COST is supported by the EU RTD Framework Programme and ESF provides the COST Office through an EC contract.

Fire Eurocodes - The Future?

March 2014

COST- the acronym for European **CO**operation in the field of **S**cientific and **T**echnical Research- is the oldest and widest European intergovernmental network for cooperation in research. Established by the Ministerial Conference in November 1971, COST is presently used by the scientific communities of 35 European countries to cooperate in common research projects supported by national funds.

The funds provided by COST - less than 1% of the total value of the projects - support the COST cooperation networks, COST Actions, through which, with only around € 20 million per year, more than 30.000 European scientists are involved in research having a total value which exceeds € 2 billion per year. This is the financial worth of the European added value which COST achieves.

A bottom up approach (the initiative of launching a COST Action comes from the European scientists themselves), à la carte participation (only countries interested in the Action participate), equality of access (participation is open also to the scientific communities of countries not belonging to the European Union) and flexible structure (easy implementation and light management of the research initiatives) are the main characteristics of COST.

As precursor of advanced multidisciplinary research COST has a very important role for the realisation of the European Research Area (ERA) anticipating and complementing the activities of the Framework Programmes, constituting a ridge towards the scientific communities of emerging countries, increasing the mobility of researchers across Europe and fostering the establishment of Networks of Excellence in many key scientific domains such as: Biomedicine and Molecular Biosciences; Food and Agriculture; Forests, their Products and Services; Materials, Physics and Nanosciences; Chemistry and Molecular Sciences and Technologies; Earth System Science and Environmental Management; Information and Communication Technologies; Transport and Urban Development; Individuals, Society, Culture and Health. It covers basic and more applied research and also addresses issues of pre-normative nature or of societal importance.

Web: http://www.cost.eu

COST Action TU0904
Integrated Fire Engineering and Response
fire.fsv.cvut.cz/ifer

Fire Eurocodes - The Future?

Wald F., Burgess I., Outinen J., Vila Real P., Horová K.

The production of this publication is supported by COST.

ISBN – 978-80-01-05476-5
CTU Publishing House, Czech Technical University in Prague
March 2014

CONTENTS

INTRODUCTION

It is current practice in the European Union that safety, including Fire safety, is nationally managed, and the demands made are determined by the specific experiences of each country. While the political motivation for this approach is obvious, and local circumstances vary between countries, it can easily lead to similar processes having to be re-researched and re-invented country by country. In the context of the European Union, safety requirements in the event of fire are based on Directive 305/2011 (9 March 2011) of the European Parliament and Council, setting harmonised conditions for the marketing of construction products and repealing the previous Council Directive 89/106/EEC. The regulation is applied to construction products, as an essential element in construction works. In Annex I of this Directive, the essential requirements for mechanical resistance and stability, and for fire safety, are summarised. The construction works must be designed and built in such a way that, in the event of the outbreak of fire:

- The load-bearing capacity of the construction can be assumed for a specific period of time;
- The generation and spread of fire and smoke within the works are limited;
- The spread of the fire to neighbouring construction works is limited;
- Occupants can leave the works or be rescued by other means;
- The safety of rescue teams is taken into consideration.

The load-bearing capacity of the construction may be modelled on the principles summarised in the parts of the structural Eurocodes which deal with fire. The materials relevant for the proper application of Eurocode fire design are described with worked examples in (Wang *et al.*, 2012) and for steel structures in (Moore *et al*., 2007) and (Franssen and Vila Real, 2011).

The first part of the material produced in this Work Package was prepared on the basis of the work of WG3 (Integrated Design) and edited by Professor Paulo Vila Real (Portugal) and Dr Jyri Outinen (Finland). The questionnaire was intended to establish current design practice in the member countries with respect to fire safety in buildings (Wald *et al*., *Integrated fire engineering and response - state of the art report*, Czech Technical University, Prague, 2011, 239, ISBN 978-80-01-04598-5). Seventeen countries provided responses (Belgium, Croatia, Czech Republic, Finland, France, Germany, Greece, Hungary, Italy, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Turkey and United Kingdom). Questions concern building regulations, design codes the approvals process, the role of insurance companies, qualification requirements for designers, the conditions for the use of performance based fire engineering design and passive fire protection. The answers have been collated and summarised in this document, so that comparisons can be made. The ways in which designers, regulators and authorities currently deal with application of the 'fire' parts of the structural Eurocodes (EN199x-1-2) in different countries, are then listed. The questions in this section, mainly suggested by Dr Florian Block, co-Chair of WG1, were finalised in 2014.

Requirements for the contents of documentation on fire safety design were prepared by Dr Jyri Outinen, on the basis of Table 2 in *Performance-based structural fire safety design* (Rautaruukki Oyj). This part covers the use of Eurocodes in fulfilling the requirements for fire safety in national regulations.

The third part of this volume summarises a collection of knowledge developed in recent European and national research projects, which suggests that amendments should be made to the 'fire' parts of the Eurocodes. It is hoped that these suggestions will help to increase the fire safety of future European buildings. The work is categorised in terms of existing and expected standards, and is intended both to inform the direct development of the Eurocodes, but also to aid the production of Technical Documents which will accompany the next generation of Eurocodes.

The text was kindly reviewed by Prof. Gintaris Kaklauskas, Vilnius Gediminas Technical University, Lithuania.

Luleå, March 2014

Ian Burgess, František Wald

1 Current application of structural fire Eurocodes

In 2011 several questions were prepared to find out which were the current design practice in some European countries regarding fire safety in buildings. Thirteen countries have responded to that questionnaire. In 2014 this questionnaire has been updated by the country members that have answered to the first edition and four new countries have also contributed to the questionnaire. Seventeen countries have responded to the call: Belgium, Croatia, Czech Republic, Finland, France, Germany, Greece, Hungary, Italy, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Turkey and United Kingdom.

Questions about building regulations, design codes approvals process, insurance companies, qualification requirements for designers, precedence of performance based fire engineering projects and passive fire protection have been made.

The aim was to provide information about the practice in the European countries. Building and design to other countries meet often a variety of problems due to different procedure and acceptance. To help in this matter and also in co-operation between researchers from different countries this questionnaire has been gathered. Although EU should make this kind of interaction easier, the national regulations vary a lot and therefore this kind of information is valuable.

All the answers have been collected and put together in this document so that a comparison could be made between them. The way in which designers, regulators and authorities currently deal with the issues of fire safety in buildings in some European countries, can be checked hereafter.

The following questions, mostly suggested by Dr Florian Block Co-chairman of WP1, have been sent to the members. A comment from Professor Paulo Vila Real and Dr Jyri Outinen has been included.

1. Building Regulations

1.1 Are the Building Regulation Prescriptive / performance based (i.e. is it possible to design from first principles using finite element analysis, CFD, etc to show that the intents of the Building Regulations are met?)

Comment*: Most of the countries allow for performance based design and the use of advanced calculation methods. Only in Greece, Hungary, Romania and Slovakia the regulations are purely prescriptive and do not allow for the use of advanced calculation methods.*

1.2 What are the Building Regulations relevant for fire called and who is the issuing body?

Comment: *Each country provided a list of their Building Regulation for Fire Safety.*

1.3 Is there additional guidance available to interpret the Building Regulations for fire?

Comment: *Some Countries have guides and FAQ's. Croatia, France, Greece and Italy do not have this type of information from the authorities.*

1.4 Are there different regulations for certain types of buildings (I.e. schools, hospitals, airports, railway stations)?

Comment: *In all the Countries the regulation covers the most type of buildings*

2. Design Codes

2.1 What are the relevant national or international/European standards required to undertake the design of:

Means of escape

Smoke management

Fire resistance of the construction

Fire fighting

Fire safety systems (alarm, suppression, …)

Comment: *Most of the Countries do not have relevant regulation for Means of escape, Smoke management, Fire fighting and Fire safety systems (alarm, suppression, …), but some guidance are given in the National Regulation for fire safety or some rules are used from NFPA. Only Poland has referred the EN 12101 - Smoke and heat control systems, which also should be used in the other European Countries. All the countries have adopted the structural Eurocodes for checking fire resistance of constructions.*

2. 2 Is it possible to use Eurocodes or other international fire standards in lieu of the local code?

Comment: *All the countries have adopted the structural Eurocodes*.

2.3 Are there available the translations of the fire parts of Eurocodes? Which ones?

Comment: *For the time being only Greece, Hungary and Italy do not have any translation available*.

2.4 Are the national annexes available in internet?

Comment: *Only Finland, Greece, Turkey and UK provide the National Annexes in the internet.*

3. Approvals process

3.1 What is the normal route to get a project approved?

Via a public body

Via a private body

Self-certified

Comment: The *projects are approved in most of the Countries via a public body.*

3.2 What is the position of the fire brigade in the process?

Comment: *In all the Countries the fire brigade plays an important role in the approval process. In Croatia Fire brigade doesn't participate in the process of design approval. Exception is the case of approval of fire approach paths for the historical buildings.*

3.3 Is there a third party review process common?

Comment: In all the Countries it is not common to have a third party review process.

3.4 Is it necessary to follow an alternative route of approvals for performance based design and what would that route be?

Comment: *For the Countries where it is possible to use performance based design the project follows the same route as for prescriptive approach, i.e. the authorities must approve the project.*

3.5 What is the normal time frame for the approvals process?

Comment: *Not easy to define. The time depends on the complexity of the project.*

3.6 What level of information must be provided to the approving body?

Comment: *In all the Countries the normal details of a project of fire safety of buildings.*

3.7 Are any specific facilitators required to help the engineer in the approvals process?

Comment: *In most of the countries there are no specific facilitators required to help the engineer in the approvals process, but in Czech Republic, Greece, Hungary, Portugal and Spain the support can be asked to the authorities.*

4. Insurance companies

4.1 Are insurance companies involved in the design process?

Comment: *In most of the countries no, but in Spain requirements of insurance companies are more restrictive that authorities for important projects, for instance; skyscrapers or industrial installations.*

4.2 Are insurance companies open to a discussion on fire safety?

Comment: *In most of the countries insurance companies are not particularly concerned with this matter when establishing insurance premium, they are normally conservatives. Only in Belgium and Finland the insurance companies open to a discussion on fire safety.*

5. Qualification requirements for designers and Insurance Companies

5.1 Is it required to hold specific certificates/licenses in the member state to undertake fire safety design and fire engineering?

Comment: *In some Countries no (Belgium, France, Germany in some federal sates, Greece, Spain, Turkey and UK) and in other yes (Croatia, Czech Republic, Finland, Germany in some federal sates, Hungary, Italy, Poland, Portugal, Romania, Slovakia and Slovenia).*

5.2 Are there certain types of buildings for which specific design licenses are required?

Comment: *In most of the countries no, but in Finland, Poland, Portugal and Spain there are certain types of buildings for which specific design licenses are required.*

5.3 Is the licenses holder an individual or an organisation?

Comment: *In most of the countries the license is individual. In France and Hungary the license holder is an organization.*

5.4 Is a specific insurance required?

Comment: *In all the Countries a specific insurance is not required.*

6. Precedence of performance based fire engineering projects

6.1 Project details.

Comment: *It depends on the Country the amount of the details. Normally are the temperature of the compartment according to the adopted fire scenario, and calculation in agreement with the standards.*

6.2 What was performance based?

Comment: *In most cases the fire scenario and structural fire behaviour, but also the evacuation time of the building.*

6.3 What techniques where used to justify the non-compliance?

Comment: *Normally Fire Safety Engineering.*

6.4 What approvals route was used?

Comment: *Usual route through the authorities.*

6.5 Is in your country standardised/recommended format of text of calculation of Performance based fire design?

Comment: *In most countries no.*

1.1 Building regulations

1.1.1 Prescriptive / performance based rules

Are the Building Regulation Prescriptive / performance based (i.e. is it possible to design from first principles using finite element analysis, CFD, etc to show that the intents of the Building Regulations are met?)

BELGIUM

The regulations are Prescriptive. For industrial buildings: mixture of prescriptive & performance based design and use some calculation methods.

CROATIA

The regulations allow performance based design and use of advanced calculation methods, but these methods have to be discussed with the public authorities for every project.

CZECH REPUBLIC

The regulation allows performance based design and use of advanced calculation methods (technical expertise). Law No. 133/1985 Coll. on fire protection (Section 99): Certified engineer in fire protection can use during the design of fire safety of building approach which is determined by technical standart or another technical document of fire protection.

FINLAND

The regulation allows both: design based on prescriptive rules, performance based design and use of advanced calculation methods.

FRANCE

The building regulation is mostly prescriptive, but allows performance based design and use of advanced calculation methods.

GERMANY

The regulations in exceptionally allow performance based design and use of advanced calculation methods. These methods have to be discussed with the public authorities for every project.

GREECE

The regulation doesn't allow the use of advanced calculation methods (finite element analysis, CFD, etc.).

HUNGARY

The regulations are really prescriptive.

ITALY

The regulations are basically prescriptive and concern several types of building use. However, the performance based design and advanced calculation methods may be applied either in the lack of prescriptive rules or in the case of "derogation" with respect to prescriptive rules.

POLAND

Generally building regulations are still prescriptive, but they allow performance based design and use of advanced calculation methods.

PORTUGAL

The regulation allows performance based design and use of advanced calculation methods.

ROMANIA

The regulations are prescriptive.

SLOVAKIA

It is not possible to use the engineering access.

SLOVENIA

The regulations are mostly Prescriptive. The regulation allows performance based design and use of advanced calculation methods but in this case additional revision of the project is required.

SPAIN

There are excellent codes in Spain based in modern concepts of Fire Engineering in harmony with European regulations. Spanish designers can use advanced models with supervision of local officers.

TURKEY

The regulations are prescriptive. The main regulation is on the fire safety of buildings. It is obliged by law to design and construct buildings according this document. The official title (in Turkish) "*Türkiye Binaların Yangından Korunması Hakkında Yönetmelik 2009*" is available online.

UNITED KINGDOM

The regulation allows performance based design and use of advanced calculation methods.

1.1.2 Relevant Building Regulations

What are the Building Regulations relevant for fire called and who is the issuing body?

BELGIUM

Les Normes de Base:

- 7 Juillet 1994. - Arrêté royal fixant les normes de base en matière de prévention contre l'incendie et l'explosion, auxquelles les bâtiments nouveaux doivent satisfaire plus modifications
- Plus a lot of regulations for all sort of building types such as hotels, hospitals, homes for elderly people.

CROATIA

Law on Fire Protection (NN 92/10), Ministry of Internal Affairs

Regulation of resistance to fire and other requirements that buildings must meet in fire (NN 29/13), Ministry of Internal Affairs

- Plus a lot of accompanying regulations which can be found on:

http://www.arhitekti-hka.hr/hr/zakoni-propisi/popis/zastita/od-pozara/

CZECH REPUBLIC

Law No. 133/1985 Coll., on Fire Protection

This Law includes obligations of state authorities, legal and natural persons on fire protection field (e.g. classification of performed business by fire risk, content evaluation of fire risk).

Decree No. 246/2001 Coll., on stipulation of fire safety conditions and on State fire supervision performance (Decree on fire prevention)

- basic requirements of fire safety
- types of dedicated fire technique, fire protection material means and fire safety equipment
- requirements to Design and istallation of fire safety equipment
- type of fire protection documentation
- method of managing the fire protection documentation
- contents and scope of fire safety design etc.

Decree No. 23/2008 Coll., on the technical requirements for the fire protection of buildings

This Decree lays down the technical requirements for fire protection in the design, construction and use of buildings.

FINLAND

The National Building Code of Finland, Series E, especially parts E1 and E2, issued by the Finnish Ministry of the Environment. Link to page with unofficial English translations of said documents:

http://www.ym.fi/fiFI/Maankaytto_ja_rakentaminen/Lainsaadanto_ja_ohjeet/Rakentamismaarayskokoelma/The_National_Building_Code_of_Finland(10420)

Also the Finnish NA's to the Eurocodes are available on this page.

FRANCE

The principal document is "Le code de la construction et de l'habitation: The Code of the Construction and the buildings".

There are some decret:

- Décret n° 69-596 of 14-06-1969 which fix the general rules of construction of dwelling buildings
- Décret n°67-1063 of 15-11-1967 which deals with the construction of high rise buildings and their fire protection
- Décret n°54-856 of 13-08-1954 retating to protection against the panic and fire hazards in the establishments receiving of the public.

The issuing body is the Direction of the civil safety of the Ministry for the interior:
http://www.interieur.gouv.fr/sections/a_l_interieur/defense_et_securite_civiles/presentation/ddsc/view

GERMANY

For the reason that Germany is a federal state, every state (bavaria, lower saxony, north-rhine-westphalia, etc.) has its own building regulations. All are based on the Musterbauordnung "MBO" which is a template and could be translated by "Master building regulation". The general requirements are written down there.

Fire resistance time for different structural members of buildings can be determined by the Eurocodes (parts 1-2).

For industrial buildings according to Musterindustriebaurichtlinie (see below) there are calculation methods listed in DIN 18230.

GREECE

The main regulations are:

- Greek Presidential Edict (71/88) 'Building Fire Protection'.
- Greek Goverment Decision (no 5905/1995) 'Industrial Fire Protection'

HUNGARY

From the Ministry of Local Government:

9/2008. (II. 22.) ÖTM rendelet az Országos Tűzvédelmi Szabályzat kiadásáról

ITALY

- Decree of the Ministry of the Interior, 16/02/2007 "Classificazione di resistenza al fuoco di prodotti ed elementi costruttivi di opere da costruzione".
- Decree of the Ministry of the Interior, 09/03/2007, "Prestazioni di resistenza al fuoco delle costruzioni nelle attività soggette al corpo nazionale dei vigili del fuoco".
- Decree of the Ministry of the Interior, 09/05/2007 "Direttive per l'attuazione all'approccio ingegneristico alla sicurezza antincendio".
- Decree of the Infrastructure Ministry 14/01/2008, "NUOVE NORME TECNICHE PER LE COSTRUZIONI".
- Infrastructure Ministry n.617 of 02/02/2009, "Istruzioni per l'applicazione delle Nuove Norme Tecniche di cui al DM 14 Gennaio 2008"
- Decree of Republic President n° 151 01/08/2011, "Regolamento recante semplificazioni della disciplina dei procedimenti ralativi alla prevenzione degli incendi, a norma dell'art. 49 c0mma 4-quater, del decreto – legge 31 maggio 2010, n. 78, convertito, con modificazioni, dalla legge 30 luglio 2010, n. 122".

- Decree of the Ministry of the Interior, 07/08/2012, “Disposizioni relative alle modalità di presentazione delle istanze concernenti I procedimenti di prevenzione incendi e alla documenazione da allegare, ai sensi dell’articolo 2, comma 7, del decreto del Presidente della Repubblica 1° Agosto 2011, n.151”.

POLAND

- Ustawa z dnia 7 lipca 1994 r. Prawo budowlane (Dz.U. z 2006 r. Nr 156, poz. 1118 z późn. zm.) – Sejm RP (Sejm of the Republic of Poland – Polish Parliment)
- Ustawa z dnia 24 sierpnia 1991 r. o ochronie przeciwpożarowej (t.j. Dz. U. Nr 178 z 2009 r. poz. 1380 z późn. zm.) – Sejm RP (Sejm of the Republic of Poland – Polish Parliment)
- Rozporządzenie Ministra Infrastruktury z dnia 12 kwietnia 2002 w sprawie warunków technicznych jakim powinny odpowiadać budynki i ich usytuowanie (Dz. U. Nr 75 z 2002 r, poz. 690 z późn. zm.) – Ministerstwo Infrastruktury (Ministry of Infrastructure)
- Rozporządzenie Ministra Spraw Wewnętrznych i Administracji z dnia 7 czerwca 2010 roku w sprawie ochrony przeciwpożarowej budynków, innych obiektów budowlanych i terenów (Dz. U. Nr 109, poz. 719) – Ministerswo Spraw Wewnętrznych i Administracji (Ministry of the Interior and Administration).

PORTUGAL

- The law Decreto-Lei n.º 220/2008, de 12 de Novembro, which establishs the juridical rules for buildings fire safety Regime Jurídico da Segurança Contra Incêndio em edifícios (RJ-SCIE);
- Technical regulation for buildings fire safety Regulamento Técnico de Segurança contra Incêndio em Edifícios e Recintos (RT-SCIE), que constitui a Portaria n.º 1532/2008, de 29 de Dezembro de 2008;
- Despacho n.º 2074/2009, de 15 de Janeiro, do Presidente da Autoridade Nacional de Protecção Civil on the technical criteria for determining the modified fire load density.

ROMANIA

“Normative for fire security of buildings“ Indicative: P118-99, issued by the Ministry of Public Works, 1999

SLOVAKIA

- The law n.º 314/2001; The protection for the fires;
- Announcement of Ministry of Interior of the Slovak Republic n. 121/2002; The fire prevention
- Part of government, which prepare juridical decree is ministry of Interior of the Slovak Republic. In the law 314/2001 are the basic duty on the part of protection for the fire and the details solve the Announcements of Ministry of interior of the Slovak Republic with technical contents;
- Fire security of buildings solve the Announcement of MI SR, n. 94/2004, which describe the technical requests on fire protection by the construction of building, so by the using of buildings.

SLOVENIA

- Zakon o varstvu pred požarom (Uradni list RS, št. 3/07 - uradno prečiščeno besedilo, 9/11 in 83/12) (eng: Fire Protection Act)
- Pravilnik o požarni varnosti v stavbah (Uradni list RS, št. 31/04, 10/05, 83/05, 14/07 in 12/13) (eng: Rules on fire safety in buildings)
- Pravilnik o zasnovi in študiji požarne varnosti (Uradni list RS, št. 12/13 in 49/13) (eng: Rules on the concept and study of fire safety)
- Pravilnik o požarnem redu (Uradni list RS, št. 52/07, 34/11 in 101/11) (eng: Rules on Fire Rules)

Issuing body is Ministry of Defense.

SPAIN

We have two relevant codes in Spain;

- The Spanish Technical Building Code (CTE) for residential, commercial and administrative buildings, from Ministry for Housing. It’s a true performance-based code but it has the prescriptive rules too.

CTE - Código Técnico de la Edificación http://www.codigotecnico.org/web/cte/

- A second code for industrial buildings is the Spanish Security Code against to Fire in Industrial Activities (RSIEI) from Ministry of Industry, Tourism and Trade. It's a specific legislation for industrial safety.

RSIEI - Reglamento de Seguridad contra Incendios en los Establecimientos Industriales

http://www.ffii.nova.es/puntoinfomcyt /Archivos/Dis_4539.pdf

TURKEY

There is one regulation on the fire safety of buildings In Turkey. It is obliged by law to design and construct buildings according this document. The issuing body is "**Ministry of Environment and Urban Planning of Turkey**".

The official title (in Turkish) "*Türkiye Binaların Yangından Korunması Hakkında Yönetmelik 2009*" is available online:

http://www.resmigazete.gov.tr/eskiler/2009/09/20090909-10.htm

UNITED KINGDOM

- 2010 No. 2214 - Building And Buildings, England And Wales - The Building Regulations 2010
- 2010 No. 2215 - Building And Buildings, England And Wales - The Building (Approved Inspectors etc.) Regulations 2010.

1.1.3 Additional guidance

Is there additional guidance available to interpret the Building Regulations for fire?

BELGIUM

Not answered.

CROATIA

There is no additional guidance.

CZECH REPUBLIC

Fire rescue service of Czech Republic provides some technical notes on fire safety of building.

For example interpretation of laws about fire protection:

http://www.hzscr.cz/clanek/odpovedi-na-nejcastejsi-dotazy.aspx

FINLAND

Guidance is available in Finnish and Swedish, e.g.

- Ympäristöopas 39 (YO39 Rakennusten paloturvallisuus & Paloturvallisuus korjausrakentamisessa) – a guidebook related to E1 / In Finnish and Swedish.
- RIL 221-2003 Paloturvallisuussuunnittelu (guidebook on fire safety engineering design) / In Finnish

FRANCE

No

GERMANY

Yes. For every state building regulation comments and reasons exist.

GREECE

No.

HUNGARY

We have some national pre standards

- 1. MSZE 595-1:2009 Építmények tűzvédelme. 1. rész: Fogalommeghatározások
- 2. MSZE 595-3:2009 Építmények tűzvédelme. 3. rész: Épületszerkezetek tűzállósági követelményei
- 3. MSZE 595-5:2009 Építmények tűzvédelme. 5. rész: Tűzszakaszolás, tűzterjedés elleni védelem
- 4. MSZE 595-6:2009 Építmények tűzvédelme. 6. rész: Kiürítés
- 5. MSZE 595-7:2009 Építmények tűzvédelme. 7. rész: A számított tűzterhelés és a mértékadó tűzidőtartam meghatározása
- 6. MSZE 595-8:2009 Építmények tűzvédelme. 8. rész: Hő és füst elleni védelem
- 7. MSZE 595-9:2009 Építmények tűzvédelme. 9. rész: Robbanási túlnyomás lefúvatása

ITALY

No, in Italy there isn't a guide available to interpret the Building Regulations for fire. However, the National Body of Fire provides some technical notes (named "Lettere Circolari") related to several decrees.

