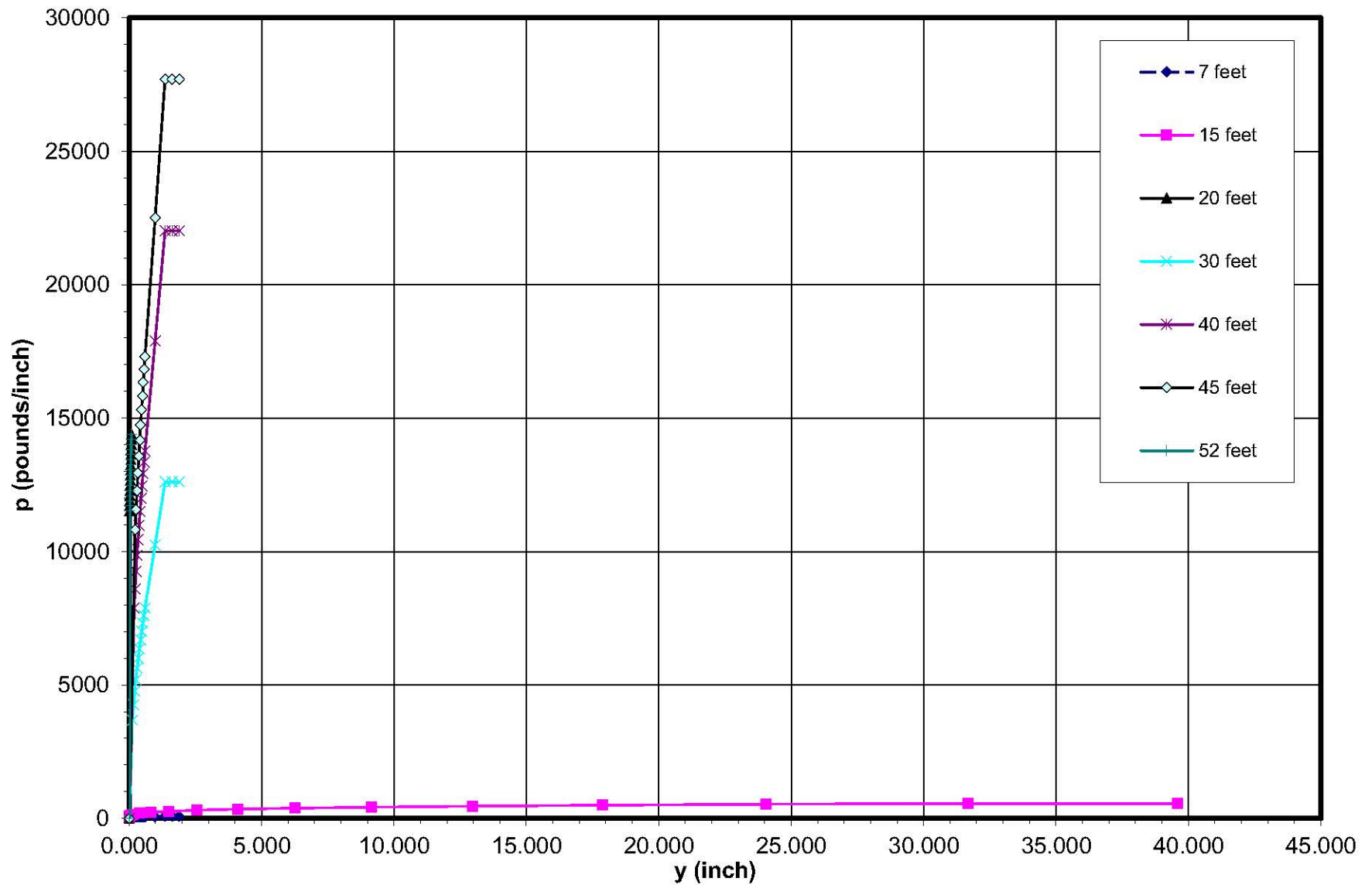
#### **Soil Profile at Abutment No. 1 (B-3)**

|                             | Depths*      |
|-----------------------------|--------------|
| Air                         | 0 - 5 feet   |
| Beach Deposit (below water) | 5 - 10 feet  |
| Alluvium                    | 10 - 18 feet |
| Basalt Formation            | 18 - 28 feet |
| Clinker                     | 28 - 50 feet |
| Basalt Formation            | 50 - 62 feet |

