CONTENTS

· 78 年 6,0	Correlations between end, end, and end median Grain Size (3.7
	to the SI Edition vi 88 yranumu 88	
Preface	Sevil fice tions for Field Companion 186 88 analdor9	
MindTap	References PAR Common Particular State Common Particular Course	
	ne Authors xiii	
	Plasticity and Structure of Solls 95 or and leader	
1	Geotechnical Engineering—A Historical Perspec	ctive
1.1	Introduction 1 20 (AA) time I bisped	
1.2	Geotechnical Engineering Prior to the 18th Century 1	
1.3	Preclassical Period of Soil Mechanics (1700–1776) 5	
1.4	Classical Soil Mechanics—Phase I (1776-1856) 6 11 29 24 11112	
1.5	Classical Soil Mechanics - Phase II (1856-1910) 6 nd wildings	
1.6	Modern Soil Mechanics (1910–1927). 7	4.7
1.7	Geotechnical Engineering after 1927 8 The Mario Violenta	
1.8	End of an Era 13 www 237 811 supported find	
	References 14 mission of Hospital Section (SEC) Viginimula	4.10
	Relationalities for Hydracisc Conductivity - Granuk Stationalders	
2	Origin of Soil and Grain Size 16 551 See 16199	
2.1	Introduction 16	
2.2	Introduction 16 Rock Cycle and the Origin of Soil 16 Rock Experies Minerals Back Structures 27	
2.3	Rock-Forming Minerals, Rock and Rock Structures 127	5.1
2.4	Soil-Particle Size 28 Total modeoffice of learning	5,2
2.5	Clay Minerals 30 CE1 workering Behavior 132 Classification	
2.6	Specific Gravity (G _s) 38 TT mistaya nousantizasio OTHZAA	5.4.
2.7	Mechanical Analysis of Soil 39 state of controlled Soil Office Soil 39 state of Soil Office Soil 39 state of Soil Office Soil	
2.8	Particle-Size Distribution Curve 48 A and massived northern Control 48	
2.9	Particle Shape 55 021 vismmu2	5,7
2.10	Summary 57	
	References 155	
	References 63	
12.0	Soil Compaction 156 - 145 musabentel	
3	Weight-Volume Relationships 64 64 moissuborant	1.8
3.1	Compaction—General Principles 157 64 noitsubortnI	
3.2	Weight-Volume Relationships 64 881 1861 1000009 brisband	8.8
3.3	Relationships among Unit Weight, Void Ratio, Moisture Content, and Specific Gravity 68	6,4

3.4	Relationships among Unit Weight, Porosity, and Moisture Content	72
3.5	Relative Density 80	
3.6	Comments on e_{max} and e_{min} 83) ₅₀) 85
3.7	Correlations between e_{max} , e_{min} , $e_{\text{max}} - e_{\text{min}}$, and Median Grain Size (<i>L</i>	50)
3.8	Summary 66	resier9
	1100icins 66	
	References 94 or serio 3 anno 0 q	
4	Plasticity and Structure of Soil 95	
4.1	Introduction 95 and A-participant isolation	
4.2	Liquid Limit (LL) 95	
4.3	Plastic Limit (PL) 105 od o o rord garaenigal I soindssice	
4.4	Plasticity Index (1700/071) seined and Mechanics (1700/7017) (xellost plasticity Index)	5.1
4.5	Classical Soit Mechanics—Phase I (1881) (1881) Similar Mechanics	
4.6	Liquidity Index and Consistency Index 113 dos M had Isabes 12	
4.7	Activity 114 7 (CCPL-0191) sciendaeM line maboth	
4.8	Plasticity Chart 117 8 7501 reflegangement leaden solution	
4.9	Soil Structure 118	
4.10	Summary 123	
	Problems 124	
	References 127 ar esile mesile time light to might	
	larroduction 16	1.5
5	Classification of Soil 129 mginO and bas slave and	
5.1	Rock-Forming Minerals, Rock and Rock Struce 129 s noisubortal	8.8
5.2	Textural Classification 130 85 axi2 alahari Jio2	2.4
5.3	Classification by Engineering Behavior 132 (18 Alarania val.)	
5.4	AASHTO Classification System 132 88 (1) yilvan O olioog8	
5.5	Unified Soil Classification System 1362 to availant A Isoinadool A	
5.6	Comparison between the AASHTO and Unified Systems 139	8.5
5.7	Summary 150 Canada Sanara Sana	0.5
	Problems 151	01.9
	References 155	
	References 63	
6	Soil Compaction 156	
6.1	Introduction 156 agirlenous less emula V-IngleW	
6.2	Compaction—General Principles 157	
6.3	Standard Proctor Test 158 40 agridanoital and armioV-trigioW	
6.4	Factors Affecting Compaction 162	

