

# LIST OF FIGURES

Figure Number	Figure Description	Page
Figure 4-1	Loaded Footing with Moment	4-2
Figure 4-2	General Shear Failure Concept	4-4
Figure 4-3	Punching Shear Failure	4-5
Figure 4-4	Local Shear Failure	4-5
Figure 4-5	Failure Modes	4-5
Figure 4-6	Influence of Groundwater Table on Bearing Capacity	4-7
Figure 4-7	Surcharge Load on Soil	4-8
Figure 4-8	Relationship Between $\phi$ and Bearing Capacity Factors	4-8
Figure 4-9	Relationship of Bearing Capacity Factors to $\phi$ and N (Standard Penetration Resistance) for Cohesionless Soils	4-9
Figure 4-10	Slope Setback for Open Excavations/Trenches	4-14
Figure 4-11	Effect of Surcharge Loads for Shored Excavations	4-15
Figure 4-12	Setback Calculation for Shored Excavations when Surcharges are not Considered in the Shoring Design	4-16
Figure 4-13	Single Stage Well Point System	4-17
Figure 4-14	Saturated vs. Submerged Unit Weight	4-18
Figure 4-15	Bottom of Excavation Stability Problems due to Excess Hydrostatic Head Against an Impervious Layer	4-19
Figure 6-1	Short Flight Auger	6-3
Figure 6-2	Continuous Flight Auger	6-3
Figure 6-3	Single Flight Auger	6-4
Figure 6-4	Double Flight Auger	6-4
Figure 6-5	Rock Auger	6-4
Figure 6-6	Drilling Bucket	6-5
Figure 6-7	Cleanout Bucket	6-5
Figure 6-8	Core Barrel	6-6
Figure 6-9	Down-hole Hammer	6-6
Figure 6-10	Rotator	6-7
Figure 6-11	Oscillator	6-8
Figure 6-12	Reverse Circulation Drilling Equipment	6-9
Figure 6-13	Steel Casing	6-10
Figure 6-14	Crawler Mounted Drill Rig	6-10
Figure 6-15	Truck Mounted Drill Rig	6-11
Figure 6-16	Crane Mounted Drill Rig	6-11



<b>Figure Number</b>	<b>Figure Description</b>	<b>Page</b>
Figure 6-17	Pile Defects – No Cleanout, Tapered Bottom of Hole	6-17
Figure 6-18	Pile Defects – Smearred Drill Cuttings	6-17
Figure 6-19	Pile Defects – Cave In	6-19
Figure 6-20	Pile Defects – Concrete Segregation	6-19
Figure 6-21	Pile Defects – Adjacent Hole Blowout	6-20
Figure 6-22	Pile Defects – Water in the Hole	6-20
Figure 6-23	Pile Defects – Casing Problems	6-21
Figure 7-1	Early Pile Hammer	7-1
Figure 7-2	Drive Cap System	7-5
Figure 7-3	Typical Pile Rig Configuration	7-6
Figure 7-4	Fixed Lead System	7-7
Figure 7-5	Swinging Lead System	7-8
Figure 7-6	Semi-Fixed Lead System	7-9
Figure 7-7	Lead Configurations for Battered Piles	7-10
Figure 7-8	Lead Types	7-11
Figure 7-9	Drop Hammer	7-13
Figure 7-10	Single Acting Steam/Air Hammer	7-14
Figure 7-11	Double Acting Steam/Air Hammer	7-15
Figure 7-12	Differential Acting Steam/Air Hammer	7-16
Figure 7-13	Single Acting Diesel Hammer	7-19
Figure 7-14	Operational Cycle for Single Acting Diesel Hammer	7-19
Figure 7-15	Double Acting Diesel Hammer	7-20
Figure 7-16	Vibratory Driver/Extractor	7-23
Figure 8-1	Static Pile Load Test (Five-Pile Array)	8-3
Figure 9-1	Slurry Displacement Method	9-3
Figure 9-2	Positive Hydrostatic Pressure	9-5
Figure 9-3	Filtration – Loose Ground Formation	9-6
Figure 9-4	Filtration – Tight Ground Formation	9-7
Figure 9-5	Stabilization with Synthetic Polymer Slurry	9-8
Figure 9-6	Slurry Sampler Schematic	9-9
Figure 9-7	Density Test Kit	9-10
Figure 9-8	Sand Content Test Kit	9-11
Figure 9-9	Marsh Funnel Viscosity Test Kit	9-12
Figure 9-10	Bentonite Slurry	9-15
Figure 9-11	Mineral Slurry Plant	9-17
Figure 9-12	De-sanding Centrifuges	9-18
Figure 9-13	Recirculation and Cleaning Schematic	9-19
Figure 9-14	SuperMud Container	9-21
Figure 9-15	SlurryPro CDP™ Container	9-21
Figure 9-16	ShorePac® Container	9-22



