APPLYING THE BUILDING CODE: STEP-BY-STEP GUIDANCE FOR DESIGN AND BUILDING PROFESSIONALS
APPLYING THE BUILDING CODE: STEP-BY-STEP GUIDANCE FOR DESIGN AND BUILDING PROFESSIONALS

Based on the 2015 International Codes®

RONALD L. GEREN, FCSI, AIA

WILEY
In memory of Ralph W. Liebing, RA, CPCA, CBO, CSI, CDT (1936–2014). A former Hamilton County, Ohio, building commissioner and a prolific writer, Ralph encouraged me to write and advised me at the beginning. Unfortunately, he was not able to see the final result.
CONTENTS

Preface ............................................................... xix
  About This Book .................................................. xix
  How to Use This Book ........................................... xix
  References .......................................................... xx
  Terminology ....................................................... xxi
  Example Project .................................................. xxi

Acknowledgments .............................................. xxiii

PART I
CODE BASICS ..................................................... 1

BUILDING CODE ORGANIZATION ........................................ 3
  Other Codes and Regulations ............................... 4
  Things to Look Out For ........................................ 6
  Know the Definitions .......................................... 6

TYPES OF FIRE-RESISTIVE ASSEMBLIES AND CONSTRUCTION .......... 8
  Fire Walls (IBC Section 706) ............................. 9
  Fire Barriers (IBC Section 707) ......................... 9
  Fire Partitions (IBC Section 708) ....................... 10
  Smoke Barriers (IBC Section 709) ....................... 10
  Horizontal Assemblies (IBC Section 711) ............. 10
  Exterior Walls ................................................... 11
  Interior Bearing Walls ....................................... 11
  Structural Frame ............................................... 11
# CONTENTS

## TYPES OF AUTOMATIC FIRE-EXTINGUISHING SYSTEMS AND STANDPIPES

- NFPA 13 (IBC Section 903.3.1.1) .................................................. 12
- NFPA 13R (IBC Section 903.3.1.2) .............................................. 13
- NFPA 13D (IBC Section 903.3.1.3) ............................................ 14

## ALTERNATIVE MATERIALS/METHODS AND MODIFICATIONS .......... 15

## PART II

### SCHEMATIC DESIGN ............................................................. 17

## Step 1. DETERMINE APPLICABLE BUILDING CODE ..................... 19

1.1. Identifying the Authority Having Jurisdiction .......................... 19
1.2. Adopted Codes and Amendments .......................................... 20
1.3. Code Alternates .................................................................. 20

## Step 2. OBTAIN ESSENTIAL BUILDING DATA .............................. 21

2.1. Total Building Area ................................................................ 21
2.2. Number of Stories .................................................................. 22
2.2.1. Grade Plane ................................................................. 24
2.2.2. Mezzanines ................................................................... 25
2.3. Building Area per Story ....................................................... 25
2.4. Building Height in Feet ......................................................... 25
2.5. Type of Sprinkler System ........................................................ 26
2.6. Proposed Construction Materials .......................................... 28
2.7. Climate Zone ....................................................................... 28
2.8. Flood Hazard Area ............................................................... 28

## Step 3. DETERMINE OCCUPANCY GROUP OR GROUPS .............. 31

3.1. Introduction to Occupancy Groups ......................................... 32
3.2. Assembly Group A (IBC Section 303) .................................... 32
3.3. Business Group B (IBC Section 304) ..................................... 32
3.4. Educational Group E (IBC Section 305) .................................. 33
3.5. Factory Group F (IBC Section 306) ....................................... 33
3.6. High-Hazard Group H (IBC Section 307) ............................. 33
3.7. Institutional Group I (IBC Section 308) ................................. 34
3.8. Mercantile Group M (IBC Section 309) ............................... 35
3.9. Residential Group R (IBC Section 310) .................................. 35
3.10. Storage Group S (IBC Section 311) ................................. 36
3.11. Utility and Miscellaneous Group U (IBC Section 312) ............ 36
3.12. Incidental Uses (IBC Section 509) ...................................... 36
## Step 4. DETERMINE CONSTRUCTION TYPE BASED ON ANTICIPATED MATERIALS ...................................................... 39
4.1. Introduction to Construction Types ........................................ 39
4.2. Type I Construction ........................................................... 40
4.3. Type II Construction .......................................................... 40
4.4. Type III Construction .......................................................... 41
4.5. Type IV Construction .......................................................... 41
4.6. Type V Construction .......................................................... 41