6.5	Modified Proctor Test 165 and ordered as large states and the state of	
6.6	Empirical Relationships 167 macf street as designed sesquel	
6.7	Structure of Compacted Clay Soil 177	
6.8	Effect of Compaction on Cohesive Soil Properties 178	
6.9	Field Compaction 181	
6.10	Specifications for Field Compaction 186 who who will be a second or second o	
6.11	Determination of Field Unit Weight of Compaction 188	
6.12	Evaluation of Soils as Compaction Material 195	
6.13	Special Compaction Techniques 195	
6.14	Summary 204	
	Problems 205	
	References 210 enapsed without Seepage 210 Stresses in Sarurated Soil without Seepage 210 Stresses	
7	Permeability 212 Permea	
7.1	Introduction 212	
7.2	Bernoulli's Equation 212 Demonstrated to State of Sta	
7.3	Darcy's Law 215 years to no be entire exercise of rights to be 217	
7.4	Hydraulic Conductivity 217 and a Village of Every Property 218 and 18 an	
7.5	Laboratory Determination of Hydraulic Conductivity 218 quality Conductivity Conduct	
7.6	Relationships for Hydraulic Conductivity—Granular Soil 226	
7.7	Relationships for Hydraulic Conductivity—Cohesive Soils 232	
7.8	Directional Variation of Permeability 238 and amount of Permeability 238	
7.9	Equivalent Hydraulic Conductivity in Stratified Soil 239	
7.10	Permeability Test in the Field by Pumping from Wells 244	
7.11	Permeability Test in Auger Holes 248	
	Hydraulic Conductivity of Compacted Clayey Soils 250	
7.13	Moisture Content—Unit Weight Criteria for Clay Liner Construction 252	5:01
7 1 4		
1.14	Summary 253 Problems 254 SEE BOOLINIO AND BEEF BEEF BOOLINIO AND BEEF BEEF BEEF BEEF BEEF BEEF BEEF BEE	
	References 259 bed I still to I row will be sun D seed 259	
	The trans I am I I was How and have I seem I seem I want	
0	Seepage 261 Stephan Vertical Stephan Seepage 261	
8	Seepage 261	
8.1	Vertical Stress Caused by a Horizontal Simp 161 and Vertical Stress Caused by a Horizontal Simp 161 and Stress Caused by a Horizontal Stress Caused by Anna Stress Caused by A	
8.2	Laplace's Equation of Continuity 261 and galess and vires and	
8.3	Vertical Stress Due to Embandanent Loading 263 serviced Stress Due to Embandanent Loading	
8.4	Seepage Calculation from a Flow Net 265 model agont a holdest	
8.5	Flow Nets in Anisotropic Soil 271	
8.6	Mathematical Solution for Seepage 274	

