Contents

Thanks xii

Author's note xiii

Foreword by David Eisenberg xv

Introduction: Thinking about sustainable building xvii

How this book works xix

1 Foundations 1

Building science for foundations
Earthbag (or flexible form rammed earth) foundations
Dry stone and mortared stone foundations
Rammed earth tires (earthships)
Helical pier, screwpile and screw pier foundations
Wooden piers
Poured concrete foundations
Lightweight concrete masonry units (CMUs)
Autoclaved aerated concrete blocks
Durisol and Faswall insulated concrete forms (ICFs)
What about rubble trenches?
Combination foundations
What's not included in this chapter
Pressure treated wood foundations
Concrete slab foundations

2 Walls 55

Building science basics for walls
Wood frame construction
Straw bale walls
Cob walls
Cordwood or stackwall
Rammed earth walls

Compressed earth block (CEB) walls
Adobe block walls
Foundations as walls
Cotton batt insulation
Straw/clay, straw light clay or slipstraw insulation
Hempcrete insulation
Hemp batt insulation
Perlite loose-fill insulation
Mineral wool insulation
Cementitious foam insulation
Wool batt insulation
Cellulose insulation (wet-sprayed and dry-blown)
Other insulation materials
What's not included in this chapter

3 Floor and roof structure 133
Building science basics for floor structures
Building science basics for roof structures
Wood framing
Wooden trusses
Wooden I-beams
Finger-jointed wood trusses
Glulam roof and floor framing
Open web steel joists
Timber framing and post and beam
Conical grain bin roofs
Slab-based floors

4 Sheathing and cladding materials 175
Building science basics for exterior cladding and sheathing
Building science basics for interior sheathing
Clay or earthen plaster
Wood plank sheathing and cladding
Plywood and oriented strand board (OSB) sheathing
Gypsum board, drywall or plaster board sheathing
Magnesium oxide board
Fired clay brick cladding
Lime and lime/cement plaster
Stone cladding
Roof sheathing materials as wall sheathing

5 Roof sheathing 213
Building science basics for roof sheathing
Metal roofing
Cedar shake and shingles
Thatch roofs
Slate
Composite shingles
Green roofs/living roofs
Clay tile roofing

6 Flooring 249
Building science basics for flooring
Clay or earthen floors
Hardwood flooring
Softwood flooring
Engineered wood floors
Tile flooring
Linoleum
Bamboo flooring
Cork flooring
Concrete flooring

7 Surface finishing materials 285
Building science basics for finishes
Clay or earthen finish plaster
Lime finish plaster
Milk paint
Clay paint and alise
Lime wash and lime paint
Silicate paint
Acrylic (latex) paint
Natural oil paint
Natural oils and waxes
Natural wallpaper and wall covering

8 Windows 321

Mechanical systems 327

9 Water systems 329
Water sources
Surface water
Well water

Rainwater catchment
Desalinated water
Pumps
Filters
Water treatment systems
Piping

10 Wastewater systems 355
Municipal wastewater treatment
Septic systems
Composting toilets

11 Heating and cooling systems 369
Means of heat production
Means of heat delivery
Passive solar heating
Solar hydronic heating
Solar hot air heating
Ground source heat pumps (GSHP)
Air source heat pumps (ASHP)
Tankless or on-demand heaters
Tank or batch heaters
Forced-air furnaces
Wood and pellet stoves
Masonry heaters

12 Electrical generation 411
Photovoltaic power
Wind turbines
Micro-hydro turbines

Conclusion 423
People make better buildings

Appendix 425
Inventory of carbon and energy (ICE) summary

Index 435

About the author 441