\*Depths below top of drilled shaft at Elevation +3 feet MSL

**LATERAL LOAD ANALYSIS - Abutment No. 1 (Scour to Elev. -2.0 ft)**  
**Kamehemeha Highway Drainage and Safety Improvements**  
**Vicinity of MP 3.06 to MP 3.54**  
**Waialua, Oahu, Hawaii**

P-Y Curves





# **LATERAL LOAD ANALYSIS - Abutment No. 2 (Scour to Elev. -2.0 ft)**

## **Kamehameha Highway Drainage and Safety Improvements**

### **Vicinity of MP 3.06 to MP 3.54**

### **Waialua, Oahu, Hawaii**

| 6 feet |               | 11 feet |               | 15 feet |               | 20 feet |               | 30 feet |               |
|--------|---------------|---------|---------------|---------|---------------|---------|---------------|---------|---------------|
| y      | p             | y       | p             | y       | p             | y       | p             | y       | p             |
| (inch) | (pounds/inch) | (inch)  | (pounds/inch) | (inch)  | (pounds/inch) | (inch)  | (pounds/inch) | (inch)  | (pounds/inch) |
| 0.000  | 0.0           | 0.000   | 0.0           | 0.000   | 0.0           | 0.000   | 0.000         | 0.000   | 0.000         |
| 0.001  | 26.1          | 0.001   | 36.6          | 0.014   | 11520.0       | 0.035   | 634.466       | 0.075   | 2256.581      |
| 0.010  | 52.2          | 0.010   | 73.3          | 0.019   | 11712.0       | 0.087   | 976.710       | 0.123   | 2856.557      |
| 0.051  | 78.3          | 0.051   | 109.9         | 0.024   | 11904.0       | 0.138   | 1221.293      | 0.171   | 3343.522      |
| 0.160  | 104.4         | 0.160   | 146.6         | 0.029   | 12096.0       | 0.189   | 1421.621      | 0.218   | 3763.553      |
| 0.391  | 130.5         | 0.391   | 183.2         | 0.034   | 12288.0       | 0.241   | 1595.203      | 0.266   | 4138.034      |
| 0.811  | 156.6         | 0.811   | 219.8         | 0.038   | 12480.0       | 0.292   | 1750.386      | 0.314   | 4478.957      |
| 1.502  | 182.7         | 1.502   | 256.5         | 0.043   | 12672.0       | 0.343   | 1891.923      | 0.361   | 4793.840      |
| 2.563  | 208.9         | 2.563   | 293.1         | 0.048   | 12864.0       | 0.395   | 2022.821      | 0.409   | 5087.763      |
| 4.106  | 235.0         | 4.106   | 329.8         | 0.053   | 13056.0       | 0.446   | 2145.127      | 0.457   | 5364.347      |
| 6.258  | 261.1         | 6.258   | 366.4         | 0.058   | 13248.0       | 0.497   | 2260.308      | 0.505   | 5626.280      |
| 9.162  | 287.2         | 9.162   | 403.0         | 0.062   | 13440.0       | 0.549   | 2369.455      | 0.552   | 5875.624      |
| 12.976 | 313.3         | 12.976  | 439.7         | 0.067   | 13632.0       | 0.600   | 2473.408      | 0.600   | 6113.998      |
| 17.873 | 339.4         | 17.873  | 476.3         | 0.072   | 13824.0       | 0.975   | 3215.431      | 0.975   | 7948.198      |
| 24.040 | 365.5         | 24.040  | 513.0         | 0.077   | 14016.0       | 1.350   | 3957.453      | 1.350   | 9782.397      |
| 31.680 | 391.6         | 31.680  | 549.6         | 0.082   | 14208.0       | 1.620   | 3957.453      | 1.620   | 9782.397      |
| 39.600 | 391.6         | 39.600  | 549.6         | 0.086   | 14400.0       | 1.890   | 3957.453      | 1.890   | 9782.397      |

