

## List of Figures

| Number |  | Page |
|--------|--|------|
| 1.1    | Bridge abutment near an inclined rock face   | 55   |
| 1.2    | Basement walls near inclined rock faces  | 56   |
| 1.3    | Hopper of the storage silo with granular material  | 57   |
| 1.4    | Different interface inclinations   | 58   |
| 2.1    | Development of in-situ stresses  | 59   |
| 2.2    | Jaky's formulation of the relationship between $K_o$ on OC and $\phi$ mobilized in OAB (after Mesri and Hayat, 1993) | 60   |
| 2.3    | Shaking table, soil box, and actuator (after Sherif et al., 1984)  | 61   |
| 2.4    | Shaking table with movable retaining wall (after Sherif et al., 1984)  | 62   |
| 2.5    | Locations of soil-pressure transducers (after Sherif et al., 1984)   | 63   |
| 2.6    | Distribution of at-rest stresses for loose sand (after Sherif et al., 1984)  | 64   |
| 2.7    | Distribution of at-rest stresses for medium-dense sand (after Sherif et al., 1984)                                   | 65   |
| 2.8    | Distribution of at-rest stresses for dense sand (after Sherif et al., 1984)  | 66   |
| 2.9    | Lock-in at-rest pressure due to soil densification (after Sherif et al., 1984)                                       | 67   |
| 2.10   | Broms's simplified compaction pressure theory (after Broms, 1971)  | 68   |
| 2.11   | Lateral pressure distribution due to compaction of fill (after Broms, 1971)  | 69   |

| Number |   | Page |
|--------|---|------|
| 2.12   | Hand-calculation for estimating $\sigma_h$ (after Peck and Mesri, 1987)   | 70   |
| 2.13   | Distribution of vertical earth pressure measured in soil mass (after Chen, 2002)  | 71   |
| 2.14   | Distribution of horizontal earth pressure after compaction (after Chen, 2002)   | 72   |
| 2.15   | Stress path of a soil element under compaction (after Chen, 2002)   | 73   |
| 2.16   | Horizontal lamina for derivation of Janssen's equations (redrawn after Safarian and Harris, 1985)                             | 74   |
| 2.17   | Lamina of stored material for derivation of the Reimbert's equations (after Reimbert and Reimbert, 1895)                      | 75   |
| 2.18   | Free-body diagram for ditch conduit (after Spangler and Handy, 1984)  | 76   |
| 2.19   | Distribution of soil pressure against fascia walls to partial support from wall friction $F$ (after Spangler and Handy, 1984) | 77   |
| 2.20   | Model retaining wall (after Frydman and Keissar, 1987)  | 78   |
| 3.1    | NCTU non-yielding retaining wall  | 79   |
| 3.2    | Location of soil pressure transducer mounted on the model wall (after Chen and Fang, 2002)                                    | 80   |
| 3.3    | Soil pressure transducer  | 81   |
| 3.4    | Data acquisition system   | 82   |
| 3.5    | Acentric force as a function of number of acentric plate (Mikasa KJ75)  | 83   |
| 3.6    | Side-view of square vibratory soil compactor  | 84   |
| 3.7    | Square vibratory soil compactor   | 85   |

| Number  | Page |
|---|------|
| 3.8 Strip vibratory soil compactor  | 86   |
| 3.9 (a) Strip compactor and model wall (Front-view)<br>(b) Strip compactor and model wall (Side-view)<br>(c) Strip compaction plate<br>(d) Acentric motor on top of compactor | 87   |
| 3.10 Compaction of backfill   | 89   |
| 3.11 Strip vibratory compactor and extended cushion   | 90   |
| 4.1 Steel interface plate and non-yielding wall   | 91   |
| 4.2 2100 mm × 1497 mm steel interface plate   | 92   |
| 4.3 Steel interface plate   | 93   |
| 4.4 Side-view of steel interface plate and non-yielding wall  | 94   |
| 4.5 Non-yielding wall and steel interface plate   | 95   |
| 4.6 Top-view of supporting frame and non-yielding wall  | 96   |
| 4.7 Base supporting frame   | 97   |
| 4.8 Top supporting beam   | 98   |
| 4.9 Interface inclination, $\alpha = 0^\circ$   | 99   |
| 4.10 Interface inclination, $\alpha = 45^\circ$   | 100  |
| 4.11 Interface inclination, $\alpha = 60^\circ$   | 101  |
| 4.12 Interface inclination, $\alpha = 70^\circ$   | 102  |

