

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 country	100
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