

Print Calculation Sheet

## PILE CAP DESIGN

### US Code (ACI 318-14) - Metric

#### Pile Cap 4

### PILE ARRANGEMENT

#### Footing Geometrical Data

##### Pedestal

Include Pedestal : Yes  
 Pedestal Shape : Rectangular  
 Pedestal Height (Ph) : 2.700 m  
 Pedestal Length - X (Pl) : 0.750 m  
 Pedestal Width - Z (Pw) : 0.750 m

#### Pile Cap Geometrical Data

Pile Cap Length **P<sub>CL</sub>** : 2.450 m  
 Pile Cap Width **P<sub>CW</sub>** : 2.450 m  
 Initial Pile Cap Thickness **t<sub>i</sub>** : 1.000 m

#### Pile Geometrical Data

Pile spacing **P<sub>s</sub>** : 1.400 m  
 Pile Edge distance **P<sub>e</sub>** : 0.525 m  
 Pile Diameter **P<sub>d</sub>** : 0.350 m

#### Pile Capacities

Axial Capacity **P<sub>P</sub>** : 665.000 kN  
 Lateral Capacity **P<sub>L</sub>** : 52.900 kN  
 Uplift Capacity **P<sub>U</sub>** : 412.300 kN

#### Material Properties

Concrete **f<sub>c</sub>** : 28000.005 kN/m<sup>2</sup>  
 Reinforcement **f<sub>y</sub>** : 390000.065 kN/m<sup>2</sup>

#### Concrete Cover

Bottom Clear Cover **CC<sub>B</sub>** : 0.050 m  
 Side Clear Cover **CC<sub>S</sub>** : 0.050 m  
 Pile in Pile Cap **PC<sub>P</sub>** : 0.100 m

#### Loading applied at top of cap

For the loads shown in this table, the sign convention is the same as that for JOINT LOADS in STAAD.Pro when global Y is the vertical axis.

#### Service Level Combinations

| Load Combination Number | Load Combination Title   | Load Case Multiplier | Self Weight Factor | Code |
|-------------------------|--|----------------------|--------------------|------|
| 801                     | *CB_NO.1*-----*1.0 (DS + DE + DO + TA-V + TA-H + TG-X + TG-Z + - | 1.00                 | 1.00               | -    |
| 802                     | *CB_NO.2*-----*1.0 (DS + DE + DO + TA-V + TA-H + TG-X - TG-Z -   | 1.00                 | 1.00               | -    |
| 803                     | *CB_NO.3*-----*1.0 (DS + DE + DO + TA-V + TA-H - TG-X + TG-Z -   | 1.00                 | 1.00               | -    |
| 804                     | *CB_NO.4*-----*1.0 (DS + DE + DO + TA-V + TA-H - TG-X - TG-Z -   | 1.00                 | 1.00               | -    |
| 805                     | *CB_5  | 1.00                 | 1.00               | -    |
| 806                     | *CB_6  | 1.00                 | 1.00               | -    |
| 807                     | *CB_7  | 1.00                 | 1.00               | -    |
| 808                     | *CB_8  | 1.00                 | 1.00               | -    |
| 809                     | *CB_9  | 1.00                 | 1.00               | -    |
| 810                     | *CB_10   | 1.00                 | 1.00               | -    |

|     |        |      |      |   |
|-----|--------|------|------|---|
| 811 | *CB_11 | 1.00 | 1.00 | - |
| 812 | *CB_12 | 1.00 | 1.00 | - |
| 813 | *CB_13 | 1.00 | 1.00 | - |
| 814 | *CB_14 | 1.00 | 1.00 | - |
| 815 | *CB_15 | 1.00 | 1.00 | - |
| 816 | *CB_16 | 1.00 | 1.00 | - |
| 817 | *CB_17 | 1.00 | 1.00 | - |
| 818 | *CB_18 | 1.00 | 1.00 | - |
| 819 | *CB_19 | 1.00 | 1.00 | - |
| 820 | *CB_20 | 1.00 | 1.00 | - |
| 821 | *CB_21 | 1.00 | 1.00 | - |
| 822 | *CB_22 | 1.00 | 1.00 | - |
| 823 | *CB_23 | 1.00 | 1.00 | - |
| 824 | *CB_24 | 1.00 | 1.00 | - |
| 825 | *CB_25 | 1.00 | 1.00 | - |
| 826 | *CB_26 | 1.00 | 1.00 | - |
| 827 | *CB_27 | 1.00 | 1.00 | - |
| 828 | *CB_28 | 1.00 | 1.00 | - |
| 829 | *CB_29 | 1.00 | 1.00 | - |
| 830 | *CB_30 | 1.00 | 1.00 | - |
| 831 | *CB_31 | 1.00 | 1.00 | - |
| 832 | *CB_32 | 1.00 | 1.00 | - |
| 833 | *CB_33 | 1.00 | 1.00 | - |
| 834 | *CB_34 | 1.00 | 1.00 | - |
| 835 | *CB_35 | 1.00 | 1.00 | - |
| 836 | *CB_36 | 1.00 | 1.00 | - |
| 837 | *CB_37 | 1.00 | 1.00 | - |
| 838 | *CB_38 | 1.00 | 1.00 | - |
| 839 | *CB_39 | 1.00 | 1.00 | - |
| 840 | *CB_40 | 1.00 | 1.00 | - |
| 841 | *CB_41 | 1.00 | 1.00 | - |
| 842 | *CB_42 | 1.00 | 1.00 | - |
| 843 | *CB_43 | 1.00 | 1.00 | - |
| 844 | *CB_44 | 1.00 | 1.00 | - |
| 845 | *CB_45 | 1.00 | 1.00 | - |
| 846 | *CB_46 | 1.00 | 1.00 | - |
| 847 | *CB_47 | 1.00 | 1.00 | - |
| 848 | *CB_48 | 1.00 | 1.00 | - |
| 849 | *CB_49 | 1.00 | 1.00 | - |
| 850 | *CB_50 | 1.00 | 1.00 | - |
| 851 | *CB_51 | 1.00 | 1.00 | - |
| 852 | *CB_52 | 1.00 | 1.00 | - |
| 853 | *CB_53 | 1.00 | 1.00 | - |
| 854 | *CB_54 | 1.00 | 1.00 | - |
| 855 | *CB_55 | 1.00 | 1.00 | - |
| 856 | *CB_56 | 1.00 | 1.00 | - |
| 857 | *CB_57 | 1.00 | 1.00 | - |
| 858 | *CB_58 | 1.00 | 1.00 | - |
| 859 | *CB_59 | 1.00 | 1.00 | - |
| 860 | *CB_60 | 1.00 | 1.00 | - |
| 861 | *CB_61 | 1.00 | 1.00 | - |
| 862 | *CB_62 | 1.00 | 1.00 | - |
| 863 | *CB_63 | 1.00 | 1.00 | - |
| 864 | *CB_64 | 1.00 | 1.00 | - |
| 865 | *CB_65 | 1.00 | 1.00 | - |
| 866 | *CB_66 | 1.00 | 1.00 | - |
| 867 | *CB_67 | 1.00 | 1.00 | - |
| 868 | *CB_68 | 1.00 | 1.00 | - |
| 869 | *CB_69 | 1.00 | 1.00 | - |
| 870 | *CB_70 | 1.00 | 1.00 | - |
| 871 | *CB_71 | 1.00 | 1.00 | - |
| 872 | *CB_72 | 1.00 | 1.00 | - |
| 873 | *CB_73 | 1.00 | 1.00 | - |
| 874 | *CB_74 | 1.00 | 1.00 | - |
| 875 | *CB_75 | 1.00 | 1.00 | - |
| 876 | *CB_76 | 1.00 | 1.00 | - |
| 877 | *CB_77 | 1.00 | 1.00 | - |
| 878 | *CB_78 | 1.00 | 1.00 | - |
| 879 | *CB_79 | 1.00 | 1.00 | - |
| 880 | *CB_80 | 1.00 | 1.00 | - |

