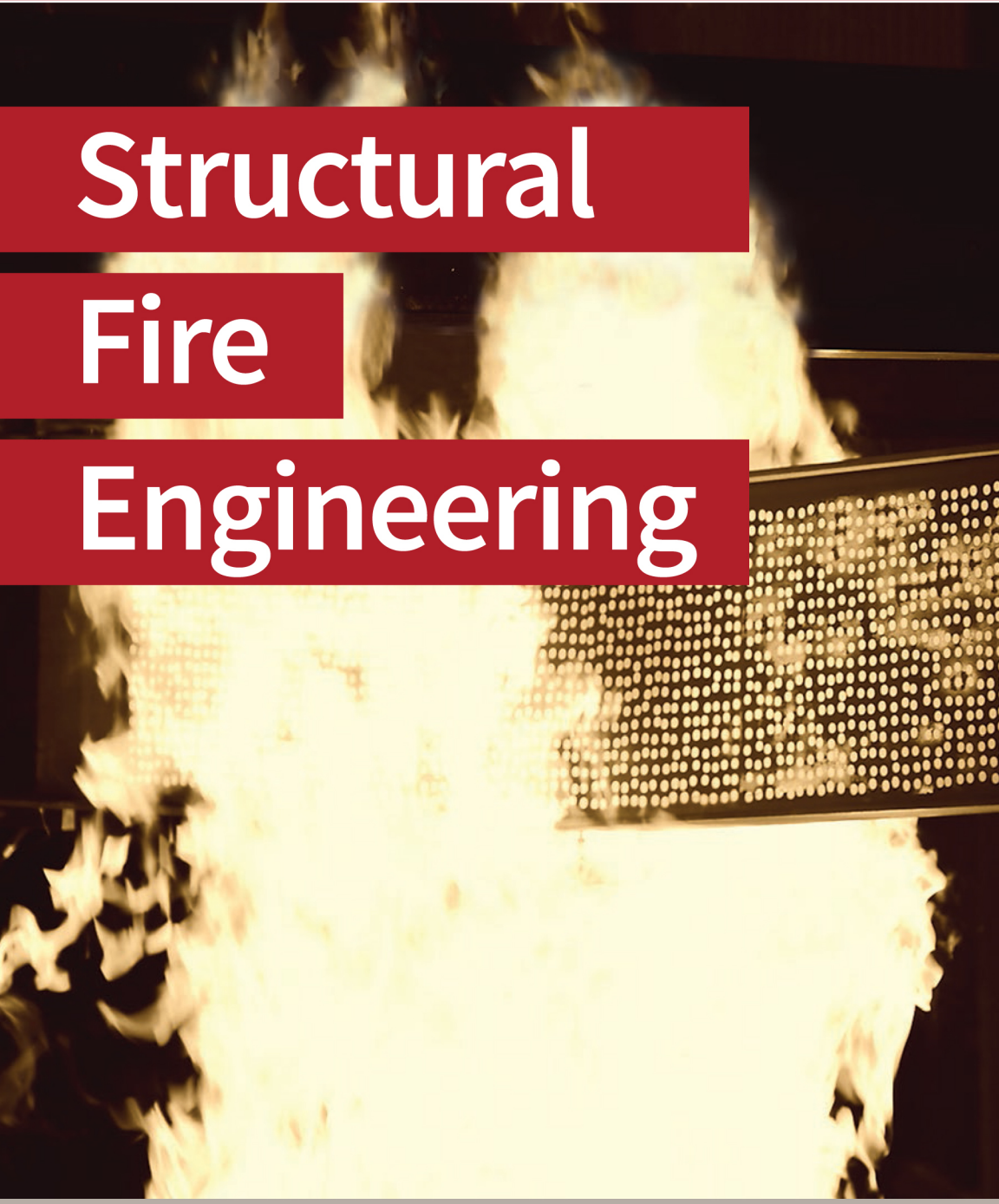
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Structural Fire Engineering



Fire Protection Committee

Edited by Kevin J. LaMalva, P.E.