POLAND

Some instructions are published by Instytut Techniki Budowlanej (Building Research Institute).

PORTUGAL

ANPC – National Authority of Civil Protection, provides some technical notes on fire safety of buildings:

http://www.prociv.pt/Pages/Detalhe4.aspx?IDitem=41

ROMANIA

A guide is available in order to interpret the normative for fire security of buildings.

SLOVAKIA

The basic requests are described in juristically decree – announcements. Concrete requests specify the Slovak technical standards.

SLOVENIA

Yes, for example:
- Tehnične smernica TSG-1-001:2010, Požarna varnost v stavbah
(eng: : Technical guideline: TSG-1-001:2010: Fire safety in buildings)
general guidance on how to reach sufficient fire safety for the building.

SPAIN

Yes, there are some guides and FAQ's to interpret the practical application of these rules. In several cases this additional information is very relevant.

- CTE
http://www.codigotecnico.org/web/cte/faqs/

- RSIEI - Technical Guide
http://www.ffii.nova.es/puntoinfomcyt/Archivos /InstProtInc/GUIA_TECNICA_RSCI.pdf

TURKEY

Additional guidance is provided by two main organizations
TUYAK – Turkish Fire Protection and Education Foundation
TUCSA – Turkish Institute of Steel Construction
By TUCSA:
These organizations adopt European Guidelines. Related documentations are the following:

European Recommendations for the Fire Safety of Steel Structures, ECCS Technical Committee (1983)
Design Manual on the European Recommendations for the Fire Safety of Steel Structures, ECCS Technical Committee (1985)
By TUYAK:
Turkey's Regulation on Fire Protection, July 2012 (Technical Books Series Number 05)

UNITED KINGDOM

Practical guidance on ways to comply with the functional requirements in the Building Regulations is outlined in a series of 'Approved Documents' published by the Department for Communities and Local Government.

Each document contains:

- general guidance on the performance expected of materials and building work in order to comply with each of the requirements of the Building Regulations; and
- practical examples and solutions on how to achieve compliance for some of the more common building situations.

All of the latest 'Approved Documents' can be downloaded free on the Planning Portal at:

www.planningportal.gov.uk/approveddocuments

1.1.4 Different regulations for certain types of buildings

Are there different regulations for certain types of buildings (I.e. schools, hospitals, airports, railway stations)?

BELGIUM

Yes for every type of buildings there is a different regulation:

- Industrial buildings (part of "les norms de base")
- Hospitals,
- All sort of different hotels
- All sort of different homes for elderly people,
- Schools,
- Homes for youngsters
- Homes for disabled people
- Homes for childcare
- ...

CROATIA

There are different regulations for certain type of buildings like:

- Regulation on fire protection in warehouses (NN 93/08)
- Regulation on fire protection in hotels (NN 100/99)
- Regulation on the essential requirements for fire protection of power plants and equipment (NN 146/05)
- Regulation on stations supplying vehicles with fuel (NN 93/93, 116/07, 141/08)
- Rules on technical standards for the design, construction, operation and maintenance of gas boilers (ex Yu regulation Sl. SFRJ 10/90, 52/90, accepted as good technical practice)

There is also an important regulation which divides buildings in different groups regarding complexity of fire protection measures:

Regulation on the classification of buildings into groups by the demanding of fire protection measures (NN 56/12)

CZECH REPUBLIC

Decree No. 23/2008 Coll., on the technical requirements for the fire protection of buildings

This Decree specifies basic technical requirements for following types of buildings:

- 1 Family homes and buildings for family recreation
- 2 Apartment buildings
- 3 Hostel buildings
- 4 Health care and social welfare buildings
- 5 Buildings with assembly areas
- 6 Lookout tower buildings
- 7 Garage buildings
- 8 Filling station, servicing and repair buildings
- 9 Buildings used for school and educational establishment activities
- 10 Agricultural buildings
- 11 Production and storage buildings
- 12 Listed buildings
- 13 Building site buildings

FINLAND

Buildings are categorised into three fire classes, P1, P2 and P3, based on the use, size and occupancy of the building. P1 is the highest class and these buildings are usually not allowed to suffer structural collapse due to a fire.

Schools, hospitals, airports etc. are usually Class P1 buildings due to their size and the amount of people using them.

FRANCE

There are some other regulations:

- Arrêté du 31-01-1986, relating to the protection of the apartment buildings against the fire
- Arrêté du 25-06-1980, retating to protection against the panic and fire hazards in the establishments receiving of the public.
- Arrêté du 18-10-1977, retating to protection against the panic and fire hazards in the high rise buildings.

There are different regulations (arêtes) for

- Car parks
- Industrial installation,
- Warehouse,
- Nuclear installations

GERMANY

As mentioned above, every state has its own code in Germany. This is the same for every building type code. The list includes the “template-versions”:

- Musterindustriebaurichtlinie (industrial buildings)
- Mustergaragenverordnung (car parks)
- Musterversammlungsstättenverordnung (meeting halls)
- Musterverkaufsstättenverordnung (shopping centres)
- Musterschulbauorndnung (schools)
- Musterbeherbergungsstaättenverordnung (hotels)
- Musterkrankenhausbauverordnung (hospitals)

GREECE

Greek Presidential Edict (71/88), Section 1, covers the following utilization-types of buildings:

- Type I «Dwelling»
- Type II « Hotels
- Type III «Schools»
- Type IV «Offices»
- Type V «Shops»
- Type VI «Places of public meetings»
- Type VII «Industrial, workshops and storage»
- Type VIII «Hospitals and nursing homes»
- Type IX «Parking places and fuel stations»

HUNGARY

We use different groups according the fire resistance of the building materials.

- In the first group there are high rise buildings and the middle high rise buildings if there is in a crowd staying room above 13m.
- In the second group there are kindergartens, social homes, closed garages, handicap people staying room if the building is taller than 2 floors, middle high rise buildings, buildings which are not in the first group with the two and three underground floors.
- In the third group there are schools, living buildings which taller than 2 level, community buildings if the top floor is not over 13,65m, more than one floors open garages, handicap people staying room.
- In the fourth group the one floor living and holiday buildings, the one floor community buildings minimum 25 maximum 50 person.
- In the fifth group, maximum ground floor living and holiday buildings maximum 25 person.

ITALY

The Decree of Republic President 01/08/2011 n.151 (Regolamento recante semplificazioni della disciplina dei procedimenti ralativi alla prevenzione degli incendi, a norma dell'art. 49 comma 4-quater, del decreto – legge 31 maggio 2010, n. 78, convertito, con modificazioni, dalla legge 30 luglio 2010, n. 122) defines 80 types of building use, which are subjected to the control of the Fire Brigades.

For many building uses the Ministry provides specific Technical Rules of Fire Fighting, generally based on a prescriptive approach.

POLAND

Regulations are general for all kinds of buildings, nevertheless they divide building into three main groups:

- Housing and public utility buildings; involving endangering people (ZL)
- Production plants and warehouses (PM)
- Agricultural (IN)

PORTUGAL

The RJ-SCIE covers the following twelve utilization-types:

- Type I «Dwelling»
- Type II «Car parks»
- Type III «Administrative»
- Type IV «Schools»
- Type V «Hospitals and nursing homes»
- Type VI «Theatres/cinemas and public meetings»
- Type VII «Hotels and restaurants»
- Type VIII «Shopping and transport centres»
- Type IX «Sports and leisure»

- Type X «Museums and art galleries»
- Type XI «Libraries and archives»
- Type XII «Industrial, workshops and storage»

Due to the big dimension in plan and height the building can be classified as "atypical danger".

ROMANIA

Regulations are general for all kinds of buildings, divided in industrial and civil buildings. A special separate normative is available for underground parkings.

SLOVAKIA

Yes they are specifying in technical decrees:

- Announcements of MI SR n.94/2004 – there are described technical requests on Fire safety by construction and using of the buildings.
- Announcements of MI SR n.96/2004, there are described principles fire protection by manipulation and the storage of flammable liquids, hard fuel oils and flowers and animal fat and oils.
- Announcements of MI SR n.121/2002 – about fire prevention
- Announcements of MI SR n.124/2000- here by the work with the flammable gasses
- Announcements of MI SR n.142/2004 about the fire safety by the construction and using the spaces, where are used pain materials.
- Announcements of MI SR n.258/2007 about demands of fire security by the storage and manipulation with solid flammable materials.

SLOVENIA

Yes, for some type of buildings with high number of possible occupant (I.e. hospitals, sport domes,..) or with higher risk of fire, like chemical companies..., regulations rules from other countries are allowed, Switzerland (VKF rules), German (MBO rules).

SPAIN

The Spanish Technical Building Code (CTE) covers the most types of buildings.

The industrial building or big storage building are covered by the Spanish Security Code against to Fire in Industrial Activities (RSIEI).

Specific activities are out of both codes, for instance; nuclear or mineral extraction.

TURKEY

No. The regulations are for all buildings. But there are the following building categories listed within the Turkish Fire Safety Regulation of Buildings "***Türkiye Binaların Yangından Korunması Hakkında Yönetmelik 2009***"

- Residents
- Hotels, Restaurants
- Cooperate buildings
- Offices
- Business type buildings
- Industrial buildings
- Shopping centers
- Storage / Warehouses
- Storages of flammables / Gas stations / Refineries
- Mixed occupation buildings

UNITED KINGDOM

- 2 (a) Institutional
- 2 (a) Other residential: a. in bedrooms; b. in bedrooms corridors; c. elsewhere
- 3 office
- 4 Shop and commercial
- 5 Assembly and recreation: a. building primarily for disabled people; b. areas with seating in rows; c. elsewhere
- 6. Industrial: normal hazard; higher hazard
- 7. Storage and other non-residential: normal hazard; higher hazard
- 2-7 Place of special fire hazard
- 2-7 Plant room or rooftop plant: a. distancewithin the room; b. escape route not in open air (overall travel distance); c. escape route in open air (overall travel distance)

1.2 Design codes

1.2.1 Relevant national or international/European standards - Means of escape

What are the relevant national or international/European standards required to undertake the design of: means of escape?

BELGIUM

There are no relevant standards on this matter.

CROATIA

There are no relevant Croatian standards issued specifically on this matter. Evacuation is covered by *Regulation of resistance to fire and other requirements that buildings must meet in fire (NN 29/13) and by Law of Safety on Works (NN 59/96, 94/96-correct., 114/03, 86/08, 75/09, 143/12)*

We also use international standards for this purpose like NFPA (USA), TRVB (Austria).

CZECH REPUBLIC

- CSN 73 0802 - Fire protection of buildings - Non-industrial buildings
- CSN 73 0804 - Fire protection of buildings - Industrial buildings

FINLAND

No information on design standards, but the relevant regulations include:

- National decree No. 805/2005 concerning lighting and signalling of escape routes, in Finnish.
- Regulations given also in Finnish National Building Code Part E1 Chapter 10 (see link above).

FRANCE

There are no relevant standards on this matter.

GERMANY

Musterbauordnung and regulation for certain type of building.

GREECE

There are no relevant standards on this matter.

HUNGARY

There are no relevant standards on this matter.

ITALY

There are national standards depending on the use of building (within the quoted prescriptive technical rules of fire fighting concerning the specific building use).

POLAND

- Rozporządzenie Ministra Infrastruktury z dnia 12 kwietnia 2002 w sprawie warunków technicznych jakim powinny odpowiadać budynki i ich usytuowanie (Dz. U. Nr 75 z 2002 r, poz. 690 z późn. zm.) – Ministerstwo Infrastruktury (Ministry of Infrastructure)
- Rozporządzenie Ministra Spraw Wewnętrznych i Administracji z dnia 7 czerwca 2010 roku w sprawie ochrony przeciwpożarowej budynków, innych obiektów budowlanych i terenów (Dz. U. Nr 109, poz. 719) – Ministerswo Spraw Wewnętrznych i Administracji. (Ministry of the Interior and Administration).
- PN-ISO 8421-6 Ochrona przeciwpożarowa. Terminologia. Ewakuacja i środki ewakuacji.
- PN-92/N-01256/02 Znaki bezpieczeństwa. Ewakuacja.

PORTUGAL

Technical Regulation for Fire Safety in Buildings (Portaria n.º 1532/2008).

ROMANIA

The regulations for the means of escape are included in the mentioned normative for fire security.

SLOVAKIA

The escape ways, which are saved for the fire and secured with air ventilation.

SLOVENIA

No information on design standards, but relevant regulations for buildings on this issue are given in: Tehnične smernica TSG-1-001:2010, Požarna varnost v stavbah (eng: : Technical guideline: TSG-1-001:2010: Fire safety in buildings)

- i.e. rules on escape routes (distance width), issues concerning emergency lighting and signalling of escape routes are given.

SPAIN

Section SI-3 of CTE is devoted to provision of a safe route(s) for emergency evacuation by horizontal and vertical escape.

Moreover, RSIEI has additional requirements for industrial buildings.

TURKEY

There are no relevant standards on this matter.

UNITED KINGDOM

BS EN's or Eurocodes primarily but functional regulations so any guidance permissible.

1.2.2 Relevant national or international/European standards - Smoke management

What are the relevant national or international/European standards required to undertake the design of: smoke management?

BELGIUM

There is not a general legislation only a these standards:

- NBN S 21-208-1 : 1995 - Protection incendie dans les bâtiments - Conception et calcul des installations d'évacuation de fumées et de chaleur (EFC) - Partie 1 : Grands espaces intérieurs non cloisonnés s'étendant sur un niveau
- NBN S 21-208-2 : 2006 - Protection incendie dans les bâtiments - Conception des systèmes d'évacuation des fumées et de la chaleur (EFC) des bâtiments de parking intérieurs
- NBN S 21-208-2/prA1 : 2010 - Protection incendie dans les bâtiments - Conception des systèmes d'évacuation des fumées et de la chaleur (EFC) des parkings fermé

CROATIA

In Croatia EU norms and standards for smoke management are used (HRN EN 12101-1 to HRN EN 12101-6)

CZECH REPUBLIC

- CSN 73 0802 - Fire protection of buildings - Non-industrial buildings (Annex H – natural smoke and heat exhaust)
- CSN P CEN/TR 12101-5 - Smoke and heat control systems - Part 5: Guidelines on functional recommendations and calculation methods for smoke and heat exhaust ventilation systems

FINLAND

No information on design standards, but the relevant regulations include:

- Regulations given in Finnish National Building Code Part E1 Chapter 11 (see link above).

FRANCE

There are:

- Technical instruction n° 246, relating to receiving smoke clearing in the establishments of the public.
- Technical instruction n° 263 relating to the construction and the receiving smoke clearing of interior free volumes (atriums) in the establishments of the public.

GERMANY

vfdb-guideline, Muster-Versammluingsstättenverordnung, Muster-Industriebaurichtlinie.

GREECE

There are no specific regulations on this matter.

HUNGARY

We use MSZ EN 12101 Smoke and heat control system standard.

ITALY

There are national standards depending on the use of building (within the quoted prescriptive technical rules of fire fighting concerning the specific building use).

POLAND

- Rozporządzenie Ministra Infrastruktury z dnia 12 kwietnia 2002 w sprawie warunków technicznych jakim powinny odpowiadać budynki i ich usytuowanie (Dz. U. Nr 75 z 2002 r, poz. 690 z późn. zm.) – Ministerstwo Infrastruktury (Ministry of Infrastructure)
- PN-B-02877-4 Ochrona przeciwpożarowa budynków -- Instalacje grawitacyjne do odprowadzania dymu i

ciepła -- Zasady projektowania. (Fire protection of buildings - Installation of gravitational devices for smoke and heat drainage - Design rules
- PN-EN-12101-1 System kontroli rozprzestrzeniania dymu i ciepła – Część 1: Wymagania techniczne dotyczące kurtyn dymowych. (Smoke and heat control systems -- Part 1: Specification for smoke barriers.)
- PN-EN-12101-2 System kontroli rozprzestrzeniania dymu i ciepła – Część 2: Wymagania techniczne dotyczące klap dymowych. (Smoke and heat control systems -- Part 2: Specification for natural smoke and heat exhaust ventilators.)
- PN-EN-12101-3 System kontroli rozprzestrzeniania dymu i ciepła – Część 3: Wymagania techniczne dotyczące wentylatorów oddymiających. (Smoke and heat control systems -- Part 3: Specification for powered smoke and heat exhaust ventilators.)
- PN-EN-12101-6 System kontroli rozprzestrzeniania dymu i ciepła – Część 6: Wymagania techniczne dotyczące systemów różnicowania ciśnień -- Zestawy urządzeń (Smoke and heat control systems -- Part 6: Specification for pressure differential systems – Kits.)
- PN-EN-12101-10 System kontroli rozprzestrzeniania dymu i ciepła – Część 10: Zasilacze (Smoke and heat control systems -- Part 10: Power supplies.)

PORTUGAL

There are no specific regulations on this matter but documents / different rules, for example, the NFPA and APSARD.

ROMANIA

The regulations for the smoke management are included in the mentioned normative for fire security.

SLOVAKIA

Systems for offtake of warm and combustion gasses. The rules are from the producers or from Slovak technical standards 12101. Accepted are technical standards DIN, NFS and the directions VdS.

SLOVENIA

General requirements on smoke management are given in:
Tehnične smernica TSG-1-001:2010, Požarna varnost v stavbah, (eng: Technical guideline: TSG-1-001:2010: Fire safety in buildings)
More design options are given:
Smernica **405-1/10** Naprave za naravni odvod dima in toplote (NODT), (Technical guidiline for natural smoke and heat exhaustion)
Smernica **405-2/10** Naravni odvod dima iz stopnišč (NODS), Technical guideline for natural smoke exhaustion from stairways)
Mainly still regulations from other EU contries are use, especially for mechanical (forced) smoke and heat : Technical guideline, mainly German (DIN) or English (BS).

SPAIN

The article 8th of Section SI-3 of CTE to remit to national standard UNE 23585:2004 and to Euronorme EN 12101-6:2005 for smoke and heat control systems.

Nowadays, this Euronorme is Spanish standard UNE-EN 1991-1-2:2004 since 2006.

The Annex II of RSIEI has additional requirements and allows using others international standards.

TURKEY

Within the Turkish Fire Safety Regulation of Buildings "***Türkiye Binaların Yangından Korunması Hakkında Yönetmelik 2009***", the Clause 86, 87, 88 give guidelines on smoke management (Chapter 6).

UNITED KINGDOM

BS EN's or Eurocodes primarily but functional regulations so any guidance permissible.

1.2.3 Relevant national or international/European standards - Fire resistance of the construction

What are the relevant national or international/European standards required to undertake the design of: Fire resistance of the construction?

BELGIUM

There is a standard for the fire resistance of

- NBN 713-020 Protection contre l'incendie - Comportement au feu des matériaux et éléments de construction - Résistance au feu des éléments de construction
- Part 1.2 (Structural fire design) from Eurocodes.

CROATIA

Requirements on fire resistance:

- *Regulation of resistance to fire and other requirements that buildings must meet in fire (NN 29/13*
- Part 1.2 (Structural fire design) from Eurocodes, HRN DIN 4102 (till 2019)

CZECH REPUBLIC

Requirements on fire resistance:

- CSN 73 0802 - Fire protection of buildings - Non-industrial buildings
- CSN 73 0804 - Fire protection of buildings - Industrial buildings
- CSN 73 0810 - Fire protection of buildings - General requirements
- Eurocodes.- Part 1.2 (Structural fire design)
- CSN 73 0821 - Fire protection of buildings - Fire resistance of engineering structures

FINLAND

Structural Eurocodes. Parts 1.2 (Structural fire design), National building code of Finland.

FRANCE

Part 1.2 (Structural fire design) from Eurocodes.

GERMANY

Part 1.2 (Structural fire design) from Eurocodes

GREECE

National *prescriptive rules* require a certain standard *fire resistance* of walls and floors, depending on their use and geometry.

HUNGARY

(Structural fire design) from Eurocodes.

ITALY

The Decree of the Ministry of the Interior, 16/02/2007 ("Classificazione di resistenza al fuoco di prodotti ed elementi costruttivi di opere da costruzione") is applicable to assess the fire resistance of the building. In addition, the Decree allows the use of the Parts 1.2 of the relevant Eurocodes.

POLAND

- Rozporządzenie Ministra Infrastruktury z dnia 12 kwietnia 2002 w sprawie warunków technicznych jakim powinny odpowiadać budynki i ich usytuowanie (Dz. U. Nr 75 z 2002 r, poz. 690 z późn. zm.) – Ministerstwo Infrastruktury (Ministry of Infrastructure)
- Eurocodes: Part 1.2 (Structural fire design).

Other codes (based on European codes)

- PN-EN 1363-1:2001 Badania odporności ogniowej -- Część 1: Wymagania ogólne (Fire resistance test – Part 1: General requirements)
- PN-EN 1364-1:2001 Badania odporności ogniowej elementów nienośnych -- Część 1: Ściany (Fire resistance tests for non-loadbearing elements: Part 1: Walls)
- PN-EN 1365-1:2001 Badania odporności ogniowej elementów nośnych -- Część 1: Ściany (Fire resistance tests for loadbearing elements: Part 1: Walls)
- Other parts of PN-EN 1363, 1964, 1965

PORTUGAL

Part 1.2 (Structural fire design) from Eurocodes.

ROMANIA

Part 1.2 (Structural fire design) from Eurocodes, translated in Romanian Standards (SR) together with the corresponding National Annexes.

SLOVAKIA

(Structural fire design) is from estimation of proof or calculation with help of Eurocodes.

SLOVENIA

Part 1.2 (Structural fire design) from Eurocodes, or if desired performance based rules.

SPAIN

Nowadays, three codes are in coexistence in Spain Regulations for fire resistance verifications of buildings:
1) Section SI-6 of Código Técnico de Edificacion is devoted to requirements for structural fire resistance and his verification for several structural materials:

- Annex C Concrete Structures
- Annex D Steel Structures
- Annex E Timber Structures
- Annex F Masonry

2) National codes; EHE (Concrete Structures) and EAE (Steel Structures)
3) Finally, the official translations of Eurocodes. They are adapted as Spanish standard UNE-EN 199x-1-2

However, national Spanish rules for structural verification under fire are very similar at the general rules of Eurocodes.

TURKEY

No. There are no standards required for fire resistance of the construction.

UNITED KINGDOM

BS EN's or Eurocodes primarily but functional regulations so any guidance permissible.

1.2.4 Relevant national or international/European standards - Fire fighting

What are the relevant national or international/European standards required to undertake the design of: Firefighting?

BELGIUM

Portable fire extinguishers

The NBN S21-011 to NBN S21-018 range should have been replaced by the NBN EN3 -1 to EN3-6. Because the Dutch version of EN3 doesn't exist, the NBN preserved this range (against all CEN-rules). These standards have become obsolete. In practice, most fire extinguishers are in accordance with the EN3 ranges, of which the last valid standard is the EN3-7: 2004.