Strength Level Combinations

| Load Combination Number | Load Combination Title   | Load Case Multiplier | Self Weight Factor | Code |
|-------------------------|--|----------------------|--------------------|------|
| 901                     | *CB_NO.1*-----*1.0 (DS + DE + DO + TA-V + TA-H + TG-X + TG-Z + - | 1.00                 | 1.00               | -    |
| 902                     | *CB_NO.2*-----*1.0 (DS + DE + DO + TA-V + TA-H + TG-X - TG-Z -   | 1.00                 | 1.00               | -    |
| 903                     | *CB_NO.3*-----*1.0 (DS + DE + DO + TA-V + TA-H - TG-X + TG-Z -   | 1.00                 | 1.00               | -    |
| 904                     | *CB_NO.4*-----*1.0 (DS + DE + DO + TA-V + TA-H - TG-X - TG-Z -   | 1.00                 | 1.00               | -    |
| 905                     | *CB_5  | 1.00                 | 1.00               | -    |
| 906                     | *CB_6  | 1.00                 | 1.00               | -    |
| 907                     | *CB_7  | 1.00                 | 1.00               | -    |
| 908                     | *CB_8  | 1.00                 | 1.00               | -    |
| 909                     | *CB_9  | 1.00                 | 1.00               | -    |
| 910                     | *CB_10   | 1.00                 | 1.00               | -    |
| 911                     | *CB_11   | 1.00                 | 1.00               | -    |
| 912                     | *CB_12   | 1.00                 | 1.00               | -    |
| 913                     | *CB_13   | 1.00                 | 1.00               | -    |
| 914                     | *CB_14   | 1.00                 | 1.00               | -    |
| 915                     | *CB_15   | 1.00                 | 1.00               | -    |
| 916                     | *CB_16   | 1.00                 | 1.00               | -    |
| 917                     | *CB_17   | 1.00                 | 1.00               | -    |
| 918                     | *CB_18   | 1.00                 | 1.00               | -    |
| 919                     | *CB_19   | 1.00                 | 1.00               | -    |
| 920                     | *CB_20   | 1.00                 | 1.00               | -    |
| 921                     | *CB_21   | 1.00                 | 1.00               | -    |
| 922                     | *CB_22   | 1.00                 | 1.00               | -    |
| 923                     | *CB_23   | 1.00                 | 1.00               | -    |
| 924                     | *CB_24   | 1.00                 | 1.00               | -    |
| 925                     | *CB_25   | 1.00                 | 1.00               | -    |
| 926                     | *CB_26   | 1.00                 | 1.00               | -    |
| 927                     | *CB_27   | 1.00                 | 1.00               | -    |
| 928                     | *CB_28   | 1.00                 | 1.00               | -    |
| 929                     | *CB_29   | 1.00                 | 1.00               | -    |
| 930                     | *CB_30   | 1.00                 | 1.00               | -    |
| 931                     | *CB_31   | 1.00                 | 1.00               | -    |
| 932                     | *CB_32   | 1.00                 | 1.00               | -    |
| 933                     | *CB_33   | 1.00                 | 1.00               | -    |
| 934                     | *CB_34   | 1.00                 | 1.00               | -    |
| 935                     | *CB_35   | 1.00                 | 1.00               | -    |
| 936                     | *CB_36   | 1.00                 | 1.00               | -    |
| 937                     | *CB_37   | 1.00                 | 1.00               | -    |
| 938                     | *CB_38   | 1.00                 | 1.00               | -    |
| 939                     | *CB_39   | 1.00                 | 1.00               | -    |
| 940                     | *CB_40   | 1.00                 | 1.00               | -    |
| 941                     | *CB_41   | 1.00                 | 1.00               | -    |
| 942                     | *CB_42   | 1.00                 | 1.00               | -    |
| 943                     | *CB_43   | 1.00                 | 1.00               | -    |
| 944                     | *CB_44   | 1.00                 | 1.00               | -    |
| 945                     | *CB_45   | 1.00                 | 1.00               | -    |
| 946                     | *CB_46   | 1.00                 | 1.00               | -    |
| 947                     | *CB_47   | 1.00                 | 1.00               | -    |
| 948                     | *CB_48   | 1.00                 | 1.00               | -    |
| 949                     | *CB_49   | 1.00                 | 1.00               | -    |
| 950                     | *CB_50   | 1.00                 | 1.00               | -    |
| 951                     | *CB_51   | 1.00                 | 1.00               | -    |
| 952                     | *CB_52   | 1.00                 | 1.00               | -    |
| 953                     | *CB_53   | 1.00                 | 1.00               | -    |
| 954                     | *CB_54   | 1.00                 | 1.00               | -    |
| 955                     | *CB_55   | 1.00                 | 1.00               | -    |
| 956                     | *CB_56   | 1.00                 | 1.00               | -    |
| 957                     | *CB_57   | 1.00                 | 1.00               | -    |
| 958                     | *CB_58   | 1.00                 | 1.00               | -    |
| 959                     | *CB_59   | 1.00                 | 1.00               | -    |
| 960                     | *CB_60   | 1.00                 | 1.00               | -    |
| 961                     | *CB_61   | 1.00                 | 1.00               | -    |
| 962                     | *CB_62   | 1.00                 | 1.00               | -    |
| 963                     | *CB_63   | 1.00                 | 1.00               | -    |
| 964                     | *CB_64   | 1.00                 | 1.00               | -    |
| 965                     | *CB_65   | 1.00                 | 1.00               | -    |
| 966                     | *CB_66   | 1.00                 | 1.00               | -    |
| 967                     | *CB_67   | 1.00                 | 1.00               | -    |