## Step 5. DETERMINE HOW MIXED USES AND OCCUPANCIES WILL BE HANDLED ............................................. 43
5.1. Introduction to Mixed Occupancies ......................................... 43
5.2. Separated Occupancies ......................................................... 44
5.3. Nonseparated Occupancies ..................................................... 44
5.4. Accessory Occupancies ......................................................... 45
5.5. Combination of Options ......................................................... 45
5.6. Deciding Which Method to Use .............................................. 47

## Step 6. DETERMINE SPECIAL USE AND OCCUPANCY IF APPLICABLE ... 50
6.1. Covered Mall and Open Mall Buildings (IBC Section 402) ............ 51
6.2. High-Rise Buildings (IBC Section 403) .................................. 52
6.3. Atriums (IBC Section 404) .................................................. 55
6.4. Underground Buildings (IBC Section 405) ............................... 56
6.5. Motor-Vehicle-Related Occupancies (IBC Section 406) ............... 57
   6.5.1. Private Garages and Carports (IBC Section 406.3) ............... 57
   6.5.2. Public Parking Garages (IBC Section 406.4) ....................... 57
      6.5.2.1. Open Parking Garages (IBC Section 406.5) ................. 58
      6.5.2.2. Enclosed Parking Garages (IBC Section 406.6) ............ 59
   6.5.3. Motor Fuel-Dispensing Facilities (IBC Section 406.7) ......... 60
   6.5.4. Repair Garages (IBC Section 406.8) ............................... 60
6.6. Group I-2 (IBC Section 407) ............................................. 61
6.7. Group I-3 (IBC Section 408) ............................................. 61
6.8. Motion Picture Projection Rooms (IBC Section 409) ................... 62
6.9. Stages, Platforms, and Technical Production Areas (IBC Section 410) .... 62
   6.9.1. Stages (IBC Section 410.3) ........................................... 62
   6.9.2. Platforms (IBC Section 410.4) ...................................... 63
6.10. Special Amusement Buildings (IBC Section 411) ...................... 63
6.11. Aircraft-Related Occupancies (IBC Section 412) ..................... 63
   6.11.1. Airport Traffic Control Towers (IBC Section 412.3) ............ 64
   6.11.2. Aircraft Hangars (IBC Section 412.4) ............................ 64
   6.11.3. Residential Aircraft Hangars (IBC Section 412.5) ............. 65
   6.11.4. Aircraft Paint Hangars (IBC Section 412.6) .................... 65
6.11.5. Aircraft Manufacturing Facilities (IBC Section 412.7) ...................... 65
6.11.6. Heliports and Helistops (IBC Section 412.8) ............................. 65
6.12. Combustible Storage (IBC Section 413) ......................................... 66
6.13. Hazardous Materials (IBC Section 414) ........................................ 66
6.15. Application of Flammable Finishes (IBC Section 416) ....................... 68
6.16. Drying Rooms (IBC Section 417) .................................................. 69
6.17. Organic Coatings (IBC Section 418) ............................................. 69
6.18. Live/Work Units (IBC Section 419) .............................................. 69
6.19. Groups I-1, R-1, R-2, R-3, and R-4 (IBC Section 420) ..................... 70
6.20. Hydrogen Fuel Gas Rooms (IBC Section 421) .................................. 70
6.21. Ambulatory Care Facilities (IBC Section 422) .................................. 71
6.22. Storm Shelters (IBC Section 423) ................................................ 71
6.23. Children's Play Structures (IBC Section 424) .................................. 71
6.24. Hyperbaric Facilities (IBC Section 425) ......................................... 72
6.25. Combustible Dusts, Grain Processing, and Storage (IBC Section 426) ... 72
6.26. Special Construction ................................................................. 73
   6.26.1. Membrane Structures (IBC Section 3102) ................................. 73
   6.26.2. Pedestrian Walkways and Tunnels (IBC Section 3104) ............... 74

