

TABLE OF CONTENTS

1.0	Introduction.....	1
1.1	Scope of Guidelines.....	2
1.2	History.....	2
2.0	Definitions.....	4
3.0	METHODS AND APPLICATIONS.....	8
3.1	Mixing Methods.....	8
3.1.1	Single Axis Methods.....	9
3.1.2	Multiple Axis Methods.....	9
3.1.3	Horizontal Axis Mixing.....	10
3.1.4	Cutter Wheel Method.....	10
3.1.5	Trench Mixing Method.....	10
3.1.6	Mixing With High Energy Jetting.....	11
3.2	Applications.....	11
3.2.1	Earth Retention.....	11
3.2.2	Liquefaction Mitigation.....	12
3.2.3	Groundwater Seepage Control and Containment Isolation.....	13
3.2.4	Bearing Capacity Improvement.....	14
3.2.5	Deep Foundations.....	15
3.2.6	Mass Stabilization, Contamination Containment and Base Stability.....	16
3.2.7	Embankment, Levee and Dam Strengthening and Stabilization.....	17
3.2.8	Casing Replacement.....	19
4.0	Site Investigation and Feasibility.....	21
4.1	Project Information.....	21
4.2	Geotechnical Information.....	22
4.3	Feasibility.....	22
5.0	Construction Considerations.....	24
5.1	Contractor Qualifications.....	24
5.2	Mix Design.....	24
5.2.1	Binders.....	24
5.2.2	Binder Slurries.....	25
5.2.3	Bentonite.....	25
5.2.4	Admixtures.....	25
5.2.5	Mix Water.....	25
5.2.6	Water-to-Binder Ratio of Binder Slurry.....	25
5.3	Air Injection During Mixing.....	26
5.4	Mixing Energy.....	26
5.5	Constructing Long Elements.....	26
5.6	Inserting Steel Piles in Soil-Mixed Material.....	28
5.7	Obstructions.....	28
5.8	Termination Depth.....	28
5.9	Spoils Handling.....	29
5.10	Production Rates.....	29
6.0	Treated Soil Properties.....	30
6.1	Index Properties of Treated Soil.....	30

	6.1.1	Binder Content	30
	6.1.2	Binder Factor	30
	6.1.3	Volume Ratio.....	30
6.2		Common Mechanical Properties of Treated soil	31
	6.2.1	Unconfined Compressive Strength.....	31
	6.2.2	Shear Strength	33
	6.2.3	Tensile Strength	33
	6.2.4	Elastic Modulus	34
	6.2.5	Poisson's Ratio	34
	6.2.6	Permeability	34
	6.2.7	Durability	34
	6.2.8	Unit Weight	34
7.0		Quality Control and Quality Assurance (QC/QA).....	36
	7.1	DMM Acceptance Criteria	36
	7.1.1	Geometric Tolerances.....	36
	7.1.2	Treated Soil Uniformity.....	37
	7.1.3	Treated Soil Strength	38
	7.1.4	Treated Soil Permeability	38
	7.2	Pre-Construction Testing	39
	7.2.1	Exploratory Borings and Laboratory Soil Testing	39
	7.2.2	Bench Scale Testing	39
	7.2.3	Field Trial Section (Contract Test Section).....	41
	7.3	Quality Control	42
	7.3.1	Horizontal Alignment	42
	7.3.2	Vertical Alignment	42
	7.3.3	Depth	42
	7.3.4	Mixing Parameters	43
	7.3.5	Binder Parameters	44
		7.3.5.1 Handling and Slurry Preparation.....	44
		7.3.5.2 Binder Injection Rate	44
	7.4	Quality Assurance.....	44
	7.4.1	Visual Inspection	44
		7.4.1.1 Continuous Sampling Methods.....	45
		7.4.1.2 Continuous Downhole Televiewers.....	45
	7.4.2	Unconfined Compression Tests	46
		7.4.2.1 Wet Samples	46
		7.4.2.2 Core Samples	46
	7.4.3	Permeability Testing.....	46
		7.4.3.1 Wet Sample Permeability Testing.....	47
		7.4.3.2 <i>In situ</i> Permeability Testing.....	47
	7.4.4	Reporting Requirements	48
8.0		Cost Considerations	50
	8.1	Mixing Costs	50
	8.2	Engineering Costs	51
	8.3	Quality Assurance Costs.....	51
	8.4	Mobilization/Demobilization	51

9.0	REFERENCES.....	52
	Appendix - Deep Mixing Method (DMM) Guide Specifications.....	54