8.7	Uplift Pressure under Hydraulic Structures 276	G.
8.8	Seepage through an Earth Dam on an Impervious Base 277	8.
8.9	L. Casagrande's Solution for Seepage through an Earth Dam 28	30
8.10	Pavlovsky's Solution for Seepage through an Earth Dam 282	8.
8.11	Filter Design 286 181 nontremo bleft	83
8.12	Summary 290 del notification for Field Compaction 186 del mary	
	Problems 290 transport of Compaction of Field Unit Weight of Compaction	PT.
	Evaluation of Soils as Compaction Material 1492 sennes	
14	Special Compaction Techniques (1957) 1818 Special Compaction Techniques	81.
9	In Situ Stresses 295	
9.1	Problems 205 continuous 205 continuo	
9.2	References 210	
9.3		
9.4	Stresses in Saturated Soil with Upward Seepage 301 Stresses in Saturated Soil with Downward Seepage 304	
9.5	Seepage Force 306	+ 1
9.6	Heaving in Soil Due to Flow around Sheet Piles 309	
9.7	Use of Filters to Increase the Factor of Safety against Heave 313	
9.8	Effective Stress in Partially Saturated Soil 318 Blood address Heave	A.
9.9	Capillary Rise in Soils 319 and Hydraglia Agraetic Capillary Rise in Soils 319 and Hydraglia Rise in Soils 319 a	ð.
	Effective Stress in the Zone of Capillary Rise 322 gidanoital 9	а.
	Relationships for Hydraulic Conductivity - Cohecks Syrammus	
	Directional Variation of Permeability 238 288 smallorq	8.
	References 1330 Shifted in Virginia Conductivity in Stration Office Hydraulic Conductivity in Strategic Conductivity in St	
	Permeability Test in the Field by Pumping from Wells 244 and	
10	Stresses in a Soil Macco 32 ton A ni tel Villacona	
10.1	Hydraulic Conductivity of Compacted Clayer 250 and Introduction 331	
10.1	Normal and Shear Stresses on a Plane 332	13
10.2	The Pole Method of Finding Stresses clara a Plane 226	
10.4	The Pole Method of Finding Stresses along a Plane 336 Stresses Caused by a Point Load 338	AT.
10.5	Vertical Strong Council by a Vertical Line Land 241	
10.6	Vertical Stress Caused by a Horizontal Line Load 343	
10.7	Vertical Stress Caused by a Horizontal Elife Load 545 Vertical Stress Caused by a Vertical Strip Load (Finite Width	
	and Infinite Length) 345	
	Vertical Stress Caused by a Horizontal Strip Load 350	1.3
10.9	Linearly Increasing Vertical Loading on an Infinite Strip 354	2.1
10.10	Vertical Stress Due to Embankment Loading 356 and wolfd	
10.11	Vertical Stress Below the Center of a Uniformly Loaded	P.
	Flow Nets in Amsorropic Soil 271 066 sarA ralusriS	8.8

10.12	Vertical Stress at Any Point below a Uniformly Loaded Circular Area 362
10 13	Vertical Stress Caused by a Rectangularly Loaded Area 366
	Influence Chart for Vertical Pressure 372
	Westergaard's Solution for Vertical Stress Due to a Point Load 375
	Stress Distribution for Westergaard Material 378 balabilozado 6.81
	Sures Distribution for westergated water and a sure of the Sure of
10.17	Problems 382 -202 West lake and Triangle Triangle State of Technology of
	References 389 (Compression Test on Saturated Compression Saturated Compression Test on Saturate
	12.13 Empirical Relationships between Undrained Cohesion (c)
11	Compressibility of Soil 290 Solution Overbuild bas
	12.14 Sensitivity and This ortopy of Clay 217 102 Decrease in Foundation
11.1	12.15 Strength Anisotropy of Clay 4514
11.2	
11.3	Relations for Elastic Settlement Calculation 393 Improved Relationship for Elastic Settlement 396
11.4	Fundamentals of Consolidation 405
11.5	Fundamentals of Consolidation 405
11.6	One-Dimensional Laboratory Consolidation Test 409
11.7	Void Ratio-Pressure Plots 412
11.8	Normally Consolidated and Overconsolidated Clays 415
11.9	Effect of Disturbance on Void Ratio-Pressure Relationship 419
11.10	Calculation of Settlement from One-Dimensional Primary Consolidation 420
11.11	Correlations for Compression Index (C_c) 422 graduation 1.81
11.12	Correlations for Swell Index (C _s) 424 assignment of the Rest. Active, and Passignment of the Rest. Active, and Passignment of the Rest. Active active and Passignment of the Rest. Active activ
11.13	Secondary Consolidation Settlement 431 A STURY OF THE SECONDARY CONSOLIDATION OF THE SECONDAR
11.14	
11.15	Construction Time Correction of Consolidation Settlement 444
11.16	Determination of Coefficient of Consolidation 447 VIOSET NO
11.17	Calculation of Consolidation Settlement under a Foundation 454
11.18	Methods for Accelerating Consolidation Settlement 456
11.19	Summary 459 AZZ theight of Limited Height 554 Gibbs 13.8
	13.2 Kanking Active and Passive Pressure with Storage 1409
anular	References, A. Generalized Case for Rankine Active and Pa 764 a research
12	Shear Strength of Soil 2469 Lateral Eart Park Strength of High Strength Strength of Soil 2469 Strength Strength of Soil 2469 Strength Stre
12.1	Walls with Vertical Back 361 Coulomb's Active Present 551 Coulomb's Active Present 572 Coulomb's Active
12.2	Make Coulomb Foilure Criterion 460
12.3	Indication of the Plane of Feilure Coursed by Shear 471
2 200 2 40	Inclination of the Flane of Failure Caused by Silear 4/1