Step 7. DETERMINE ALLOWABLE AREA AND HEIGHT ............................ 75
7.1. Introduction to Area and Height Requirements ................................... 75
7.2. Determining Allowable Height (IBC Section 504) ............................ 76
   7.2.1. Allowable Height in Feet ...................................................... 76
   7.2.2. Allowable Height in Stories .................................................. 77
   7.2.3. Allowable Height for Mixed Occupancies .................................. 77
7.3. Determining Allowable Area (IBC Section 506) ................................ 77
   7.3.1. Calculating Frontage Increase ............................................... 78
   7.3.2. Allowable Area of Single-Occupancy and Nonseparated
          Mixed-Occupancy Buildings .................................................. 80
   7.3.3. Allowable Area of Separated Mixed-Occupancy Buildings ............. 84
   7.3.4. Unlimited Area Buildings (IBC Section 507) ............................. 88
7.4. Special Provisions (IBC Section 510) ........................................... 88
7.5. Design Options ............................................................................ 93

Step 8. CALCULATE OCCUPANT LOAD .............................................. 99
8.1. Introduction to Occupant Loads ..................................................... 99
8.2. Calculating Occupant Loads ......................................................... 100
   8.2.1. Calculating Occupant Loads for Mall Buildings ......................... 101
8.3. Organizing Occupant Load Data ................................................... 104
Step 9. **ESTABLISH POINTS OF EGRESS** ........................................ 106

9.1. Introduction to the Means of Egress System ... 106
9.2. Number of Egress Doors ................................................. 107
  9.2.1. Number of Doorways from Spaces .......................... 107
  9.2.2. Number of Egress Points from Stories ....................... 107
    9.2.2.1. One Exit from Stories of Group R-2 Dwelling Units—IBC
     Table 1006.3.2(1) ................................................ 108
    9.2.2.2. One Exit from Stories of Other Occupancies—IBC
     Table 1006.3.2(2) ................................................ 108
    9.2.2.3. One Exit for Mixed Occupancies .......................... 108
  9.3. Separation of Exit and Exit Access Doorways ................. 110
  9.4. Door Operation ...................................................... 112

Step 10. **CHECK EGRESS PATHWAYS** ....................................... 116

10.1. General Requirements ................................................ 116
10.2. The Exit Access (IBC Section 1016) ............................... 118
  10.2.1. Exit Access Travel Distance (IBC Section 1017) ....... 119
  10.2.2. Common Path of Egress Travel (IBC Section 1006) ..... 123
  10.2.3. Aisles (IBC Sections 1018 and 1029) ....................... 125
  10.2.4. Exit Access Stairways and Ramps (IBC Section 1019) .... 127
  10.2.5. Corridors (IBC Section 1020) ............................... 128
  10.2.6. Egress Balconies (IBC Section 1021) ....................... 129
  10.3. The Exit (IBC Section 1022) ..................................... 130
    10.3.1. Interior Exit Stairways and Ramps (IBC Section 1023) .. 130
    10.3.2. Exit Passageways (IBC Section 1024) .................... 131
    10.3.3. Horizontal Exits (IBC Section 1026) ..................... 131
    10.3.4. Exterior Exit Stairways and Ramps (IBC Section 1027) .... 133
  10.4. The Exit Discharge (IBC Section 1028) ......................... 134
    10.4.1. Egress Courts (IBC Section 1028.4) ..................... 134
  10.5. Accessible Means of Egress (IBC Section 1009) ............. 135
    10.5.1. Stairways (IBC Section 1009.3) .......................... 135
    10.5.2. Elevators (IBC Section 1009.4) .......................... 136
    10.5.3. Areas of Refuge (IBC Section 1009.6) ................... 136
    10.5.4. Exterior Areas for Assisted Rescue (IBC Section 1009.7) .. 137
    10.5.5. Platform Lifts (IBC Section 1009.5) ...................... 137
  10.6. Minimum Egress Pathway Capacities ............................ 137

Step 11. **DETERMINE FIXTURE COUNTS** .................................... 142

11.1. Introduction to Plumbing Fixtures ............................... 142
  11.1.1. Occupant Load for Plumbing Fixtures ....................... 143
  11.1.2. Plumbing Fixture Access and Location ...................... 144
11.2. Basic Fixture Count Calculations .................................................. 145
11.3. Fixture Count Calculations for Mixed Occupancies ..................... 147
11.4. Substitutions ........................................................................... 148
11.5. Toilet Room Planning ............................................................... 149

Step 12. IDENTIFY FIRE DEPARTMENT ACCESS ROADS ............... 153
12.1. Minimum Requirements ............................................................ 153
12.2. Access Road Design ............................................................... 155