| 40 feet |               | 50 feet |               |
|---------|---------------|---------|---------------|
| y       | p             | y       | p             |
| (inch)  | (pounds/inch) | (inch)  | (pounds/inch) |
| 0.000   | 0.0           | 0.000   | 0.0           |
| 0.014   | 11520.0       | 0.014   | 11520.0       |
| 0.019   | 11712.0       | 0.019   | 11712.0       |
| 0.024   | 11904.0       | 0.024   | 11904.0       |
| 0.029   | 12096.0       | 0.029   | 12096.0       |
| 0.034   | 12288.0       | 0.034   | 12288.0       |
| 0.038   | 12480.0       | 0.038   | 12480.0       |
| 0.043   | 12672.0       | 0.043   | 12672.0       |
| 0.048   | 12864.0       | 0.048   | 12864.0       |
| 0.053   | 13056.0       | 0.053   | 13056.0       |
| 0.058   | 13248.0       | 0.058   | 13248.0       |
| 0.062   | 13440.0       | 0.062   | 13440.0       |
| 0.067   | 13632.0       | 0.067   | 13632.0       |
| 0.072   | 13824.0       | 0.072   | 13824.0       |
| 0.077   | 14016.0       | 0.077   | 14016.0       |
| 0.082   | 14208.0       | 0.082   | 14208.0       |
| 0.086   | 14400.0       | 0.086   | 14400.0       |

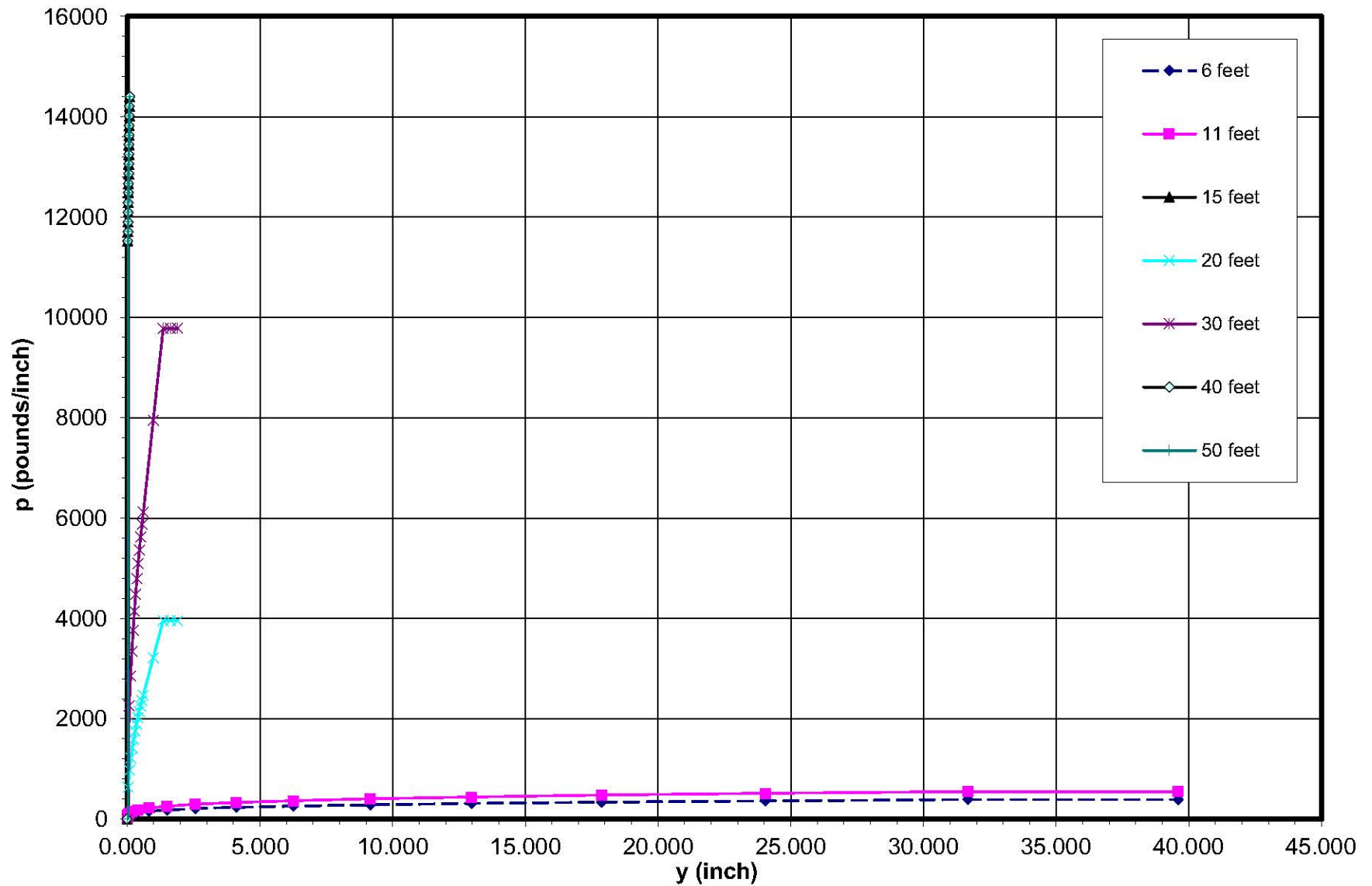
#### Soil Profile at Abutment No. 2 (B-4)