<b>Figure Number</b>	<b>Figure Description</b>	<b>Page</b>
Figure 9-17	Novagel Container	9-22
Figure 9-18	Hole Collapse Induced by Pressure Changes	9-26
Figure 9-19	Cleanout Bucket	9-27
Figure 9-20	Airlift Schematic	9-28
Figure 9-21	Use of Casing	9-29
Figure 9-22	Inspection Pipes	9-37
Figure 9-23	Location of Inspection Pipes within the Pile	9-37
Figure 9-24	Gamma-Gamma Logging Test Schematic	9-39
Figure 9-25	Defects from Settled Materials	9-42
Figure 9-26	Defect from Improperly Mixed Mineral Slurry	9-43
Figure 9-27	Defect from Excess Filter Cake Buildup	9-43
Figure 9-28	Defect from Concrete Placement Problems	9-44
Figure 11-1	Sub Horizontal Ground Anchor Schematic	11-2
Figure 11-2	Vertical Ground Anchor Schematic	11-5
Figure 11-3	Soil Nail Schematic	11-9
Figure 11-4	Soil Nail Detail	11-10
Figure 11-5	Verification/Test Nail Detail	11-13
Figure 12-1	Single Sheet Piling	12-1
Figure 12-2	Lapped and Wakefield Sheet Piling	12-2
Figure 12-3	Tongue and Groove Wood Sheet Piling	12-2
Figure 12-4	Concrete Sheet Piling	12-2
Figure 12-5	Concrete Sheet Piling with Steel Interlocks	12-2
Figure 12-6	Straight-Web Steel Sheet Piling	12-3
Figure 12-7	Arch-Web Steel Sheet Piling	12-3
Figure 12-8	Deep-Arch Steel Sheet Piling	12-3
Figure 12-9	Z-Section Steel Sheet Piling	12-4
Figure 14-1	CMS Details from 2010 Standard Plan S116	14-3
Figure C-1	Seismic Retrofit Strategy – Add Top Mat	C-6
Figure C-2	Seismic Retrofit Strategy – Enlarged Footing	C-7
Figure D-1	Pier Column – Caltrans Bridge Design Details, page 7-20	D-2
Figure D-2	SFOBB East Span Pier W2 Footing Excavations	D-3
Figure D-3	Blasting Photos	D-11
Figure D-4	Bents 2 & 3 Column Details – 580/205 Separation, Contract No. 04-470804	D-13
Figure D-5	580/205 Separation General Plan	D-14
Figure D-6	580/205 Separation CIDH Pile Construction 1	D-15
Figure D-7	580/205 Separation CIDH Pile Construction 2	D-16
Figure D-8	580/205 Separation CIDH Pile Rebar Cage Construction	D-17