Step 13. IDENTIFY ACCESSIBLE ROUTES AND REQUIREMENTS ....... 158
13.1. Introduction to Accessibility in the Building Code ...................... 158
13.2. Scoping Requirements (IBC Section 1103) ................................. 160
13.3. Accessible Routes (IBC Section 1104 and ICC/ANSI A117.1
    Chapters 4 and 5) ................................................................. 161
13.3.1. Technical Requirements for Accessible Routes .................... 162
13.3.2. Technical Requirements for Accessible Site Elements .......... 166
13.4. Dwelling and Sleeping Units (IBC Section 1107 and ICC/ANSI A117.1
    Chapter 10) ..... ................................................................ 166
13.5. Toilet and Bathing Facilities (IBC Section 1109.2 and ICC/ANSI A117.1
    Chapter 6) ....................................................................... 167

PART III
DESIGN DEVELOPMENT .................................................................. 173

Step 14. CONFIRM STEPS 2 THROUGH 13 ....................................... 175
14.1. Review of Changes .................................................................. 175
14.2. Changes to Building Area and/or Height .................................. 176
14.3. Changes in Function and/or Size of Spaces ............................... 176
14.4. Changes in Building Structural Materials ................................. 178
14.5. Changes in Space Arrangement ................................................ 178
14.6. Changes in Location on Site .................................................... 179

Step 15. IDENTIFY LOCATIONS OF FIRE-RESISTIVE CONSTRUCTION,
ASSEMBLIES, AND OPENINGS ................................................... 186
15.1. Identifying Fire-Resistive Assemblies and Construction ............. 186
15.1.1. Fire Walls ........................................................................ 187
15.1.1.1. Fire Wall Horizontal Continuity .................................... 187
15.1.1.2. Fire Wall Vertical Continuity ....................................... 191
15.1.2. Fire Barriers ..................................................................... 193
15.1.3. Smoke Barriers ............................................................... 194
15.1.4. Fire Partitions ................................................................... 194
15.1.5. Smoke Partitions ............................................................... 196
15.1.6. Horizontal Assemblies .............................................................. 197
15.1.7. Primary Structural Frame and Bearing Wall Structure .............. 198
15.2. Opening Protection ................................................................. 199

Step 16. DEVELOP EXTERIOR WALL AND EXPOSED FLOOR ASSEMBLIES ........................................ 208
16.1. Exterior Wall Fire Resistance and Opening Protection ................. 208
16.2. Projections ............................................................................. 213
16.3. Thermal Performance .............................................................. 213
   16.3.1. Commercial Thermal Performance ..................................... 214
       16.3.1.1. R-Value Method (IECC Section C402.1.3) .................. 215
       16.3.1.2. U-Factor, C-Factor, and F-Factor Method (IECC Section C402.1.4) ........................ 215
       16.3.1.3. Component Performance Alternative Method (IECC Section C402.1.5) .................. 216
   16.3.2. Residential Thermal Performance ..................................... 216
       16.3.2.1. R-Value Computation Method (IECC Section R402.1.3) .... 216
       16.3.2.2. U-Factor Alternative Method (IECC Section R402.1.4) ..... 217
       16.3.2.3. Total UA Alternative Method (IECC Section R402.1.5) ...... 218
16.4. Air and Water Management .................................................... 218
   16.4.1. Air Management ............................................................... 218
   16.4.2. Water Management .......................................................... 219
       16.4.2.1. Above-Grade Exterior Walls ..................................... 219
       16.4.2.2. Basement Walls ......................................................... 220
16.5. Exterior Wall Materials .......................................................... 220
16.6. Fire Propagation .................................................................... 221