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Prepared by the Fire Protection Committee of the Structures Engineering Institute of the American Society of Civil Engineers and Edited by Kevin J. LaMalva, P.E.

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CONTENTS

PREFACE ix

ACKNOWLEDGMENTS xi

PART 1: INTRODUCTION TO STRUCTURAL FIRE ENGINEERING DESIGN **1**

1. INTRODUCTION AND KEY TERMINOLOGY **3**
1.1 Overview 3
1.2 Background 4

2. DESIGN APPROACHES **15**
2.1 Overview 15
2.2 Standard Fire Resistance Design (SFRD) 16
2.2.1 Standard Fire Testing 17
2.2.2 Calculation Methods 21
2.3 Structural Fire Engineering Design (SFED) 21
2.3.1 Professional Responsibility 22

3. PERFORMANCE OBJECTIVES **27**
3.1 Minimum Performance Objectives 27
3.2 Discretionary Performance Objectives 28

PART 2: THERMAL RESPONSE OF STRUCTURES UNDER FIRE **31**

4. THERMAL BOUNDARY CONDITIONS **33**
4.1 Fuel Load 33
4.2 Fire Exposure Conditions 34
4.2.1 Enclosure Fires 37

4.2.2 Localized Fires 38
4.2.3 Exterior Fire Exposure 38
4.2.4 Traveling Fires 40
4.2.5 Post-Hazard Event Fires 42
4.3 Fire Exposure Calculation Methods 44
4.3.1 Algebraic Correlations 44
4.3.2 Zone Models 45
4.3.3 Field Models 45
4.3.4 Validation of Fire Models 46

5. MATERIAL THERMAL PROPERTIES 51
5.1 Spray-Applied Fire Resistant Materials 52
5.2 Gypsum Board Products 56
5.3 Intumescent Coatings 59
5.4 Steel 61
5.5 Concrete 63
5.6 Masonry 68
5.7 Timber 71

6. HEAT TRANSFER CALCULATION 81
6.1 Steel Structures 83
6.1.1 Variability of SFRM Thickness and Density 84
6.1.2 Localized Insulation Damage 85
6.1.3 Thermal Bridging 86
6.2 Concrete Structures 87
6.3 Timber Structures 87
6.4 Nonuniform Heating 88
6.5 Mechanical Integrity 89
6.6 Methods of Heat Transfer Analysis 91
6.6.1 Lumped Mass Method 91
6.6.2 Finite Element Method 93
6.6.3 Finite Difference Method 94

PART 3: STRUCTURAL RESPONSE TO FIRE EFFECTS 99

7. STRUCTURAL FIRE EFFECTS 101
7.1 Overview 101
7.2 Fire Effects on Structural Demand and Capacity 103
7.2.1 Thermal Expansion and Contraction 103
7.2.2 Nonuniform Heating 104
7.2.3 Cooling Phase Effects 104
7.3 Failure Modes 105
7.3.1 Structural Steel 105
7.3.2 Reinforced Concrete and Masonry 107

7.3.3 Timber 110
7.3.4 Nonstructural Components 110

8. MECHANICAL MATERIAL PROPERTIES 115
8.1 Overview 115
8.2 Mechanical Properties of Steel 117
8.2.1 Structural Steel 117
8.2.2 High-Strength Bolts 129
8.2.3 High-Strength Steel 140
8.2.4 Cold-Formed Steel 147
8.2.5 Steel Grades with Improved Properties 152
8.3 Mechanical Properties of Concrete and Reinforcing Steel 161
8.3.1 Concrete 161
8.3.2 Reinforcing Steel 174
8.3.3 Prestressing Steel 178
8.4 Mechanical Properties of Masonry 184
8.5 Mechanical Properties of Timber 186
8.5.1 Moisture Effects 187
8.5.2 Parallel-to-Grain Properties 187
8.5.3 Perpendicular-to-Grain Properties 189
8.5.4 Char Rates 190