12.13 Common Types of Retaining Walls in the Field 594

12.4	Laboratory Test for Determination of Shear Strength Parameters	473
12.5	Direct Shear Test 473	
12.6	Drained Direct Shear Test on Saturated Sand and Clay 478	
12.7	General Comments on Direct Shear Test 481	
12.8	Triaxial Shear Test-General 486	10.15
12.9	Consolidated-Drained Triaxial Test 487	8t.01
12.10	Consolidated-Undrained Triaxial Test 497	10.17
12.11	Unconsolidated-Undrained Triaxial Test 505 S85 emaldor T	
12.12	Unconfined Compression Test on Saturated Clay 509	
12.13	Empirical Relationships between Undrained Cohesion (c_u) and Effective Overburden Pressure (σ'_o) 511	
12.14	Sensitivity and Thixotropy of Clay 512	1.11
12.15	Strength Anisotropy in Clay 514	
12.16	Vane Shear Test 516	
12.17	Other Methods for Determining Undrained Shear Strength 523	A.11
12.18	Shear Strength of Unsaturated Cohesive Soils 523	
12.19	Summary 526 and nottebusend wastereds I Isnoisnomi Gen O	
	Problems 527 CLA goo'l comes it comes how	
	References 533 hatabiliosnooravi i bas bembilosnoo yilaario i	
825	Filed of Disturbance on Void Ratio-Pressure Relationship 419	
13	Lateral Earth Pressure: At-Rest, Rankine,	Otot
-	and Coulomb 535 024 Hoffsbillorno	Gine
13.1	Introduction 535 (2) (3) You is not another than 100 and another than 100 and 100 another than 100 another tha	
13.2	At-Rest, Active, and Passive Pressures 535	
13.3	Earth Pressure At-Rest 538 Suprilles nonabilisation visitings	
13.4	Earth Pressure At-Rest for Partially Submerged Soil 540	
13.5	Lateral Pressure on Unyeilding Retaining Walls from Surcharges on Theory of Elasticity 545	-Basec
13.6	Rankine's Theory of Active Pressure 549	TEET
13.7	Theory of Rankine's Passive Pressure 552	
13.8	Yielding of Wall of Limited Height 554	
13.9	Rankine Active and Passive Pressure with Sloping Backfill 555	
13.10	A Generalized Case for Rankine Active and Passive Pressure—Gr Backfill 558	anular
13.11	Diagrams for Lateral Earth-Pressure Distribution against Retaining Walls with Vertical Back 561	- Controller
13.12	Coulomb's Active Pressure 575	
13.13	Coulomb's Passive Pressure 581	12.2
13.14	Active Force on Retaining Walls with Earthquake Forces 582	
	Common Types of Retaining Walls in the Field 594	