Numéro de norme	Titre	Date de publication	Langue	Statut
NBN S 21-011/A1 : 1977	Matériel de sauvetage et de lutte contre l'incendie - Extincteurs d'incendie portatifs - Prescriptions communes applicables à tous les types d'extincteurs	1977	NL/FR	Actif
NBN S 21-011/A2 : 1977	Matériel de sauvetage et de lutte contre l'incendie - Extincteurs d'incendie portatifs - Prescriptions communes applicables à tous les types d'extincteurs	1977	NL/FR	Actif
NBN S 21-011/A3 : 1987	Matériel de sauvetage et de lutte contre l'incendie - Extincteurs d'incendie portatifs - Prescriptions communes applicables à tous les types d'extincteurs	1987	NL/FR	Actif
NBN S 21-011/A4 : 1988	Matériel de sauvetage et de lutte contre l'incendie - Extincteurs d'incendie portatifs - Prescriptions communes applicables à tous les types d'extincteurs	1988	NL/FR	Actif
NBN S 21-011 : 1974	Matériel de sauvetage et de lutte contre l'incendie - Extincteurs d'incendie portatifs - Prescriptions communes applicables à tous les types d'extincteurs	1974	NL/FR	Actif
NBN S 21-012 : 1974	Matériel de sauvetage et de lutte contre l'incendie - Extincteurs d'incendie portatifs - Extincteurs à eau	1974	NL/FR	Actif
NBN S 21-013 : 1974	Matériel de sauvetage et de lutte contre l'incendie - Extincteurs d'incendie portatifs - Extincteurs à réaction chimique	1974	NL/FR	Actif
NBN S 21-014 : 1974	Matériel de sauvetage et de lutte contre l'incendie - Extincteurs d'incendie portatifs - Extincteurs à poudre	1974	NL/FR	Actif
NBN S 21-015/A1 : 1977	Matériel de sauvetage et de lutte contre l'incendie - Extincteurs d'incendie portatifs - Extincteurs à anhydride carbonique (C02)	1977	NL/FR	Actif
NBN S 21-015/A2 : 1987	Matériel de sauvetage et de lutte contre l'incendie - Extincteurs d'incendie portatifs - Extincteurs à anhydride carbonique (C02)	1987	NL/FR	Actif
NBN S 21-015 : 1974	Matériel de sauvetage et de lutte contre l'incendie - Extincteurs d'incendie portatifs - Extincteurs à anhydride carbonique (C02)	1974	NL/FR	Actif
NBN S 21-016/A1 : 1977	Matériel de sauvetage et de lutte contre l'incendie - Extincteurs d'incendie portatifs - Extincteurs à hydrocarbures halogénés	1977	NL/FR	Actif
NBN S 21-016 : 1974	Matériel de sauvetage et de lutte contre l'incendie - Extincteurs d'incendie portatifs - Extincteurs à hydrocarbures halogénés	1974	NL/FR	Actif
NBN S 21-017/A1 : 1977	Matériel de sauvetage et de lutte contre l'incendie - Extincteurs d'incendie portatifs - Foyers-types et puissance minimale d'extinction	1977	NL/FR	Actif
NBN S 21-017/A2 : 1987	Matériel de sauvetage et de lutte contre l'incendie - Extincteurs d'incendie portatifs - Foyers-types et puissance minimale d'extinction	1987	NL/FR	Actif
NBN S 21-017 : 1974	Matériel de sauvetage et de lutte contre l'incendie - Extincteurs d'incendie portatifs - Foyers-types et puissance minimale d'extinction	1974	NL/FR	Actif
NBN S 21-018 : 1974	Matériel de sauvetage et de lutte contre l'incendie - Extincteurs d'incendie - Essai de vibration - Essai d'efficacité - Essai diélectrique - Procès-verbal d'essai - Certificat d'agrément	1974	NL/FR	Actif

CROATIA

All EU norms which covered fire fighting equipment are used in Croatia. There are stipulated in *Technical regulation on construction products, group H (NN 33/10, 87/10, 146/10, 81/11, 100/11-correct. 130/12, 81/13). Beside this there are a lot specific regulations related to fire fighting. Main regulation is Law of Fire fighting.*

CZECH REPUBLIC

CSN 73 0873 - Fire protection of buildings - Equipment for fire-water supply (Annex B – Fundamentals for analyses fire fighting).

FINLAND

No information on design standards, but the relevant regulations include:

- Regulations given in Finnish National Building Code Part E1 Chapter 11 (see link above).

FRANCE

There are no relevant standards on this matter.

GERMANY

Feuerwehrdienstvorschrift 3 (FwDV 3), Feuerwehrdienstvorschrift 4 (FwDV 4) (fire brigade codes), Fire Protection Law.

GREECE

There are no relevant standards on this matter.

HUNGARY

There are no relevant standards on this matter.

ITALY

There are national standards depending on the use of building (within the quoted prescriptive technical rules of fire fighting concerning the specific building use).

POLAND

- Rozporządzenie Ministra Spraw Wewnętrznych i Administracji z dnia 7 czerwca 2010 roku w sprawie ochrony przeciwpożarowej budynków, innych obiektów budowlanych i terenów (Dz. U. Nr 109, poz. 719) – Ministerswo Spraw Wewnętrznych i Administracji (Ministry of the Interior and Administration).
- Rozporządzenie Ministra Spraw Wewnętrznych i Administracji z dnia 24 lipca 2009 r. w sprawie przeciwpożarowego zaopatrzenia w wodę oraz dróg pożarowych (Dz.U. Nr 124, poz. 1030).
- Rozporządzenie Ministra Spraw Wewnętrznych i Administracji z dnia 29 grudnia w sprawie szczegółowych zasad organizacji krajowego systemu ratowniczo-gaśniczego (Dz. U. 111, poz.1311)
- PN-B-02864 Ochrona przeciwpożarowa budynków. Przeciwpożarowe zaopatrzenie wodne. Zasady obliczania zapotrzebowania na wodę do zewnętrznego gaszenia pożaru.
- PN-B-02865 Ochrona przeciwpożarowa budynków. Przeciwpożarowe zaopatrzenie wodne. Instalacja wodociągowa przeciwpożarowa.
- PN-82/B-02857 Ochrona przeciwpożarowa w budownictwie. Przeciwpożarowe zbiorniki wodne. Wymagania ogólne.

PORTUGAL

There are no relevant standards on this matter.

ROMANIA

There are national regulations depending on the use of building (within the quoted prescriptive technical rules of fire fighting concerning the specific building use).

SLOVAKIA

It is solved the adequate conditions for efficient of fire fighting units.

SLOVENIA

In technical guideline:
Tehnične smernica TSG-1-001:2010, Požarna varnost v stavbah (eng: : Technical guideline: TSG-1-001:2010: Fire safety in buildings)
There are some points considering firefighting issues, mainly accessibility for fire fighting.
And rules:
-Pravilnik o izbiri in namestitvi gasilnih aparatov (Ur.l. RS, št. 67/2005) (Rules on the selection and installation of fire extinguishers)
-Pravilnik o preizkušanju hidrantnih omrežij Ur.l. RS, št. 22/1995) (Rules on the testing of the hydrant network)

SPAIN

Section SI-5 of **CTE** is devoted to accessibility for fire fighting.

TURKEY

Within the Turkish Fire Safety Regulation of Buildings "***Türkiye Binaların Yangından Korunması Hakkında Yönetmelik 2009***", Chapter 7 gives fire extinguishing systems and management. However, no clearly defined fire fighting guidelines.

UNITED KINGDOM

BS EN's or Eurocodes primarily but functional regulations so any guidance permissible.

1.2.5 Relevant national or international/European standards - Fire safety systems (alarm, suppression, …)

What are the relevant national or international/European standards required to undertake the design of: Fire safety systems (alarm, suppression, …)?

BELGIUM

There are specific standards only some demands in the regulations

- NBN EN 54 part 1,2,3,4,5,7,10,11,12,13,16,17,18, 20, 21, 23, 24, 25; specifies requirements for all component parts of a fire alarm system

Numéro de norme	Titre	Date de publication	Langue	Statu
NBN EN 54-1 : 1996	Systèmes de détection et d'alarme incendie - Partie 1: Introduction	05/1996	NL/FR/EN	Actif
NBN EN 54-2 : 1998	Systèmes de détection et d'alarme incendie - Partie 2: Equipement de contrôle et de signalisation (+ AC:1999)	01/1998	FR/EN	Actif
NBN EN 54-2/A1 : 2007	Systèmes de détection et d'alarme incendie - Partie 2: Equipement de contrôle et de signalisation	05/2007	FR/EN/DE	Actif
NBN EN 54-3 : 2001	Systèmes de détection et d'alarme incendie - Partie 3 : Dispositifs sonores d'alarme feu	08/2001	FR/EN/DE	Actif
NBN EN 54-3/A1 : 2002	Systèmes de détection et d'alarme incendie - Partie 3: Dispositifs sonores d'alarme feu	09/2002	FR/EN/DE	Actif
NBN EN 54-3/A2 : 2006	Systèmes de détection et d'alarme incendie - Partie 3: Dispositifs sonores d'alarme feu	10/2006	FR/EN/DE	Actif
NBN EN 54-4 : 1998	Systèmes de détection et d'alarme incendie - Partie 4: Equipement d'alimentation électrique (+ AC:1999)	01/1998	FR/EN	Actif
NBN EN 54-4/A1 : 2003	Systèmes de détection et d'alarme incendie - Partie 4: Equipement d'alimentation électrique	04/2003	FR/EN/DE	Actif
NBN EN 54-4/A2 : 2006	Systèmes de détection et d'alarme incendie - Partie 4 : Equipement d'alimentation électrique	12/2006	FR/EN/DE	Actif
NBN EN 54-5/A1 : 2002	Systèmes de détection et d'alarme incendie - Partie 5: Détecteurs de chaleur - Détecteurs ponctuels	09/2002	FR/EN/DE	Actif
NBN EN 54-5 : 2001	Systèmes de détection et d'alarme incendie - Partie 5: Détecteurs de chaleur - Détecteurs ponctuels	02/2001	NL/FR/EN/DE	Actif
NBN EN 54-7 : 2001	Systèmes de détection et d'alarme incendie - Partie 7: Détecteurs de fumée - Détecteurs ponctuels fonctionnant suivant le principe de la diffusion de la lumière, de la transmission de la lumière ou de l'ionisation	02/2001	FR/EN/DE	Actif
NBN EN 54-7/A1 : 2002	Systèmes de détection et d'alarme incendie - Partie 7: Détecteurs de fumée - Détecteurs ponctuels fonctionnant suivant le principe de la diffusion de la lumière, de la transmission de la lumière ou de l'ionisation	09/2002	FR/EN/DE	Actif
NBN EN 54-7/A2 : 2006	Systèmes de détection et d'alarme incendie - Partie 7 : Détecteurs de fumée - Détecteurs ponctuels fonctionnant suivant le principe de la diffusion de la lumière, de la transmission de la lumière ou de l'ionisation	12/2006	FR/EN/DE	Actif
NBN EN 54-10 : 2002	Systèmes de détection et d'alarme d'incendie - Partie 10 : Détecteurs de flamme - Détecteurs ponctuels	03/2002	FR/EN/DE	Actif
NBN EN 54-10/A1 : 2006	Systèmes de détection et d'alarme incendie - Partie 10 : Détecteurs de flamme - Détecteurs ponctuels	03/2006	FR/EN/DE	Actif
NBN EN 54-11 : 2001	Systèmes de détection automatique d'incendie - Partie 11 : Déclencheurs manuels d'alarme	08/2001	FR/EN/DE	Actif
NBN EN 54-11/A1 : 2006	Systèmes de détection et d'alarme incendie - Partie 11 : Déclencheurs manuels d'alarme	03/2006	FR/EN/DE	Actif
NBN EN 54-12 : 2003	Systèmes de détection et d'alarme incendie - Partie 12: Détecteurs de fumée - Détecteurs linéaires fonctionnant suivant le principe de la transmission d'un faisceau d'ondes optiques rayonnées	03/2003	FR/EN/DE	Actif
NBN EN 54-13 : 2005	Systèmes de détection et d'alarme incendie - Partie 13 : Evaluation de la compatibilité des composants d'un système	10/2005	FR/EN/DE	Actif
NBN EN 54-16 : 2008	Systèmes de détection et d'alarme incendie - Partie 16: Élément central du système d'alarme incendie vocale	09/2008	FR/EN/DE	Actif
NBN EN 54-17 : 2006	Systèmes de détection et d'alarme incendie - Partie 17 : Isolateurs de court-circuit (+ AC:2007)	03/2006	FR/EN/DE	Actif
NBN EN 54-17/AC : 2007	Systèmes de détection et d'alarme incendie - Partie 17: Isolateurs de court-circuit	10/2007		Actif
NBN EN 54-18 : 2006	Systèmes de détection et d'alarme incendie - Partie 18: Dispositifs d'entrée/sortie (+ AC:2007)	03/2006	FR/EN/DE	Actif
NBN EN 54-18/AC : 2007	Systèmes de détection et d'alarme incendie - Partie 18: Dispositifs d'entrée/sortie	01/2007		Actif
NBN EN 54-20 : 2006	Systèmes de détection et d'alarme incendie - Partie 20 : Détecteurs de fumée par aspiration (+ AC:2008)	11/2006	FR/EN/DE	Actif
NBN EN 54-20/AC : 2008	Systèmes de détection et d'alarme incendie - Partie 20 : Détecteurs de fumée par aspiration	11/2008		Actif
NBN EN 54-21 : 2006	Systèmes de détection et d'alarme incendie - Partie 21 : Dispositif de transmission de l'alarme feu et du signal de dérangement	11/2006	FR/EN/DE	Actif
NBN EN 54-23 : 2010	Systèmes d'alarme feu et de détection d'incendie - Partie 23: Dispositifs d'alarme feu - Alarmes visuelles	08/2010	FR/EN/DE	Actif
NBN EN 54-24 : 2008	Systèmes de détection et d'alarme incendie - Composants des systèmes d'alarme vocale - Partie 24 : Haut-parleurs	09/2008	FR/EN/DE	Actif
NBN EN 54-25 : 2008	Systèmes de détection et d'alarme incendie - Partie 25: Composants utilisant des liaisons radioélectriques (+ AC:2010)	09/2008	FR/EN/DE	Actif
NBN EN 54-25/AC : 2010	Systèmes de détection et d'alarme incendie - Partie 25: Composants utilisant des liaisons radioélectriques	09/2010		Actif

NBN EN 12094 Fixed fire fighting systems: part 1, 13 + 16

Numéro de norme	Titre	Date de publication	Langue	Statut
NBN EN 12094-1 : 2003	Installations fixes de lutte contre l'incendie - Eléments constitutifs pour installations d'extinction à gaz - Partie 1: Exigences et méthodes d'essais applicables aux dispositifs électriques automatiques de commande et de temporisation	10/2003	NL/FR/EN/DE	Actif
NBN EN 12094-2 : 2003	Installations fixes de lutte contre l'incendie - Eléments constitutifs pour installations d'extinction à gaz - Partie 2: Exigences et méthodes d'essai pour les dispositifs non électriques de commande et de temporisation	06/2003	NL/FR/EN/DE	Actif
NBN EN 12094-3 : 2003	Installations fixes de lutte contre l'incendie - Eléments constitutifs pour installations d'extinction à gaz - Partie 3: Exigences et méthodes d'essai pour dispositifs manuels de déclenchement et d'arrêt d'urgence	05/2003	NL/FR/EN/DE	Actif
NBN EN 12094-4 : 2004	Installations fixes de lutte contre l'incendie - Eléments constitutifs pour installations d'extinction à gaz - Partie 4: Exigences et méthodes d'essai pour les vannes de réservoir et leurs déclencheurs	09/2004	FR/EN/DE	Actif
NBN EN 12094-5 : 2006	Installations fixes de lutte contre l'incendie - Eléments constitutifs des installations d'extinction à gaz - Partie 5: Exigences et méthodes d'essai pour vannes directionnelles haute et basse pression et leurs déclencheurs	10/2006	FR/EN/DE	Actif
NBN EN 12094-6 : 2006	Installations fixes de lutte contre l'incendie - Eléments constitutifs des installations d'extinction à gaz - Partie 6: Exigences et méthodes d'essai pour dispositifs non électriques de mise hors service	10/2006	FR/EN/DE	Actif
NBN EN 12094-7 : 2001	Installations fixes de lutte contre l'incendie - Eléments constitutifs des installations d'extinction à gaz - Partie 7: Exigences et méthodes d'essai pour les diffuseurs de systèmes à CO2	02/2001	FR/EN/DE	Actif
NBN EN 12094-7/A1 : 2005	Installations fixes de lutte contre l'incendie - Eléments constitutifs des installations d'extinction à gaz - Partie 7 : Exigences et méthodes d'essai pour les diffuseurs de systèmes à CO2	04/2005	FR/EN/DE	Actif
NBN EN 12094-8 : 2006	Installations fixes de lutte contre l'incendie - Eléments constitutifs des installations d'extinction à gaz - Partie 8: Exigences et méthodes d'essai pour raccords	10/2006	FR/EN/DE	Actif
NBN EN 12094-9 : 2003	Installations fixes de lutte contre l'incendie - Eléments constitutifs pour installations d'extinction à gaz - Partie 9: Exigences et méthodes d'essai pour détecteurs spéciaux	05/2003	FR/EN/DE	Actif
NBN EN 12094-10 : 2003	Installations fixes de lutte contre l'incendie - Eléments constitutifs pour installations d'extinction à gaz - Partie 10: Exigences et méthodes d'essai pour manomètres et contacts à pression	06/2003	FR/EN/DE	Actif
NBN EN 12094-11 : 2003	Installations fixes de lutte contre l'incendie - Eléments constitutifs pour installations d'extinction à gaz - Partie 11: Exigences et méthodes d'essai pour dispositifs de pesée mécaniques	05/2003	FR/EN/DE	Actif
NBN EN 12094-12 : 2003	Installations fixes de lutte contre l'incendie - Eléments constitutifs pour systèmes d'extinction à gaz - Partie 12: Exigences et méthodes d'essai pour dispositifs pneumatiques d'alarme	05/2003	FR/EN/DE	Actif
NBN EN 12094-13 : 2001	Installations fixes de lutte contre incendies - Eléments d'installation d'extinction à gaz - Partie 13: Exigences et méthodes d'essai pour clapet anti-retour (+AC:2002)	05/2001	FR/EN/DE	Actif
NBN EN 12094-13/AC : 2002	Installations fixes de lutte contre l'incendie - Eléments d'installation d'extinction à gaz - Partie 13: Exigences et méthodes d'essai pour clapets anti-retour	02/2002		Actif
NBN EN 12094-16 : 2003	Installations fixes de lutte contre l'incendie - Eléments constitutifs pour installations d'extinction à gaz - Partie 16: Exigences et méthodes d'essai pour dispositifs odorisants pour installations à CO2 basse pression	05/2003	FR/EN/DE	Actif

CROATIA

All EU norms which covered fire safety systems are used in Croatia. There are stipulated in *Technical regulation on construction products, group H (NN 33/10, 87/10, 146/10, 81/11, 100/11-correct. 130/12, 81/13)*

CZECH REPUBLIC

- CSN EN 54 – x (Fire detection and fire alarm systems)
- CSN 73 0875 - Fire protection of buildings – Design of fire detection systems

FINLAND

- SFS-EN 12845 + A2 Kiinteät palonsammutusjärjestelmät. Automaattiset sprinklerilaitteistot. Suunnittelu, asennus ja huolto. (Fixed firefighting systems. Automatic sprinkler systems. Design, installation and maintenance)
- prNS-INSTA 900-1: Residential sprinkler systems – Part 1: Design, installation and maintenance
- CEA 4001 Sprinkler Systems: Planning and Installation
- A national decree on extuingishing methods is under preparation.
- CEN / TC 72 published standards, list available at

http://www.cen.eu/CEN/Sectors/TechnicalCommitteesWorkshops/CENTechnicalCommittees/Pages/Standards.aspx?param=6055&title=CEN%2FTC+72

- CEA 4040 Fire Protection Systems - Specifications for automatic fire detection and fire alarm systems - Planning and Installation.
- ST-ohjeisto 1 Paloilmoittimen suunnittelu, asennus, huolto ja kunnossapito 2009 (guidance in Finnish)

FRANCE

European standards and the NFPA documents.

GERMANY

DIN EN 54: Brandmeldeanlagen (EN 54: Fire detection and fire alarm systems), DIN 14675: Brandmeldeanlagen - Aufbau und Betrieb (DIN 14675: Fire alarm systems – setup and operation), DIN VDE 0833: Gefahrenmeldeanlagen für Brand, Einbruch und Überfall (DIN VDE 0833: Alarm systems for fire, intrusion and hold-up).

GREECE

National standards and NFPA documents.

HUNGARY

European standards and the NFPA documents.

ITALY

There are national standards depending on the use of building (within the quoted prescriptive technical rules of fire fighting concerning the specific building use).

POLAND

- Rozporządzenie Ministra Spraw Wewnętrznych i Administracji z dnia 7 czerwca 2010 roku w sprawie ochrony przeciwpożarowej budynków, innych obiektów budowlanych i terenów (Dz. U. Nr 109, poz. 719) – Ministerswo Spraw Wewnętrznych i Administracji (Ministry of the Interior and Administration).

- PN-EN 54-1 Systemy sygnalizacji pożarowej – Wprowadzenie. Fire detection and fire alarm systems – Part 1: Introduction.
- PN-EN 54-2 Systemy sygnalizacji pożarowej – Część 2: Centrale sygnalizacji pożarowej. Fire detection and fire alarm systems – Part 2: Introduction.
- PN-EN 54-3 Systemy sygnalizacji pożarowej -- Część 3: Pożarowe urządzenia alarmowe -- Sygnalizatory akustyczne.
- PN-EN 54-4 Systemy sygnalizacji pożarowej -- Część 4: Zasilacze.
- PN-EN 54-5 Systemy sygnalizacji pożarowej -- Część 5: Czujki ciepła -- Czujki punktowe.
- PN-EN 54-7 Systemy sygnalizacji pożarowej -- Część 7: Czujki dymu -- Czujki punktowe działające z wykorzystaniem światła rozproszonego, światła przechodzącego lub jonizacji.
- PN-EN 54-10 Systemy sygnalizacji pożarowej -- Część10: Czujki płomienia -- Czujki punktowe.
- PN-EN 54-11 Systemy sygnalizacji pożarowej -- Część 11: Ręczne ostrzegacze pożarowe.
- PN-EN 54-12 Systemy sygnalizacji pożarowej -- Część 12: Czujki dymu -- Czujki liniowe działające z wykorzystaniem wiązki światła przechodzącego.
- PN-EN 54-13 Systemy sygnalizacji pożarowej -- Część 13: Ocena kompatybilności podzespołów systemu.
- PN-EN 54-16 Systemy sygnalizacji pożarowej -- Część 16: Dźwiękowe systemy ostrzegawcze – Centrale.
- PN-EN 54-17 Systemy sygnalizacji pożarowej -- Część 17: Izolatory zwarć.
- PN-EN 54-18 Systemy sygnalizacji pożarowej -- Część 18: Urządzenia wejścia/wyjścia.
- PN-EN 54-20 Systemy sygnalizacji pożarowej -- Część 20: Czujki dymu zasysające.
- PN-EN 54-21 Systemy sygnalizacji pożarowej -- Część 21: Urządzenia transmisji alarmów pożarowych i sygnałów uszkodzeniowych.
- PN-EN 54-23 Systemy sygnalizacji pożarowej -- Część 23: Pożarowe urządzenia alarmowe -- Sygnalizatory optyczne.
- PN-EN 54-24 Systemy sygnalizacji pożarowej -- Część 24: Dźwiękowe systemy ostrzegawcze – Głośniki.
- PN-EN 54-25 Systemy sygnalizacji pożarowej -- Część 25: Urządzenia wykorzystujące łączność radiową.
- PKN-CEN/TS 54-14 Systemy sygnalizacji pożarowej -- Część 14: Wytyczne planowania, projektowania, instalowania, odbioru, eksploatacji i konserwacji.
- PN-EN 1838 Zastosowania oświetlenia -- Oświetlenie awaryjne. Lighting applications – Emergency lighting.
- PN-EN 50172 Systemy awaryjnego oświetlenia ewakuacyjnego.
- PN-EN 12845 Stałe urządzenia gaśnicze -- Automatyczne urządzenia tryskaczowe -- Projektowanie, instalowanie i konserwacja. Fixed firefighting systems – Automatic sprinkler systems – Design, installation and maintenance.
- PN-EN 15004-1 Stałe urządzenia gaśnicze -- Urządzenia gaśnicze gazowe -- Część 1: Ogólne wymagania dotyczące projektowania i instalowania.
- PN-EN 60849 Dźwiękowe systemy ostrzegawcze.

PORTUGAL

European standards and the NFPA documents.

ROMANIA

There are national regulations depending on the use of building (within the quoted prescriptive technical rules of firefighting concerning the specific building use).

SLOVAKIA

European standards.

SLOVENIA

European standards and the DIN and NFPA documents.

SPAIN

Section SI-4 of CTE is devoted to fire safety systems. More requirements are described in Annex II of Spanish Security Code against to Fire in Industrial Activities (RSIEI) with reference to Euronormes

TURKEY

Within the Turkish Fire Safety Regulation of Buildings "***Türkiye Binaların Yangından Korunması Hakkında Yönetmelik 2009***", Chapter 5 (Section 4) includes fire alarm systems and Chapter 7 includes fire extinguishing systems.

UNITED KINGDOM

BS EN's or Eurocodes primarily but functional regulations so any guidance permissible

1.2.6 Use of Eurocodes or other international fire standards

Is it possible to use Eurocodes or other international fire standards in lieu of the local code?

BELGIUM

Yes, but you must request a deviation. When documenting your file, you can apply these standards.

CROATIA

Yes

CZECH REPUBLIC

Yes

FINLAND

Yes

FRANCE

Yes

GERMANY

Yes

GREECE

Yes

HUNGARY

Yes. In some cases we have to use fire models prove the situation.

ITALY

Yes.

At the present the National annexes have not yet been published; however, some Eurocodes (EN1992-1-2; EN1993-1-2; EN1994-1-2; EN1995-1-2) may be applied assuming the suggested values as NDPs.