|     |        |      |      |   |
|-----|--------|------|------|---|
| 968 | *CB_68 | 1.00 | 1.00 | - |
| 969 | *CB_69 | 1.00 | 1.00 | - |
| 970 | *CB_70 | 1.00 | 1.00 | - |
| 971 | *CB_71 | 1.00 | 1.00 | - |
| 972 | *CB_72 | 1.00 | 1.00 | - |
| 973 | *CB_73 | 1.00 | 1.00 | - |
| 974 | *CB_74 | 1.00 | 1.00 | - |
| 975 | *CB_75 | 1.00 | 1.00 | - |
| 976 | *CB_76 | 1.00 | 1.00 | - |
| 977 | *CB_77 | 1.00 | 1.00 | - |
| 978 | *CB_78 | 1.00 | 1.00 | - |
| 979 | *CB_79 | 1.00 | 1.00 | - |
| 980 | *CB_80 | 1.00 | 1.00 | - |
| 981 | *CB_81 | 1.00 | 1.00 | - |
| 982 | *CB_82 | 1.00 | 1.00 | - |
| 983 | *CB_83 | 1.00 | 1.00 | - |
| 984 | *CB_84 | 1.00 | 1.00 | - |

| Applied Loads - Service Stress Level |                        |   |                        |                         |                         |
|--------------------------------------|------------------------|---|------------------------|-------------------------|-------------------------|
| Load Case                            | F <sub>x</sub><br>(kN) | F <sub>y</sub><br>(kN)<br>Downwards is<br>negative Upwards<br>is positive | F <sub>z</sub><br>(kN) | M <sub>x</sub><br>(kNm) | M <sub>z</sub><br>(kNm) |
| 801                                  | 23.454                 | -128.436  | 24.510                 | 0.000                   | 0.000                   |
| 802                                  | 26.346                 | -240.223  | -21.124                | 0.000                   | 0.000                   |
| 803                                  | -13.035                | -87.984   | 25.614                 | 0.000                   | 0.000                   |
| 804                                  | -10.143                | -199.771  | -20.020                | 0.000                   | 0.000                   |
| 805                                  | 24.559                 | -212.297  | 24.432                 | 0.000                   | 0.000                   |
| 806                                  | 27.753                 | -333.294  | -24.029                | 0.000                   | 0.000                   |
| 807                                  | -12.150                | -171.060  | 25.575                 | 0.000                   | 0.000                   |
| 808                                  | -8.956                 | -292.057  | -22.886                | 0.000                   | 0.000                   |
| 809                                  | 24.612                 | -213.025  | 23.734                 | 0.000                   | 0.000                   |
| 810                                  | 27.688                 | -329.916  | -23.472                | 0.000                   | 0.000                   |
| 811                                  | -12.054                | -171.664  | 24.925                 | 0.000                   | 0.000                   |
| 812                                  | -8.978                 | -288.555  | -22.281                | 0.000                   | 0.000                   |
| 813                                  | 24.675                 | -216.529  | 23.746                 | 0.000                   | 0.000                   |
| 814                                  | 27.611                 | -331.635  | -23.278                | 0.000                   | 0.000                   |
| 815                                  | -11.993                | -175.454  | 24.813                 | 0.000                   | 0.000                   |
| 816                                  | -9.057                 | -290.560  | -22.211                | 0.000                   | 0.000                   |
| 817                                  | 47.091                 | -211.039  | 6.185                  | 0.000                   | 0.000                   |
| 818                                  | 48.234                 | -219.131  | -0.693                 | 0.000                   | 0.000                   |
| 819                                  | -34.923                | -109.076  | 5.183                  | 0.000                   | 0.000                   |
| 820                                  | -33.780                | -117.168  | -1.695                 | 0.000                   | 0.000                   |
| 821                                  | 14.324                 | 97.293  | 126.396                | 0.000                   | 0.000                   |
| 822                                  | 25.537                 | -452.661  | -122.749               | 0.000                   | 0.000                   |
| 823                                  | -12.226                | 124.454   | 127.239                | 0.000                   | 0.000                   |
| 824                                  | -1.014                 | -425.500  | -121.906               | 0.000                   | 0.000                   |
| 825                                  | 34.301                 | -195.984  | 5.743                  | 0.000                   | 0.000                   |
| 826                                  | 35.444                 | -204.076  | -1.134                 | 0.000                   | 0.000                   |
| 827                                  | -22.133                | -124.131  | 5.624                  | 0.000                   | 0.000                   |
| 828                                  | -20.990                | -132.223  | -1.253                 | 0.000                   | 0.000                   |
| 829                                  | 16.243                 | 1.820   | 68.220                 | 0.000                   | 0.000                   |
| 830                                  | 23.618                 | -357.188  | -64.573                | 0.000                   | 0.000                   |
| 831                                  | -10.307                | 28.981  | 69.063                 | 0.000                   | 0.000                   |
| 832                                  | -2.932                 | -330.027  | -63.730                | 0.000                   | 0.000                   |
| 833                                  | 41.040                 | -265.596  | 4.800                  | 0.000                   | 0.000                   |
| 834                                  | 42.183                 | -273.688  | -2.078                 | 0.000                   | 0.000                   |
| 835                                  | -27.108                | -182.333  | 4.258                  | 0.000                   | 0.000                   |
| 836                                  | -25.965                | -190.426  | -2.619                 | 0.000                   | 0.000                   |
| 837                                  | 16.465                 | -34.347   | 94.958                 | 0.000                   | 0.000                   |
| 838                                  | 25.160                 | -448.836  | -93.621                | 0.000                   | 0.000                   |
| 839                                  | -10.086                | -7.186  | 95.801                 | 0.000                   | 0.000                   |
| 840                                  | -1.390                 | -421.675  | -92.778                | 0.000                   | 0.000                   |
| 841                                  | 31.448                 | -254.305  | 4.468                  | 0.000                   | 0.000                   |
| 842                                  | 32.590                 | -262.397  | -2.409                 | 0.000                   | 0.000                   |
| 843                                  | -17.516                | -193.625  | 4.590                  | 0.000                   | 0.000                   |
| 844                                  | -16.373                | -201.717  | -2.288                 | 0.000                   | 0.000                   |
| 845                                  | 17.904                 | -105.951  | 51.326                 | 0.000                   | 0.000                   |
| 846                                  | 23.721                 | -377.231  | -49.988                | 0.000                   | 0.000                   |
| 847                                  | -8.646                 | -78.791   | 52.169                 | 0.000                   | 0.000                   |
| 848                                  | -2.830                 | -350.070  | -49.145                | 0.000                   | 0.000                   |
| 849                                  | 30.373                 | -177.329  | -1.108                 | 0.000                   | 0.000                   |
| 850                                  | -25.091                | -102.527  | -2.954                 | 0.000                   | 0.000                   |
| 851                                  | -2.394                 | 131.003   | 119.103                | 0.000                   | 0.000                   |
| 852                                  | 7.676                  | -410.859  | -123.165               | 0.000                   | 0.000                   |
| 853                                  | 16.089                 | -160.040  | -1.598                 | 0.000                   | 0.000                   |
| 854                                  | -10.807                | -119.816  | -2.464                 | 0.000                   | 0.000                   |
| 855                                  | -0.164                 | 17.984  | 54.631                 | 0.000                   | 0.000                   |
| 856                                  | 5.446                  | -297.840  | -58.692                | 0.000                   | 0.000                   |
| 857                                  | 4.580                  | -266.832  | -4.943                 | 0.000                   | 0.000                   |
| 858                                  | 4.110                  | -240.685  | -3.796                 | 0.000                   | 0.000                   |
| 859                                  | 4.111                  | -241.932  | -3.507                 | 0.000                   | 0.000                   |

