
CONTENTS

Preface

Chapter 1 Shallow Foundations

	History, Concepts, and Types	
1.2	Miscellaneous Details Regarding Shallow Foundations	5
	1.2.1 Freeze-Thaw Zones 1.2.2 Frost Heave 1.2.3 Ground Water Level 1.2.4 Scour 1.2.5 Expansive Soils 1.2.6 Creep-Sensitive Soils 1.2.7 Ground Subsidence 1.2.8 Collapsing Soils (including Loess) 1.2.9 Rockhead Formations (including Karst Formations) 1.2.10 Underground Facilities 1.2.11 Adjacent Structures	
1.3	Bearing Capacity Theory	24
1.4	Shallow Foundation Design	31
	1.4.1 Spread Footings 1.4.2 Continuous Footings 1.4.3 Combined Footings 1.4.4 Mat Footings 1.4.5 Footing Flexibility 1.4.6 Compensated and Raft Footings	
1.5	Footing Settlement	40
	1.5.1 Immediate Settlement 1.5.2 Time-Dependent Settlement 1.5.3 Allowable Settlement	
	Problems	51
	References	55

Chapter 2 Deep Foundations

2.1	Overview	57
2.2	History, Concepts, and Types	57
2.3	Types of Deep Foundations	58
	2.3.1 Piles 2.3.2 Piers 2.3.3 Caissons	
2.4	Design of Deep Foundations	86
	2.4.1 Loads 2.4.2 Classical Dynamic Methods 2.4.3 Static Methods 2.4.4 Exploration Design Methods 2.4.5 Advanced	

Deep Foundation Design Methods	2.4.6	Pile Load Tests	2.4.7	Pile Group Capacity	2.4.8	Single Pile Settlement	2.4.9	Pile Group Settlement	2.4.10	Lateral Movement Problems	132				
References											137				
Chapter 3	Soil Stability										140				
3.1	Background, Concepts, and Methods										140				
3.2	Unbraced Excavations										142				
3.3	Braced Excavations										143				
3.3.1	Overview	3.3.2	Skeleton Sheeting	3.3.3	Design Elements of Continuous Sheeting							3.3.4	Soldier Beams and Lagging	3.3.5	Continuous Sheeting
3.4	Permanent Construction Walls										161				
3.4.1	Sheet Pile Bulkheads		3.4.2	Continuous Concrete Piles								3.4.3	Diaphragm (Slurry) Walls		
3.5	Anchors and Tiebacks														
3.5.1	Rock Anchors		3.5.2	Soil Tiebacks		3.5.3	Soil Nailing					3.5.4	Reinforced Earth		
3.6	Underpinning										195				
	Problems										202				
	References										208				
Chapter 4	In Situ Densification Methods in Granular Soils										210				
4.1	Introduction										210				
4.2	Vibration at the Ground Surface										215				
4.3	Impact at the Ground Surface										223				
4.4	Vibration at Depth										226				
4.5	Impact at Depth										231				
	Problems										234				
	References										236				
Chapter 5	In Situ Densification Methods in Cohesive Soils										238				
5.1	Introduction										238				
5.2	Preloading or Dewatering										239				
5.3	Radial Drainage via Drain Wells										246				
5.4	Electrical Methods										256				
5.5	Thermal Methods										259				
	Problems										266				
	References										269				
Chapter 6	Grouting										270				
6.1	Overview										270				
6.2	Suspension Grouts										271				
6.2.1	Grouting with Soil Itself		6.2.2	Grouting with Bentonite-Cement Mixes								6.2.3	Grouting with Cement Mixes		
6.2.4	Grouting with Asphalt Emulsions														