| Depths*          |              |
|------------------|--------------|
| Air              | 0 - 5 feet   |
| Alluvium         | 5 - 14 feet  |
| Basalt Formation | 14 - 17 feet |
| Clinker          | 17 - 39 feet |
| Basalt Formation | 39 - 56 feet |

\*Depths below top of drilled shaft at Elevation +3 feet MSL

**LATERAL LOAD ANALYSIS - Abutment No. 2 (Scour to Elev. -2.0 ft)**  
**Kamehemeha Highway Drainage and Safety Improvements**  
**Vicinity of MP 3.06 to MP 3.54**  
**Waialua, Oahu, Hawaii**

P-Y Curves



**LATERAL LOAD ANALYSIS - Center Pier (Scour to Elev. -2.0 ft)**  
**Kamehemeha Highway Drainage and Safety Improvements**  
**Vicinity of MP 3.06 to MP 3.54**  
**Waialua, Oahu, Hawaii**

| 6 feet |               | 10 feet |               | 15 feet |               | 18 feet |               | 25 feet |               |
|--------|---------------|---------|---------------|---------|---------------|---------|---------------|---------|---------------|
| y      | p             | y       | p             | y       | p             | y       | p             | y       | p             |
| (inch) | (pounds/inch) | (inch)  | (pounds/inch) | (inch)  | (pounds/inch) | (inch)  | (pounds/inch) | (inch)  | (pounds/inch) |
| 0.000  | 0.0           | 0.000   | 0.0           | 0.000   | 0.0           | 0.000   | 0.000         | 0.000   | 0.000         |
| 0.013  | 9.7           | 0.001   | 30.5          | 0.001   | 41.0          | 0.014   | 11520.000     | 0.059   | 1422.864      |
| 0.067  | 14.7          | 0.010   | 61.0          | 0.010   | 82.0          | 0.019   | 11712.000     | 0.108   | 1901.257      |
| 0.120  | 17.1          | 0.051   | 91.5          | 0.051   | 123.0         | 0.024   | 11904.000     | 0.158   | 2274.941      |
| 0.173  | 18.9          | 0.160   | 122.0         | 0.160   | 164.0         | 0.029   | 12096.000     | 0.207   | 2591.574      |
| 0.227  | 20.2          | 0.391   | 152.5         | 0.391   | 205.0         | 0.034   | 12288.000     | 0.256   | 2870.963      |
| 0.280  | 21.4          | 0.811   | 183.1         | 0.811   | 246.0         | 0.038   | 12480.000     | 0.305   | 3123.595      |
| 0.333  | 22.3          | 1.502   | 213.6         | 1.502   | 287.0         | 0.043   | 12672.000     | 0.354   | 3355.814      |
| 0.387  | 23.2          | 2.563   | 244.1         | 2.563   | 328.0         | 0.048   | 12864.000     | 0.403   | 3571.803      |
| 0.440  | 24.0          | 4.106   | 274.6         | 4.106   | 368.9         | 0.053   | 13056.000     | 0.453   | 3774.490      |
| 0.493  | 24.7          | 6.258   | 305.1         | 6.258   | 409.9         | 0.058   | 13248.000     | 0.502   | 3966.018      |