|     |        |          |         |       |       |
|-----|--------|----------|---------|-------|-------|
| 860 | 4.110  | -240.685 | -3.796  | 0.000 | 0.000 |
| 861 | 15.989 | -261.313 | -4.169  | 0.000 | 0.000 |
| 862 | -7.417 | -229.747 | -4.947  | 0.000 | 0.000 |
| 863 | 2.161  | -131.197 | 46.561  | 0.000 | 0.000 |
| 864 | 6.411  | -359.863 | -55.677 | 0.000 | 0.000 |
| 865 | 15.519 | -235.166 | -3.022  | 0.000 | 0.000 |
| 866 | -7.886 | -203.600 | -3.801  | 0.000 | 0.000 |
| 867 | 1.692  | -105.050 | 47.707  | 0.000 | 0.000 |
| 868 | 5.941  | -333.716 | -54.530 | 0.000 | 0.000 |
| 869 | 15.519 | -236.413 | -2.732  | 0.000 | 0.000 |
| 870 | -7.886 | -204.846 | -3.511  | 0.000 | 0.000 |
| 871 | 1.692  | -106.297 | 47.997  | 0.000 | 0.000 |
| 872 | 5.941  | -334.963 | -54.240 | 0.000 | 0.000 |
| 873 | 15.519 | -235.166 | -3.022  | 0.000 | 0.000 |
| 874 | -7.886 | -203.600 | -3.801  | 0.000 | 0.000 |
| 875 | 1.692  | -105.050 | 47.707  | 0.000 | 0.000 |
| 876 | 5.941  | -333.716 | -54.530 | 0.000 | 0.000 |
| 877 | 3.823  | -219.829 | -3.718  | 0.000 | 0.000 |
| 878 | 3.810  | -218.937 | -3.104  | 0.000 | 0.000 |
| 879 | 2.647  | -140.374 | -2.338  | 0.000 | 0.000 |
| 880 | 2.635  | -139.482 | -1.724  | 0.000 | 0.000 |