POLAND

Yes

PORTUGAL

Yes

ROMANIA

The revision of P118-99 includes the possibility to determine the fire resistance by means of calculation, using the specific Romanian Standards (SR) translated from the Eurocodes, together with the corresponding National Annexes. The new normative for fire safety is planned to be issued in 2014.

SLOVAKIA

Yes

SLOVENIA

Yes

SPAIN

Yes, the Technical Guide of Spanish Security Code against to Fire in Industrial Activities (RSIEI) allows using Eurocode 2, 3, 4, 5, and 6 for checking structural fire resistance.

The rules for structural verification under fire of CTE SI-6 are very similar of the rules of Eurocodes.

TURKEY

Yes. It's accepted to use the Eurocodes.

UNITED KINGDOM

Yes

1.2.7 Translations of the fire parts of Eurocodes and it National annexes

Are there available the translations of the fire parts of Eurocodes? Which ones?

BELGIUM

NBN EN 1991-1-2: FR – GE – NL
NBN EN 1992-1-2: FR – GE - NL
NBN EN 1993-1-2: FR – GE – NL
NBN EN 1994-1-2: FR – GE – NL
NBN EN 1995-1-2: FR – GE – NL
NBN EN 1996-1-2: FR – GE
NBN EN 1999-1-2: FR – GE

CROATIA

HRN EN 1991-1-2 – Yes
HRN EN 1992-1-2 – Yes

HRN EN 1993-1-2 – Yes
HRN EN 1994-1-2 – Yes
HRN EN 1995-1-2 – Yes
HRN EN 1996-1-2 – Yes
HRN EN 1999-1-2 – No. Will be available soon

CZECH REPUBLIC

CSN EN 1991-1-2 – Yes
CSN EN 1992-1-2 – Yes
CSN EN 1993-1-2 – Yes
CSN EN 1994-1-2 – Yes
CSN EN 1995-1-2 – Yes
CSN EN 1996-1-2 – Yes
CSN EN 1999-1-2 – Yes

FINLAND

SFS-EN 1991-1-2 – Yes
SFS-EN 1992-1-2 – Yes
SFS-EN 1993-1-2 – Yes
SFS-EN 1994-1-2 – Yes
SFS-EN 1995-1-2 – Yes
SFS-EN 1996-1-2 – Yes
SFS-EN 1999-1-2 – No

Available for purchase at http://sales.sfs.fi

FRANCE

NBN EN 1991-1-2 – Yes
NBN EN 1992-1-2 – Yes
NBN EN 1993-1-2 – Yes
NBN EN 1994-1-2 – Yes
NBN EN 1995-1-2 – Yes
NBN EN 1996-1-2 – Yes
NBN EN 1999-1-2 – Yes

GERMANY

DIN EN 1991-1-2 – GER
DIN EN 1992-1-2 – GER
DIN EN 1993-1-2 – GER
DIN EN 1994-1-2 – GER
DIN EN 1995-1-2 – GER
DIN EN 1996-1-2 – GER (is not approved yet)
DIN EN 1999-1-2 – GER

GREECE

No

HUNGARY

No

ITALY

No, the translations of the final versions of the Eurocodes are not yet available at the present.

POLAND

PN-EN 1990 – Yes
PN-EN 1991-1-2 – Yes
PN-EN 1992-1-2 – Yes
PN-EN 1993-1-2 – Yes
PN-EN 1994-1-2 – Yes
PN-EN 1995-1-2 – Yes
PN-EN 1996-1-2 – Yes
PN-EN 1999-1-2 – Will be available soon

PORTUGAL

NP EN 1991-1-2 – Yes
NP EN 1992-1-2 – Yes
NP EN 1993-1-2 – Yes
NP EN 1994-1-2 – Yes
NP EN 1995-1-2 – No. Will be available soon
NP EN 1996-1-2 – Yes
NP EN 1999-1-2 – No. Will be available soon

ROMANIA

SR EN 1991-1-2
SR EN 1992-1-2
SR EN 1993-1-2
SR EN 1994-1-2
SR EN 1995-1-2
SR EN 1996-1-2
SR EN 1999-1-2

SLOVAKIA

STN EN 1991-1-2 – Yes
STN EN 1992-1-2 – Yes
STN EN 1993-1-2 – Yes
STN EN 1994-1-2 – Yes
STN EN 1995-1-2 – Yes
STN EN 1996-1-2 – Yes
STN EN 1999-1-2 – Yes

SLOVENIA

SIST EN 1991-1-2
SIST EN 1993-1-2

SPAIN

The Spanish translations of Eurocodes are managed by AENOR (Asociación Española de Normalización) and they are adapted as Spanish standard UNE-EN. These translations UNE-EN are available in paper or electronic format for their acquisition in the official website of AENOR:

http://www.aenor.es/aenor/normas/ctn/fichactn.asp?codigonorm=AEN/CTN%20140&pagina=1

Nowadays, the state of relevant documents is as follows:

UNE-EN 1991-1-2:2004 Available since 14/05/2004

UNE-EN 1992-1-2:2011 Available since 27/04/2011

UNE-EN 1993-1-2:2011 Available since 07/12/2011
UNE-EN 1994-1-2:2011 Available since 23/03/2011
UNE-EN 1995-1-2:2011 Available since 13/07/2011
UNE-EN 1996-1-2:2011 Available since 28/12/2011
UNE-EN 1999-1-2 Only ENV available

TURKEY

Yes. They are available on Turkish Standards Institution (TSE) website:

No	TS No	Date of Approval
1	**TS EN 1992-1-1** Eurocode 2: Design of concrete structures - Part 1-1: General rules and rules for buildings 100,00 TL + %8 KDV	09.04.2009
2	**TS EN 1992-1-1/AC** Eurocode 2: Design of concrete structures - Part 1-1: General rules and rules for buildings	28.04.2009
3	**TS EN 1994-1-1** Eurocode 4: Design of composite steel and concrete structures - Part 1-1: General rules and rules for buildings 70,00 TL + %8 KDV	12.04.2011
4	**TS EN 1994-1-1/AC** Eurocode 4: Design of composite steel and concrete structures - Part 1-1: General rules and rules for buildings AC free of charge	12.04.2011
5	**TS EN 1998-5** Eurocode 8: Design of structures for earthquake resistance - Part 5: Foundations, retaining structures and geotechnical aspects 30,00 TL + %8 KDV	13.03.2007
6	**TS EN 14399-8** High-strength structural bolting assemblies for preloading - Part 8: System HV - Hexagon fit bolt and nut assemblie 40,00 TL + %8 KDV	13.04.2010
7	**TS EN 14399-7** High-strength structural bolting assemblies for preloading - Part 7: System HR - Countersunk head bolt and nut assemblies 40,00 TL + %8 KDV	13.04.2010
8	**TS EN 14399-4** High-strength structural bolting assemblies for preloading - Part 4: System HV - Hexagon bolt and nut assemblies 40,00 TL + %8 KDV	13.04.2010

UNITED KINGDOM

N/A

1.2.8 National annexes to Structural fire Eurocodes

Are the national annexes available in internet?

BELGIUM

No. The national annexes are part of the translations of the Eurocodes. You have to command them via the NBN

CROATIA

No. The national annexes are property of the Croatian Standards Institute (HZN).
You have to command them via the HZN: http://www.hzn.hr/

CZECH REPUBLIC

No. The national annexes are part of the Czech translations of the Eurocodes.

FINLAND

Yes, at: http://www.eurocodes.fi/

FRANCE

No. The national annexes are part of french office of standardisation AFNOR: http://www.afnor.org/

GERMANY

No

GREECE

Yes. Many national annexes are available at the internet site: http//www.fireservice.gr

HUNGARY

Yes. The fire code is a law so we can use it free.

ITALY

Yes, the national annexes were discussed and approved by a National Committee and published with Decree of the Infrastructure Ministry 31 luglio 2012 (*Approvazione delle Appendici nazionali recanti i parametri tecnici per l'applicazione degli Eurocodici*).

POLAND

No. The national annexes are part of the Polish translations of the Eurocodes.

PORTUGAL

No. The national annexes are part of the Portuguese translations of the Eurocodes.

ROMANIA

No. The national annexes are part of Romanian office of standardisation ASRO.

SLOVAKIA

No the standards are not available on internet.

SLOVENIA

No

SPAIN

No

TURKEY

Yes.

UNITED KINGDOM

Yes

1.3 Approvals process

1.3.1 Route to get a project approved

What is the normal route to get a project approved?

BELGIUM

Via a public body.

CROATIA

Via a public body (Ministry of Internal Affairs).

CZECH REPUBLIC

Via a public body.

FINLAND

Via a public body.

FRANCE

Via a public body. Local fire safety commission and with a favourable opinion of a notified body for not prescriptive fire safety engineering projects.

GERMANY

Via a public body. Via a private body.

In eastern and some northern federal states by inspection engineers.

GREECE

Via a public body.

HUNGARY

Via a public body.

Self-certified. It depends the type of the licence.

ITALY

Via a public body.

POLAND

Via a public body.

PORTUGAL

Via a public body. The National Authority of Civil Protection.

ROMANIA

Via a public body.

SLOVAKIA

Via a public body.

SLOVENIA

Via a public body.

SPAIN

Via a public body. It is usually route. In Spain the local government gives the permission to open the commercial or industrial activity. The local officer analyses the project of fire safety and sometimes he orders a not compulsory report to Fire Service for more complex problems.

Via a private body. It is other possible route. In Spain some local governments use outsourcing to delegate the supervision and control of projects of fire safety by authorized private body.

Self-certified. In the future the local government would authorize the project by a “responsible statement” of designer but only for a small project or activity without risk.

TURKEY

Via the public body.

UNITED KINGDOM

Via a public body.

Via a private body.

Self-certified.

1.3.2 Fire brigade in the process

What is the position of the fire brigade in the process?

BELGIUM

For public buildings you need a report of the fire brigade before you receive a building permission

CROATIA

Fire brigade doesn’t participate in the process of design approval.
Exception is the case of approval of fire approach paths for the historical buildings.

CZECH REPUBLIC

Fire protection documentation shall be prepared, managed or supplied to State fire supervision body for approval and control.

If the supplied background or documentation shows imperfections with respect to fire safety of buildings, the state fire supervision body stipulates conditions in the approving opinion according to the importance of the imperfections.

FINLAND

The building authority usually consults the relevant fire safety authority (usually employed by the fire brigade) for a statement.

FRANCE

They are consulted in the beginning of the project.

GERMANY

Consulting for the authorities / inspection engineers.

GREECE

Principal role regarding to approval of fire safety design projects, fire inspections etc.

HUNGARY

There are two level in the legislation. In normal situation just the local fire department give the licence. If we need deviation from the code the Civil Defence is the authority having jurisdiction.

ITALY

The degree of Republic President n. 151 dived the place of work activities in three categories, in function fir risk level. For the category C (high risk level) the fire brigades control and approve the projects and issue the "certificate of fire prevention", instead for the category B (medium fire risk levels) the fire brigades check same projects and approve the Certified Signal of Start Industry (S.C.I.A. – Segnalazione Certificata di Inizio Attività), finally for the category A (low fire risk levels) the fire brigades approve the S.C.I.A. only.

POLAND

Projects must be agreed with a fire expert (fire engineer) appointed after passing the state exam, by the Chief Commandant of the State Fire Service. Before putting building into operation/use it must be checked and officially approved by the fire officer (State Fire Service).

PORTUGAL

Nowadays, due to the responsibility of technicians, is more limited with regard to approval of projects but will continue to play a role in the act of inspections and monitoring.

ROMANIA

The fire brigades control and approve the projects.

SLOVAKIA

Fire brigade is belonging to the process of accreditation.

SLOVENIA

Consulting for the authorities / inspection engineers, but minor influence mostly none.

SPAIN

Fire Service has a position only advisory but its reports have an important role in complex projects of fire safety.

TURKEY

Just as an advisory, the fire brigade could be consulted.

UNITED KINGDOM

Statutory consulters to the building control approvals process

1.3.3 Review by third party

Is there a third party review process common?

BELGIUM

No

CROATIA

No

CZECH REPUBLIC

No

FINLAND

Third-party review is usually required for FSE design.

FRANCE

No

GERMANY

No

GREECE

No

HUNGARY

No

ITALY

No

POLAND

No

PORTUGAL

No

ROMANIA

No

SLOVAKIA

I do not know the answer.

SLOVENIA

Yes, for performance based design.

SPAIN

No

TURKEY

I don’t know for sure but there is no position for the fire brigade in the process.

UNITED KINGDOM

No

1.3.4 Alternative route of approvals for performance based design

Is it necessary to follow an alternative route of approvals for performance based design and what would that route be?

BELGIUM

Yes via a request for deviation.

Only in the regulations of fire protections in industrial buildings is there a possibility to use performance base design methods

CROATIA

No. Validated programs and calculations are accepted.

CZECH REPUBLIC

The legislation has an article that allows engineers to develop projects based on fire safety engineering.

In case of any doubts which scope shall be prepared or managed the fire protection documentation, the decision appertains to the State fire supervision body, which shall decide on the basis of local conditions and after the examination of necessary documents.

FINLAND

No, because all approvals go through the local Building Authority.

FRANCE

No

GERMANY

No

GREECE

No

HUNGARY

This is only possible for buildings to which it is not possible to apply the law. In these cases it is always required the agreement of the OKF The Civil Defence.

ITALY

Yes, the Performance Based Approach may be applied within a Derogation procedure according to the Decree of the Ministry of the Interior 09/05/2007.

POLAND

For new buildings (only) – there is so called "departure from regulation": an investor applies to the Ministry of Infrastructure via a local building authority; The Ministry issues the final approval (usually after consultation with the State Fire Service).

Existing buildings - so called „substitute solution": fire expert/fire engineer prepares the expert's technical report of the substitute solution which must be agreed with the Regional Chief Fire Officer of the State Fire Service.

PORTUGAL

The legislation has an article that allows engineers to develop projects based on fire safety engineering. This is only possible for buildings to which it is not possible to apply the law. In these cases it is always required the agreement of ANPC – National Authority of Civil Protection.

ROMANIA

The revision of P118-99 includes the possibility to determine the fire resistance by means of calculation, using the specific Romanian Standards (SR) translated from the Eurocodes, together with the corresponding

National Annexes. After the issue of the new normative (2014), no alternative route for approvals would be necessary.

SLOVAKIA

Our legislation do not adapt the conditions for possibility of proceed building design. For example engineering access. If there are some buildings do not have respect to prescription of Slovak Republic, they are adapted after consultation with other concrete departments.

SLOVENIA

No - regulations allow fire engineering as option in part of process, but for some buildings additional review may be asked.

SPAIN

In practice the designers use the Prescriptive Rules and only for exceptional projects the Performance-Based Code is allowed but in this case it isn't necessary to use an alternative route.

TURKEY

No.

UNITED KINGDOM

No - functional regulations allow fire engineering as normal part of process

1.3.5 Time frame for the approvals process

What is the normal time frame for the approvals process?

BELGIUM

Not defined.

CROATIA

30 days.

CZECH REPUBLIC

Time for obtaining opinion issue:

- 30 days (design of common buildings)

- 60 days (design of specific buildings)

FINLAND

Not defined.

FRANCE

The last fire regulation allows the application of fire safety engineering (performance based design), but in this case a favourable opinion for the study by a notified body is required. The fire scenarios for a performed based design are defined by local fire safety commissions.

GERMANY

2-6 months.

GREECE

Not defined.

HUNGARY

Not defined.

ITALY

The approval process, according to D.M. 07/08/2012 is different for the three categories of D.P.R. 151:

Category A: After completing works, the fire safety engineer must present the S.C.I.A. (Certified Signal of Start Industry – Segnalazine Certificate di Inizio Attività), with all technical documentation concerning the building and the project, at the provincial command of the fire brigade. The fire brigade could control same of these documents and they could make an inspection too.

Category B: First to start the works, the fire safety engineer must present the project at the provincial command of the fire brigade; the fire brigade could control same of this project and they may ask for any additions within 30 days. After completing works, the fire safety engineer must present the S.C.I.A. (Certified Signal of Start Industry – Segnalazine Certificate di Inizio Attività), with all technical documentation concerning the building, at the provincial command of the fire brigade. The fire brigade could make an inspection.

Category C: First to start the works, the fire safety engineer must present the project at the provincial command of the fire brigade; the fire brigade control all this project and they may ask for any additions within 30 days. After completing works, the fire safety engineer must present the S.C.I.A. (Certified Signal of Start Industry – Segnalazine Certificate di Inizio Attività), with all technical documentation concerning the building, at the provincial command of the fire brigade. The fire brigade must make an inspection within 60 days; within other 15 day the Fire Prevention Certificate has to be issued. If the fire inspector ensures the lack of security requirements provided by law, during the inspection, he must request the adjustment. In this case, the manager of the industry has 45 days to make changes.

POLAND

Normal time frame - 1 month. In a complex/complicated 2 months are allowed.

PORTUGAL

Not defined.

ROMANIA

Normal time – 30 days.

SLOVAKIA

The standard time is 30 days.

SLOVENIA

By regulation:
30 days
60 days (for special cases)
In practice can be much more.

SPAIN

According to route selected for his approval

TURKEY

I don’t know the answer.

UNITED KINGDOM

Variable dependent on complexity.

1.3.6 Level of information needs

What level of information must be provided to the approving body?

BELGIUM

The project of fire safety of the building.

CROATIA

Complete main design, including Elaborate of Fire Safety.

CZECH REPUBLIC

The project of fire safety of the building.

A preparation of project of fire safety shall be proceeded on the basis of the requirements of specific legislation, normative requirements and requirements of the issued territorial decision.

FINLAND

All relevant information and documentation related to the fire safety of the building.

FRANCE

The project of fire safety of the building.

GERMANY

Detailed information. Fire safety concept and reports of all calculations.

GREECE

The project of fire safety of the building.

HUNGARY

The project of fire safety of the building.

ITALY

The project of fire safety of the building and every technical documentations concerning the building.

POLAND

The expert's technical report must proves that proposed alternative/substitute solution will provide not lower level of safety than prescriptive requirement.

PORTUGAL

The project of fire safety of the building.

ROMANIA

All relevant information and documentation related to the fire safety of the building.

SLOVAKIA

The project of fire safety of the building.

SLOVENIA

The project of fire safety of the building.

SPAIN

The full project of fire safety of the building, with engineering calculations and certificates of applicator of coatings or paints and its laboratory test

TURKEY

The project of fire safety of the building must be provided. All the requirements by the aforementioned Turkish regulation must be met.

UNITED KINGDOM

All areas covered by regulations and approved documents

1.3.7 Specific facilitators

Are any specific facilitators required to help the engineer in the approvals process?

BELGIUM

No

CROATIA

No.

CZECH REPUBLIC

Yes, Fire rescue service gives support to the designers.

FINLAND

Not defined.

FRANCE

No.

GERMANY

No

GREECE

Yes, Technical chamber of Greece could possibly give support to the designers.

HUNGARY

Yes, OKF gives support to the designers.

ITALY

Yes, Italian Fire Brigades gives support to the designers.

POLAND

No.

PORTUGAL

Yes, ANPC gives support to the designers.

ROMANIA

No

SLOVAKIA

Do not exist.

SLOVENIA

No

SPAIN

Usually the dialogue is open with the local officer

TURKEY

I don't know the answer.

UNITED KINGDOM

No

1.3.8 Product approvals

What are the possible product approvals of fire protection materials and methods (National, ETA or CE marking)?

BELGIUM

National is BENOR ATG

ETA

CE marking.

CROATIA

National and CE marking.

DIN norms till 2019.

CZECH REPUBLIC

Namely CE marking.

FINLAND

- CE marking / ETA for cases where Eurocodes are used
- National product approvals for cases where the National Building Code is used for design / CE-marking or ETAs can sometimes also be used in this case.

FRANCE

CE marking.

GERMANY

National ü-marking or European CE-marking.

GREECE

CE marking.

HUNGARY

CE marking.

ITALY

CE marking.

POLAND

European Certification Process (CE marking)- with requirements of the EU harmonized standards. This procedure is required to issue a declaration of conformity with CPD (construction products) or PPE (personal protective equipment) directives by manufacturer – obligatory for all products used for fire protection.

National:

- Regulation of the Minister of Interior and Administration dated 20th of June, 2007 regarding the list of products which ensure public safety or health care and life protection or property protection and concerning the rules of issue the certificate of admittance for these products to use (O. J. No. 143 pos. 1002),

With requirements of Polish Standards, national technical approvals - this procedure is required to issue the national declaration of conformity and mark products with construction marking by its manufacturer.

PORTUGAL

CE marking.

ROMANIA

CE marking.

SLOVAKIA

Certificate.

SLOVENIA

National and CE marking.

SPAIN

At the moment, the CE marking is not mandatory in Spain. The national standards tests in Spanish laboratories are required to certificate the fire protection materials and its application.

Nevertheless, there are several protocols for semiautomatic certification of products by the inter-laboratories European network.

After an extended period of transition, there are previsions of more two years for the mandatory CE marking in Spain

TURKEY

CE marking is used. Efectis Era Laboratory (in Kocaeli, Turkey) seems to be the only fire resistance lab to provide European Standardization and Certification Tests.

UNITED KINGDOM

National and CE marking.

1.4 Insurance companies

1.4.1 Involvement of insurance companies

Are insurance companies involved in the design process?

BELGIUM

Indirectly

Some companies give discount when fire protection systems are foreseen.

Some companies ask for specific fire protection systems.

CROATIA

No.

CZECH REPUBLIC

The insurance companies are involved rarely.

FINLAND

Not necessarily, but their views and conditions may have an influence on the design. It would be recommended to be in touch with the insurance companies at an early stage of the project and include them in the design process if necessary.

FRANCE

No.

GERMANY

Usually not.

GREECE

In most cases not.

HUNGARY

No

ITALY

In most cases no.

POLAND

In most cases no.

PORTUGAL

In most cases no.

ROMANIA

Usually not.

SLOVAKIA

No

SLOVENIA

No.

SPAIN

Requirements of insurance companies are more restrictive that the local regulations in important projects, for instance; skyscrapers or industrial installations.

TURKEY

I don't know the answer.

UNITED KINGDOM

In most cases no.

1.4.2 Discussion with insurance companies

Are insurance companies open to a discussion on fire safety?

BELGIUM

Yes

CROATIA

Not as the regular process.

CZECH REPUBLIC

The insurance companies don´t usually deal with discussion on fire safety. Insurance premium are offered in exceptional cases.

FINLAND

Yes, they usually are.

FRANCE

No.

GERMANY

Often they are conservative.

GREECE

In most cases, insurance companies are not particularly concerned with this matter when establishing insurance premium (except for high risk building categories).

HUNGARY

NO!

ITALY

In most cases, insurance companies are not particularly concerned with this matter when establishing insurance premium.

POLAND

In most cases, insurance companies are not particularly concerned with this matter when establishing insurance premium. They usually run routine fire risk assessment. In an opinion of fire authorities it is not satisfactory.

PORTUGAL

In most cases, insurance companies are not particularly concerned with this matter when establishing insurance premium.

ROMANIA

Yes.

SLOVAKIA

In present time are the first steps in this field.

SLOVENIA

They don't take part in design process.

SPAIN

No. Insurance companies only have an important role in arson investigations

TURKEY

Yes. They get involved when there is a dispute regarding a fire safety concern of a building between the building owner (or renter) and the contractor (e.g. building a fire barrier or extra fire escape routes etc.)

UNITED KINGDOM

In most cases, insurance companies are not particularly concerned with this matter when establishing insurance premium.

1.5 Qualification requirements for designers

1.5.1 Certificates/licenses requirements

Is it required to hold specific certificates/licenses in the member state to undertake fire safety design and fire engineering?

BELGIUM

Not really but there is a specific master degree

International Master of Science in Fire Safety Engineering

CROATIA

Yes. Fire safety person need to be certified by Ministry of Internal Affairs.

CZECH REPUBLIC

The fire safety design and fire engineering are elaborated only by qualified experts (certified technicians or certified engineers) according to Act No. 360/1992 Coll. on the Professional Practice of Certified Architects and on the Professional Practice of Certified Engineers and Technicians Active in Construction.

The conditions for qualification (certification) are required education, working experience and carry out expert test.

FINLAND

Fire safety engineers need to be certified. The certification process is administered by FISE Ltd. (www.fise.fi) and the requirements include:

- an applicable engineering degree
- sufficient studies in fire physics and relevant engineering topics
- a passed exam
- sufficient work experience in the field.

Design based on prescriptive regulation can usually be carried out by practicing structural engineers.

FRANCE

No, is not required a special certificate for the realization of FSE studies, but in fact the number of the persons involved in these studies is very limited. The most of FSE studies in France are realised by notified bodies.

GERMANY

Since the designer is a person with technical qualification, such as anengineer or an architect, a specific license is generally not necessary. Nevertheless, in some federal states a license is required.

