Table of Contents

Authors' Preface 9

Chapter 1 Cut and Cover
1.1 Characteristics 11
1.2 Areas of Use 12
1.3 Techniques of Construction 20
Bibliography 26

Chapter 2 Submerged Tunnels
2.1 Definitions and Applications 29
2.2 Tunnel Depth 30
2.3 Resources 32
2.4 History 32
2.5 Sequence of Operations 35
2.6 Steel Cylinders 35
2.7 Rectangular Concrete Tunnels 40
2.8 Topography 47
2.9 Tidal Waters 49
2.10 Advantages 50
2.11 Channel Tunnel 51
Bibliography 52

Chapter 3 Shafts and Caissons
3.1 Working Shafts 54
3.2 Requirements 55
3.3 Permanent Shafts 57
3.4 Water in Shafts 57

3.5 Sinking Techniques 58
3.6 Shaft Bottoms 71
3.7 Tunnel Eye 72
3.8 Subaqueous Shafts 72
Bibliography 74

Chapter 4 Geology
4.1 Relevance 75
4.2 Survey Requirements 75
4.3 Lithology 79
4.4 Stratification 82
4.5 Discontinuities 86
4.6 Water 88
4.7 Rock Stresses 91
4.8 Geotechnology 92
4.9 Earthquakes 96
Bibliography 97

Chapter 5 Ground Treatment
5.1 Objectives 98
5.2 Grouting 98
5.3 Freezing 112
5.4 Dewatering 124
Bibliography 127

Chapter 6 Highway Tunnels
6.1 Highway Requirements 129
6.2 Geometry of Centre Line 133
6.3 Cross Section 135
6.4 Road Construction 139
6.5 Secondary Linings 141
6.6 Lighting 145
6.7 Traffic Management 149
6.8 Fire Precautions 156
6.9 Pipes and Cables 157
Bibliography 159

Chapter 7 Metro Tunnels
7.1 Characteristics 161
7.2 Compulsory Powers 162

7.3 General Pattern of Planning . . 164
7.4 Design . . 179
7.5 Construction . . 197
7.6 Major Systems . . 204
Bibliography . . 205

Chapter 8 Railway Tunnels
8.1 General Considerations . . 208
8.2 Route Selection . . 218
8.3 Geometry of Alignment . . 220
8.4 Form of Tunnel . . 223
8.5 Track . . 227
8.6 Subaqueous Tunnels . . 228
8.7 Tunnel Linings . . 231
8.8 Current Activity . . 232
Bibliography . . 234

Chapter 9 Ventilation and Aerodynamics in Vehicle Tunnels
9.1 History . . 236
9.2 Highway Tunnel Requirements . . 237
9.3 Pollutants . . 239
9.4 Air Supply . . 243
9.5 Systems of Air Distribution . . 248
9.6 Ventilation in Fires . . 261
9.7 Railway Ventilation . . 262
9.8 Main Line Railways . . 268
Bibliography . . 273

Bibliography 276

Index 316