

## I The technology of earth building

### 1 Introduction 11

- History 11
- Earth as a building material: the essentials 13
- Improving indoor climate 15
- Prejudices against earth as a building material 18

### 2 The properties of earth as a building material 19

- Composition 19
- Tests used to analyse the composition of loam 21
- Effects of water 24
- Effects of vapour 29
- Influence of heat 31
- Strength 32
- pH-value 35
- Radioactivity 35
- Shelter against high-frequency electromagnetic radiation 35

### 3 Preparing of loam 36

- Soaking, crushing and mixing 36
- Sieving 38
- Mechanical slurring 38
- Water curing 38
- Thinning 38

### 4 Improving the earth's characteristics by special treatment or additives 39

- Reduction of shrinkage cracks 39
- Stabilisation against water erosion 40
- Enhancement of binding force 42
- Increasing compressive strength 43
- Strength against abrasion 47
- Increasing thermal insulation 47

### 5 Rammed earthworks 52

- Formwork 53
- Tools 54
- Method of construction 55
- Shaping of openings 55
- New wall construction techniques 56
- Rammed earth domes 59
- Drying 59
- Labour input 60
- Thermal insulation 60
- Surface treatment 60

### 6 Working with earth blocks 61

- History 61
- Production of earth blocks 62
- Material composition 65
- Laying earth blocks 65
- Surface treatment 66
- Fixing fasteners to walls 67
- Lightweight loam blocks 67
- Special acoustic green bricks 68

### 7 Large blocks and prefabricated panels 69

- Large blocks 69
- Prefabricated wall panels 70
- Floor slabs 70
- Floor tiles 71
- Extruded loam slabs 71

### 8 Direct forming with wet loam 72

- Traditional wet loam techniques 72
- The "Dünne loam loaf" technique 74
- The *stranglehm* technique 75

### 9 Wet loam infill in skeleton structures 80

- Thrown loam 80
- Sprayed loam 80
- Rolls and bottles of straw loam 81
- Lightweight loam infill 82
- Infill with *stranglehm* and earth-filled hoses 82

### 10 Tamped, poured or pumped lightweight loam 83

- Formwork 83
- Tamped lightweight straw loam walls 83
- Tamped lightweight wood loam walls 84
- Tamped, poured or pumped lightweight mineral loam walls 85
- Pumped lightweight mineral loam floors 88
- Loam-filled hollow blocks 89
- Loam-filled hoses 90

### 11 Loam plasters 92

- Preparation of ground 92
- Composition of loam plaster 92
- Guidelines for plastering earth walls 94
- Sprayed plaster 95
- Lightweight mineral loam plaster 95
- Thrown plaster 95
- Plastered straw bale houses 95
- Wet formed plaster 96
- Protection of corners 96

## 12 Weather protection of loam surfaces 98

- Consolidating the surface 98
- Paints 98
- Making surfaces water-repellent 101
- Lime plasters 101
- Shingles, planks and other covers 103
- Structural methods 103

## 13 Repair of loam components 104

- The occurrence of damage in loam components 104
- Repair of cracks and joints with loam fillers 104
- Repair of cracks and joints with other fillers 105
- Repairing larger areas of damage 105
- Retrofitting thermal insulation with lightweight loam 106

## 14 Designs of particular building elements 107

- Joints 107
- Particular wall designs 108
- Intermediate floors 110
- Rammed earth floorings 112
- Inclined roofs filled with lightweight loam 115
- Earth-covered roofs 115
- Earth block vaults and domes 117
- Earthen storage wall in winter gardens 131
- Loam in bathrooms 132
- Built-in furniture and sanitary objects from loam 133
- Wall heating systems 134
- Passive solar wall heating system 134

## 15 Earthquake-resistant building 135

- Structural measures 136
- Openings for doors and windows 140
- Bamboo-reinforced rammed earth walls 141
- Domes 144
- Vaults 145
- Textile walls with loam infill 147

- Residence and studio at Gallina Canyon,  
New Mexico, USA 160
- Residence at Villa de Leyva, Colombia 162
- Low Compound at Scottsdale, Arizona, USA 164
- Residence at Des Montes, near Taos,  
New Mexico, USA 166
- Casita Nuaanarpoq at Taos, New Mexico, USA 168
- Residence and office at Bowen Mountain,  
New South Wales, Australia 169
- Vineyard residence at Mornington Peninsula,  
Victoria, Australia 170
- Residence, Helensville, New Zealand 172
- Residence, São Francisco Xavier, Brazil 174
- Three-family house, Stein on the Rhine,  
Switzerland 176

## Cultural, Educational and Sacral Buildings

- School at Solvig, Järna, Sweden 177
- Kindergarten, Sorsum, Germany 178
- School in Rudrapur, Bangladesh 180
- Kindergarten and nursery of Druk White Lotus School,  
Ladakh, India 182
- Panafrican Institute for Development, Ouagadougou,  
Burkina Faso 184
- Youth centre at Spandau, Berlin, Germany 186
- Printing plant in Pielach, Austria 188
- Office building, New Delhi, India 190
- Mii amo spa at Sedona, Arizona, USA 192
- Tourist resort at Baird Bay, Eyre Peninsula,  
South Australia 194
- Charles Sturt University at Thurgoona,  
New South Wales, Australia 195
- Chapel of the central clinic in Suhl, Germany 196
- Cultural centre, La Paz, Bolivia 198
- Mosque, Wabern, Germany 199
- Chapel of Reconciliation, Berlin, Germany 200
- Center of Gravity Foundation Hall at Jemez Springs,  
New Mexico, USA 202

## II Built examples

### Residences

- Two semi-detached houses, Kassel, Germany 150
- Residence cum office, Kassel, Germany 152
- Residence at Phoenix, Arizona, USA 154
- Farmhouse, Wazirpur, India 156
- Honey house at Moab, Utah, USA 157
- Residence, La Paz, Bolivia 158
- Residence, Turku, Finland 159

- Future prospects 204
- Measures 205
- Bibliographical references 206
- Acknowledgements 207
- Illustration credits 207