Step 17. DEVELOP ROOF ASSEMBLIES ............................................ 229
17.1. Roof Assembly Performance .................................................. 229
   17.1.1. Fire Classification and Resistance ........................................ 230
   17.1.2. Wind Resistance ............................................................... 230
   17.1.3. Thermal Performance ....................................................... 231
       17.1.3.1. Commercial Buildings .............................................. 231
       17.1.3.2. Residential Buildings ............................................... 233
   17.2. Roof Openings and Penetrations ........................................... 234
       17.2.1. Fire Resistance ............................................................... 234
       17.2.2. Skylights .................................................................... 234
       17.2.3. Roof Hatches ............................................................... 236
   17.3. Rooftop Structures and Equipment ........................................ 236
17.4. Roof Construction Materials .................................................. 236
   17.4.1. Roof Coverings ............................................................... 236
   17.4.2. Underlayments ............................................................... 238
   17.4.3. Insulation ..................................................................... 238
   17.4.4. Flashings ..................................................................... 238
Step 18. SELECT FINISHES ................................................................................. 242
18.1. Introduction to Finishes ........................................................................ 242
18.2. Interior Wall and Ceiling Finishes .......................................................... 243
18.2.1. Flame and Smoke Performance ......................................................... 243
18.2.2. Sanitation ............................................................................................ 244
18.2.3. Moisture and Mold Resistance ............................................................ 244
18.3. Interior Floor Finishes ............................................................................ 244
18.3.1. Flame and Smoke Performance ......................................................... 244
18.3.2. Sanitation ............................................................................................ 245
18.3.3. Slip Resistance .................................................................................... 245
18.3.4. Firmness and Stability ....................................................................... 246
18.4. Elevator Finishes .................................................................................... 246
18.5. Decorations and Trim ............................................................................. 246

Step 19. CHECK EGRESS WIDTHS ................................................................ 250
19.1. Calculation of Minimum Egress Width .................................................... 250
19.1.1. Exit Width from Buildings .................................................................. 253
19.1.2. Exit Width from Stories ...................................................................... 253
19.1.3. Exit Width for Corridors ...................................................................... 254
19.1.4. Exit Width from Spaces ...................................................................... 255
19.2. Calculation of Aisle and Aisle Accessway Widths ................................... 256

Step 20. CHECK ACCESSIBILITY REQUIREMENTS .................................... 264
20.1. Reach and Clearance Detail Requirements .............................................. 264
20.2. Accessible Assembly Seating (IBC Section 1108.2 and ICC/ANSI A117.1
Section 802) .................................................................................................. 265
20.3. Kitchens (IBC Section 1109.4 and ICC/ANSI A117.1 Section 804) .......... 267
20.4. Dwelling and Sleeping Units (ICC/ANSI A117.1 Chapter 10) ................. 268
20.4.1. Toilet and Bathing Facilities in Dwelling and Sleeping Units ............... 268
20.4.2. Kitchens in Dwelling and Sleeping Units ............................................ 269
20.5. Recreational Facilities ............................................................................ 269

Step 21. INTEGRATE SPECIAL REQUIREMENTS ........................................... 277
21.1. Special Uses and Occupancies ............................................................... 277
21.2. Sound Transmission .............................................................................. 277
21.2.1. Airborne Sound Transmission ............................................................ 279
21.2.2. Structure-Borne Sound Transmission ................................................ 279
21.3. Emergency Escape and Rescue ............................................................. 280
21.3.1. Minimum Size of Openings ............................................................... 280
21.3.2. Window Wells for Below-Grade Openings ......................................... 280
<table>
<thead>
<tr>
<th>21.4. Elevators and Conveying Systems</th>
<th>281</th>
</tr>
</thead>
<tbody>
<tr>
<td>21.4.1. General Elevator Requirements</td>
<td>281</td>
</tr>
<tr>
<td>21.4.1.1. Pits and Clearances</td>
<td>283</td>
</tr>
<tr>
<td>21.4.1.2. Machine Rooms</td>
<td>283</td>
</tr>
<tr>
<td>21.4.1.3. Elevator Lobbies and Hoistway Opening Protection</td>
<td>284</td>
</tr>
<tr>
<td>21.4.2. Fire Service Access Elevators (IBC Section 3007)</td>
<td>284</td>
</tr>
<tr>
<td>21.4.3. Occupant Evacuation Elevators (IBC Section 3008)</td>
<td>285</td>
</tr>
<tr>
<td>21.4.4. Conveying Systems Other Than Elevators</td>
<td>285</td>
</tr>
<tr>
<td>21.5. Flood-Resistant Design</td>
<td>286</td>
</tr>
<tr>
<td>21.6. Special Construction</td>
<td>287</td>
</tr>
</tbody>
</table>

PART IV
CONSTRUCTION DOCUMENTS .......................................................... 291

Step 22. CONFIRM STEPS 14 THROUGH 21 ........................................... 293
| 22.1. Review of Changes | 293 |
| 22.2. Changes in Function and/or Size of Spaces | 294 |
| 22.3. Changes in Space Arrangement | 294 |
| 22.4. Changes in Building Structural Materials | 294 |
| 22.5. Changes in Location on Site | 295 |
| 22.6. Changes in Wall and Roof Assemblies | 295 |
| 22.7. Changes in Interior Finish Materials | 296 |