| Applied Loads - Ultimate Stress Level |                        |   |                        |                         |                         |
|---------------------------------------|------------------------|---|------------------------|-------------------------|-------------------------|
| Load Case                             | F <sub>x</sub><br>(kN) | F <sub>y</sub><br>(kN)<br>Downwards is<br>negative Upwards<br>is positive | F <sub>z</sub><br>(kN) | M <sub>x</sub><br>(kNm) | M <sub>z</sub><br>(kNm) |
| 901                                   | 32.866                 | -175.754  | 36.009                 | 0.000                   | 0.000                   |
| 902                                   | 37.061                 | -338.716  | -30.373                | 0.000                   | 0.000                   |
| 903                                   | -18.579                | -119.175  | 37.550                 | 0.000                   | 0.000                   |
| 904                                   | -14.240                | -282.246  | -28.991                | 0.000                   | 0.000                   |
| 905                                   | 29.896                 | -283.553  | 31.485                 | 0.000                   | 0.000                   |
| 906                                   | 34.064                 | -439.970  | -30.900                | 0.000                   | 0.000                   |
| 907                                   | -14.571                | -233.838  | 32.826                 | 0.000                   | 0.000                   |
| 908                                   | -10.283                | -390.371  | -29.700                | 0.000                   | 0.000                   |
| 909                                   | 29.987                 | -284.903  | 30.294                 | 0.000                   | 0.000                   |
| 910                                   | 33.953                 | -434.344  | -29.927                | 0.000                   | 0.000                   |
| 911                                   | -14.409                | -234.995  | 31.708                 | 0.000                   | 0.000                   |
| 912                                   | -10.328                | -384.539  | -28.647                | 0.000                   | 0.000                   |
| 913                                   | 30.089                 | -290.620  | 30.292                 | 0.000                   | 0.000                   |
| 914                                   | 33.821                 | -437.041  | -29.603                | 0.000                   | 0.000                   |
| 915                                   | -14.302                | -241.163  | 31.508                 | 0.000                   | 0.000                   |
| 916                                   | -10.460                | -387.697  | -28.524                | 0.000                   | 0.000                   |
| 917                                   | 68.335                 | -309.627  | 7.713                  | 0.000                   | 0.000                   |
| 918                                   | 69.746                 | -320.499  | -1.088                 | 0.000                   | 0.000                   |
| 919                                   | -52.831                | -157.146  | 5.708                  | 0.000                   | 0.000                   |
| 920                                   | -51.411                | -168.071  | -3.164                 | 0.000                   | 0.000                   |
| 921                                   | 15.536                 | 195.404   | 205.420                | 0.000                   | 0.000                   |
| 922                                   | 33.409                 | -704.501  | -200.194               | 0.000                   | 0.000                   |
| 923                                   | -16.731                | 228.244   | 206.656                | 0.000                   | 0.000                   |
| 924                                   | 1.730                  | -673.134  | -200.245               | 0.000                   | 0.000                   |
| 925                                   | 45.534                 | -295.441  | 6.750                  | 0.000                   | 0.000                   |
| 926                                   | 46.950                 | -306.381  | -2.092                 | 0.000                   | 0.000                   |
| 927                                   | -29.376                | -199.046  | 6.327                  | 0.000                   | 0.000                   |
| 928                                   | -27.956                | -210.047  | -2.573                 | 0.000                   | 0.000                   |
| 929                                   | 19.482                 | -6.122  | 98.922                 | 0.000                   | 0.000                   |
| 930                                   | 30.156                 | -531.877  | -95.427                | 0.000                   | 0.000                   |
| 931                                   | -12.705                | 26.533  | 100.010                | 0.000                   | 0.000                   |
| 932                                   | -1.738                 | -499.418  | -94.604                | 0.000                   | 0.000                   |
| 933                                   | 66.683                 | -215.184  | 9.049                  | 0.000                   | 0.000                   |
| 934                                   | 68.079                 | -225.644  | 0.452                  | 0.000                   | 0.000                   |
| 935                                   | -54.336                | -62.773   | 7.079                  | 0.000                   | 0.000                   |
| 936                                   | -52.931                | -73.280   | -1.584                 | 0.000                   | 0.000                   |
| 937                                   | 14.047                 | 285.757   | 204.989                | 0.000                   | 0.000                   |
| 938                                   | 31.793                 | -606.563  | -197.631               | 0.000                   | 0.000                   |
| 939                                   | -18.166                | 318.589   | 206.237                | 0.000                   | 0.000                   |
| 940                                   | 0.037                  | -574.256  | -196.915               | 0.000                   | 0.000                   |
| 941                                   | 43.393                 | -175.062  | 8.425                  | 0.000                   | 0.000                   |
| 942                                   | 44.789                 | -185.459  | -0.149                 | 0.000                   | 0.000                   |
| 943                                   | -31.396                | -78.650   | 8.044                  | 0.000                   | 0.000                   |
| 944                                   | -29.995                | -89.100   | -0.584                 | 0.000                   | 0.000                   |
| 945                                   | 17.481                 | 111.305   | 99.370                 | 0.000                   | 0.000                   |
| 946                                   | 27.914                 | -407.994  | -92.250                | 0.000                   | 0.000                   |
| 947                                   | -14.640                | 143.957   | 100.479                | 0.000                   | 0.000                   |
| 948                                   | -3.917                 | -375.508  | -91.388                | 0.000                   | 0.000                   |
| 949                                   | 47.023                 | -199.726  | -0.464                 | 0.000                   | 0.000                   |
| 950                                   | -41.849                | -79.902   | -3.445                 | 0.000                   | 0.000                   |
| 951                                   | -5.593                 | 299.202   | 194.602                | 0.000                   | 0.000                   |
| 952                                   | 10.813                 | -578.569  | -197.704               | 0.000                   | 0.000                   |
| 953                                   | 21.654                 | -157.681  | -1.185                 | 0.000                   | 0.000                   |
| 954                                   | -16.810                | -100.221  | -2.432                 | 0.000                   | 0.000                   |
| 955                                   | -1.674                 | 99.106  | 80.264                 | 0.000                   | 0.000                   |
| 956                                   | 6.518                  | -356.956  | -83.691                | 0.000                   | 0.000                   |
| 957                                   | 4.748                  | -253.967  | -4.550                 | 0.000                   | 0.000                   |
| 958                                   | 4.096                  | -217.403  | -2.979                 | 0.000                   | 0.000                   |
| 959                                   | 4.087                  | -218.994  | -2.504                 | 0.000                   | 0.000                   |

|     |         |          |          |       |       |
|-----|---------|----------|----------|-------|-------|
| 960 | 4.096   | -217.403 | -2.979   | 0.000 | 0.000 |
| 961 | 5.946   | -353.841 | -6.151   | 0.000 | 0.000 |
| 962 | 5.390   | -322.506 | -4.817   | 0.000 | 0.000 |
| 963 | 5.380   | -323.839 | -4.393   | 0.000 | 0.000 |
| 964 | 5.390   | -322.506 | -4.817   | 0.000 | 0.000 |
| 965 | 29.658  | -293.980 | -3.790   | 0.000 | 0.000 |
| 966 | -20.377 | -226.549 | -5.477   | 0.000 | 0.000 |
| 967 | -0.031  | -11.001  | 106.870  | 0.000 | 0.000 |
| 968 | 9.327   | -509.440 | -115.875 | 0.000 | 0.000 |
| 969 | 29.098  | -262.644 | -2.445   | 0.000 | 0.000 |
| 970 | -20.933 | -195.202 | -4.131   | 0.000 | 0.000 |
| 971 | -0.574  | 19.898   | 108.002  | 0.000 | 0.000 |
| 972 | 8.754   | -477.657 | -114.316 | 0.000 | 0.000 |
| 973 | 29.118  | -264.015 | -2.038   | 0.000 | 0.000 |
| 974 | -20.968 | -196.567 | -3.726   | 0.000 | 0.000 |
| 975 | -0.621  | 19.406   | 108.802  | 0.000 | 0.000 |
| 976 | 8.786   | -479.901 | -114.302 | 0.000 | 0.000 |
| 977 | 29.098  | -262.644 | -2.445   | 0.000 | 0.000 |
| 978 | -20.933 | -195.202 | -4.131   | 0.000 | 0.000 |
| 979 | -0.574  | 19.898   | 108.002  | 0.000 | 0.000 |
| 980 | 8.754   | -477.657 | -114.316 | 0.000 | 0.000 |
| 981 | 4.695   | -272.173 | -4.478   | 0.000 | 0.000 |
| 982 | 4.675   | -270.756 | -3.502   | 0.000 | 0.000 |
| 983 | 2.645   | -140.527 | -2.446   | 0.000 | 0.000 |
| 984 | 2.625   | -139.105 | -1.468   | 0.000 | 0.000 |

## PILE CAP DESIGN CALCULATION

### Self Weight Calculation

Self Weight : 141.054 kN  
Pedestal Weight : 35.689 kN  
Soil Weight : 85.541 kN  
Extra weight for Surcharge : 0.000 kN  
Buoyancy Reduction : 0.000 kN

### Maximum Pile Reactions for service load cases

| Reaction Type | Load case No. | Pile No. | X Coord. (m) | Z Coord. (m) | Reaction (kN) | Allowable (kN) |
|---------------|---------------|----------|--------------|--------------|---------------|----------------|
| Axial         | 822           | 4        | 0.700        | -0.700       | -374.686      | 665.000        |
| Lateral       | 823           | 1        | -0.700       | -0.700       | 31.956        | 52.900         |
| Uplift        | 823           | 4        | 0.700        | -0.700       | 149.836       | 412.300        |

### Maximum Pile Reactions for Ultimate Load Cases

Governing Load Case : 922

This is the load case for which the pilecap depth required is the maximum. If there are multiple load cases for which the same maximum depth is required, then the load case with the highest axial load (absolute value) is considered as the critical load case.