<b>Figure Number</b>	<b>Figure Description</b>	<b>Page</b>
Figure D-9	580/205 Separation CIDH Pile Rebar Cage Setting	D-18
Figure D-10	580/205 Separation CIDH Pile Concrete Placement	D-19
Figure D-11	580/205 Separation Column Construction	D-20
Figure D-12	580/205 Separation CIDH Pile and Column Construction	D-21
Figure E-1	Gates Formula Excel Spreadsheet	E-15
Figure E-2	Example Field Acceptance Charts	E-22
Figure F-1	FTB Pile Load Test Request Form	F-2
Figure F-2	FTB Pile Driving Analysis Test Request Form	F-3
Figure F-3	Pile Load Test 5 Pile Group	F-4
Figure F-4	Pile Load Test 3 Pile Group	F-5
Figure G-1	FTB CIDH Pile Acceptance Test Request Form	G-2
Figure H-1	Completed Soldier Pile Wall	H-2
Figure H-2	Soldier Pile Wall – Before and After	H-3
Figure H-3	Soil Nail Wall – Sculpted Facing	H-4
Figure H-4	Soil Nail Wall Construction 1	H-5
Figure H-5	Soil Nail Wall Construction 2	H-6
Figure H-6	Soil Nail Wall Construction 3	H-7
Figure I-1	Seal Course Thickness Chart (BDA Section 2)	I-2
Figure I-2	Seal Course Width Chart (BDA Section 2)	I-3
Figure J-1	Duncan’s Mills Retaining Wall – Typical Cap Beam-Curtain Wall Cross Sections	J-3
Figure J-2	Duncan’s Mills Retaining Wall – Cap Beam Construction	J-4
Figure J-3	Ortega Highway Excavation and Backfill Details	J-8
Figure J-4	Ortega Highway Micropile Details 1	J-9
Figure J-5	Ortega Highway Micropile Details 2	J-10
Figure J-6	Ortega Highway Micropile Construction Photo 1	J-11
Figure J-7	Ortega Highway Micropile Construction Photo 2	J-11
Figure J-8	Richmond-San Rafael Bridge (Photo from Caltrans Office of Geotechnical West Photo Gallery)	J-12
Figure J-9	BIRIS Cover Sheet	J-13
Figure J-10	Richmond-San Rafael Bridge Micropile Details	J-14
Figure J-11	Devil’s Slide – Revised Wall Design Sketch – “L” Footing	J-17
Figure J-12	Devil’s Slide Micropile Construction Photos 1	J-18
Figure J-13	Devil’s Slide Micropile Construction Photos 2	J-19
Figure J-14	Devil’s Slide Micropile Construction Photos 3	J-20
Figure J-15	Devil’s Slide Micropile Testing Photos	J-21



<b>Figure Number</b>	<b>Figure Description</b>	<b>Page</b>
Figure J-16	Devil's Slide Micropile Construction-SWPP Measures	J-22
Figure J-17	Spanish Creek General Plan	J-25
Figure J-18	Spanish Creek Pile Data	J-26
Figure J-19	Spanish Creek Footing Details No. 1	J-27
Figure J-20	Spanish Creek Footing Details No. 2	J-28
Figure J-21	Spanish Creek Micropile Details	J-29
Figure J-22	Spanish Creek Micropile Test Details No. 1	J-30
Figure J-23	Spanish Creek Micropile Test Details No. 2	J-31
Figure J-24	API N80 Casing Prior to Threaded Rod Installation	J-32
Figure J-25	Micropile Assemblies Ready for Installation	J-33
Figure J-26	Foreground – Micropile Assembly Installation Underway with Post Grouting Tube. Background – Pier 6 Micropile Drilling with Articulated Down-hole Percussive Rotary Method.	J-34
Figure J-27	Pier 6 Micropile Installation	J-35
Figure J-28	Pier 2 Installed Micropiles	J-36
Figure J-29	Pier 2 Installed Micropiles, Preparing for Load Testing	J-37
Figure J-30	Pier 6 Micropiles with Load Test Frame	J-38