GREECE

Fire safety design projects are mainly edited by civil engineers (passive fire protection) or mechanical/electrical engineers (active fire protection) according to their professional rights.

HUNGARY

Fire experts need an exam. The Civil Defence who give these permit to the fire experts.

ITALY

The designers are required to hold a professional qualification attending the " Specialization Course of Fire Prevention", supported by the Fire Department, according to law n. 818/1984 and Decree of the Ministry of the Interior 05/08/2011 "Procedure e requisiti per l'autorizzazione e l'iscrizione dei professionisti negli elenche del minister dell'Interno di cui all'16 del decreto legislativo del 08/03/2006 n. 139".

POLAND

Yes, but there are separate licenses for the structural designing and for the assessment of fire protection.

PORTUGAL

In the case of fire safety design for buildings of utilization-type of 3rd and 4th risk category, i.e., for those which have greater complexity, only designers with proven experience by professional association or that have been approved in recognized courses by ANPC can undertake fire safety projects related with the uses mentioned above.

ROMANIA

Civil engineers for passive fire protection and building services engineers for active fire protection, according to their professional rights.

SLOVAKIA

In Slovak Republic is important to have seemly education, specialist preparation and do the exam. After completion of that all conditions the people get the acknowledgment with name "specialist of fire protection, which is limited only for 5 years.

SLOVENIA

Yes. Licences are given by Slovenian Chamber of Engineers (IZS)

SPAIN

No. In Spain the designer is a person with technical academic formation, such engineer or architect.

In practice, there are professional designers for fire safety projects but not a specific license is necessary.

Otherwise, for a local officer or a referee of private body who revises and approves projects is required a specific licence.

TURKEY

No requirement.

UNITED KINGDOM

Currently there is no requirement.

1.5.2 Specific design licenses

Are there certain types of buildings for which specific design licenses are required?

BELGIUM

No

CROATIA

No

CZECH REPUBLIC

No

FINLAND

Yes, see answer directly above.

FRANCE

Actually, only for smoke evacuation of big volumes is delivered a licence by the Ministry of Interior.

GERMANY

No

GREECE

No

HUNGARY

No

ITALY

There are no specific cases.

POLAND

Yes, the regulations specify types of buildings for which a project must be agreed with a fire expert (fire engineer).

PORTUGAL

Yes, for buildings of 3^{rd} and 4^{th} risk category.

ROMANIA

No

SLOVAKIA

The solution of fire safety all buildings solve he specialist of fire protection.

SLOVENIA

No

SPAIN

Yes. The level of the licence allows the control of more complex projects of fire safety for local officers or external referees.

Usually, there are two levels: 1 or 2, function of local government of Spain.

TURKEY

No.

UNITED KINGDOM

No

1.5.3 Licenses holder

Is the licenses holder an individual or an organisation?

BELGIUM

Not answered

CROATIA

The license holder is individual.

CZECH REPUBLIC

The license holder is individual, but under the auspices of the Czech Chamber of Certified Engineers.

FINLAND

The license holder is an individual.

FRANCE

Organisation

GERMANY

The license holder is an individual.

GREECE

The license holder is individual.

HUNGARY

The license holder is organisation.

ITALY

The license holder is individual.

POLAND

The license holder is individual.

PORTUGAL

The license holder is individual.

ROMANIA

N/A

SLOVAKIA

The license holder is personal entity.

SLOVENIA

The license holder is individual.

SPAIN

The license holder is individual (levels 1 or 3).

The private body of control should have an additional licence which has a periodical inspection for its renovation from local government

TURKEY

Civil Engineering License (to practice) is issued by the Union of Chambers of Turkish Engineers and Architects.

UNITED KINGDOM

N/A

1.5.4 Specific insurance

Is a specific insurance required?

BELGIUM

Not answered

CROATIA

No. The ordinary professional insurance is enough for individual holders.
For non members of engineer Chambers it is obligatory to have specific insurance.

CZECH REPUBLIC

No

FINLAND

Usually liability insurance is required, or at least recommended.

FRANCE

No

GERMANY

Specific liability insurance is only needed for inspection engineers, not for designers.

GREECE

No.

HUNGARY

No

ITALY

Yes, the Italian engineers must have a professional insurance to practice the profession of engineer.

POLAND

All licensed structural engineers have to be insured.

For a fire expert (fire engineer) it is not obligatory, this is only a good practice but most are insured.

PORTUGAL

No

ROMANIA

No

SLOVAKIA

No. If you like it is solved with Standards.

SLOVENIA

All licensed structural engineers have to be insured. Usually by the company, yet individual insurances are also possible.

SPAIN

No. The ordinary professional insurance is enough for individual holders.

TURKEY

No.

UNITED KINGDOM

No

1.6 Sequence of performance based fire engineering projects

1.6.1 Project details

Project details

BELGIUM

There were already some PHD projects in the Ghent University.

And also the master thesis's of the first session of the International Master of Science in Fire Safety Engineering.

CROATIA

Performance based approach is used for complex buildings with many users (sport halls, malls, airports) but not as the obligation, only as alternative to prescriptive design.

CZECH REPUBLIC

Fire dynamic analysis and design of construction protection.

FINLAND

Salmisaari Wellness Centre, Helsinki, about 20 000 m^2

Shopping Center Futurum, Czech Republic

http://www.ruukki.com/References/

FRANCE

The temperature of the fire compartment according the adopted fire scenario.

GERMANY

Performance based fire-prevention concept for industrial livestock farming (pig farming). Since the requirements of the industrial construction regulations cannot be fulfilled because of special terms of use, performance based fire-prevention concepts are recommended.

Confer: Hagen, E.; Upmeyer, J. (2013) Brandschutzkonzepte für Massentierhaltungsanlagen und deren Prüfung (*Fire-prevention concepts for industrial livestock farming und their verification*). In:

Braunschweiger-Brandschutz-Tage 2013, Braunschweig, September 2013. Braunschweig: Dietmar Hosser, S. 159-166.

GREECE

Not answered.

HUNGARY

The all properties of the fire compartment are decided by authority having jurisdiction.

ITALY

The definition of fire scenarios and the temperature of the fire compartment according the adopted fire scenario.

POLAND

Fire scenarios, temperatures in particular compartments, fire duration, final safety certificate.

PORTUGAL

The temperature of the fire compartment according the adopted fire scenario.

ROMANIA

Calculation in agreement with Standards.

SLOVAKIA

Calculation in agreement with Standards.

SLOVENIA

Fire dynamic analysis (fire scenarios, duration and size of fire) and design of construction protection.

SPAIN

- Smoke control, temperatures and evacuation.
- Structural resistance of structure.
- Alternative measures of security

TURKEY

No precedence as far as I know.

UNITED KINGDOM

No specific criteria for the use of fire engineering as an alternative to other methods but usually size and complexity are the main reasons

1.6.2 Performance based fire design

What was performance based?

BELGIUM

N/A

CROATIA

The fire scenarios, smoke management and the structural fire behaviour

CZECH REPUBLIC

Use various methods of quantitative analyses (deterministic or combined methods), not only in the area of fire protection of buildings.

FINLAND

Structural fire design of steel structures.

FRANCE

The time evacuation of the building, the stability of the building must be ensured throughout all fire, etc...

GERMANY

Primary and stiffening structures (walls and columns) were built without the requirement of fire resistance-ratings. Based on the determination of the fire load, numerical fire simulations were conducted where the component temperatures were calculated and evaluated.

The fire section area deviated with 20,000 m² from the maximum limit value of 1,600 m². CFD-analyses were conducted to analyse the conditions in the event of fire. In addition the fire load was limited and smoke ventilations were installed.

Exceeding of the length of the escape route (62 m instead of 35 m). This is possible because of the maintenance of the low-smoke layer and the staff who is familiar with the location.

GREECE

Not answered

HUNGARY

The fire scenarios and the structural fire behaviour.

ITALY

The fire scenarios and the structural fire behaviour.

POLAND

Calculation of RSET (required safe escape time) or ASET (available safe escape time); selection of fire protection installations in an individual building - based on the assumed scenario of the fire development (computer simulations - fire models); defining parameters of fire protection installations (e.g. smoke control systems).

The fire scenarios and the structural fire behaviour.

PORTUGAL

The fire scenarios and the structural fire behaviour.

ROMANIA

The structural fire behaviour.

SLOVAKIA

Calculations.

SLOVENIA

Up to now mainly the fire scenarios and the structural fire behaviour.

SPAIN

The fire scenarios

TURKEY

N/A

UNITED KINGDOM

Tenability for life safety, means of escape and structural stability are the main performance criteria.

1.6.3 Used techniques

What techniques where used to justify the non-compliance?

BELGIUM

N/A

CROATIA

N/A

CZECH REPUBLIC

In technical standards is defined generally that in these techniques are buildings with extraordinary risk or special risk character in term of fire safety.

FINLAND

FDS simulations based on statistical data on fire loads in different premises. The cooling effect of sprinklers was partly accepted. Ozone software.

FRANCE

The difficulties to apply the prescriptive rules

GERMANY

Advanced fire simulations and CFD-analyses were conducted where the component temperatures and the conditions in the event of fire were calculated and evaluated.

Since the fire load was limited, it was possible to exceed the fire section area. The exceeded escape route was justified by the maintenance of the low-smoke layers with the help of air-handling systems.

GREECE

Not answered.

HUNGARY

If the regulation, due to the big dimension in plan and height of the building, is not adequate to be adopted, the building can be classified as “atypical danger” and fire safety engineering can be used.

ITALY

The regulations are basically prescriptive and concern several types of building use (DM 12/02/1982).

The performance based design and advanced calculation methods may be applied either in the lack of prescriptive rules or in the case of “derogation” with respect to prescriptive rules. The performance based design has to developed according to D.M. 09/05/2007.

POLAND

Calculations, an individual assessment, agreements with local fire brigade authorities; a new project on creation of the supporting system for all fire brigades (State Fire Service) has been implemented (special IT tools allowing simple exchange of digital data).

PORTUGAL

If the regulation, due to the big dimension in plan and height of the building, is not adequate to be adopted, the building can be classified as “atypical danger” and fire safety engineering can be used.

ROMANIA

N/A

SLOVAKIA

If it is in conflict with legal prescriptions.

SLOVENIA

Fire engineering can be used along with code-based methods – no specific reasons or techniques required before it can be employed, but usually if code-based methods don’t give sufficient informations or are too strict for modern type buildings.

SPAIN

Fire dynamic analysis techniques and advanced calculation models

TURKEY

N/A.

UNITED KINGDOM

Fire engineering is used along with code-based methods – no specific reasons or techniques required before it can be employed.

1.6.4 Approvals route

What approvals route was used?

BELGIUM

N/A

CROATIA

The fire safety concept must be approve by Fire Authority .

CZECH REPUBLIC

The fire safety project must be approved by Fire rescue service.

FINLAND

Local building and fire authorities together with responsible Fire Consultant, structural designer and steel structure manufacturer. The main simulation was done together with research institutes, VTT, TUT. In Czech Republic, help from CVUT.

FRANCE

The fire safety project must be approved by local fire safety commission.

GERMANY

The fire safety (proof of stability; proof of the fire scenario; etc.) can be approved by an inspection engineer or a certified inspector.

GREECE

Not answered

HUNGARY

The fire safety project must be approved by Civil Defence.

ITALY

The fire safety project must be approved by Regional Fire Brigades.

POLAND

The fire safety project must be approved by entitled fire officer or (depending on a type of building) by Authority of Fire Brigade.

PORTUGAL

The fire safety project must be approved by ANPC – National Authority of Civil Protection.

ROMANIA

Usual route through functional building regulations.

SLOVAKIA

The accreditation does the fire brigade of Slovak Republic.

SLOVENIA

Usual route according to building regulations.

SPAIN

Ordinary route in local government.

TURKEY

N/A.

UNITED KINGDOM

Usual route through functional building regulations.

1.6.5 Asked documentation

Is in your country standardised/recommended format of text of calculation of Performance based fire design?

CROATIA

No.

CZECH REPUBLIC

The recommended format is summarised in Wald F., Proof of fire resistance by structural analysis, ČVUT in Prague, 2010, ISBN 978-80-01-04509-1, verify by the General directorate of Fire rescue service of Ministry of interior.

FINLAND

Not standardized but documentation rules from " Performance based structural fire design"

GERMANY

There are for example some recommendations for the application of natural fire models in: Wathling, K.-D. (2013) Umgang mit Naturbrandnachweisen nach Eurocode im bauaufsichtlichen Verfahren (*Dealings with the approval of natural fire models according to the Eurocodes in the construction supervision process*). In: Braunschweiger-Brandschutz-Tage 2013, Braunschweig, September 2013. Braunschweig: Dietmar Hosser, S. 159-166.

ITALY

In Italy there is only a guideline for the application of the engineering according to DM 09/05/2007

PORTUGAL

No.

ROMANIA

N/A

SLOVENIA

No

TURKEY

No. There is none.

1.6.6 Location in nationally required documents

How fits performance based fire design to nationally required documents for fire safety of the building?

CROATIA

Performance based design is equal as the prescriptive design according Croatian legislation.

CZECH REPUBLIC

The basic procedure for ensuring fire safety building regulations determine the Technical conditions for the fire protection of buildings No. 23/2008 Coll. § 2 paragraph 1 and 2, a decree establishing the conditions for Fire safety and state fire supervision No. 246/2001 Coll. Fire safety solution that is an integral part of the construction documents and in accordance with Decree No. 499/2006 Coll., which includes cl. e) Evaluation of the proposed structures and fire doors in terms of fire resistance for approval by structural analysis according to European standards.

FINLAND

The fire safety issues, e.g. structural safety, smoke extraction, evacuation, fire distinquishing, should be identified in a Fire safety design done by Fire engineering consultant or specialist. The performance based fire design is allowed and the documentation needed is decided case by case. It is checked by a third-party inspector.

GERMANY

It is possible to develop performance based fire protection concepts in consideration of the state construction laws (Landesbauordnung), whereas each state has its own construction law.

ITALY

In according to article 6 of the D.P.R. 151, the fire safety engineer can use the performance based fire design if he submits the technical documentations and the project with an exception request (Istanza di Deroga); that request must be approved by regional fire brigade.

PORTUGAL

Performance based fire design is allowed by the Portuguese regulation for fire safety in buildings. Normally numerical modelling of fire scenarios and structural behaviour under fire conditions using advanced calculation methods are part of the project of stability of the building submitted to the authorities for approval.

ROMANIA

The revision of the actual normative for fire safety includes the possibility to determine the fire resistance by means of calculation, using the specific Romanian Standards (SR) translated from the Eurocodes, together with the corresponding National Annexes.

TURKEY

N/A.

2 Tasks and deliverables of structural fire safety design

2.1 Background

Performance-based fire safety design is an accepted methodology in European building regulations for the verification of structural resistance in fire conditions. This calculation procedure takes into account the individual characteristics of the building and passive and active fire protection methods. A realistic understanding of the behaviour of structures in fire can be achieved and the overall safety of the building can be verified by using performance-based fire safety design. Through the more profound understanding of phenomena and a more precise analysis of structures in fire, an equal to or higher safety level than with prescriptive fire design is obtained.

Performance-based fire safety design, or natural fire safety design, is generally carried out as shown in Fig. 1. Fire safety is mostly checked by comparing the required fire resistance time $t_{fi,requ}$ to the calculated fire resistance time $t_{fi,d}$ in the same way as in fi re design based on the standard fire curve. This leads to the simple equation $t_{fi,d} \geq t_{fi,requ}$, which nevertheless can be used to take into account all the aforementioned factors. However, it should be noted that the required fire resistance time in this equation is not the same value as in standard fi re design, but is also determined using a performance based approach. On the other hand, a similar comparison can be carried out also in the strength domain and temperature domain, see EN1991-1-2 cl. 2.5 Mechanical Analysis.

2.2 List of the requirements set

The characteristics of the building have to be known compartment by compartment before performance-based fi re design can be used. In the following table, the main tasks included in structural fi re safety design and the corresponding deliverables are listed.

The following lists, Tab. 2.1 the requirements set for the contents of the documentation on fire design, was prepared based nationally approved material on Table 2 in *Performance-based structural fire safety design*, Rautaruukki Oyj, and *Suomen Rakentamismääräyskokoelma.Rakennusten paloturvallisuus*. Määräykset ja ohjeet, 2002. This part is completing the use of Eurocodes to approve the asked fire safety in national materials. The similar material was approved for all European countries.

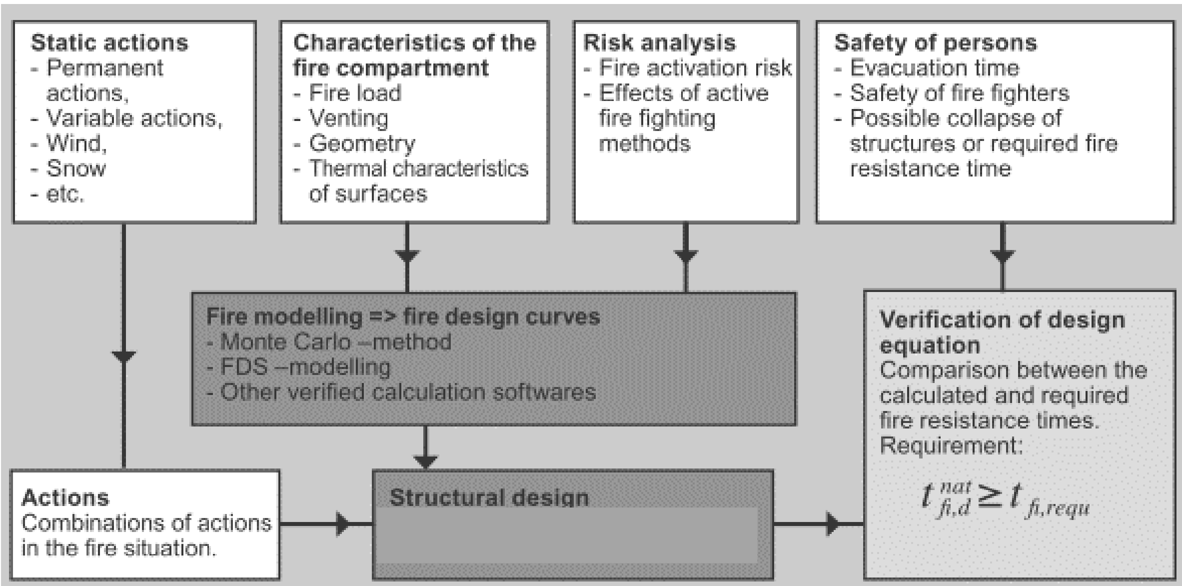


Fig. 2.1 Progress of performance-based fire safety design in a simplified form

Tab. 2.1 Requirements set for the contents of the documentation on fire design

A. DETERMINATION OF THE USE OF DESIGN DATA OF THE BUILDING

Tasks	Deliverables
Determination of factors affecting fire engineering design.	Assumptions made on the uses of the building during its whole life cycle. Explanations of the assumptions. Assumptions made on the possibilities for action of fire fighters and emergency personnel. Explanations of the assumptions. Failure analysis with explanations. Required service and maintenance during the use of the building.
Choice of methods and determination of their applicability. Regulations prescribe the use of only verified methods. Additionally, the methods have to be used by experts.	Description of the methods used. The description should state the calculation and testing methods used and their limitations, as well as initial data and made assumptions with explanations. All source references must be clearly stated.
Determination of acceptability criteria. Acceptability criteria set the limits for the safety of the design solutions. For the time being, these are agreed upon case by case with local authorities.	Structural acceptability criteria with explanations.
Choice of design standard and modelling methods. The same design standard system has to be used throughout the design process.	Determination of design standards to be used in design. If the design standard system does not include all necessary methods for the analysis of all different factors and other methods are used, the methods have to be validated. The application of all methods in the design has to be described with sufficient accuracy for it to make possible the repetition of the calculations by another party.
The inclusion of all necessary information regarding fire safety in the service and maintenance documentation of the building.	All necessary information on the use and modifications of use regarding fire safety are included in the service and maintenance documentation of the building. The documentation is updated during the life cycle of the building so that the latest information is always available to the owner and occupier of the building.

B. FIRE MODELLING

Determination of the geometry of the fire compartment.	The length, width, height and other necessary dimensions of the fire compartment. Small irregularities (e.g. consoles, columns and beams) do not usually have an effect on fire modelling using computer software and can often be ignored during this phase.
Determination of the surface characteristics confining the fire compartment.	The thermal characteristics (thermal conductivity, specific heat, emissivity, density etc.) of the walls, ceiling and floor of the fire compartment as functions of temperature,
Openings in the fire compartment.	Locations and dimensions of the openings, such as doors, windows and smoke vents. The opening and closing of openings during the fire. Evaluation of the durability of window panes during the fire. Assumption made on the breakage of windows. It should be noted that the breakage of windows is often difficult to determine accurately, for which reason a sensitivity analysis is necessary. Determination of the opening factor of the fire compartment.

Determination of different possible fire scenarios. Performance-based fire design is based on chosen risk scenarios and the corresponding design fires that are set in cooperation with fire authorities before the start of the design project. A certain risk scenario is a description of how, where and when a fire takes place and what are the factors under fire threat.	Determination and description of different fire scenarios. This requires sufficient expertise from the designer and experience in the determination of different fire characteristics. A design fire describes how the strength of the fire or the amount of heat energy released by the fire changes over fire duration.
Choice of fire scenarios for closer analysis.	Critical evaluation of different fire scenarios and the choice of critical fire scenarios for closer inspection. The description of critical fire scenarios and the background for the choices. Explanation on the sufficiency of the chosen scenarios.
Closer determination of the critical fire scenarios.	The type, size and location of the fire load are determined for all different fire scenarios. The fire load density is not an accurately defined variable, but instead varies statistically according to the purpose of use of the building. A large part of fire load densities given in different reference documents are based on expired data and should be considered with caution. In certain cases it may be necessary to carry out additional verification calculations in order to define the fire loads.
Consideration of active fire fighting methods.	Effects of active fire fighting methods on structural fire resistance. Active fire fighting methods include appliances and instruments used to extinguish a fire or to prevent its spread by active means, such as fire detectors, first-aid extinguishing equipment and sprinklers. Also fire fighters are counted among active methods, but also the possible displacement of the fire department during the life cycle of the building should be taken into account. The sufficiently effective use of active fire fighting methods and appliances may make it possible to prevent all structural problems during the duration of the fire.
Consideration of venting.	Location and operation of venting and air-conditioning devices. Can the system be turned off completely or does it turn itself off automatically when signalled by fire detectors? The venting system may have a considerable influence on the availability of oxygen and fire spread.
Modelling of fire scenarios.	The modelling of each fire scenario that has been deemed critical is carried out with the chosen accuracy using appropriate methods and tools. At least the temperatures and heat fluxes of the gas in the fire compartment have to be given as functions of time and location during the whole duration of the fire. The deliverables shall also include the thickness of the smoke layer at different times and the realised fire heat release rate so that the verification and evaluation of the calculation results is made possible.
Sensitivity analyses.	Description and explanation of the sensitivity analyses carried out on different affecting factors. The sufficiency of the analyses shall be shown and conclusions made.
Reporting.	Detailed report on fire modelling, calculations and sensitivity analyses. Conclusions on the complete fire modelling and analysis.

C. CALCULATION OF HEAT TRANSFER FROM FIRE TO STRUCTURES

Determination of structural geometries.	Dimensions and locations of individual load-carrying structural members.

Determination of heat transfer characteristics of the structural materials.	The heat transfer properties of different structural building materials as functions of temperature. Commonly necessary properties include heat conductivity, specific heat, density, surface emissivity and convection factor for the surface.
Definition of passive fire protection.	Definition of all passive fire protection methods and products, if they are used. Examples of passive fire protection products for steel structures include fire boards, fire coatings, sprayed masses and other building materials, such as concrete. The protection provided by the fire protection product shall be determined as function of temperature and/or time on the basis of the thickness and type of the protective layer. Depending on the design case, the resulting passive fire protection is determined only after the basis of the complete fire design process.
Determination of critical structural members with regard to different fire scenarios.	Critical structural members are determined in the case of each different critical fire scenario. Depending on the design case, these can be situated close to the fire or at a distance from it. The designer may have to analyse several structural members in order to define the critical case.
Choice of accuracy level of analyses.	Presentation on the accuracy level of the heat transfer analyses: 1D, 2D or 3D. In some cases, or for some building parts, several analyses of different accuracy levels may have to be carried out.
Heat transfer analyses in different fire scenarios.	Determination of the influence of shadowing effects on the heat transfer to different parts of structural members. Some calculation softwares can carry this out automatically. Detailed report on the calculations taking into account passive and active fire protection methods. Separate report on each critical fire scenario.
Sensitivity analyses.	Description and explanation on the sensitivity analyses carried out on different affecting factors. The sufficiency of the analyses shall be shown and conclusions made.
Reporting.	Detailed report on heat transfer, calculations and sensitivity analyses. Conclusions on the complete fire modelling and analysis. Results of the temperature development calculations at the chosen accuracy for different structural members during the whole duration of the fire.