| 0.547  | 25.4          | 9.162   | 335.6         | 9.162   | 450.9         | 0.062   | 13440.000     | 0.551   | 4148.013      |
| 0.600  | 26.0          | 12.976  | 366.1         | 12.976  | 491.9         | 0.067   | 13632.000     | 0.600   | 4321.743      |
| 0.975  | 30.3          | 17.873  | 396.6         | 17.873  | 532.9         | 0.072   | 13824.000     | 0.975   | 5618.266      |
| 1.350  | 34.5          | 24.040  | 427.1         | 24.040  | 573.9         | 0.077   | 14016.000     | 1.350   | 6914.788      |
| 1.620  | 34.5          | 31.680  | 457.6         | 31.680  | 614.9         | 0.082   | 14208.000     | 1.620   | 6914.788      |
| 1.890  | 34.5          | 39.600  | 457.6         | 39.600  | 614.9         | 0.086   | 14400.000     | 1.890   | 6914.788      |

| 35 feet |               | 50 feet |               |
|---------|---------------|---------|---------------|
| y       | p             | y       | p             |
| (inch)  | (pounds/inch) | (inch)  | (pounds/inch) |
| 0.000   | 0.0           | 0.000   | 0.0           |
| 0.108   | 3900.4        | 0.014   | 11520.0       |
| 0.153   | 4603.7        | 0.019   | 11712.0       |
| 0.198   | 5206.2        | 0.024   | 11904.0       |
| 0.242   | 5741.2        | 0.029   | 12096.0       |
| 0.287   | 6227.0        | 0.034   | 12288.0       |
| 0.332   | 6674.8        | 0.038   | 12480.0       |
| 0.377   | 7092.2        | 0.043   | 12672.0       |
| 0.421   | 7484.5        | 0.048   | 12864.0       |
| 0.466   | 7855.8        | 0.053   | 13056.0       |
| 0.511   | 8208.9        | 0.058   | 13248.0       |
| 0.555   | 8546.3        | 0.062   | 13440.0       |
| 0.600   | 8869.8        | 0.067   | 13632.0       |
| 0.975   | 11530.8       | 0.072   | 13824.0       |
| 1.350   | 14191.7       | 0.077   | 14016.0       |
| 1.620   | 14191.7       | 0.082   | 14208.0       |
| 1.890   | 14191.7       | 0.086   | 14400.0       |

| Soil Profile at Center Pier (B-3 and B-4) |              |
|-------------------------------------------|--------------|
|                                           | Depths*      |
| Air                                       | 0 - 5 feet   |
| Beach Deposit (below water)               | 5 - 7 feet   |
| Alluvium                                  | 7 - 16 feet  |
| Basalt Formation                          | 16 - 20 feet |
| Clinker                                   | 20 - 45 feet |
| Basalt Formation                          | 45 - 62 feet |

\*Depths below top of drilled shaft at Elevation +3 feet MSL

**LATERAL LOAD ANALYSIS - Center Pier (Scour to Elev. -2.0 ft)**  
**Kamehameha Highway Drainage and Safety Improvements**  
**Vicinity of MP 3.06 to MP 3.54**  
**Waialua, Oahu, Hawaii**

P-Y Curves