Total number of piles **N** : 4

| Pile No. | Arrangement |        | Reaction   |              |             |
|----------|-------------|--------|------------|--------------|-------------|
|          | X (m)       | Z (m)  | Axial (kN) | Lateral (kN) | Uplift (kN) |
| 1        | -0.700      | -0.700 | -462.091   | 50.741       | 0.000       |
| 2        | -0.700      | 0.700  | 0.000      | 50.741       | 66.994      |
| 3        | 0.700       | 0.700  | -21.301    | 50.741       | 0.000       |
| 4        | 0.700       | -0.700 | -550.386   | 50.741       | 0.000       |

### Reinforcement Calculation for Pile Cap

Maximum bar size allowed along length : # 16  
Maximum bar size allowed along width : # 16  
Bending Moment At Critical Section : -167.867 kNm (About Z-axis)  
Bending Moment At Critical Section : -327.038 kNm (About X-axis)  
Pile Cap Thickness **t** : 1.000 m  
Selected bar size along length : # 16  
Selected bar size along width : # 16  
Selected bar spacing along length : 97.25 mm  
Selected bar spacing along width : 97.25 mm

### Pile Cap Thickness Check

Critical Load Case : 922

### Two Way Shear Check For Pile Reactions

Critical Load Case : 922

Note:  $C_w$  = Column or Pedestal Width

$C_L$  = Column or Pedestal Length

| Pile No. | Pile Reactions<br>Contributing Two-way<br>Shear (kN) |
|----------|--|
| 1        | -193.076   |
| 2        | 27.992   |
| 3        | -8.900   |
| 4        | -229.969   |

Note: A value of 0.0 in the pile reaction contribution table signifies that the pile is located completely inside the punching shear boundary.

Punching shear force is calculated per CRSI method (Punching Shear = Applied Load + Self Weight - Pile reaction inside punching perimeter)

According to ACI-318-14 Clause No. 8.4.4.2, an additional factor is added to account for the moment effect

$$\text{Design Shear for Two-Way Action} = S_t = -266.940 \text{ kN}$$

$$\text{Beta} = \frac{C_L}{C_w} \text{ or } \frac{P_L}{P_w} = 1.000$$

$$b_0 = 2 \times (C_L + C_w + 2 \times d) \text{ or } 2 \times (C_L + C_w) = 6.336 \text{ m}$$

$$\text{ACI 318 - 14 Table 22.6.5.2, (b) : } V_{C1} = 0.17 \times \left(1 + \frac{2}{\beta}\right) \times \lambda \times \sqrt{f'_c} \times b_0 \times d = 14262.969 \text{ kN}$$

$$\text{ACI 318 - 14 Table 22.6.5.2, (c) : } V_{C2} = 0.083 \times \left(\frac{a_s \times d}{b_0} + 2\right) \times \lambda \times \sqrt{f'_c} \times b_0 \times d = 16864.769 \text{ kN}$$

$$\text{ACI 318 - 14 Table 22.6.5.2, (a) : } V_{C3} = 0.33 \times \lambda \times \sqrt{f'_c} \times b_0 \times d = 9228.980 \text{ kN}$$

$$V_C = \text{minimum of } (V_{C1}, V_{C2}, V_{C3}) = 9228.980 \text{ kN}$$

$$S_t \leq 0.75 V_C \text{ hence, safe}$$

### Check for One-way Shear in YZ Plane(Shear Line Parallel to Width)

Critical Load Case : 984

| Pile No. | Shear Force $x_1-x_1$ (kN) | Shear Force $x_2-x_2$ (kN) |
|----------|----------------------------|----------------------------|
| 1        | 0.000                      | 0.000                      |
| 2        | 0.000                      | 0.000                      |
| 3        | 0.000                      | 0.000                      |
| 4        | 0.000                      | 0.000                      |
| TOTAL    | 0.000                      | 0.000                      |

Note: A value of 0.0 in the pile reaction contribution table signifies that the position of the pile with respect to the one-way shear line is such that this pile does not contribute to the shear force. The reason is either the pile is located completely inside the zone bounded by the one-way shear line, or, it is on the other side of the pedestal / column.

$$\text{Design Shear for One-Way Action (Shear Line Parallel to Width)} = S_{OL} = 2.292 \text{ kN}$$

$$\text{Width of Shear Area} = b_w = 2.450 \text{ m}$$

$$V_C = 0.17 \times \lambda \times b_w \times d \times \sqrt{f'_c} = 1820.761 \text{ kN}$$

$$S_{OL} \leq 0.75 V_C \text{ Hence, safe}$$

### Check for One-way Shear in XY Plane(Shear Line parallel to Length)

Critical Load Case : 984

| Pile No. | Shear Force $z_1-z_1$ (kN) | Shear Force $z_2-z_2$ (kN) |
|----------|----------------------------|----------------------------|
| 1        | 0.000                      | 0.000                      |

|       |       |       |
|-------|-------|-------|
| 2     | 0.000 | 0.000 |
| 3     | 0.000 | 0.000 |
| 4     | 0.000 | 0.000 |
| TOTAL | 0.000 | 0.000 |

Note: A value of 0.0 in the pile reaction contribution table signifies that the position of the pile with respect to the one-way shear line is such that this pile does not contribute to the shear force. The reason is either the pile is located completely inside the zone bounded by the one-way shear line, or, it is on the other side of the pedestal / column.