D. STRUCTURAL ANALYSIS

Determination of fire resistance requirements.	Required structural fire resistance time. Limits to the use of the structure.
Determination of the properties of structural building materials.	Strength and heat expansion properties as functions of temperature for the load-carrying structural members according to the applicable EN- (or national) standard.
Specification of design standard system used for the structural analysis.	Accurate and unambiguous determination of design standards and methods used during structural analyses. If the chosen standards system does not include instructions for the consideration of all necessary factors, and a different method is used, the reliability and applicability of this other method has to be established. Design standards belonging to different standardization systems are

	generally not allowed to be used in combination, i.e. if for instance actions are determined according to EN-standards, also the structural resistance shall be determined according to EN-standards.
Determination of structural analysis model.	The sketching of a simplified structural model. This can be done in a similar way as in normal temperature design. The connections between members and other boundary conditions that may cause forced actions due to heat expansion shall be shown in the structural analysis model. The designer shall decide if the structural members are considered as individual members or if the complete structure is considered. This will also have an effect on the choice of analysis software, and vice versa.
Determination of actions on structures during the fire situation.	Determination of actions and combinations of actions on structures during the fire situation according to the regulations and instructions given in the applicable design standard.
Structural analysis.	Stability analysis. The verification of the functioning of the complete structural frame. Design analysis in the accidental situation (fire situation). Calculation of deflections and deformations. Local stability analysis. Design of connections.
Sensitivity analyses.	Description and explanation on the sensitivity analyses carried out on different affecting factors. The sufficiency of the analyses shall be shown and conclusions made.
Reporting.	Detailed report on analyses of structural behaviour, calculations and sensitivity analyses. Conclusions on the complete structural analysis. Documentation of the behaviour and degrees of utilization of all different structural members at the chosen accuracy.

3 Proposals for improvement of Eurocodes based on local/European projects

The Eurocodes are a set of ten harmonized technical standards developed for the structural design of construction works in the European Union. According the Eurocode "0" (EN 1990), Eurocodes serve as reference documents to prove compliance of building and civil engineering works with the essential requirements of Council Directive 89/106/EEC (replaced by Regulation (EU) No 305/2011 of 9 March 2011 of the European Parliament and of the Council, laying down harmonised conditions for the marketing of construction products), particularly Essential Requirement N°1 – Mechanical resistance and stability and Essential Requirement N°2 – Safety in case of fire. Regarding essential requirement N°2, Annex I of the Regulation (EU) No 305/2011 states that the construction works must be designed and built in such a way that in the event of an outbreak of fire:

(a) the load-bearing capacity of the construction can be assumed for a specific period of time;

(b) the generation and spread of fire and smoke within the construction works are limited;

(c) the spread of fire to neighbouring construction works is limited;

(d) occupants can leave the construction works or be rescued by other means;

(e) the safety of rescue teams is taken into consideration.

Eurocode 1, where the actions on structures are defined, and all the Eurocodes related with the different structural materials have the so-called Fire Parts (Parts 1-2) listed below:

Eurocode 1: Actions on structures - Part 1-2: General actions - Actions on structures exposed to fire

Eurocode 2: Design of concrete structures - Part 1-2: General rules - Structural fire design

Eurocode 3: Design of steel structures - Part 1-2: General rules - Structural fire design

Eurocode 4: Design of composite steel and concrete structures - Part 1-2: General rules - Structural fire design

Eurocode 5: Design of timber structures - Part 1-2: General - Structural fire design

Eurocode 6: Design of masonry structures - Part 1-2: General rules - Structural fire design

Eurocode 9: Design of aluminium structures - Part 1-2: Structural fire design

In 2007 all the 58 Parts of the Eurocodes have been published and the implementation of the Eurocodes was extended to all European countries. According to the Joint Research Centre (JRC), Institution that supports the implementation, harmonization and further development of the Eurocodes, they are currently at the stage of maintenance and evolution. CEN/TC250 is responsible for the maintenance of the Eurocodes, which involves: correction of errors; technical amendments with regard to urgent matters of health and safety; technical and editorial improvements; resolution of questions of interpretation and; elimination of inconsistencies and misleading statements. Maintenance will be largely based on the feedback from the use of the Eurocodes in the Member States and on requests for revision from industrial organisations or public authorities. Regarding the evolution of the Eurocodes it is expected that new findings related to materials and products, construction techniques and design methods are incorporated in the next generation of the Eurocodes.

In the framework of WP 6 - Thought for Eurocodes upgrade of COST Action TU0904 - Integrated Fire Engineering and Response, the members of the Action were asked to propose new improvements to the next generation of the Eurocodes based on local/European research projects. Ten countries have responded sending 40 proposals. Some of these proposals are completely new formulations and others are proposals for changing the existing formulae or parameters. It is hoped that these proposals presented in the current chapter can contribute to the maintenance and evolution of the Eurocodes. Figure 3.1 shows the number of proposals by country and Figure 3.2 depicts the number of proposal by Eurocode.

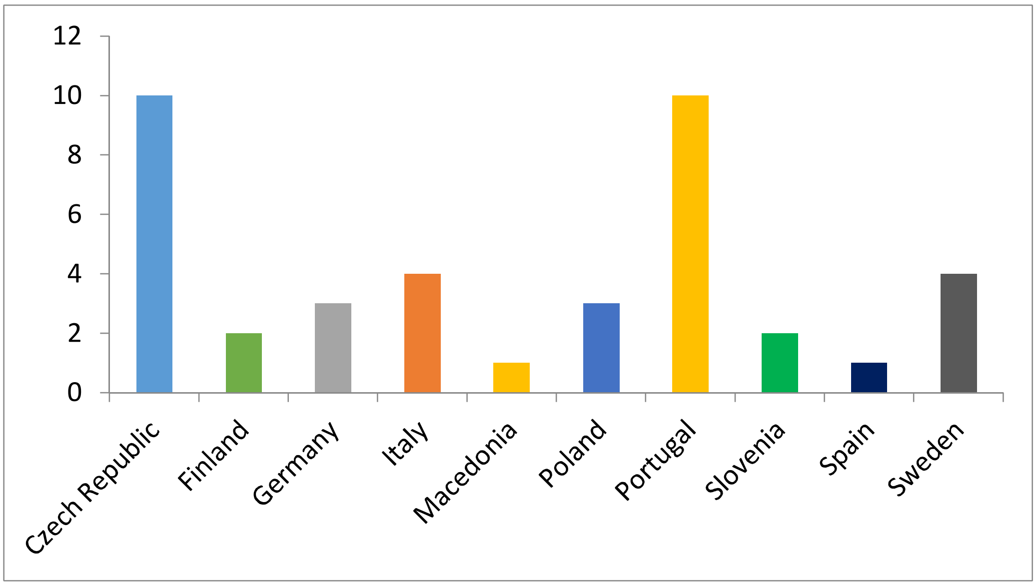


Figure 1: Number of proposals sent by the COST Action TU0904 members

From Figure 2 it can be seen that no proposal has been made to the Eurocode 6 (Design of masonry structures) and one proposal was submitted for the new Eurocodes on fibre-reinforced polymer (FRP) composites.

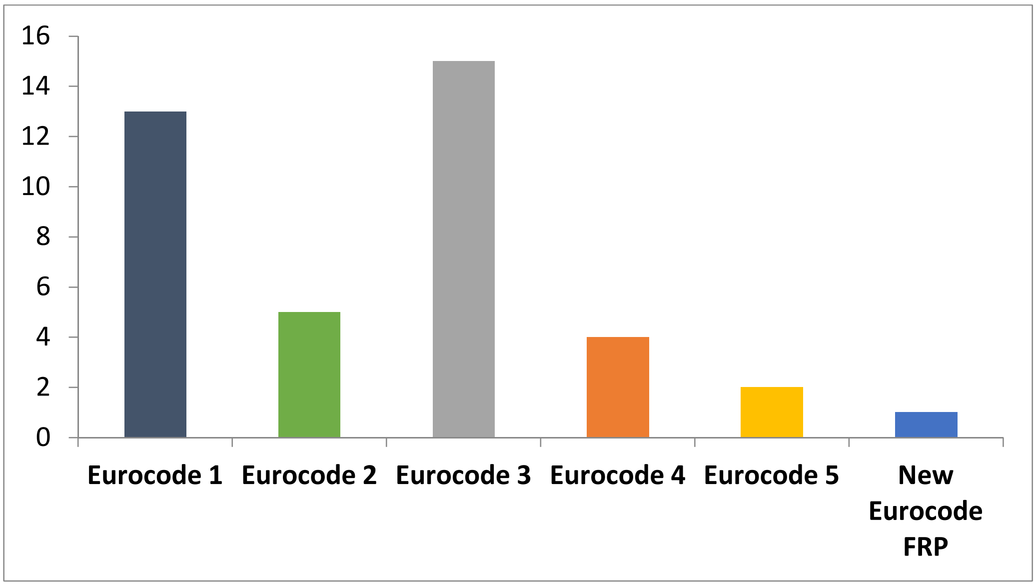
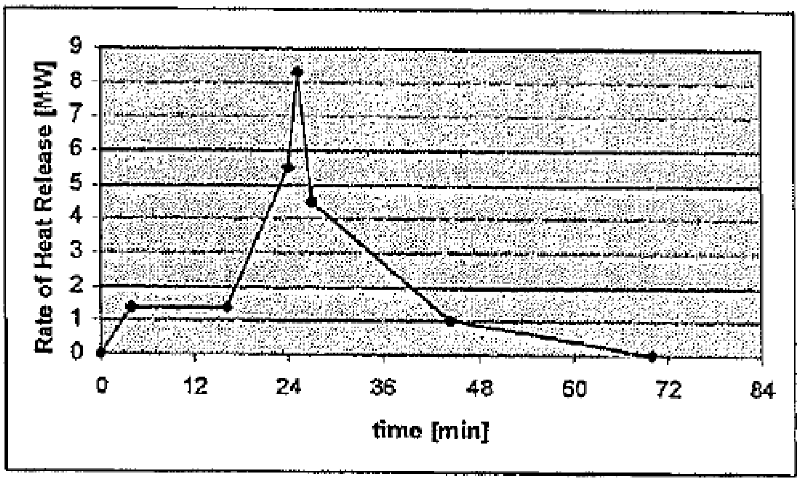


Figure 2: Number of proposals sent by Eurocode

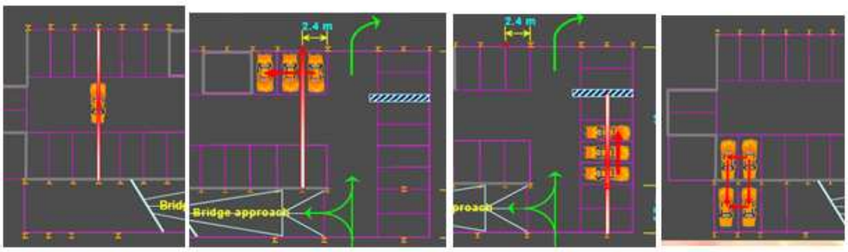
The proposals presented hereafter are of the entire responsibility of the proponents and have been published according the original submission, without any editorial modification.

3.1 EN 1991-1-2

<table>
<tr><td colspan="2">Proposals for improvement of Eurocodes based on local/European projects</td></tr>
<tr><td colspan="2">Eurocode: EN 1991-1-2</td></tr>
<tr><td>Country</td><td>Finland</td></tr>
<tr><td>Proposers</td><td>Markku Heinisuo, Jyri Outinen</td></tr>
<tr><td>Subject</td><td>Car fires in car parks</td></tr>
<tr><td>Clause No.</td><td>New clause E.2.5(5)</td></tr>
<tr><td>Reasons for improvement</td><td>No information is given for car fires. Car fire is an important scenario in fire. No common rules are given so many different applications are used in real projects for this deeply studied subject. This means high financial risks for contractors.</td></tr>
<tr><td>Proposed Changes</td><td>The following rate of heat release should be used for one car in car park fires.



The following fire scenarios should be considered in design.


</td></tr>
<tr><td>Status of the proposal (Finished/in progress)</td><td>Finished</td></tr>
<tr><td>Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)</td><td>No</td></tr>
</table>

Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	Yes, European and many local projects, see the references
References (background information)	Mangs, J., Loikkanen, P., Fire tests in passenger cars, VTT Research Report No.TSPAL00455/90, VTT Espoo, Finland, 1991. Schleich, J.B., Cajot, L.G., Franssen, J.M., Kruppa, J., Joyeux, D., Twilt, L., Van Oerle, J., Aurtenetxe, G. Development of design rules for steel structures subjected to natural fires in closed car parks (1997), EUR 18867EN, Report. Joyeux, D., Kruppa, J. Cajot, L.G. Schleich, J.B. Van de Leur, P. Twilt, L. Demonstration of real fire tests in car parks and high buildings (2001), European Research Contract n° 7215 PP 025, Final report. [4] BRE, Martin M., Fire Spread in Car Parks, Final Research Report BD 2552 (D14 V1)231-569, 16.2.2009, 116 pages. Obiala R., Vassart O., Open steel car park design using structural fire engineering. Proc. CMM-2013- Computer Methods in Mechanics. 27-31 August, Poznan, Poland, 2013, pp. MS04-21-22. Case Studies, COST TU0904 Integrated Fire Engineering and Response, Eds. Wald F., Burgess I., Rein G., Kwasniewski L., Vila Real P., Horová K. CTU Publishing Production, Czech Technical University in Prague. March 2012. 374 pages. Shleich, J.B, Modern Fire Engineering, Fire Design of Car Parks, Arcelor Profil, Luxembourg Research Centre. (Internet publication), 2010. [8] Mc Grattan, K., et al., Fire Dynamics Simulator, Technical reference guide. National Institute of Standards and Technology, version 5.5, 2010, USA. Partanen M., Heinisuo M., Car fires with sprinklers: A study on the Eurocodes for sprinklers. Proceedings of International Conference Prague, 19-20 April 2013: Applications of Structural Fire Engineering. Eds. Frantisek Wald, Ian Burgess. COST Action TU0904 (fire.fsv.cvut.cz/ifer). CTU Publishing House, Czech Technical University in Prague, 2013. pp. 23-28.

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1991-1-2	
Country	Czech Republic
Proposers	Kamila Horova, František Wald
Subject	Definition of use of parametric time-temperature curve
Clause No.	Annex A (1)
Reasons for improvement	Temperature is not homogeneous in horizontal plane across a floor area of a compartment even for compartments smaller than 500 m^2. Results of numerical study validated to measurements from full-scale fire test proved highly non-uniform temperature even in small fire compartment.
Proposed Changes	Change of definition of use in Annex A paragraph (1) is proposed. Limits of use should be based on calculation of presence of flashover. The presence of flashover can be proved by calculation of oxygen balance.
Status of the proposal (Finished/in progress)	In progress
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	No
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	LD11039 Travelling fire in multi-storey buildings, Ministry of education and sports, Czech Republic National project
References (background information)	Horova K et al. Temperature heterogeneity during travelling fire on experimental building. Adv Eng Softw (2013), http://dx.doi.org/10.1016/j.advengsoft.2013.05.001 Stern-Gottfired, Jamie and Rein, Guillermo. Travelling fires for structural design – Part I.: Literature review. Fire Safety Journal (2012). Stern-Gottfired, Jamie and Rein, Guillermo. Travelling fires for structural design – Part II.: Design methodology. Fire Safety Journal (2012),

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1991-1-2	
Country	Czech Republic
Proposers	Kamila Horova, Guillermo Rein, Jamie Stern-Gottfired, Angus Law, František Wald
Subject	Add design fire model of travelling fire into advanced design fire models
Clause No.	3.3.2.(2) and Annex D
Reasons for improvement	Travelling fire model describes temporal and spatial temperature distribution in a large compartment before flashover more realistic. Highly non-uniform temperature conditions were proved by full-scale fire experimental study. Structural behaviour is influenced by spatial non-uniform temperature conditions in different manners.
Proposed Changes	Travelling fire model based on Ref. 1 should be included into advanced design fire models in chapter 3.3.2. to complete the family of design fire models. However the method should not be too prescriptive as the current parametric curve is, as this could do more harm than good by encouraging engineers without sufficient knowledge/experience to use it.
Status of the proposal (Finished/in progress)	In progress
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	No
Was the proposal studied in the framework of a project?	LD11039 Travelling fire in multi-storey buildings, Ministry of education and sports, Czech Republic National project
References (background information)	Stern-Gottfired, Jamie and Rein, Guillermo. Travelling fires for structural design – Part II.: Design methodology. Fire Safety Journal (2012). Stern-Gottfired, Jamie and Rein, Guillermo. Travelling fires for structural design – Part I.: Literature review. Fire Safety Journal (2012). A Law, M Gillie, J Stern-Gottfried, G Rein, The Influence of Travelling Fires on a Concrete Frame, Engineering Structures 33, pp. 1635–1642, 2011. doi:10.1016/j.engstruct.2011.01.034 Horova K et al. Temperature heterogeneity during travelling fire on experimental building. Adv Eng Softw (2013).

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1991-1-2	
Country	Czech Republic
Proposers	Kamila Horova, František Wald
Subject	Fire load densities for different occupancies
Clause No.	Annex E, Table E.4
Reasons for improvement	In table E.4 values of 80 % fractile of fire load densities for different occupancies are higher than it was proved in recent studies and experiments in U.S.A., Canada and Finland (mainly for dwellings). Values of 80 % fractile of fire load densities in table E.4 was set higher to be more conservative.
Proposed Changes	Modification of values of 80 % fractile of fire load densities for different occupancies in tab. E.4 according to latest studies is proposed.
Status of the proposal (Finished/in progress)	In progress
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	No
Was the proposal studied in the framework of a project?	LD11039 Travelling fire in multi-storey buildings, Ministry of education and sports, Czech Republic National project
References (background information)	Horova, Kamila. *Heat release rate – the key parametr which defines the fire*, Czech Technical University in Prague, 2012. Hietaniemi, J.; Mikkola, E. *Design Fires for Fire Safety Engineering*, VTT Technical Research Centre of Finland, 2010, ISBN 978-951-38-7479-7. Madrzykowski, D.; Walton, W.D. *Cook County Administration Building Fire, 69 West Washington, Chicago, Illinois, October 17, 2003: Heat Release Rate Experiments and FDS Simulations*, NIST Special Publication SP-1021. Bwalya, A.C.; Sultan, M.A.; Bénichou, N. *Towards the development of design for residential buildings: literature review and survey results of fire loads in Canadian homes*, Interflam 2004, 10th International Fire Science and Engineering Conference, Edinburgh, Scotland, July 5-7, 2004, pp. 1-6. Laasonen, Mauri; Heinisuo, Markku; Outinen, Jyri; Hietaniemi, Jukka. *Systematisation of fire loads in Ruukki´s integrated fire design*, Tampere University of Technology, 2011.

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1991-1-2	
Country	Czech Republic
Proposers	Kamila Horova, František Wald
Subject	The maximum rate of heat release for different occupancies
Clause No.	Annex E, Table E.5
Reasons for improvement	In table E.5 values of the maximum rate of heat release produced by 1 m^2 of fire for different occupancies are lower than it was proved in recent studies and experiments in U.S.A., Canada and Finland (mainly for dwellings). Statistical value from table E.5 is about four times lower.
Proposed Changes	Modification of values of the maximum rate of heat release produced by 1 m^2 of fire for different occupancies in tab. E.5 according to latest studies is proposed.
Status of the proposal (Finished/in progress)	In progress
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	No
Was the proposal studied in the framework of a project?	LD11039 Travelling fire in multi-storey buildings, Ministry of education and sports, Czech Republic National project
References (background information)	Horova, Kamila. *Heat release rate – the key parametr which defines the fire*, Czech Technical University in Prague, 2012. Hietaniemi, J.; Mikkola, E. *Design Fires for Fire Safety Engineering*, VTT Technical Research Centre of Finland, 2010, ISBN 978-951-38-7479-7. Madrzykowski, D.; Walton, W.D. *Cook County Administration Building Fire, 69 West Washington, Chicago, Illinois, October 17, 2003: Heat Release Rate Experiments and FDS Simulations*, NIST Special Publication SP-1021. Bwalya, A.C.; Sultan, M.A.; Bénichou, N. *Towards the development of design for residential buildings: literature review and survey results of fire loads in Canadian homes*, Interflam 2004, 10th International Fire Science and Engineering Conference, Edinburgh, Scotland, July 5-7, 2004, pp. 1-6. Laasonen, Mauri; Heinisuo, Markku; Outinen, Jyri; Hietaniemi, Jukka. *Systematisation of fire loads in Ruukki´s integrated fire design*, Tampere University of Technology, 2011.

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1991-1-2	
Country	Germany
Proposers	Christoph Klinzmann
Subject	Improved safety concept for fire safety design
Clause No.	Annex E (E.1)
Reasons for improvement	In the original safety concept published in informative Annex E the design value of the heat load density as a basis for design fires considers active fire protection measures via a multiplicative factor. The individual factors remain the same even in case the active fire protection measures are dependent. This is not correct in every case, e.g. in case a plant brigade or a sprinkler system is present in a building, the effect of a public brigade on the resulting HRR cannot be identical to a situation in which such protection measures are not available.
Proposed Changes	In a local project, a new safety concept for the German national annex DIN EN 1991-1-2/NA was developed on the basis of full probabilistic analyses. This safety concept could replace the original safety concept in EC1-1-2.
Status of the proposal (Finished/in progress)	Not yet submitted
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	No
Was the proposal studied in the framework of a project?	Local project, DIBT-Forschungsvorhaben *ZP 52-5-4.168-1239/07*
References (background information)	Albrecht, C., Hosser, D.: “A risk-informed framework for performance-based structural fire protection according to the Eurocode fire parts”; Proceedings of Interflam 2010, Nottingham, UK Klinzmann, C., Hosser, D.: ”Active fire protection measures and probabilistic system analysis as a basis for a national fire safety concept in Germany” Hosser, D.; Weilert, A.; Klinzmann, C.; Schnetgöke, R.; Albrecht, C.: Erarbeitung eines Sicherheitskonzeptes für die brandschutztechnische Bemessung unter Anwendung von Ingenieurmethoden gemäß Eurocode 1 Teil 1-2“ (Sicherheitskonzept zur Brand-schutzbemessung). Abschlussbericht zum DIBT-Forschungsvorhaben ZP 52-5-4.168-1239/07. Institut für Baustoffe, Massivbau und Brandschutz (iBMB), Techni-sche Universität Braunschweig, November 2008, in German

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1991-1-2	
Country	Slovenia
Proposers	Jerneja Kolšek, Robert Pečenko, Tomaž Hozjan
Subject	Annex A Parametric temperature-time curves
Clause No.	(A.2a) parameter Γ
Reasons for improvement	According to extensive analysis performed by Buchanan [2002] eq. A.1, temperatures of gas are often too low.
Proposed Changes	Instead of b_{ref} = 1160, it is suggested to use value b_{ref} = 1900. Current parameter $\Gamma = [O/b]^2/[0.04/1160]^2$ should be calculated as: $\Gamma_{mod} = [O/b]^2/[0.04/1900]^2$
Status of the proposal (Finished/in progress)	/
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	/
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	/
References (background information)	Buchanan, A. H. 2002. Structural Design for Fire Safety. New Zealand, University of Canterbury: 421 p.

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1991-1-2	
Country	Slovenia
Proposers	Jerneja Kolšek, Robert Pečenko, Tomaž Hozjan
Subject	Annex A Parametric temperature-time curves
Clause No.	(A.11 – A.12) parameter Γ in decay phase, i.e. t^*_{max} .
Reasons for improvement	According to extensive analysis performed by Buchanan [2002] eq. (A.11 – A.12), calculation of the duration of the cooling phase, i.e. reference decay rate, should be modified.
Proposed Changes	Buchanan (2002) suggests that it is more accurate to modify the reference rate for ventilation factor and thermal insulation in a different way, with the resulting design decay rate by: $\frac{dT}{dt} = \left(\frac{dT}{dt}\right)_{ref} \frac{\sqrt{O/0.04}}{\sqrt{b/1900}}$
Status of the proposal (Finished/in progress)	/
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	/
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	/
References (background information	Buchanan, A. H. 2002. Structural Design for Fire Safety. New Zealand, University of Canterbury: 421 p.

