

Table of contents

Preface 7

1 Introduction 9

- History 9
- Earth as a building material: the essentials 11
- Improving indoor climate 13
- Prejudices against earth as a building material 16

2 The properties of earth as a building material 17

- Composition 17
- Tests used to analyse the composition of loam 19
- Effects of water 22
- Effects of vapour 26
- Influence of heat 29
- Strength 30
- pH-value 32
- Radioactivity 33
- Shelter against high-frequency electromagnetic radiation 33

3 Preparing of loam 34

- Soaking, crushing and mixing 34
- Sieving 36
- Mechanical slurring 36
- Water curing 36
- Thinning 36

4 Improving the characteristics of loam by special treatment or additives 37

- Reduction of shrinkage cracks 37
- Stabilisation against water erosion 38
- Enhancement of binding force 40
- Increasing compressive strength 40
- Strength against abrasion 45
- Increasing thermal insulation 45
- Lightweight loams 46

5 Rammed earthworks 50

- Formwork 51
- Tools 52
- Method of construction 53
- Shaping of openings 53
- Wall construction techniques 54
- Rammed earth domes 59
- Drying 59
- Labour input 59
- Thermal insulation 59
- Surface treatment 59

6 Working with earth blocks 60

- History 60
- Production of earth blocks 61
- Material composition 64
- Laying earth blocks 64
- Surface treatment 65
- Fixing fasteners to walls 65
- Lightweight earth blocks 65
- Special acoustic green bricks and adobes 66

7 Large blocks and panels 67

- Large blocks 67
- Earth-filled wall panels 67
- Clay panels 69
- Heating panels 71
- Floor slabs 71
- Floor tiles 72
- Extruded loam slabs 72

8 Direct forming with wet loam 73

- Traditional wet loam techniques 73
- The “Dünne loam loaf” technique 75
- 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 81
- Infill with *stranglehm* and earth-filled hoses 82
- Sprayed loam in steel-reinforced walls and ceilings 82

10 Tamped, poured or pumped lightweight loam 85

- Formwork 85
- Tamped lightweight straw loam walls 85
- Tamped lightweight wood loam walls 87
- Tamped, poured or pumped lightweight mineral loam walls 87
- Pumped lightweight mineral loam floors 88
- Loam-filled hollow blocks 88
- Loam-filled hoses 90

11 Loam plasters 92

- Preparation of substrate 92
- Composition of loam plaster 92
- Guidelines for plastering earth walls 94
- Sprayed lightweight plaster 94
- Lightweight mineral loam plaster 95

Thrown plaster	95
Plastered straw bale houses	95
Wet formed plaster	97
Protection of corners	97
Stabilised loam plasters	97
Characteristics of different loam plasters	97
12 Weather resistance, coatings and coverings	100
Consolidating the surface	100
Paints	100
Making surfaces water-repellent	103
Lime plasters	104
Shingles, planks and other covers	105
Structural methods	105
13 Repair of loam structures	106
Occurrence of damage	106
Repair of cracks and joints with loam fillers	106
Repair of cracks and joints with other fillers	107
Repairing larger damaged areas	107
Retrofitting thermal insulation with lightweight loam	107
14 Customised design solutions	109
Joints	109
Special wall constructions	111
Intermediate floors	113
Rammed earth floorings	113
Inclined roofs filled with lightweight loam	115
Earth-covered roofs	115
Earth block vaults and domes	117
Earthen storage wall in winter gardens	129
Loam in bathrooms	129
Built-in furniture and sanitary objects from loam	131
Passive solar wall heating system	132
15 Earthquake-resistant building	133
Structural measures	134
Openings for doors and windows	136
Bamboo-reinforced rammed earth walls	139
Steel-reinforced sprayed loam walls	139
Steel-reinforced adobe wall system	141
Domes	141
Vaults	141
Textile walls with loam infill	144
Steel-reinforced earth walls	146

Built examples

Residences

Vineyard residence, Mornington Peninsula, Victoria, Australia	148
Residence cum office, Kassel, Germany	150
Residence, Helensville, New Zealand	152
Residence, Palo Alto, California, USA	154
Weekend house, Ajijic, Mexico	156
Desert Outpost residence, Paradise Valley, Arizona, USA	158
Artist's residence, Boulder, Colorado, USA	160
Casa Martha, La Misión, Baja California, Mexico	162
Condominiums Los Maitenes, Peñalolén, Santiago de Chile, Chile	164
Residence at Valle Tucán, Emboscada, Paraguay	168
Barrel-vaulted residential buildings at Valle Tucán, Emboscada, Paraguay	170

Cultural, educational and sacred buildings

National Environment Centre at Thurgoona Campus, Albury, New South Wales, Australia	174
School, Rudrapur, Bangladesh	176
Chapel of Reconciliation, Berlin, Germany	178
WISE Centre for Alternative Technology, Machynlleth, Wales, UK	180
Primary school, Tanouan Ibi, Mali	182
Cemetery, Bushey, Hertfordshire, UK	186
The Village Nursery, Bellingdon, Buckinghamshire, UK	190
Centre for People with Disabilities and Dipdii Textiles Studio, Rudrapur, Bangladesh	194
Adobe Dome Music Space, Aiguá, Uruguay	198
Burkina Institute of Technology, Koudougou, Burkina Faso	202
Maison pour tous, Four, Isère, France	206

Commercial, hospitality and health buildings

Rivergreen Centre, Aykley Heads, Durham, UK	210
High Country Visitor Information Centre, Mansfield, Victoria, Australia	212
Mii Amo Spa, Sedona, Arizona, USA	214
Bayalpata Hospital, Acham, Nepal	216
Office pavilion Earthbox, Asunción, Paraguay	220
Alnatura Office Building, Darmstadt, Germany	224
Prototype building TECLA, Massa Lombarda, Italy	228
Dior Pop-up Store, Jumeirah, Dubai	230

Bibliography

About the author

Illustration credits

Subject Index