13.16	Summary 598	12.14
	Problems d 600 (all) strength of States and the notice of the Problems and	15.15
	References 604 (20) ValO hatsitus 2	
Sag II		15.16
14	Lateral Earth Pressure: Curved Failure Surface	606
14.1	Introduction 606	
14.2	Retaining Walls with Friction 606	
14.3	Properties of a Logarithmic Spiral 608	
14.4	Procedure for Determination of Passive Earth Pressure	
	(P_p) —Cohesionless Backfill 1610 loaqu O gurma Θ -lio O stamith	9.01
14.5	Coefficient of Passive Earth Pressure (K_p) 612	2.07
14.6	Caquot and Kerisel Solution for Passive Earth Pressure	
	(Granular Backfill) 617 PIT VISIAS to 2010114	
14.7	Passive Force on Walls with Earthquake Forces 621 H [1970]	
14.8	Braced Cuts—General 625 miles wolled and beat stempt U	C.O.
14.9	Determination of Active Thrust on Bracing Systems of Open	
	Cuts-Granular Soil 627 Secontrol Book John James Continuous Footing Under Eccentric 627 Secontrol 62	
14.10	the state of the s	16.9
	for Cuts—Cohesive Soil 629	ot.at
14.11	Constitution in	0
14.12	Summary 633	
	Problems 634	
	References 637 SAV noise-olgx3 lioadu2	
15	Slope Stability 638	1.71
	Planning for Soil Exploration 749	2.77
15.1	Introduction 638 Oct abodieM gaino E	17.3
15.2	Factor of Safety 640 about M gailemas nomino	47,4
15.3	Stability of Infinite Slopes 641 PRO STABILITY OF STABILI	
15.4	Infinite Slope with Steady-state Seepage 644	17.6
15.5	Finite Slopes – General 648	7.77
15.6	Analysis of Finite Slopes with Plane Failure Surfaces (Culmann's Method) 648	
15.7	Analysis of Finite Slopes with Circular Failure Surfaces—Genera	1 652
15.8	Mass Procedure – Slopes in Homogeneous Clay Soil with $\phi = 0$	ALC: THE RESERVE OF THE PERSON NAMED IN COLUMN TO PERSON NAMED IN COLU
15.9	Slopes in Clay Soil with $\phi = 0$; and c_{μ} Increasing with Depth 66.	
15.10	# # # # # # # # # # # # # # # # # # #	25.17
15.11	Ordinary Method of Slices 671	
	Bishop's Simplified Method of Slices 680	
	Stability Analysis by Method of Slices for Steady-State Seepage	682

15.14	Solutions for Steady-State Seepage 685	
15.15	Fluctuation of Factor of Safety of Slopes in Clay Embankment or Saturated Clay 699	1
15.16	Summary 703	
	Problems 703	
	References 709	
16	Soil Bearing Capacity for Shallow Foundations	710
16.1	Procedure for Determination of Passive Fart 910, and on Passive Fart 91	
16.2	Ultimate Soil-Bearing Capacity for Shallow Foundations 712	
16.3	Terzaghi's Ultimate Bearing Capacity Equation 713	14.5
16.4	Effect of Groundwater Table 717 resulted feets A bits 104 ps 2	
16.5	Factor of Safety 719	
16.6	General Bearing Capacity Equation 723 LEW BO SOTO A SURREY	
16.7	Ultimate Load for Shallow Footings Under Eccentric Load (One Eccentricity) 729	-Way
16.8	Continuous Footing Under Eccentrically Inclined Load 734	
16.9	Bearing Capacity of Sand Based on Settlement 740	14,10
16.10	Summary 742	
0	Problems 5742 turis Strutter Design of Sheetings Strutter & Remains Problems	
	References 746	
17	Subsoil Exploration 748 (6.8) Subsoil Exploration 748	
17.1	Introduction 748	
17.2	Planning for Soil Exploration 749	
17.3	Boring Methods 750	
17.4	Common Sampling Methods 754	
17.5	Sample Disturbance 759	
17.6	Correlations for N_{60} in Cohesive Soil 760	
17.7	Correlations for Standard Penetration Number in Granular Soil	761
17.8	Other In Situ Tests 767 Stanford the appeal of the devian A	15.6
17.9		15.7
17.10	Borehole Pressuremeter Test 767	
17.11	Cone Penetration Test 769	15.0
17.12	Rock Coring 774	101.81
17.13	Soil Exploration Report 776 MOH in asquiz — emblooi TazaM	
17.14	Summary 7/6	15,12
	Problems 778 85 Single Method of Spices 877 smallers and spices 1879 smallers and spices 1870 sm	
THE SHO	References 781	

18	An Introduction to Geosynthetics	783
18.1	Introduction 783	
18.2	Geotextile 784	

18.3 Geogrid 789

18.4 Geomembrane 795

18.5 Geonet 799

18.6 Geosynthetic Clay Liner 801

18.7 Summary 803 References 803

Answers to Selected Problems 805

Index 815

Life Introduction

spaces between the solid particles. Sail is a rid as a construction material in various lengthering projects, and it is promiss to constitute the properties of sail such as its origin, a sanstize distribution, ability drain water, compressionly, a rength, and its origin, to support attribution, ability deformation. Sail mechanics is the families of science that deals with the study of physical properties of sail and the between of soil masser, subjected to various as a physical properties of sail and the between of soil masser, subjected to various as

that involves natural meteriors found close to the surface. The easth. It includes to application of the principles of soil mechanics into took mechanics to the design of

foundations, resolution structures, and earth Structures.