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1991-1-2	
Country	Italy
Proposers	E. Nigro, G. Cefarelli, I. Del Prete, A. Ferraro, D. Sannino
Subject	Selection of design fire scenarios through the Fire Risk Assessment (FRA) in FSE Approach
Clause No.	Update of Annex E or possible new Annex
Reasons for improvement	Traditional Eurocode approach, proposed in Annex E, concerns the mechanical resistance and stability of structures, with reference to a single fire event, in which the effective value of fire load is modified in a semi-probabilistic way by means of partial safety factors, in order to take into account the events that can affect fire development. In many cases studied the approach proposed in Annex E is not consistent.
Proposed Changes	The identification of design fire scenarios can be carried out by means of Fire Risk Assessment, applying the event tree approach and the risk ranking evaluation according to ISO-16732 Guidelines. Different design fire scenarios may be related to different fire performance levels (e.g. resistance of structures for highest risk fire scenario and limited damage for the most probable fire scenario).
Status of the proposal (Finished/in progress)	In progress.
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	No
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	No
References (background information)	*1)* E. NIGRO, G. CEFARELLI, A. FERRARO, I. DEL PRETE, D. SANNINO, G. MANFREDI. *Application of Structural Fire Engineering to an Italian Tall Office Building.* 7th International Conference on Structures in Fire (SIF'2012), Zurich, Switzerland, June 6-8, 2012, p. 13-22. Editors: M Fontana, A. Frangi, M. Knobloch. Printed and bound by ETH Zurich. DOI: 10.3929/eth-a-0070501097. *2)* DEL PRETE I., CEFARELLI G., FERRARO A., NIGRO E., SANNINO D.*, Selection Criteria of Fire Scenarios for Buildings,* XXIV Italian Conference on Steel Constructions, Turin (ITALY), 30 Sept-02 Oct. 2013.

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1991-1-2	
Country	Italy
Proposers	E. Nigro, A. Ferraro, G. Cefarelli
Subject	Design fire scenarios for open car parks
Clause No.	Possible new Annex.
Reasons for improvement	A crucial aspect for the application of Structural Fire Engineering is the definition of design fire scenarios. In particular for open car parks, the fire scenarios are significantly affected, among other things, by the number of vehicles involved in the fire and the timing of fire initiation by a car to adjacent one. These issues, in 2001, were object of investigation by a European research called CEC AGREEMENT 7215-PP/025 "*Demonstration of Real Fire Tests in Car Parks and High Buildings*", which allowed the publication of a French guideline called INERIS "*Parcs de stationnement en superstructure largement ventiles*".
Proposed Changes	Introduction of an additional Annex on the design fire scenarios for open car parks.
Status of the proposal (Finished/in progress)	Finished
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	No
Was the proposal studied in the framework of a project?	CEC AGREEMENT 7215-PP/025 "*Demonstration of Real Fire Tests in Car Parks and High Buildings*". European Project.
References (background information)	CEC AGREEMENT 7215-PP/025 (2001). *Demonstration of Real Fire Tests in Car Parks and High Buildings*. INERIS (2001). *Parcs de stationnement en superstructure largement ventiles*. Avis d'expert sur les scénarios d'incendie. NIGRO E., CEFARELLI G., FERRARO A., MANFREDI G., COSENZA E. (2011). *Fire Safety Engineering for open and closed car parks: C.A.S.E Project for L'Aquila.* Applied Mechanics and Materials, vol. 82 (2011), p. 746-751. ISSN: 1662-7482. ISBN-13 978-3-03785-217-0. doi:10.4028/www.scientific.net/AMM.82.746.

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1991-1-2	
Country	Germany
Proposers	Prof. Dr. Jochen Zehfuss
Subject	Improved rules for design fires
Clause No.	Annex A and E
Reasons for improvement	The approaches for design fire published in annex A und E of EC1-1-2 in cases of fire are insufficient. The parametric temperature-time curves for small compartments published in annex A in some cases provide an unrealistic temperature increase and decrease. For fire compartments with large openings and an enclosure with low thermal conductivity the Annex A gives an extremely fast enhancement and decay of the temperature. For fire compartments with small openings and an enclosure with high thermal conductivity however an extremely slow decay of the temperature is assumed. The parametric temperature-time curves in annex A only describe the phase of the fully-developed fire without considering the growing phase of the fire. The most critical point is that the parametric temperature-time curves of Eurocode 1-1-2 annex A have no temporal connection with the rate of heat release of Eurocode 1-1-2 annex E. On the other hand Eurocode 1-1-2 offers only poor approaches for the definition of design fires. There are no rules for specification of ventilation openings, considering travelling fires, flash over and fire intervention.
Proposed Changes	In a local project, a new method for parametric fire curves was developed which is published in the German national annex DIN EN 1991-1-2/NA. In Germany and other countries pre-normative papers exist with approaches for travelling fires, flash over and fire intervention.
Status of the proposal (Finished/in progress)	finished
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	No
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	Local project, DIBt-Forschungsvorhaben ZP 52-5-3.83-1041/03
References (background information)	Zehfuss, J.; Hosser, D.: A parametric natural fire model for the structural fire design of multi-storey buildings. In: Fire Safety Journal 42. Kidlington, Oxford: Elsevier, (2007), S. 115-126.

	Zehfuss, J.: Case studies of a new simplified natural fire model and safety concept for structural fire safety design. In: ASFE. Application of Structural Fire Design, 29 April 2011, Prague. (in German) Hosser, D., Kampmeier, B., Zehfuß, J.: Überprüfung der Anwendbarkeit von alternativen Ansätzen nach Eurocode 1 Teil 1-2 zur Festlegung von Brandschutzanforderungen bei Gebäuden. Schlussbericht Forschungsvorhaben im Auftrag des Deutschen Instituts für Bautechnik, Berlin. Institut für Baustoffe, Massivbau und Brandschutz, TU Braunschweig, 2004. prINSTA TS 950 Fire safety Engineering – Verification of fire safety design in buildings.

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1991-1-2	
Country	Sweden
Proposers	Ulf Wickström, Milan Veljkovic
Subject	General rules changes
Clause No.	3.1 General rules
Reasons for improvement	Harmonization with nomenclature used in research and practice, experimental evidences provided in references, results of national project.
Proposed Changes	1. Reconsider nomenclature. Heat is e.g. normally denoted *q* and heat transfer coefficient *h*. 2. The emissivity of the fire should always be assumed as unity. 3. Provisions should be made for using incident radiation as a boundary condition. The radiation temperature needs to be defined in relation to the incident radiation. Eq. (3.3) is wrong when the configuration factor ϕ is not unity. It should not influence the emitted radiation.
Status of the proposal (Finished/in progress)	Topic 1, it is matter of harmonization with nomenclature used in research and practice. Topic 2, experimental evidences are provided in references. Topic 3 is in progress
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	No
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	
References (background information)	

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1991-1-2	
Country	Sweden
Proposers	Ulf Wickström, Milan Veljkovic
Subject	Fire modelling
Clause No.	3.3 Natural fires
Reasons for improvement	Recent research should be considered where not only semi-infinite compartment boundaries, but also composite structures, and different wall, ceiling and floor structures may be considered. In addition the radiation out the openings could be considered in a more consistent way. No new software need be developed.
Proposed Changes	the radiation out the openings could be considered in a more consistent way
Status of the proposal (Finished/in progress)	In progress
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	No
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	
References (background information)	

3.2 EN 1992-1-2

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1992-1-2	
Country	Czech Republic
Proposers	Jan Bednář, František Wald
Subject	Material properties of steel fibre-concrete at elevated temperature
Clause No.	3.2.2.2 or new chapter
Reasons for improvement	Fibre concrete is increasingly used and has properties which can be used for ambient and elevated temperatures. Various certificates and technical regulations are for fibre concrete, but it is not entered in the standards yet.
Proposed Changes	The description of the stress strain diagram of the fibre concrete and coefficients for change tensile strength and strain at elevated temperature.
Status of the proposal (Finished/in progress)	In progress
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	No
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	Gran Agency of Czech Republic No. P105/10/2159 Modelling of Membrane Action of floor slabs exposed to fire National project
References (background information)	BEDNÁŘ J., WALD F., VODIČKA J., KOHOUTKOVÁ A.; Experiments on membrane action of composite floors with steel fibre reinforced concrete slab exposed to fire; Fire safety Journal; 59; 2013; 111-121. FIKE R., KODUR V.; Enhancing the fire resistance of composite floor assemblies through the use ofsteel fiber reinforced concrete; Engineering Structures, 33; 2011, 2870-2878.

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1992-1-2	
Country	Czech Republic
Proposers	Jaroslav Procházka, František Wald, Jan Bednář
Subject	Fire resistance of lightweight concrete elements
Clause No.	3.3.1; 3.3.2; 3.3.3; 4.5
Reasons for improvement	The design of the construction from lightweight concrete is based on the codes for normal concrete. Those methods are appropriate to improve to take into account specific parameters and properties of lightweight concrete.
Proposed Changes	Description of characteristics of lightweight concrete is proposed to be added into each clause.
Status of the proposal (Finished/in progress)	Start of investigation
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	No
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	No
References (background information)	OTHUMAN M.A.; WANG Y.C.: Elevated-temperature thermal properties of lightweight foamed concrete. Construction and Building Materials. Elsevier 2010 AL-SIBAHY A.; EDWARDS R.: Thermal behavior of novel lightweight concrete at ambient and elevated temperatures: Experimental, modeling and parametric studies. Construction and Building Materials. Elsevier 2011 ANDC-CAKIR O.; HIZAL S.: Influence of elevated temperature on the mechanical properties and microstructure of self-consolidating lightweight aggregate concrete. Construction and Building Materials. Elsevier 2012

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1992-1-2	
Country	Macedonia
Proposers	Meri Cvetkovska, Ljupco Lazarov, Marijana Lazarevska
Subject	Simplified method for defining fire resistance of centrically and eccentrically loaded RC columns by using fire resistance curves and fuzzy neural networks prognostic model
Clause No.	Annex B- Simplified calculation methods
Reasons for improvement	This simplified method should offer quick assessment of the fire resistance of centrically and eccentrically loaded RC columns exposed to fire from all sides or only from one side.
Proposed Changes	
Status of the proposal (Finished/in progress)	Finished in case when fire exposure is from all sides. For the second case (fire exposure only from one side) the analysis are in progress.
Is the proposal being considered on the Evolution Group	No
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	Meri Cvetkovska, "Nonlinear stress strain behavior of RC elements and RC frames exposed to fire", Doctoral thesis, University Sts Cyril and Methodius, September 2002 Meri Cvetkovska, Ljupco Lsazarov, "Fire resistance of reinforced concrete structures", Research project, Ministry of Education and Science, Republic of Macedonia, 2006 (National project) Marijana Lazarevska, "Application of fuzzy-neural networks for modelling of civil engineering problems", Doctoral thesis, University of Montenegro, 2014
References (background information)	M.Cvetkovska, L.Lazarov, "Nonlinear Stress Strain Behaviour of RC Columns Exposed to Fire" 2nd International Conference, Lifetime-Oriented Design Concepts, Ruhr-Universitat Bochum, Germany, March 2004 Cvetkovska M., Cvetanovski P., Mihajlov V., "Fire resistance curves for RC columns", Proceedings of International Conference-Applications of Structural Fire Engineering, Prague, 19-20 February 2009, pp 196-202 Marijana Lazarevska, Miloš Knežević, Meri Cvetkovska, Nenad Ivanišević, Todorka Samardzioska, Ana Trombeva-Gavriloska , "Fire resistance prognostic model for reinforced concrete columns", Gradjevinar 64 (ISSN: 1333-9095), July 2012, pp 565-571 M.Lazarevska, M.Knezevic, M.Cvetkovska, „Application of artificial neural networks for prognostic modeling of fire resistance of reinforced concrete pillars", International Journal - Applied Mechanics and Materials, Volume 148-149, 2012, pp 856-861

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1992-1-2	
Country	Poland
Proposers	Robert Kowalski
Subject	Calculation of cross-section load bearing capacity of flexural RC members subjected to fire
Clause No.	B.1.2 (2), Figure B.2
Reasons for improvement	The range of the concrete compressed zone (λx) should be limited in different way than it is recommended for room temperature analyses.
Proposed Changes	When only concrete compressed zone is heated up, the maximal value of λx should be bigger than the one in room temperature. When only tensioned reinforcement is heated up, the maximal value of λx should be smaller than the one in room temperature.
Status of the proposal (Finished/in progress)	Not finished completely yet.
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	No
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	There was a local internal project realised in Civil Engineering Faculty of Warsaw University of technology
References (background information)	Not published yet.

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1992-1-2	
Country	Sweden
Proposers	Ulf Wickström, Milan Veljkovic
Subject	Thermal properties
Clause No.	2.2 Actions 3.3 Thermal and physical properties of concrete… 3.3.2 Specific heat 3.3.3 Thermal conductivity
Reasons for improvement	2.2 Actions The emissivity of a concrete surface is likely to be more than 0.7. 3.3.2 Specific heat The values presented must be looked over. 3.3.3 Thermal conductivity The given data should be updated.
Proposed Changes	2.2 Actions The emissivity of a concrete surface should be 0.9 for all materials unless anything else is proven. 3.3.2 Specific heat In relation to the accuracy of the values available a simpler model should be recommended for the specific heat and the density of concrete varying with temperature. As an alternative the volumetric enthalpy i.e. the integral of the density and the specific heat over the temperature should be given. The influence of the heat capacity of water under 100 °C should be considered. 3.3.3 Thermal conductivity The given data should be updated.
Status of the proposal (Finished/in progress)	In progress
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	No
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	
References (background information)	

3.3 EN 1993-1-2

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1993-1-2	
Country	Portugal
Proposers	António Correia; João Paulo Rodrigues and Paulo Vila Real
Subject	Interaction Diagrams Axial Force-Bending Moment for steel sections embedded in walls
Clause No.	
Reasons for improvement	The EN 1993-1-2, does not consider the combined effect of axial force and bending moment, in structural elements, when the temperature distribution is not uniform within the cross-section, in the design resistance of the cross-section.
Proposed Changes	The proposal consists of interaction diagrams for H steel sections, with non-uniform temperature distribution, when in contact with walls. The contact with the walls provides huge thermal gradients, which vary with the orientation of the web of the profile, in relation to the walls.
Status of the proposal (Finished/in progress)	Finished
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	No
Was the proposal studied in the framework of a project?	PTDC/ECM/65696/2006 - FIRECOLUMN – Fire Resistance of steel and Composite Steel and Concrete Columns with Restrained Thermal Elongation (National Project)
References (background information)	Correia, A.M., "Fire Resistance of Steel and Composite Steel-Concrete Columns", Thesis presented in fulfilment of the requirements for the degree of Doctor of Philosophy in Civil Engineering, Coimbra, July, 2011. Correia, A. J. M. & Rodrigues, J. P. C., *Fire Resistance of Partially Encased Steel Columns with Restrained Thermal Elongation*, Journal of Constructional Steel Research (ISSN: 0143-974X), Elsevier, vol. 67, Issue 4, April 2011, pp. 593-601, (doi:10.1016/j.jcsr.2010.12.002). Correia, António J. M.; Rodrigues, João P. C. & Silva, V., *A Simplified Calculation Method for Temperature Evaluation of Steel Columns Embedded in Walls*, Fire and Materials (ISSN: 1099-1018), Wiley, 35, 2011, pp. 431–441. (doi: 10.1002/fam.1063). Correia, A. J. M. & Rodrigues, J. P. C., *Fire Resistance of Steel Columns with Restrained Thermal Elongation*, Fire Safety Journal (ISSN: 0379-7112), Elsevier,

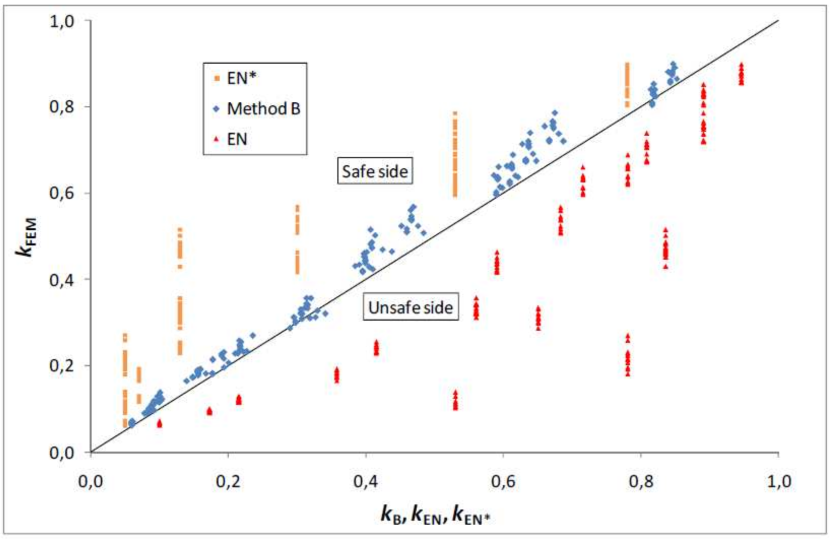
	vol. 50, May 2012, pp. 1-11, (doi: 10.1016/j.firesaf.2011.12.010). Correia, A. M., Rodrigues, J. P. C. & Korzen, M., *Experimental Research on Composite Columns made of Partially Encased Steel Sections under Fire Conditions*, Journal of Structural Fire Engineering (ISSN 2040-2317), Multi-Science, vol. 3, Num. 1 / March 2012, pp. 81-94, (doi: 10.1260/2040-2317.3.1.81).

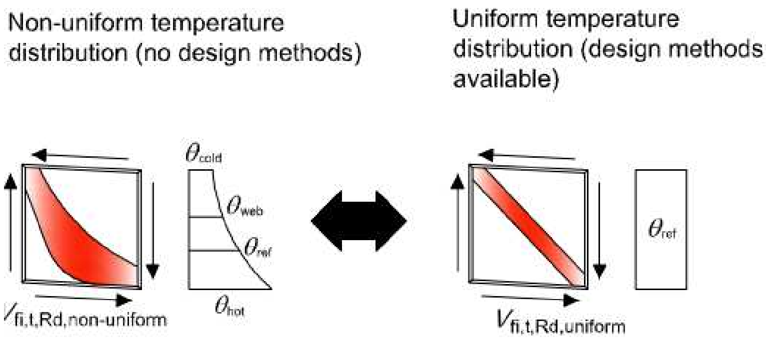
Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1993-1-2	
Country	Portugal
Proposers	António Correia; João Paulo Rodrigues & Fernando T. Gomes
Subject	Simplified calculation method for fire Design of steel columns with Restrained Thermal Elongation
Clause No.	4.2.5
Reasons for improvement	The simplified calculation method proposed in EN 1993-1-2 for fire design of steel columns, in the time domain and in the temperature domain, involves a great deal of calculation work, due to the great number of parameters involved in the buckling phenomenon at high temperatures. The critical temperature evaluation of a column requires an iterative process.
Proposed Changes	The proposal of a new simplified calculation method consists of a set of easy-to-use formulae, to assess the critical temperatures and critical times, as a function of the slenderness of the column, and the load level. For each column to be assessed its fire resistance, only one formula is used, so the calculation time is very much reduced comparing with the methods of the EN 1993-1-2.
Status of the proposal (Finished/in progress)	Finished
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	No
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	PTDC/ECM/65696/2006 - FIRECOLUMN – Fire Resistance of steel and Composite Steel and Concrete Columns with Restrained Thermal Elongation (National Project)
References (background information)	C Correia, A.M., “Fire Resistance of Steel and Composite Steel-Concrete Columns”, Thesis presented in fulfilment of the requirements for the degree of Doctor of Philosophy in Civil Engineering, Coimbra, July, 2011. Correia, A. M.; Rodrigues, J. P. C. & Real, P. V.; *Parametric Study on the Behaviour of Steel Columns Embedded on Walls*, 7th International Conference on Structures in Fire - SIF’2012, (DOI:10.3929/ethz-a-007050197), Zurich, Switzerland, June 2012 pp. 65-74. Correia, A. J. M. & Rodrigues, J. P. C., *Fire Resistance of Partially Encased Steel Columns with Restrained Thermal Elongation*, Journal of Constructional Steel Research (ISSN: 0143-974X), Elsevier, vol. 67, Issue 4, April 2011, pp. 593-601,

	(doi:10.1016/j.jcsr.2010.12.002). Correia, António J. M.; Rodrigues, João P. C. & Silva, V., *A Simplified Calculation Method for Temperature Evaluation of Steel Columns Embedded in Walls*, Fire and Materials (ISSN: 1099-1018), Wiley, 35, 2011, pp. 431–441. (doi: 10.1002/fam.1063). Correia, A. J. M. & Rodrigues, J. P. C., *Fire Resistance of Steel Columns with Restrained Thermal Elongation*, Fire Safety Journal (ISSN: 0379-7112), Elsevier, vol. 50, May 2012, pp. 1-11, (doi: 10.1016/j.firesaf.2011.12.010). Correia, A. M., Rodrigues, J. P. C. & Korzen, M., *Experimental Research on Composite Columns made of Partially Encased Steel Sections under Fire Conditions*, Journal of Structural Fire Engineering (ISSN 2040-2317), Multi-Science, vol. 3, Num. 1 / March 2012, pp. 81-94, (doi: 10.1260/2040-2317.3.1.81). Correia, A. M., Rodrigues, J. P., Gomes, F. T., “A simplified calculation method for fire design of steel columns with restrained thermal elongation”, Computers and Structures 116 (2013) 20-34

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1993-1-2	
Country	Portugal
Proposers	António Correia; João Paulo Rodrigues & Valdir Silva
Subject	Simplified calculation method for temperature evaluation of steel columns embedded on walls
Clause No.	4.2.5
Reasons for improvement	The EN 1993-1-2 for fire design, does not take into account the case of steel elements embedded in walls, presenting only a formulation considering uniform temperature. Thus the thermal gradients observed within the cross-section are neglected.
Proposed Changes	The proposal consists of a new simplified calculation method to evaluate the temperature of steel columns embedded in walls. The method is based on finite element analyses and fire resistance tests. Steel columns totally or partially embedded in walls, with the web perpendicular or parallel to the wall surface, were studied.
Status of the proposal (Finished/in progress)	Finished
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	No
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	PTDC/ECM/65696/2006 - FIRECOLUMN – Fire Resistance of steel and Composite Steel and Concrete Columns with Restrained Thermal Elongation (National Project)
References (background information)	Correia, A.M., "Fire Resistance of Steel and Composite Steel-Concrete Columns", Thesis presented in fulfilment of the requirements for the degree of Doctor of Philosophy in Civil Engineering, Coimbra, July, 2011. Correia, António J. M.; Rodrigues, João P. C. & Silva, V., *A Simplified Calculation Method for Temperature Evaluation of Steel Columns Embedded in Walls*, Fire and Materials (ISSN: 1099-1018), Wiley, 35, 2011, pp. 431–441. (doi: 10.1002/fam.1063). Correia, A. M.; Rodrigues, J. P. C.; Silva, V. P. & Laím, L., Section Factor and Steel Columns Embedded in Walls, Nordic Steel Conference 2009, (ISBN: 91-7127-058-2), Malmö, Sweden, 2009, pp 172-179.

<table>
<tr><td colspan="2">Proposals for improvement of Eurocodes based on local/European projects</td></tr>
<tr><td colspan="2">Eurocode: EN 1993-1-2</td></tr>
<tr><td>Country</td><td>Finland</td></tr>
<tr><td>Proposers</td><td>Markku Heinisuo</td></tr>
<tr><td>Subject</td><td>Shear resistance of plate in non-uniform elevated temperature</td></tr>
<tr><td>Clause No.</td><td>New NOTE after clause 4.2.1(3)</td></tr>
<tr><td>Reasons for improvement</td><td>Using maximum temperature and EN rules (EN* in the figure) the design is very safe. Using mean temperature θ_{web} and EN rules (EN in the figure) the design is unsafe. Instead of reduction factor $k_{y,\theta,web}$ (class 1,2 and 3 cross-sections) or $k_{p0.2,\theta,web}$ (class 4 cross-sections) which are based on mean temperature, a reduction factor $k_{y,\theta,ref}$ (class 1,2 and 3 cross-sections) or $k_{p0.2,\theta,ref}$ (class 4 cross-sections) based on the new reference temperature θ_{ref} has shown to be relevant (Method B in the figure). Verification was done using a comprehensive non-linear FEM.


</td></tr>
<tr><td>Proposed Changes</td><td>Note. Shear resistance of the plate in non-uniform temperature as shown in the Figure.