Step 23. INTEGRATE EGRESS DETAILS ............................................... 297
| 23.1. Stairs, Ramps, Handrails, and Guards | 297 |
| 23.1.1. Stairs (IBC Section 1011) | 297 |
| 23.1.2. Ramps (IBC Section 1012) | 298 |
| 23.1.3. Handrails (IBC Section 1014) | 298 |
| 23.1.4. Guards (IBC Section 1015) | 299 |
| 23.2. Unenclosed Exit Access Stairways and Ramps | 299 |
| 23.3. Luminous Markings | 300 |

Step 24. IDENTIFY LOCATIONS OF SAFETY GLAZING .......................... 304
| 24.1. Introduction to Safety Glazing | 304 |
| 24.2. Human Impact Resistance | 305 |
| 24.2.1. Glazing in Athletic Facilities | 308 |
| 24.2.2. Glazing in Elevators | 309 |
| 24.2.3. Wired Glass | 309 |
| 24.3. Sloped Glazing Assemblies | 310 |
Step 25. DETAIL FIRESTOPPING, FIRE-RESISTANT JOINTS, AND FIREPROOFING ............................................................ 311
   25.1. Penetrations (IBC Section 714) .......................................................... 311
      25.1.1. Penetrations in Fire-Resistance-Rated Walls (IBC Section 714.3) ........ 312
      25.1.2. Penetrations in Horizontal Assemblies (IBC Section 714.4) ............. 313
   25.2. Fire-Resistant Joint Systems (IBC Sections 715) ................................. 314
   25.3. Fireproofing ................................................................................. 315
   25.4. Special Inspections (IBC Sections 1705.14, 1705.15, and 1705.17) ............ 316

Step 26. LOCATE PORTABLE FIRE EXTINGUISHERS AND CABINETS ... 318
   26.1. Fire Extinguisher Requirements Overview (IBC Section 906) ................. 318
   26.2. Selection of Fire Extinguishers .......................................................... 319
   26.3. Determining Number of Required Extinguishers .................................... 320
   26.4. Location and Installation of Fire Extinguishers ....................................... 320

Step 27. DETAIL CONSTRUCTION BASED ON SPECIFIC BUILDING MATERIALS AND EQUIPMENT ............................................. 327
   27.1. Code Requirements for Specific Materials ............................................ 327
      27.1.1. Concrete .................................................................................. 327
      27.1.2. Masonry ................................................................................ 328
      27.1.3. Steel ....................................................................................... 329
      27.1.4. Wood ..................................................................................... 330
      27.1.5. Gypsum and Plaster ................................................................. 330
      27.2. Accessibility Details ..................................................................... 331

Step 28. PREPARE CODE INFORMATION FOR CONSTRUCTION DOCUMENTS ............................................................................. 333
   28.1. Submittal Documents Overview (IBC Section 107 and IECC Section C103) .... 333
   28.2. Code Data on Construction Documents ................................................. 335
      28.2.1. Basic Code Data ..................................................................... 336
      28.2.2. Code Data on Drawings ............................................................. 337
      28.2.3. Code Data in the Project Manual .................................................. 338

PART V
EXISTING BUILDINGS ........................................................................ 339

TYPES OF WORK ............................................................................... 341

COMPLIANCE METHODS .................................................................. 342
   Overview ............................................................................................. 342
   Prescriptive Compliance Method ............................................................. 343
   Additions ............................................................................................ 343
   Alterations ......................................................................................... 343
<table>
<thead>
<tr>
<th>CONTENTS</th>
<th>xvii</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repairs</td>
<td>344</td>
</tr>
<tr>
<td>Fire Escapes</td>
<td>344</td>
</tr>
<tr>
<td>Glass and Window Replacement</td>
<td>344</td>
</tr>
<tr>
<td>Change of Occupancy</td>
<td>344</td>
</tr>
<tr>
<td>Historic Buildings</td>
<td>345</td>
</tr>
<tr>
<td>Other Requirements</td>
<td>345</td>
</tr>
<tr>
<td>Work Area Compliance Method</td>
<td>346</td>
</tr>
<tr>
<td>Performance Compliance Method</td>
<td>347</td>
</tr>
</tbody>
</table>