9. STRUCTURAL ANALYSIS FOR FIRE EFFECTS 199
9.1 Load Combinations 199
9.2 Structural Analysis Tools 201
9.2.1 Mapping Thermal Results to the Structural Model 201
9.2.2 Simplified Analytical Tools 202
9.2.3 Finite Element Analysis 203
9.3 Structural Analysis Methods 209
9.3.1 Primary Structural Framing 209
9.3.2 Composite Slabs and Floor Systems 210
9.3.3 Structural Connections 211
9.3.4 Structural Walls 213

10. STRUCTURAL ACCEPTANCE CRITERIA 217
10.1 Overview 217
10.2 Structural Steel 218
10.2.1 Local Behavior 218
10.2.2 Gross Member Behavior 219
10.2.3 Connection Design 220
10.2.4 Compartmentalization 222
10.2.5 Egress Path Levelness 222
10.2.6 Exit Stairways 223

10.3 Composite Steel and Concrete 223
10.3.1 Local Behavior 223
10.3.2 Gross Member 224
10.3.3 Connection Design 227
10.4 Reinforced and Prestressed Concrete 227
10.4.1 Concrete Cover Spalling 227
10.4.2 Local and Global Behavior 228
10.4.3 Analytical Tools and Analysis 229
10.5 Timber 229
10.5.1 Gross Member 229
10.5.2 Connection Design 231

INDEX 235

PREFACE

Uncontrolled fire within a contemporary building is an extraordinary event that can have severe consequences. When structural systems are heated by fire, they experience thermal effects that are not contemplated by conventional structural engineering design. Since the early 20th century, building codes have primarily adopted standard fire resistance design. This design option is based on furnace testing of isolated structural components and relies almost exclusively on insulation for structural fire protection. Using this approach, designers select qualified assemblies from available listings to meet prescribed levels of fire resistance. As an alternative approach, structural fire engineering design explicitly evaluates the performance of structural systems under fire exposure, in a similar manner as other design loads are treated in structural engineering practice.

The 2016 edition of ASCE/SEI 7 (*Minimum Design Loads and Associated Criteria for Buildings and Other Structures*) includes a new Chapter 1, Section 1.3.7, "Fire Resistance." In addition to being the first time that fire resistance has ever been addressed in this standard, this section is intended to commence a new industry-consensus standard of care for structural fire protection. The default option is for the designer to strictly adhere to the requirements and restrictions of standard fire resistance design per the applicable building code without exception or extrapolation. As an alternative, ASCE/SEI 7-16 permits the designer to adopt a structural fire engineering approach as constituted in the standard's new Appendix E, "Performance-Based Design Procedures for Fire Effects on Structures." Notably, the inclusion of Appendix E in ASCE/SEI 7 marks the first time that fire effects are considered as an explicit design load in a U.S. structural engineering standard.

The main objective of the manual is to provide best practices when a structural fire engineering design approach is adopted, as permitted by ASCE/SEI 7 Chapter 1, Section 1.3.7, and as constituted in Appendix E. Because standard fire resistance design does not contemplate structural

system performance or explicit performance objectives, there is no practical method for a designer to quantitatively compare the level of safety provided by a structural fire engineering design to that provided by a standard fire resistance design. Furthermore, it is not reasonable to require that a structural fire engineering design be "equivalent" to a standard fire resistance design, which does not provide any affirmative quantification of structural system performance under fire exposure. Hence, the best practices described in this manual for successful implementation of a structural fire engineering design are intended to stand independently from acceptance criteria in standard fire resistance design. Although the manual was written with the aim of providing best practices for engineers, it is hoped that it will also be useful to architects, building officials, and academics concerned with performance-based design for structural fire safety. Also, the combination of ASCE/SEI 7 Appendix E, this manual, and other related standards should advance structural fire engineering design as a distinct discipline within structural engineering.

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