| Number  | Page |
|---|------|
| 4.13 Interface inclination, $\alpha = 80^\circ$   | 103  |
| 5.1 Grain size distribution of Ottawa sand  | 104  |
| 5.2 Shear box of direct shear test device (after Wu, 1992)                                    | 105  |
| 5.3 Relationship between unit weight $\gamma$ and internal friction angle (after Chang, 2000) | 106  |
| 5.4 Soil hopper   | 107  |
| 5.5 Pluviation of the Ottawa sand into soil bin   | 108  |
| 5.6 Backfill compacted with square compactor in 5 lifts                                       | 109  |
| 5.7 Backfill compacted with strip compactor in 15 lifts                                       | 110  |
| 5.8 Backfill compacted with square compactor in 6 lanes                                       | 111  |
| 5.9 Backfill compacted with strip compactor in 15 lanes                                       | 112  |
| 5.10 Soil-density control cup   | 113  |
| 5.11 Soil-density cup   | 114  |
| 5.12 Soil density cups buried at the different elevations                                     | 115  |
| 5.13 Location of soil density cups at same elevation  | 116  |
| 5.14 Distribution of soil density for loose sand  | 117  |
| 5.15 Compaction of backfill with square compactor   | 118  |

| Number | Page   |
|--------|--|
| 5.16   | Distribution of soil density compacted with square compactor 119   |
| 5.17   | Compaction of backfill with strip compactor 120  |
| 5.18   | Distribution of soil density compacted with strip compactor (Lift = 0.5 m) 121                           |
| 5.19   | Distribution of soil density compacted with strip compactor (Lift = 0.1 m) 122                           |
| 5.20   | Comparison of density distribution compacted with strip and square compactor 123                         |
| 5.21   | Relative density vs. depth relation for vibratory roller compaction (after D'Appolonia et al., 1969) 124 |
| 5.22   | Lubrication layer hung on the side wall 125  |
| 5.23   | Schematic diagram of sliding block test (after Fang et al., 2004) 126                                    |
| 5.24   | Sliding block test apparatus (after Fang et al., 2004) 127   |
| 5.25   | Viriation of interface angle with normal stress (after Fang et al., 2004) 128                            |
| 5.26   | Direct shear test arrangement to determinate wall friction angle 129                                     |
| 5.27   | Relationship between unit $\gamma$ and wall friction angle $\delta$ (after Ho, 1999) 130                 |
| 5.28   | Direct shear test arrangement to determine interface friction angle 131                                  |
| 5.29   | Relationship between unit weight $\gamma$ and steel interface plate friction angle $\delta_i$ 132        |
| 5.30   | Relationship between unit weight $\gamma$ and friction angles 133  |
| 6.1    | Different interface inclinations 134   |

| Number | Page  |     |
|--------|---|-----|
| 6.2    | Distribution of lateral earth pressure at $\alpha = 0^\circ$ for loose sand                             | 135 |
| 6.3    | Distribution of lateral earth pressure at $\alpha = 45^\circ$ for loose sand                            | 136 |
| 6.4    | Distribution of lateral earth pressure at $\alpha = 60^\circ$ for loose sand                            | 137 |
| 6.5    | Distribution of lateral earth pressure at $\alpha = 70^\circ$ for loose sand                            | 138 |
| 6.6    | Distribution of lateral earth pressure at $\alpha = 80^\circ$ for loose sand                            | 139 |
| 6.7    | Distribution of lateral earth pressure at various $\alpha$ for loose sand                               | 140 |
| 6.8    | Variation of $K_{o,h}$ at various $\alpha$ for loose sand   | 141 |
| 6.9    | Point of application of resultant force at various $\alpha$ for loose sand                              | 142 |
| 7.1    | Different interface inclinations  | 143 |
| 7.2    | Distribution of lateral earth pressure at $\alpha = 0^\circ$ for sand compacted with a square compactor | 144 |
| 7.3    | Distribution of lateral earth pressure at $\alpha = 0^\circ$ for sand compacted with strip compactor    | 145 |
| 7.4    | Comparison of lateral earth pressure at $\alpha = 0^\circ$ for sand compacted                           | 146 |
| 7.5    | Stress path of a soil element under compaction  | 147 |
| 7.6    | Distribution of lateral earth pressure at $\alpha = 45^\circ$ for compacted sand                        | 148 |
| 7.7    | Distribution of lateral earth pressure at $\alpha = 60^\circ$ for compacted sand                        | 149 |
| 7.8    | Distribution of lateral earth pressure at $\alpha = 70^\circ$ for compacted sand                        | 150 |



| Number |   | Page |
|--------|---|------|
| 7.9    | Distribution of lateral earth pressure at $\alpha = 80^\circ$ for compacted sand                    | 151  |
| 7.10   | Distribution of lateral earth pressure at various $\alpha$ for sand compacted with square compactor | 152  |
| 7.11   | Distribution of lateral earth pressure at various $\alpha$ for sand compacted with strip compactor  | 153  |
| 7.12   | Variation of $K_{o,h}$ at various $\alpha$  | 154  |
| 7.13   | Horizontal lamina of Ottawa sand  | 155  |
| 7.14   | Point of application of resultant force at various $\alpha$   | 156  |
| 7.15   | Overturning moments above the base, $M_o$ at various $\alpha$                                       | 157  |