$$\text{Design Shear for One-Way Action (Shear Line parallel to Length)} = S_{OL} = 2.292 \text{ kN}$$

$$\text{Width of Shear Area} = b_w = 2.450 \text{ m}$$

$$V_c = 0.17 \times \lambda \times b_w \times d \times \sqrt{f'_c} = 1820.761 \text{ kN}$$

$$S_{OL} \leq 0.75 V_c. \text{ Hence, safe}$$

#### Punching Shear Check for Corner Piles

| Pile No. | Shear Force (kN) |
|----------|------------------|
| 1        | -462.091         |
| 2        | 66.994           |
| 3        | -21.301          |
| 4        | -550.386         |

$$\text{Governing reaction (P}_c\text{)} = \text{maximum of (P}_i, P_j, \dots P_n\text{)} = 550.386 \text{ kN}$$

$$\text{Pile Edge distance (P}_e\text{)} = 0.525 \text{ m}$$

$$\text{Effective Depth (d)} = 0.826 \text{ m}$$

$$d_1 = \frac{P_{cr}}{\lambda \times \phi \times 0.33 \times \sqrt{f'_c} \left[ \frac{\pi}{4} \times (P_d + d) + 2 P_e \right]} \text{ OR } \frac{P_{cr}}{\lambda \times \phi \times 0.33 \times \sqrt{f'_c} \left[ \frac{\pi}{4} \times (P_d) + 2 P_e \right]} = 0.212 \text{ m}$$

$$d_2 = \frac{R_{cr}}{\lambda \times \phi \times 0.17 \times \sqrt{f'_c} \times \text{length of shear line}} = 0.239 \text{ m}$$

$$d_{\text{critical}} = \text{maximum of (d}_1, d_2\text{)} = 0.239 \text{ m}$$

$$d > d_{\text{critical}}. \text{ Hence, safe.}$$

#### Calculation of Maximum Bar Size

##### Along Length (Along global X)

$$\text{Selected maximum bar size} = \# 16$$

$$\text{Bar diameter corresponding to max bar size (d}_b\text{)} = 15.900 \text{ mm}$$

$$\text{Required development length for bars...} = \frac{d_b \times f_y}{2.1 \times \lambda \times \sqrt{f'_c}} = 0.558 \text{ m}$$

##### Along Width (Along global Z)

$$\text{Selected maximum bar size} = \# 16$$

$$\text{Bar diameter corresponding to max bar size (d}_b\text{)} = 15.900 \text{ mm}$$

$$\text{Required development length for bars} = \frac{d_b \times f_y}{2.1 \times \lambda \times \sqrt{f'_c}} = 0.558 \text{ m}$$

#### Selection of Reinforcement

##### Along Length (Along global X)

$$\text{Critical Load Case : 922}$$



Moments in pilecap due to individual pile reactions alone

| Pile No. | Moment about $x_1-x_1$ (kNm) | Moment about $x_2-x_2$ (kNm) |
|----------|------------------------------|------------------------------|
| 1        | -150.177                     | 0.000                        |
| 2        | 21.773                       | 0.000                        |
| 3        | 0.000                        | -6.923                       |
| 4        | 0.000                        | -178.872                     |

$$\text{Governing moment (M}_u\text{)after deducting the moments due to selfweight and surcharge} = \frac{\max(M_{t1}, M_{t2})}{0.9} = -167.867 \text{ kNm}$$

$$d\text{Beta} = \begin{cases} 0.85, & f'_c \leq 28 \text{ Mpa} \\ \max\left[0.65, 0.85 - \frac{0.05}{7}(f'_c - 28 \text{ Mpa})\right], & f'_c > 28 \text{ Mpa} \end{cases} = 0.650$$

$$\text{Maximum Reinforcement Ratio (R}_{\max}\text{)} = \frac{0.85 \times 600 \times d\text{beta} \times f'_c}{1.33 \times f_y \times (600 + f_y)} = 0.0180$$

$$\text{Minimum Reinforcement Ratio (R}_{\min}\text{)} = 0.0020$$

$$\text{Calculated Reinforcement Ratio (R)} = 0.0021$$

Note - Calculated Reinforcement Ratio reported here is the larger value between the Calculated Reinforcement Ratio and minimum steel ratio required as per code stipulations

$$R_{\min} \leq R \leq R_{\max}, R \text{ is accepted.}$$

$$\text{Minimum spacing allowed (S}_{\min}\text{)} = 1.5 \times d_b = 54 \text{ mm}$$

$$\text{Selected Bar Size} = \# 16$$

$$\text{Provided Number of Bars} = 25$$

$$\text{Provided spacing (S)} = 97.25 \text{ mm}$$

$$S_{\min} \leq S \leq 18 \text{ inch and selected bar size} < \text{selected maximum bar size. The reinforcement is accepted.}$$

Along Width (Along global Z)

$$\text{Critical Load Case} = 922$$

Moments in pilecap due to individual pile reactions alone

| Pile No. | Moment about $z_1-z_1$ (kNm) | Moment about $z_2-z_2$ (kNm) |
|----------|------------------------------|------------------------------|
| 1        | -150.177                     | 0.000                        |
| 2        | 0.000                        | 21.773                       |
| 3        | 0.000                        | -6.923                       |
| 4        | -178.872                     | 0.000                        |

$$\text{Governing moment (M}_u\text{)after deducting the moments due to selfweight and surcharge} = \frac{\max(M_{t1}, M_{t2})}{0.9} = -327.038 \text{ kNm}$$

$$d\text{Beta} = \begin{cases} 0.85, & f'_c \leq 28 \text{ Mpa} \\ \max\left[0.65, 0.85 - \frac{0.05}{7}(f'_c - 28 \text{ Mpa})\right], & f'_c > 28 \text{ Mpa} \end{cases} = 0.650$$

$$\text{Maximum Reinforcement Ratio (R}_{\max}\text{)} = \frac{0.85 \times 600 \times d\text{beta} \times f'_c}{1.33 \times f_y \times (600 + f_y)} = 0.0180$$

$$\text{Minimum Reinforcement Ratio (R}_{\min}\text{)} = 0.0020$$

$$\text{Calculated Reinforcement Ratio (R)} = 0.0021$$

Note - Calculated Reinforcement Ratio reported here is the larger value between the Calculated Reinforcement Ratio and minimum steel ratio required as per code stipulations

$$R_{\min} \leq R \leq R_{\max}, R \text{ is accepted.}$$

Minimum spacing allowed ( $S_{min}$ ) =  $1.5 \times d_b$  = 54 mm

Selected Bar Size = # 16

Provided Number of Bars = 25

Provided spacing (S) = 97.25 mm

$S_{min} \leq S \leq 18$  inch and selected bar size < selected maximum bar size. The reinforcement is accepted.