**APPLYING THE STEP-BY-STEP PROCESS TO EXISTING BUILDINGS** 349

- Schematic Design 349
- Design Development 351
- Construction Documents 352

**PART VI**

**CODE ENFORCEMENT** 353

**AUTHORITY HAVING JURISDICTION** 355

- Statutory AHJ 356
- Contractual AHJ 356

**THE DEPARTMENT OF BUILDING SAFETY** 357

- The Building Official 358
- Plans Examiners 358
- Inspectors 359

**PLAN REVIEWS** 361

**CODE ENFORCEMENT AND THE BUILDING CODE APPLICATION PROCESS** 363

**APPENDIX** 365

- **A. ARCHITECTURAL PROGRAM FOR PRIVATIZED STUDENT HOUSING** 367
- **B. CODE DATA INFORMATION TEMPLATE** 370
- **C. CODE DATA INFORMATION FOR EXAMPLE PROJECT** 400

**References** 417

**Index** 421
Preface

ABOUT THIS BOOK

Building codes are complex documents and they get more complex every time they are revised. However, the methods used to educate design professionals on the proper application of the building code have largely focused on explaining the code on a requirement-by-requirement basis—devoid of any explanation on how or when the code requirements are applied within the context of the building design process. This book fills that void by explaining the building code using a straightforward step-by-step method that conforms to the standard design phases that design professionals have used for decades.

The American Institute of Architects (AIA; www.aia.org) has established five phases of basic services that are described in its Document B101-2007, Standard Form of Agreement Between Owner and Architect, which consist of the following:

- Schematic design phase
- Design development phase
- Construction documents phase
- Bidding or negotiation phase
- Construction phase

The first three phases make up the design phases of a project, which involves the architect taking the owner’s requirements (i.e., program) and transforming them into a set of drawings and specifications that eventually form the basis of a construction contract between the owner and contractor. This book offers a step-by-step process for applying the building code based on the three design phases of an architect’s basic services.

HOW TO USE THIS BOOK

This book is not intended to be used in lieu of the building code, since the building code provides more requirements than what could be adequately discussed in this book. The book intentionally does not replicate requirements in the code but directs the user to the specific location where
the information can be found. Therefore, to properly use this book, a copy of the building code must be available.

The steps within each design phase are placed in a logical order based on the availability of project information, some of which is provided by previous steps. However, not all steps must follow the sequence exactly as presented in this book—slight alterations can be made to adjust for project-specific situations. Additionally, one step does not need to be completed before the next step can begin. Many of the steps can be accomplished concurrently.

The steps are placed in the latest possible phase they can be accomplished with minimal risk to the project. If a step is accomplished in a later phase, there is a possibility that portions of the design may need to be revised, costing time and money. For example, waiting until the construction documents phase to calculate occupant load may require redesign of the egress system (e.g., adding doors, widening stairways and corridors) or restroom facilities (e.g., adding plumbing fixtures) and could have a domino effect by impacting other elements of the building design. Similarly, accomplishing a step earlier in the process may affect time and money by performing unnecessary work that may need to be abandoned or revised significantly. However, there are some steps that may be accomplished earlier with little to no risk to the project.

Design professionals are frequently retained to provide predesign services that may include site selection and programming. While performing these predesign services, the design professional has access to some basic project information and can accomplish some of the early steps indicated for the schematic design phase. For example, Steps 1 through 8 could be completed using data the design professional generated for the programming statement—information most design professionals get at the schematic design phase if they are hired only to perform basic services.

As previously mentioned, the step-by-step process is structured around the traditional design services provided by design professionals under common owner–architect agreements, such as those published by the AIA and ConsensusDocs (www.consensusdocs.org). However, with the various delivery methods in use today, the design professional may be bound under a variety of contractual arrangements that use alternate phasing. For example, if the design–build delivery method is used, then preliminary design and final design phases may be used in lieu of the three design phases previously mentioned. The same applies to contracts utilizing documents published by the Engineering Joint Contract Documents Committee (EJCDC; www.ejcdc.org). These documents may be used when an engineering firm is the prime design professional to the owner and the architect is a consultant to the engineering firm.

Even though the design phases used on a project may be different from those presented in this book, the step-by-step process can easily be adjusted to accommodate any type of delivery method. Regardless of the delivery method used, the steps and the order in which they are discussed should remain relatively unaltered—it is mostly a matter of where to stop at each phase. For example, if the design period is split into preliminary and final design phases, Steps 1 through 18 can be accomplished during preliminary design and the remaining steps accomplished during final design.