6.3	Solution Grouts	278
	6.3.1 Silicate Derivatives 6.3.2 Lignosulfate Derivatives (Chromlignins) 6.3.3 Polyacrylamides 6.3.4 Phenoplasts 6.3.5 Aminoplasts 6.3.6 Water-Reactive Grouts 6.3.7 Water-Reactive Foam Grouts 6.3.8 Summary	
6.4	Grouting Equipment and Methods	287
	6.4.1 Drilling of Grout Holes 6.4.2 Injection Methods 6.4.3 Grout Plant Equipment 6.4.4 Grout Injection Measurements	
6.5	Grouting Designs and Layouts	294
	6.5.1 Seepage Control in Rock under Dams 6.5.2 Seepage Control in Soil under Dams 6.5.3 Seepage Control in Soil for Advancing Tunnels 6.5.4 Seepage Control in Soil for Cutoff Walls (Jet Grouting) 6.5.5 Stabilization Grouting in Soil in Advance of Tunnels 6.5.6 Stabilization Grouting for Underpinning	
6.6	Grout Monitoring Schemes	302
	Problems	305
	References	307
Chapter 7	Geotextiles (Filter Fabrics)	309
7.1	Overview	309
7.2	Geotextiles as Separators	314
7.3	Geotextiles as Reinforcement	318
7.4	Geotextiles in Filtration and Drainage	326
7.5	Geotextiles in Erosion Control	334
	7.5.1 Use of Geotextiles Alone 7.5.2 Geotextiles beneath Rock Rip-Rap 7.5.3 Geotextiles beneath Precast-Articulated Concrete Blocks 7.5.4 Erosion Control Mattresses 7.5.5 Geotextiles as Silt Fences	
7.6	Geotextiles as Flexible Forms	344
	7.6.1 Providing for Uniform Bearing 7.6.2 Remedying Scour beneath Existing River Piers 7.6.3 Providing Support and Stability for Underwater Pipelines 7.6.4 Pile Jacketing 7.6.5 In Situ Columns for Providing Mine and Cavern Stability	
7.7	Summary	350
	Problems	351
	References	354
Chapter 8	Landfilling, Liners, and Covers for Waste Disposal	356
8.1	Overview	356
8.2	Proper Landfilling Procedures	357
8.3	Landfill Gas Generation and Movement	362
8.4	Landfill Leachate Generation and Movement	364
8.5	Landfill Liners Including Geomembranes	365
	8.5.1 Rigid Liners 8.5.2 Flexible Liners (Natural Materials) 8.5.3 Flexible Liners (Synthetic Materials)	

8.6	Landfill Caps (Closures)	390
8.7	Seepage Cutoff Walls	392
	Problems	394
	References	397

Chapter 9 Foundation Control Techniques 399

9.1	Overview	399
9.2	Laboratory Testing	400
9.3	Traditional Field Testing	401
	9.3.1 Standard Penetration Test (SPT) 9.3.2 Vane Shear Test 9.3.3 Cone Penetration Test 9.3.4 Pressuremeter Test	
9.4	Nondestructive Testing (NDT), including Geophysics	407
	9.4.1 Seismic Reflection 9.4.2 Seismic Refraction	
	9.4.3 Electrical Resistivity 9.4.4 Magnetometry	
	9.4.5 Ground-Probing Radar (GPR) 9.4.6 Continuous-Wave (CW) Microwave 9.4.7 Eddy Current Methods (Metal Detector and Inductance Methods) 9.4.8 Pulse-Echo Ultrasonics 9.4.9 Acoustic Emission (AE) 9.4.10 Heat Pulse 9.4.11 Nuclear Methods 9.4.12 Borehole Monitoring Methods	
9.5	Foundation Instrumentation	419
	9.5.1 Load Measurement 9.5.2 Earth Pressure Measurement 9.5.3 Deformation Monitoring 9.5.4 Pore Water Pressure Measurement 9.5.5 Summary	
	Problems	434
	References	437

Appendixes

A	Soil Classification Systems, Soil Components and Fractions, and Engineering Use Chart	
B	A Collection of Typical Soil Properties and Representative Laboratory Test Values	448
C	Technical Details of Various Impact Pile Hammers	460
D	Technical Details of Various Vibratory Pile Drivers	471
E	Geotextile (Filter Fabric) Directory	474
F	Geomembrane (Flexible Membrane), Bentonite, and Other Liner Systems Directory	479

Index