DRILLED-IN DISPLACEMENT MICROPILE (DDM) DESIGN GUIDELINES

STRUCTURAL CAPACITY:

Design DDM's using the structural capacity of the full-length steel tube and the interior, confined grout column (Refer to table 1). Another factor in determining the central shaft is the torque required to advance the pile to the required depth. The torque required is a function of the type of soil and volume of soil that is being displaced (Refer to table 1). Little to no torque is required for shaft friction since the diameter of the annulus created by the displacement head exceeds the diameter of both the central shaft and the reverse grout auger. Also, the shaft is 'lubricated' by the grout that fully encapsulates the steel shaft and reverse grout auger.

GEOTECHNICAL CAPACITY:

Design DDM's as a displacement pile using the diameter of the deformation, not the displacement, for the bond. Several methods are available to estimate the ultimate geotechnical capacity of the DDM. The Federal Highway Administration's "Micropile Design and Construction Reference Manual", December, 2005 (FHWA NHI-05-039) provides guidance on analyzing the ultimate bond strength of the pile. Empirical evidence has proven that the jagged, irregular grout-to-ground interface created by the deformation structure typically produces results comparable to Type B grout-to-ground bond values presented in FHWA NHI-05-039, Table 5-3. Meyerhof, G.G., 1976 provides methods for analyzing end bearing capacity. The area of the drive plate may be used for end bearing capacity as is appropriate for the particular application. AllPile or LPile design software programs are typically used to analyze lateral capacities. For design in highly plastic soils, modification of pile configurations may be necessary to address the unique characteristics of this soil type. Consult with the IDEAL Design Team for project specific recommendations.

LOAD TEST ESTABLISHES STANDARD FOR PRODUCTION PILES:

DDM's are typically load tested in accordance with applicable ASTM standards (i.e., D3689 for tension, D1143 for compression, and / or D3966 for lateral loading) to verify or determine their geotechnical capacity. As in all pile types, the load test establishes the installation parameters including depth, grout take, and capacity for production piles in the job specific soil. Empirical evidence has proven that the mechanical method used to displace soil, and the immediate grout occupancy of the annulus created, provides for a high degree of repeatability of the test pile throughout similar soils at the jobsite.

WATER TABLE:

Since the viscosity of the grout mix is approximately two times the viscosity of water, no alteration of STELCOR design or installation is required with high water table.

TABLE 1:

STELCOR CONFIGURATION & SELECTION GUIDE

	STEEL/GROUT COMPONENTS			INSTALLATION			CAPACITY
PART #	STEEL CORE O.D. X W.T. (INCHES)	TIP O.D. (DRIVE PLATE) (INCHES)	NOMINAL GROUT COLUMN O.D. (DEFORMATION STRUCTURE) (INCHES)	MAX TORQUE (FT*LBS)	BPF THAT MAY REQUIRE PRE-AUGERING	DRIVE MOTOR REQUIRED (FT*LBS)	ALLOWABLE STRUCTURAL CAPACITY (KIPS)
SC1200-350300-14129-7	3.50x0.300	14	12	17,200	15+	20,000	105.2
SC1200-450290-14129-7-2	4.50x0.290	14	12	26,500	20+	30,000	138.7
SC1200-450290-14129-7-3	4.50x0.290	14	12	33,500	25+	40,000	138.7
SC1200-550361-14129-8-2	5.50x0.361	14	12	40,000	25+	50,000	210.2
SC1200-550361-14129-8-3	5.50x0.361	14	12	60,000	35+	70,000	210.2
SC1200-550415-14129-8-3	5.50x0.415	14	12	60,000	35+	70,000	234.8
SC1400-450290-161411-7-2	4.50x0.290	16	14	26,500	20+	30,000	138.7
SC1400-450290-161411-7-3	4.50x0.290	16	14	33,500	20+	40,000	138.7
SC1400-550361-161411-8-2	5.50x0.361	16	14	40,000	20+	50,000	210.2
SC1400-550361-161411-8-3	5.50x0.361	16	14	60,000	30+	70,000	210.2
SC1400-550415-161411-8-3	5.50x0.415	16	14	60,000	30+	70,000	234.8
SC1600-550361-181613-8-2	5.50x0.361	18	16	40,000	20+	50,000	210.2
SC1600-550361-181613-8-3	5.50x0.361	18	16	60,000	30+	70,000	210.2
SC1600-550415-181613-8-3	5.50x0.415	18	16	60,000	30+	70,000	234.8
SC1600-700408-181613-11	7.00x0.408	18	16	70,000	35+	80,000	310.0
SC1600-700408-181613-11-O	7.00x0.408	18	16	120,000	45+	130,000	310.0
SC1600-700453-181613-11	7.00x0.453	18	16	130,000	50+	130,000	336.7
SC1800-700408-201815-11	7.00x0.408	20	18	70,000	35+	80,000	310.0
SC1800-700408-201815-11-O	7.00x0.408	20	18	120,000	45+	130,000	310.0
SC1800-700453-201815-11	7.00x0.453	20	18	130,000	50+	130,000	336.7
SC2000-700408-222017-11	7.00x0.408	22	20	70,000	30+	80,000	310.0
SC2000-700453-222017-11-O	7.00x0.408	22	20	120,000	45+	130,000	310.0
SC2000-700453-222017-11	7.00x0.453	22	20	130,000	45+	130,000	336.7

NOTES:

1. Structural capacities are calculated in accordance with the 2014 New York City Building Code (NYCBC 2014) and the 2012 & 2015 International Building Code (IBC 2012 & IBC 2015) using an 80 KSI steel core filled with 4 KSI grout.
2. For geotechnical design, use the Grout column O.D. which is the diameter of the Deformation Structure.
3. Installation parameters can vary depending on site specific soils.
4. This table is a guide only. Additional shaft sizes and grout configurations can be utilized for specific projects.

Key Concepts:

- The pile shaft provides unbroken structural integrity from the tip to the top of the pile
- The interior, confined grout column is pure grout and can be calculated as such
- The exterior grout column is dependably created due to:
    - The 'screw pump' action of the reverse grout auger driving the grout down at 3 times the pile installation rate.
    - The increase in hydraulic pressure of the grout column as the overburden pressures of the soil and water increase.

The STELCOR Drilled-In Displacement Micropile has been likened to an 'epoxied screw'. Exhumed STELCOR in different soils shown below: