## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>List of figures</td>
<td>ix</td>
</tr>
<tr>
<td>List of tables</td>
<td>xiii</td>
</tr>
<tr>
<td>Preface to fourth edition</td>
<td>xv</td>
</tr>
<tr>
<td>Acknowledgements</td>
<td>xvii</td>
</tr>
<tr>
<td>Disclaimer</td>
<td>xix</td>
</tr>
<tr>
<td>1. Introduction to building pathology</td>
<td>1</td>
</tr>
<tr>
<td>1.1 Context</td>
<td>1</td>
</tr>
<tr>
<td>1.2 Background to the construction industry</td>
<td>11</td>
</tr>
<tr>
<td>1.3 A model of best practice in building pathology</td>
<td>18</td>
</tr>
<tr>
<td>1.4 Evidence-based practice</td>
<td>19</td>
</tr>
<tr>
<td>1.5 Personal-based practice</td>
<td>22</td>
</tr>
<tr>
<td>1.6 Summary</td>
<td>28</td>
</tr>
<tr>
<td>2. Principles of building diagnostics</td>
<td>29</td>
</tr>
<tr>
<td>2.1 Introduction to diagnostics</td>
<td>29</td>
</tr>
<tr>
<td>2.2 Judgment and decision making in defects diagnosis</td>
<td>37</td>
</tr>
<tr>
<td>2.3 Risk in building diagnostics</td>
<td>47</td>
</tr>
<tr>
<td>2.4 Assessing the severity of a defect</td>
<td>50</td>
</tr>
<tr>
<td>2.5 Summary</td>
<td>52</td>
</tr>
<tr>
<td>3. Basic investigative methodology</td>
<td>53</td>
</tr>
<tr>
<td>3.1 Background</td>
<td>53</td>
</tr>
<tr>
<td>3.2 General investigative procedure</td>
<td>55</td>
</tr>
<tr>
<td>3.3 Diagnostic process</td>
<td>57</td>
</tr>
<tr>
<td>3.4 Models of analysing defects</td>
<td>64</td>
</tr>
<tr>
<td>3.5 Problems in defects diagnosis</td>
<td>70</td>
</tr>
<tr>
<td>3.6 Summary</td>
<td>74</td>
</tr>
</tbody>
</table>
## 4 Diagnostic techniques and tools  
4.1 Information and decision aids 75  
4.2 Physical aids 76  
4.3 Background to analytical techniques 77  
4.4 Spectroscopy 79  
4.5 Other analytical techniques 83  
4.6 Non-destructive testing 92  
4.7 Summary 97  

## 5 Deterioration mechanisms  
5.1 Background 99  
5.2 Principal deterioration mechanisms 100  
5.3 Degrees of deterioration 111  
5.4 Staining 112  
5.5 Relationship between deterioration, obsolescence and depreciation 115  
5.6 Summary 116  

## 6 Durability and service life assessment  
6.1 Durability of materials 117  
6.2 Service life assessment 141  
6.3 Summary 147  

## 7 Moisture  
7.1 Introduction 148  
7.2 Sources of moisture 148  
7.3 Moisture from human activities 153  
7.4 Condensation 153  
7.5 Avoidance of condensation 157  
7.6 Summary 159  

## 8 Foundations  
8.1 Introduction 160  
8.2 Type and structure of the soil 160  
8.3 Interaction between soils and buildings 161  
8.4 Soil movement 161  
8.5 Fill 167  
8.6 Summary 169  

## 9 Floors, floor finishes and DPMs  
9.1 Background 170  
9.2 Hardcore 170
9.3 Damp-proofing of floors 173
9.4 Concrete floors 174
9.5 Magnesite flooring 179
9.6 Timber flooring 179
9.7 Clay floor tiles 183
9.8 Plastic sheets and tiles 183
9.9 Summary 185

10 Walls and DPCs 186
10.1 Moisture penetration from the ground 186
10.2 Rain penetration 187
10.3 Cold bridges and interstitial condensation 194
10.4 Cracking and spalling of masonry through movement 195
10.5 Damage to walls by chemical attack 199
10.6 Damage to walls by physical attack 202
10.7 Problems with renderings 205
10.8 Summary 207

11 Cladding 208
11.1 Background 208
11.2 Differential movement 208
11.3 Inaccuracies in construction 211
11.4 Faults caused by movement and inaccuracy 212
11.5 Sealants 215
11.6 Fixing methods 215
11.7 Prevention of loss of integrity in cladding 218
11.8 Water entry 220
11.9 Metal cladding 222
11.10 Summary 223

12 Doors and windows 224
12.1 Background 224
12.2 Doors 224
12.3 Windows 225
12.4 Prevention of failure and remedial work 231
12.5 Summary 232

13 Roofs 233
13.1 Background 233
13.2 Flat roofs 233
13.3 Pitched roofs 250
13.4 Summary 255
14 Services
14.1 Background 256
14.2 Heating installations 256
14.3 Chimneys and flues 258
14.4 Plumbing and drainage 261
14.5 Electricity supply 263
14.6 Summary 264

15 Failure patterns and control
15.1 Background 265
15.2 Ongoing defects 265
15.3 Review of causes 266
15.4 Recap on reasons for failure 267
15.5 Problems of innovation 269
15.6 Minimising building failures 271
15.7 Towards better control 274
15.8 Summary 278

Appendix A Glossary 280
Appendix B Schedule of defects 296
Appendix C Various defects data analysis checklists 297
Appendix D Sample diagnostic report 302
Bibliography 306
Index 319