### Pedestal Design

| Pedestal at Support No. | Axial Capacity Ratio, Critical Load Case, Location | Flexural Capacity Ratio | % of Main Steel | Main Reinforcement | Links     |
|-------------------------|--|-------------------------|-----------------|--------------------|-----------|
| 4                       | 0.088, 922, Bottom                                 | 0.966                   | 1.380           | 20-#22             | 10 @ 300m |

### Pedestal Size

Pedestal Shape = Rectangular

Dimension Along Global X = 750.000 mm

Dimension Along Global Z = 750.000 mm

### Longitudinal Reinforcement Details

Area of Longitudinal Bars = 7741.600 sq.mm

Number of Bars and Bar Dia = 20-#22

Longitudinal Steel Percentage = 1.380

Bar arrangement sequence on each side along Global X = 6 # 22

Bar arrangement sequence on each side along Global Z = 6 # 22

### **Flexure - Governing Load Case Details**

Governing Load Case Number = 939

Critical Location = Bottom

Axial load = -269.681 kN

Moment about X axis = 763.062 kNm

Moment about Z axis = 67.214 kNm

Resultant moment = 766.016 kNm

Moment Capacity = 792.580 kNm

Angle of inclination of Neutral Axis with respect to local Z = 84.966 degrees

| Serial No. | P (kN)    | M (kNm)  | Strength Reduction Factor ( $\Phi$ ) |
|------------|-----------|----------|--------------------------------------|
| 1          | -2717.302 | 0.000    | 0.900                                |
| 2          | -2714.238 | 1.237    | 0.900                                |
| 3          | -2565.916 | 57.849   | 0.900                                |
| 4          | -1517.572 | 408.342  | 0.900                                |
| 5          | -486.491  | 731.287  | 0.900                                |
| 6          | 405.093   | 982.132  | 0.900                                |
| 7          | 1233.655  | 1187.356 | 0.900                                |
| 8          | 1979.271  | 1341.979 | 0.900                                |
| 9          | 2712.719  | 1455.537 | 0.890                                |
| 10         | 2948.150  | 1435.794 | 0.846                                |
| 11         | 3130.704  | 1407.199 | 0.808                                |
| 12         | 3331.375  | 1382.793 | 0.774                                |
| 13         | 3492.987  | 1351.155 | 0.744                                |
| 14         | 3663.845  | 1320.072 | 0.717                                |
| 15         | 3816.356  | 1286.718 | 0.693                                |
| 16         | 3973.809  | 1252.884 | 0.671                                |
| 17         | 4139.011  | 1209.336 | 0.651                                |
| 18         | 4415.963  | 1189.768 | 0.650                                |
| 19         | 4745.930  | 1169.767 | 0.650                                |
| 20         | 5019.135  | 1148.174 | 0.650                                |
| 21         | 5322.507  | 1123.696 | 0.650                                |
| 22         | 5587.129  | 1098.270 | 0.650                                |
| 23         | 5877.231  | 1068.211 | 0.650                                |
| 24         | 6128.748  | 1038.294 | 0.650                                |
| 25         | 6404.099  | 1003.209 | 0.650                                |
| 26         | 6658.297  | 967.319  | 0.650                                |
| 27         | 6920.649  | 927.205  | 0.650                                |
| 28         | 7390.627  | 845.969  | 0.650                                |
| 29         | 7879.815  | 748.137  | 0.650                                |
| 30         | 8364.901  | 636.629  | 0.650                                |
| 31         | 8842.245  | 512.585  | 0.650                                |
| 32         | 9288.999  | 382.987  | 0.650                                |
| 33         | 9727.681  | 242.183  | 0.650                                |
| 34         | 9996.293  | 150.062  | 0.650                                |

| Serial No. | P<br>(kN) | M<br>(kNm) | Strength Reduction Factor<br>( $\phi$ ) |
|------------|-----------|------------|---|
| 35         | 10071.142 | 127.704    | 0.650                                   |
| 36         | 10152.247 | 108.376    | 0.650                                   |
| 37         | 10218.200 | 91.685     | 0.650                                   |
| 38         | 10275.165 | 77.212     | 0.650                                   |
| 39         | 10323.411 | 64.604     | 0.650                                   |
| 40         | 10364.377 | 53.535     | 0.650                                   |
| 41         | 10399.185 | 43.842     | 0.650                                   |
| 42         | 10429.070 | 35.282     | 0.650                                   |
| 43         | 10455.738 | 27.614     | 0.650                                   |
| 44         | 10497.053 | 15.150     | 0.650                                   |
| 45         | 10527.409 | 5.641      | 0.650                                   |
| 46         | 10543.804 | 0.362      | 0.650                                   |
| 47         | 10544.307 | 0.191      | 0.650                                   |
| 48         | 10544.608 | 0.000      | 0.650                                   |

#### Shear - Governing Load Case Details

Critical Load Case for Shear Along X = 918  
 Critical Load Case for Shear Along Z = 923  
 Shear force along X = 69.746 kN  
 Shear force along Z = 206.656 kN

#### Transverse Stirrups Details

Rebar Links = 10 @ 300 mm  
 No. of Legs in X direction = 6  
 No. of Legs in Z direction = 6

#### Material Take Off

##### Footing Reinforcement

| Direction         | Size  | Number | Total Length (m) | Weight (kg) |
|-------------------|-------|--------|------------------|-------------|
| Along X on Bottom | 16 mm | 25     | 58.75            | 91.19       |
| Along Z on Bottom | 16 mm | 25     | 58.75            | 91.19       |
| Along X on Top    | N/A   | N/A    | N/A              | N/A         |
| Along Z on Top    | N/A   | N/A    | N/A              | N/A         |

##### Pedestal Reinforcement

| Type                       | Size  | Number | Total Bar Length<br>(m) | Weight (kg) |
|----------------------------|-------|--------|-------------------------|-------------|
| Main Steel<br>(Vertical)   | 22 mm | 20     | 73.98                   | 225.03      |
| Transverse Steel<br>(Ties) | 10 mm | 3      | 8.26                    | 4.62        |
| Internal Steel<br>(Ties)   | 10 mm | 24     | 19.26                   | 10.78       |

Total Reinforcement Weight : 422.81 kg

#### Concrete

| -        | Length (m) | Width (m) | Thickness (m) | Volume (m <sup>3</sup> ) |
|----------|------------|-----------|---------------|--------------------------|
| Footing  | 2.45       | 2.45      | 1.00          | 6.00                     |
| Pedestal | 0.75       | 0.75      | 2.70          | 1.52                     |

Total Concrete Volume : 7.52 m<sup>3</sup>

#### Formwork

Footing : 9.80 m<sup>2</sup>  
 Pedestal : 8.10 m<sup>2</sup>  
 Total : 17.90 m<sup>2</sup>

#### Soil Excavation

Pit Depth : 1.85 m  
 Pit Slope (a : b) : 1 : 1 (Assumed)  
 Side Distance, s : 0 (Assumed)

Excavation Volume : 36.32 m<sup>3</sup>

Backfill Volume : 29.84 m<sup>3</sup>