

TABLE OF CONTENTS

List of symbols and acronyms	6
Introduction.....	8
1 Introduction on Eurocodes structural fire safety design	9
1.1 List of Eurocodes	9
1.2 Fire safety design of structures	9
1.3 Simple calculation models & tabulated data in Eurocodes	12
1.4 Advanced calculation models.....	13
2 Establishing the thermal effect of fire.....	15
2.1 Temperature curves.....	16
2.1.1 Nominal temperature curves.....	16
2.1.2 Parametric temperature curves.....	17
2.2 Simplified fire models.....	18
2.2.1 Compartment fire models	18
2.2.2 Localised fire models.....	18
2.3 Advanced fire models	19
2.3.1 Zone models	19
2.3.2 CFD fire models.....	24
2.4 Fire scenarios and design fires	26
2.4.1 Design fire scenarios	26
2.4.2 Design fires.....	27
2.5 Country-specific recommendations regarding the use of the above models	27
2.5.1 Fire simulation practice in Hungary – background	27
2.5.2 Fire modelling practice in Hungary.....	28
3 Thermal response & heat transfer – interfacing fire and structural models.....	31
3.1 Physical bases for heat exchange between the fire and the structure	32
3.2 Convective heat flux	33
3.3 Radiative heat flux	34
3.3.1 Shadow effect.....	36
3.4 Adiabatic surface temperature	36
3.4.1 Concept of adiabatic surface temperature	36
3.4.2 Calculation of AST based on plate thermometer output	38
3.5 Heat conduction.....	40
3.6 Modelling approaches	41
3.6.1 Lumped capacitance model	41

3.6.2 Semi-infinite solids and 1D heat transfer 45

3.6.3 Intermediate models 48

3.6.4 2D heat transfer analyses using Finite Element Method..... 51

4 Thermal and mechanical response calculation models 53

4.1 Simplified structural fire resistance models..... 53

4.2 Advanced structural models..... 55

4.3 Integrated advanced structural models..... 57

5 Control..... 58

5.1 Situation (structure & fire) representation..... 58

5.2 Sensitivity and uncertainty 58

5.3 Verification and validation 61

5.4 Data and their sources..... 62

6 Case studies 64

6.1 Industrial offshore hall..... 64

6.1.1 General description of the structure..... 64

6.1.2 Numerical methods..... 65

6.1.3 CFD fire model..... 65

6.1.4 FEM mechanical model..... 67

6.1.5 Fire scenario determination..... 68

6.1.6 Results 68

6.2 Refurbishment and converting the old industrial Eiffel-hall into Workshop and Rehearsal Centrum for the Opera..... 75

6.2.1 Introduction 75

6.2.2 The load-bearing steel structure of the Eiffel-hall 76

6.2.3 Fire safety design..... 77

6.2.4 Checking of the steel structure against fire load..... 81

6.2.5 Summary 83

6.3 Car park..... 84

6.3.1 Description 84

6.3.2 Fire modelling 85

6.3.3 Structural modelling..... 88

Bibliography 94

Annex – Brief summary on establishing fire resistance requirements in V4 countries and the partner country100

Czech republic..... 100

Fire resistance requirements 100

Literature.....	102
Hungary	103
Fire safety design of the structures	103
Literature.....	108
Poland.....	109
Literature.....	110
Slovak republic	111
Fire resistance requirements	111
Literature.....	114
Serbia.....	115
Fire resistance requirements	115
Literature.....	116