Contents

Page

Chapter 1 Introduction 7

Chapter 2 Green oak past and present 10
- 2.1 The medieval period 10
- 2.2 The post-medieval period 12
- 2.3 The present day 13

Chapter 3 The supply of green oak 16
- 3.1 Timber supply 16
- 3.2 Environmental issues 17
- 3.3 Costs 20

Chapter 4 The properties of oak 22
- 4.1 The living oak tree 22
- 4.2 Timber properties 23
- 4.3 Moisture content and drying movement 24
- 4.4 Durability 29
- 4.5 Strength properties 31
- 4.6 Creep deflection 33
- 4.7 Working qualities 33
- 4.8 Chemical properties 33
- 4.9 Behaviour in fire 34

Chapter 5 Design of green oak structures 35
- 5.1 The design of the frame 35
- 5.2 Performance of the structure 39
- 5.3 Historical forms as models for today 43
- 5.4 Drying movements 54

Chapter 6 The green oak framing process 56
- 6.1 The traditional approach 56
- 6.2 Automation 58
- 6.3 Selecting the timber 59
- 6.4 Appearance considerations 69

Chapter 7 Enclosing green oak structures 74
- 7.1 Design criteria and construction forms 74
- 7.2 Construction detailing 74
- 7.3 Drying movements and maintenance 77
- 7.4 Example details 77

Chapter 8 Exterior uses of green oak 90
- 8.1 General approach to durability in design 90
- 8.2 Appearance grading 95
- 8.3 External cladding 95
- 8.4 Decking 96
- 8.5 Bridges and other external structures 98

Chapter 9 Case Studies 102

Historic reconstructions:
9.1 The Globe Theatre 104
9.2 Stirling Castle Roof 108

Traditional models:
9.3 Mill O'Braco house 112
9.4 Abingdon School Boathouse 114

Modern frames:
9.5 New roof to the South Transept of York Minster 118
9.6 Bedales School, Olivier Theatre 122
9.7 Darwin College, Cambridge 124

Innovative frames:
9.8 Weald and Downland Museum Gridshell 129

Exterior uses
9.9 The National Maritime Museum, Falmouth 133
9.10 Ealing Bridge 136
9.11 Polesden Lacey Bridge 139

Appendix I Specifying oak for traditional framing 141
AI.1 Defects 141
AI.2 Specification 143

Appendix II Green oak strength grading rules 148
AII.1 Scope 148
AII.2 The grades 148
AII.3 Definitions 149
AII.4 Measurement of features 150
AII.5 Grade limits 155
AII.6 Reference documentation 159

Appendix III Engineering design data 160
AIII.1 Strength design to BS 5268-2: 2002 160
AIII.2 Strength design to Eurocode 5 Part 1.1 161
AIII.3 Deflection of beams 161
AIII.4 Self weight of frames 163
AIII.5 Strength of pegged joints in tension 163

Appendix IV The green oak strength grading rules: Quick reference sheet 164

References and further reading 166

Glossary of terms 172