REFERENCES
Since referencing the contents within the various codes covered by this book, as well as content in other areas of this book, can be very confusing, all references made will conform to the following conventions:

- For referenced sections, tables, equations, and appendices from the various codes and standards covered, each reference will begin with the code's or standard's acronym followed by the type of item referenced (i.e., Section, Table, Equation, or Appendix) and the number. For example, "IBC
Section 104" refers to Section 104 of the International Building Code. See Part I “Code Basics” for acronyms used for the various codes and standards.

- For references to other areas within this book that are a part of the step-by-step process, the reference will be preceded by the word “Step” followed by the specific number reference. For example, “Step 7.3” refers to the “Determining Allowable Area” section of Step 7.
- For references to other areas within this book that are not part of the step-by-step process, the reference will identify the part number (i.e., I, V, or VI) followed by the title of the specific area within the Part. For example, Part VI “The Building Official” refers to the section titled “The Building Official” located in Part VI.
- References to an appendix that is not preceded by an acronym refer to the appendix within this book.

TERMINOLOGY

Identification of building code terminology used in this book is similar to that used in the IBC with some exceptions. The descriptions below explain how terminology is used in this book:

<table>
<thead>
<tr>
<th>Term Format</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBC term</td>
<td>Terms used within the IBC will be italicized as indicated. Use the IBC to obtain the definition. Example: Fire areas are used in determining sprinkler requirements.</td>
</tr>
<tr>
<td>Other code term (Code)</td>
<td>Terms used in other codes referenced by the IBC are also italicized but will be followed by the acronym for the code in which the term is defined. Since many terms are defined in multiple ICC codes, if a term is provided in the IBC, then it will be considered an IBC term unless specifically identified with another code. Example: When the existing occupancy group is changed, it is considered a change of occupancy (IEBC).</td>
</tr>
<tr>
<td>Noncode term</td>
<td>Terms defined by sources other than a code will be bold and italicized. The definitions for these terms are provided in this book.</td>
</tr>
</tbody>
</table>

EXAMPLE PROJECT

To assist in illustrating the application of the step-by-step process, an example project is used throughout all steps provided. The project is a mixed-use residential building that incorporates apartments, parking, amenity, and commercial uses.

Although individual examples are used throughout the book to explain specific applications of code requirements, the use of a single example project for all steps will explain how the level of information available at that phase of design can be used when applying the building code. Additionally, the example project will also show how information collected and decisions made during previous steps are used for subsequent steps.

A copy of the programming statement for the example project is located in Appendix A.
Acknowledgments

First and foremost I want to thank my wife, Susan, and my daughters, Sarah, Rebecca, and Whitney for their encouragement and endurance through this challenging but rewarding experience of writing my first book—I love you all. To my parents, Al and Bonnie, thank you for the love and support that only a mom and dad can give.

Thank you to Richard Baxter, CSI, past president of the Salt Lake City CSI chapter, who graciously invited me to be the keynote speaker at the chapter's annual Education Symposium by asking me to speak on a topic something like a "step-by-step code analysis." From that simple request and ensuing presentation grew the idea for this book.

I also want to thank the readers of my Code Corner articles for their thirst of building code knowledge and the many unsolicited positive comments I have received. It gave me the confidence as a writer to accomplish this enormous undertaking.

To my students and fellow faculty, past and present, at Taliesin, the Frank Lloyd Wright School of Architecture, I want to thank you for your support of building code education and giving me the opportunity to preach what I practice.

Thank you to the many folks at Wiley for their patience and understanding while working with this novice book author. Your efforts and support are greatly appreciated.

Finally, I want to acknowledge my extended family, friends, clients, and CSI colleagues for their shared enthusiasm throughout this experience.
APPLYING THE BUILDING CODE: STEP-BY-STEP GUIDANCE FOR DESIGN AND BUILDING PROFESSIONALS
The International Building Code® (IBC), like the history of model building codes before it, does not intend that a building be designed in a particular manner or style or that it must use certain materials. The IBC establishes minimum requirements for the protection of public health, safety, and welfare, but within those requirements is great flexibility for the design professional. Some code requirements offer only one method for compliance, but many have options or alternatives for the design professional to consider. It is the design professional’s responsibility to consider these code options and alternatives and compare them to the owner’s program requirements and budget, as well as the design professional’s own design vision for the building, to decide which option provides the most value for the building’s owner.