The reference temperature is calculated as: $\theta_{ref}=\theta_{hot}-d(\theta_{hot}-\theta_{web})$ where</td></tr>
</table>

	$$d = k_y k_a k_d \left[0.33 + 0.025\left(\frac{\theta_{hot} - \theta_{web}}{\theta_{web} - \theta_{cold}} - 1\right)\right]$$ and $$k_y = 1 + 0.00035(f_y - 235), \quad 1 \le k_y \le 1.06$$ $$k_a = 0.9 + 0.1\left(\frac{a}{h}\right), \qquad 0.95 \le k_a \le 1.15$$ $$k_d = 1 + \left(\frac{\theta_{hot} - \theta_{web}}{\theta_{web} - \theta_{cold}} - 1\right)\left(\frac{\theta_{cold} - 200}{2000}\right), \qquad 1 \le k_d \le 1.40$$
Status of the proposal (Finished/in progress)	Finished
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	No
Was the proposal studied in the framework of a project?	Yes, see references. Local project.
References (background information)	Salminen M., Shear resistance of thin metal plate at non-uniform elevated temperatures. Doctoral thesis. Tampere University of Technology. Publication 1012. Tampere, 2012. Salminen M., Heinisuo M., Analysis of thin steel plates loaded in shear at non-uniform elevated temperatures. Submitted to JCSR 2013 (JCSR-D-13-00407).

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1993-1-2	
Country	Czech Republic
Proposers	Tomáš Jána, František Wald
Subject	Temperature of fire protected connection in unprotected steel structure at fire.
Clause No.	D.3 Temperature of joints in fire
Reasons for improvement	Local fire protection of connections in fire unprotected steel structure provides adequate fire robustness along with low economic demands of the building construction. To determine the degradation of the mechanical properties is necessary to find out temperature distribution which can be used in the component method.
Proposed Changes	In using the lumped capacitance method, local section factor values of the parts forming a connection and a minimum length of fire protection on the beam and column are proposed to calculate the temperature of the connection.
Status of the proposal (Finished/in progress)	In progress.
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	No.
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	European project RFCS COMPFIRE – Design of joints to composite columns for improved fire robustness.
References (background information)	Jana T., Wald F.: "*Reduction of connection resistance during Veseli fire tests*", in: Proceedings of International Conference Applications of Structural Fire Engineering. Praha: Česka technika - nakladatelstvi ČVUT, ČVUT v Praze, 2013, p. 278-283. ISBN 978-80-01-05204-4.

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1993-1-2	
Country	Czech Republic
Proposers	Jiří Jirků, František Wald, Markku Heinisuo
Subject	Emissivity of zinc coated members in fire design
Clause No.	2.2 Actions
Reasons for improvement	The influence of change of the surface emissivity thanks to surfacing is not taken into account in calculation of steel structures´ temperature in fire design.
Proposed Changes	Change value of surface emissivity in fire resistance calculation for zinc coated steel members.
Status of the proposal (Finished/in progress)	In progress
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	No
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	No
References (background information)	JIRKŮ, J. - WALD, F.: *Influence of zinc coating to a temperature of steel members in fire*. In Proceedings of International Conference Applications of Structural Fire Engineering. Prague: Česká technika, CTU in Prague, 2013, pages. 294-298. ISBN 978-80-01-05204-4. JIRKŮ, J. - WALD, F.: *Increase of fire resistance of surface by zinc coating surface finishing*. In *Proceedings 19th Hot Dip Galvanizing Conference*. Ostrava: ASCZ, 2013, part 1., pages. 88-94. ISBN 978-80-905298-1-6

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1993-1-2	
Country	Poland
Proposers	Lesław Kwaśniewski, Piotr Smardz
Subject	Temperature distribution in steel beams
Clause No.	4.2.5
Reasons for improvement	For structural steel elements the calculation of temperature increase in an unprotected member exposed to fire is based on the assumption of uniform temperature filed in the element. The formula for temperature increase is therefore based on a single section factor of the structural member (as per item 4.2.5 of EN 1993-1-2). For certain elements (e.g. large beams with tall webs supporting concrete floors) this assumption does not seem to be realistic. This approach is also not consistent with calculation methods for composite floor presented in EN 1994-1-2
Proposed Changes	Provide criteria when it is appropriate to assume uniform temperature distribution in a steel member, and when it is more appropriate to split the member notionally into different parts, each having uniform temperature.
Status of the proposal (Finished/in progress)	In progress
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	
References (background information)	n/a

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1993-1-2	
Country	Portugal
Proposers	Nuno Lopes; Paulo Vila Real
Subject	Stainless steel members subjected to combined bending and axial compression in case of fire
Clause No.	4.2.3.5 (1)
Reasons for improvement	Due to the existing differences in the constitutive laws of carbon steel and stainless steel, it is not possible to use in both materials the same design formulae for members subjected to combined bending and axial compression, as proposed in Eurocode 3.
Proposed Changes	Different formulae for the interaction.
Status of the proposal (Finished/in progress)	Finished
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	Yes
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	no

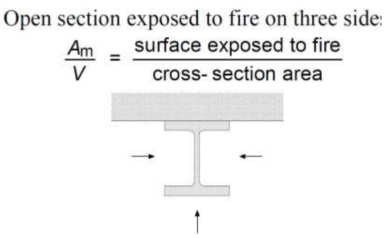
Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1993-1-2	
Country	Portugal
Proposers	Nuno Lopes; Paulo Vila Real
Subject	Flexural buckling resistance of stainless steel columns in case of fire
Clause No.	4.2.3.2 (1)
Reasons for improvement	Due to the existing differences in the constitutive laws of carbon steel and stainless steel, it is not possible to use in both materials the same design formulae for columns, as proposed in Eurocode 3.
Proposed Changes	Different buckling curve.
Status of the proposal (Finished/in progress)	Finished
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	Yes
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	no

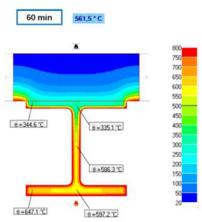
<table>
<tr><td colspan="2">Proposals for improvement of Eurocodes based on local/European projects</td></tr>
<tr><td colspan="2">Eurocode: EN 1993-1-2</td></tr>
<tr><td>Country</td><td>Spain</td></tr>
<tr><td>Proposers</td><td>Frederic Marimon, Ana Lacasta, Miquel Ferrer and Miquel Casafont</td></tr>
<tr><td>Subject</td><td>Section factor Am/V in columns with asymmetric heating</td></tr>
<tr><td>Clause No.</td><td>4.2.5.1 Unprotected internal steelwork

4.2.5.2 Internal steelwork insulated by fire protection material</td></tr>
<tr><td>Reasons for improvement</td><td>Calculations of section factor Am/V in columns have some problems in the case of non uniform temperature distribution, for instance the non-uniform heating produces thermal gradients through the cross-section.

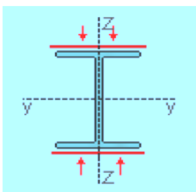
There are two problems, especially in the case of an <u>strong asymmetric distribution of temperature</u>:

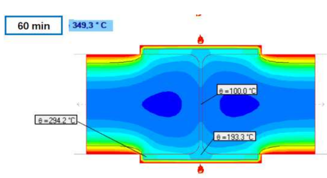
i. Assumption of uniform temperature distribution can give an unconservative estimate of the column or beam-column capacity, especially in slender beams
ii. Displacements out of axis of column -bowing effect- produce distortion or break of the wall and the loss of its integrity (E criterion)</td></tr>
<tr><td>Proposed Changes</td><td>Some advices for application of general formulae 4.25 and 4.26 in the cases of columns or beam-columns with asymmetric heating from Tables 4.3 and 4.4 of Eurocode EN 1993-1-2. For instance, the addition a new clause or note to warning in the case of columns or beam-columns to calculate the section factor Am/V with asymmetry.





Otherwise, it may be possible to incorporate new cases of columns or beam-columns with mechanical and thermal double symmetry in these tables 4.3 and 4.4.




</td></tr>
<tr><td>Status of the proposal</td><td>In progress</td></tr>
</table>

Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	We don't know exactly if the subject will be studied in the Evolution Group of CEN TC 250/SC3
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	No, these subjects are preceded from questions of Fire Brigade of local government of Catalonia to university UPC
References (background information)	AGARWAL, A.; CHOE, L.; VARMA, A.H. "Fire design of steel columns: Effects of thermal gradients". Journal of Constructional Steel Research, ELSEVIER, ISSN: 0143-974X. Volume 93, Pages 107–118, 2014 CORREIA, A.; RODRIGUES, J.P.C; VALDIR, V.P.; LAÍM, L. "Section factor and steel columns embedded in walls". Proceedings of the Nordic Steel Construction Conference 2009. NSCC2009- Malmö (Sweden), Luleå University of Technology and Swedish Institute of Steel Construction. Pages 172-179, 2009 RENAUD, C. "Guide de vérification des entrepôts en structure métallique en situation d'incendie". Centre Technique Industriel de la Construction Métallique. CTICM, Référence: SRI – 05/78f – CR/NB, n° Affaire: CA 030166, 2006

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1993-1-2	
Country	Portugal
Proposers	Paulo Vila Real; Nuno Lopes
Subject	Lateral-torsional buckling resistance moment in case of fire
Clause No.	4.2.3.3 (5)
Reasons for improvement	The influence of the bending diagram is not properly taken into account in Lateral-torsional buckling resistance moment.
Proposed Changes	A factor *f* similar to the one introduced in EN 1993-1-1, to take into account the influence of the bending diagrams, is proposed.
Status of the proposal (Finished/in progress)	Finished
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	Yes
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	PRAXIS/P/ECM/14176/1998 entitled *Lateral-torsional buckling resistance of Steel beams in case of fire* National project
References (background information)	VILA REAL, P. M. M.; LOPES, N.; SIMÕES DA SILVA, L.; FRANSSEN, J.-M. – "*Parametric analysis of the Lateral-torsional buckling resistance of Steel beams in case of fire*", Fire Safety Journal, ELSEVIER, ISSN: 0379-7112,Volume 42, Issues 6-7, Pages 416-424, September-October 2007. LOPES, N.; VILA REAL, P.; SIMÕES DA SILVA, L.; FRANSSEN, J.-M. "Lateral-torsional buckling on carbon steel and stainless steel beams with lateral loads plus end moments in case of fire", proceedings of the 6th International Conference on Structures in Fire SiF'10, pp. 67-74, ISBN 978-1-60595-027-3, East Lansing, United States of America, 2 to 4 of June of 2010.

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1993-1-2	
Country	Portugal
Proposers	Paulo Vila Real; Nuno Lopes
Subject	Lateral-torsional buckling resistance moment of stainless steel beams in case of fire
Clause No.	4.2.3.3 (5)
Reasons for improvement	Due to the existing differences in the constitutive laws of carbon steel and stainless steel, it is not possible to use in both materials the same design formulae for unrestrained beams, as proposed in Eurocode 3. In addition the influence of the bending diagram is not properly taken into account in Lateral-torsional buckling resistance moment.
Proposed Changes	Different buckling curve and a factor *f* similar to the one introduced in EN 1993-1-1, for taking into account the influence of the bending diagram, is proposed.
Status of the proposal (Finished/in progress)	Finished
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	Yes
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	no
References (background information)	VILA REAL, P.; LOPES, N.; SIMÕES DA SILVA, L.; FRANSSEN, J.-M. *"Lateral-torsional buckling of Stainless steel I-beams in case of fire"*, Journal of Constructional Steel Research, ELSEVIER, ISSN 0143-974X, volume 64/11, pp 1302-1309, November of 2008. LOPES, N.; VILA REAL, P.; SIMÕES DA SILVA, L.; FRANSSEN, J.-M. "Lateral-torsional buckling on carbon steel and stainless steel beams with lateral loads plus end moments in case of fire", proceedings of the 6th International Conference on Structures in Fire SiF'10, pp. 67-74, ISBN 978-1-60595-027-3, East Lansing, United States of America, 2 to 4 of June of 2010.

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1993-1-2	
Country	Portugal
Proposers	Paulo Vila Real; Carlos Couto; Nuno Lopes
Subject	Buckling lengths of columns of unbraced frames under fire conditions
Clause No.	4.2.3.2 (3)
Reasons for improvement	Although Part 1.2 of Eurocode 3 states that the buckling length of a column for the fire design situation should be determined as for normal temperature design, guidance is given for braced frames, but no rules are given for unbraced frames.
Proposed Changes	A proposal of buckling lengths of columns of unbraced structures is made.
Status of the proposal (Finished/in progress)	In progress
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	Yes
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	PTDC/ECM/65696/2006 - FIRECOLUMN-*Fire Resistance of Steel and Composite Steel and Concrete Columns with Restrained Thermal Elongation* National project
References (background information)	COUTO, C.; VILA REAL, P.; LOPES, N.; RODRIGUES, J.-P. “Buckling analysis of braced and unbraced steel frames exposed to Fire”, Journal Engineering Structures, Elsevier, ISSN: 0141-0296, volume 49, pp. 541–559, doi 10.1016/j.engstruct.2012.11.020, April of 2013.

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1993-1-2	
Country	Portugal
Proposers	João Paulo C. Rodrigues; Luís Laím; Hélder David Craveiro
Subject	Simple calculation models for the resistance of cold-formed steel members in fire
Clause No.	4.2
Reasons for improvement	There is a relative absence of specific guidelines in the EN 1993-1-2 for this type of members (beams and columns) under fire conditions. The available design rules do not properly consider the influence of section shape, slenderness and loading type on the fire behaviour of these members especially in the critical temperature model presented in this Eurocode. Another interesting parameters not taking into account in beams are the effects of the axial and rotational restraints on their fire performance.
Proposed Changes	Simplified calculation methods taking into account the parameters mentioned before so that they might be useful to provide safe structural designs and economical CFS structures in fire situations.
Status of the proposal (Finished/in progress)	In progress
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	Yes
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	PTDC/ECM/116859/2010 – “FIRE_COLDFSTEEL – Experimental and numerical analysis of cold-formed steel members subjected to fire”. National project.
References (background information)	Laím, L., Rodrigues, J.P.C., Simões da Silva, L. (2014), Experimental analysis on cold-formed steel beams subjected to fire, Thin-Walled Structures, Vol. 74, pp. 104-117. Laím, L., Rodrigues, J.P.C., Simões da Silva, L. (2013), Experimental and numerical analysis on the structural behaviour of cold-formed steel beams, Thin-Walled Structures, Vol. 72, pp. 1-13. Laím, L., Rodrigues, J.P.C., Simões da Silva, L. (2013), Flexural behaviour of cold-formed steel beams, In: Proceedings of the International Conference on Design, Fabrication and Economy of Metal Structures, Miskolc, Hungary, pp. 133-138.

	Craveiro, H.D.S., Rodrigues, J.P.C., Laím, L. (2013), Baseline study on the behaviour of cold-formed steel columns subjected to fire, In: Proceedings of the International Conference on Applications of Structural Fire Engineering, Prague, Czech Republic, pp. 251-257. Craveiro, H.D., Rodrigues, J.P.C., Laím, L. (2013), Cold-formed steel columns with restrained thermal elongation subjected to fire, In: Proceedings of the 13th International Conference and Exhibition on Fire Science and Engineering (Interflam 2013), London, United Kingdom, Vol. 2, pp. 1107-1118. Laím, L., Rodrigues, J.P.C., Simões da Silva, L. (2013), Numerical analysis of cold-formed steel beams in fire, In: Proceedings of the 13th International Conference and Exhibition on Fire and Materials, San Francisco, USA, pp. 163-174. Laím, L., Rodrigues, J.P.C., Simões da Silva, L. (2013), Comportamento estrutural de vigas em aço enformado a frio em situação de incêndio – análise experimental, In: Proceedings of the 2nd Ibero-American-Latin Congress on Fire Safety Engineering, Coimbra, Portugal, pp. 37-46. Laím, L., Rodrigues, J.P.C., Simões da Silva, L. (2013), Comportamento estrutural de vigas em aço enformado a frio em situação de incêndio – análise numérica, In: Proceedings of the 2nd Ibero-American-Latin Congress on Fire Safety Engineering, Coimbra, Portugal, pp. 47-56. Craveiro, H.D., Rodrigues, J.P.C., Laím, L. (2013), Análise experimental do comportamento ao fogo de elementos comprimidos em aço enformado a frio, In: Proceedings of the 2nd Ibero-American-Latin Congress on Fire Safety Engineering, Coimbra, Portugal, pp. 67-76.

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1993-1-2	
Country	Sweden
Proposers	Ulf Wickström, Milan Veljkovic
Subject	Thermal properties
Clause No.	2.2 Actions 3.4.1.2 Specific heat 4.2.5.1 Shadow effect
Reasons for improvement	2.2 Actions The emissivity of a concrete surface is likely to be more than 0.7. It should be 0.9 for all materials unless anything else is proven. 3.3.2 Specific heat The values presented must be looked over. Is the peak at 735 °C really as dominant? 4.2.5.1 Shadow effect The reduction factor 0.9 is has simply no physical reason and should be removed. It cause too low temperatures and thereby compromise safety.
Proposed Changes	2.2 Actions The emissivity of a concrete surface should be 0.9 for all materials unless anything else is proven. 4.2.5.1 Shadow effect The reduction factor 0.9 should be removed. It cause too low temperatures and thereby compromise safety.
Status of the proposal (Finished/in progress)	In progress
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	No
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	
References (background information)	

3.4 EN 1994-1-2

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1994-1-2	
Country	Poland
Proposers	Lesław Kwaśniewski, Piotr Smardz
Subject	Temperature distribution in steel beams
Clause No.	4.3.4.2.2 item (11)
Reasons for improvement	Item (11) in section 4.3.4.2.2 of EN 1994-1-2 states, that if "the beam depth does not exceed 500 mm, the temperature of the web may be taken as equal to that of the lower flange". For a beam with relatively thin web but significantly thicker bottom flange this approach may underestimate the temperature of the web
Proposed Changes	Provide criteria additional criteria for the limiting ratio of the web thickness to lower flange thickness
Status of the proposal (Finished/in progress)	In progress
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	
References (background information)	n/a

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1994-1-2	
Country	Italy
Proposers	E. Nigro, G. Cefarelli, I. Del Prete, D. Sannino
Subject	Simplified method for partially encased composite beams
Clause No.	Annex F.
Reasons for improvement	The simplified method proposed in the Annex F of Eurocode 1994-1-2 provides results often unsafe in comparison to the results obtained through experimental test and advanced numerical models. The new proposed method is easy to apply and it is more reliable than the previous one.
Proposed Changes	Update of Annex F by introducing a simplified method for partially encased composite beams.
Status of the proposal (Finished/in progress)	In progress.
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	Yes
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	NO
References (background information)	NIGRO E., CEFARELLI G., *Some Remarks on the Simplified Design Methods for Steel and Concrete Composite Beams*, Proceedings of Workshop of "COST Action C26 - Urban Habitat Constructions under Catastrophic Events", *Fire Resistance*, Prague (CZK), 30-31 March 2007, pp. 70-75. NIGRO E., DEL PRETE I., BOCCIA C., SANNINO D., CEFARELLI G., *Simplified and Advanced Methods for Safety Checks of Partially Encased Composite Beams in Case of Fire,* XXIV Italian Conference on Steel Constructions, Turin (ITALY), 30 Sept-02 Oct. 2013.

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1994-1-2	
Country	Portugal
Proposers	João Paulo C. Rodrigues; Tiago Ancelmo de C. Pires & Luis M Laim
Subject	Improving the simple calculation method for composite columns made of concrete filled circular hollow (CFCH) sections subjected to fire
Clause No.	Annex H (simple calculation method) of the EN1994-1-2
Reasons for improvement	The critical times of the CFCH columns tested in this research were slender than those suggested in EN1994-1-2 and registered in the international literature; The most of researches with CFCH columns in fire do not consider the restraining to their thermal elongation; The tabulated data (item 4.2.3.4) showed to be slightly unsafe for larger columns in Fire; Simplified calculation method (annex H) leads to conservative results, is difficult to be applied in practical cases and unsafe for slender columns.
Proposed Changes	Suggest for CFCH columns fire resistance lower than the presented in item 4.2.3.4 of the EN 1994-1-2 Propose new simplified equations able to predict the fire resistance of CFCH columns with restrained thermal elongation in fire and other parameters which had influence on the behavior of these columns in fire.
Status of the proposal (Finished/in progress)	In progress
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	In part Yes
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	Yes. FRISCC - RFSR-CT-2012-00025 - Fire Resistance of Innovative and Slender Concrete Filled Tubular Composite Columns fire"
References (background information)	Pires, T.A.C, Rodrigues, J.P.C., Rêgo Silva, J.J., (2010) "Buckling of concrete filled steel hollow columns in case of fire". *In: International Colloquium on Stability and Ductility of Steel Structures*, V. 1., pp 481-488, Brazil. Pires, T.A.C, Rodrigues, J.P.C., Rêgo Silva, J.J., Correia, A.M., (2010). "Concrete filled steel hollow columns subjected to fire". *In: International Symposium Steel Structures: Culture & Sustainability,* pp 427-436, Turkey.

	Pires, T.A.C, Rodrigues, J.P.C., Rêgo Silva, J.J., Correia, A.M., (2011) "CHS and Partially Encased Columns Subjected to Fire". *In: 6th European Conference on Steel and Composite Structures*, Vol. B. pp. 1569-1574, Hungary. Pires, T.A.C, Rodrigues, J.P.C., Rêgo Silva, J.J. (2012a). "Fire resistance of concrete filled circular hollow columns with restrained thermal elongation". *Journal of Constructional Steel Research*, vol. 77, pp. 82-94. Pires, T.A.C, Rodrigues, J.P.C., Rêgo Silva, J.J., Correia A.M. (2012b). "Fire resistance tests on concrete filled hollow columns". *In: 15th International Conference on Experimental Mechanics - ICEM15,* Portugal. Pires, T.A.C, Rodrigues, J.P.C., Rêgo Silva, J.J.(2013) "Numerical Assessment of the Fire Resistance of Tubular Steel Columns Filled with Concrete". *In: Design Fabrication and Economy of Metal Structures,* Hungary. Pires, T.A.C, Rodrigues, J.P.C., Rêgo Silva, J.J. (2013). "Numerical and experimental analysis of concrete filled steel hollow columns subjected to fire". *In: 13th International Conference and Exhibition on Fire Science and Engineering - INTERFLAM2013,* pp. 606-610, United Kingdom. Correia, A.M., Pires, T.A.C., Rodrigues, J.P.C., (2010) "Behaviour of Steel Columns Subjected to Fire". *In: Sixth International Seminar on Fire and Explosion Hazards.* pp. 879-890, United Kingdom.

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1994-1-2	
Country	Germany
Proposers	Peter Schaumann; Waldemar Weisheim
Subject	Structural behaviour of composite columns (simple calculation model)
Clause No.	4.3.5.1; Annex H
Reasons for improvement	Results for fire buckling loads based on Clause 4.3.5.1 and Annex H reveal to be on the "unsafe" side for composite columns with a relative slenderness higher than 0.5. (cf. Zhao and Espinós).
Proposed Changes	Proposal of a new simplified calculation method developed by Bergmann. (Remark: the method is not verified yet).
Status of the proposal (Finished/in progress)	In progress
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	No
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	The simplified calculation method was developed during a PhD thesis: Bergmann, M., Zur Bemessung von Hohlprofilverbundstützen im Brandfall (*Design of composite hollow- section columns in fire*), Institut für Konstruktiven Ingenieurbau, Bergische Universität Wuppertal, Diss. **2013**.
References (background information)	Zhao B.: Slenderness limit for composite columns with concrete filled hollow sections under fire situation. Centre Technique Industriel de la Construction Métallique (CTICM), France 2010. Espinós A., Romero M.L., Research Report: Fire Resistance of Concrete Filled Tubular Columns. EN 1994-1-2 Simple Calculation Model Revision. Universidad Politecnica de Valencia, Spain 2010.

3.5 EN1995-1-2

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1995-1-2	
Country	Czech Republic
Proposers	Petr Kuklík, Magdaléna Dufková, Václav Rada
Subject	Proposal to supplement t_{ch} and t_f for parametric fire exposure
Clause No.	Annex A (new A.4??)
Reasons for improvement	The calculation is only for unprotected element for parametric fire exposure.
Proposed Changes	Determination of: - t_{ch}: time of start of charring of protected members (delay of start of charring due to protection), or - t_f: failure time of protection for parametric fire exposure (Annex A), for wood-based panels or wood panelling and gypsum plasterboard. There is no sufficient number of experiments.
Status of the proposal (Finished/in progress)	In progress
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	No
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	- SGS research project “Behavior of light timber-framed buildings exposed to fire” - European Union, OP RDI project No. CZ.1.05/2.1.00/03.0091 – University Centre for Energy Efficient Buildings
References (background information)	DUFKOVÁ, M., KUKLÍK, P.: „Behavior of timber framed buildings in fire“ Lísek u Bystřice – conference organized by RIGIPS

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: EN 1995-1-2	
Country	Czech Republic
Proposers	Petr Kuklík, Magdaléna Dufková, Václav Rada
Subject	Charring rate
Clause No.	C.2.1 (2)
Reasons for improvement	Increased rate of charring does not take place throughout fire exposure.
Proposed Changes	Charring rate for load-bearing floor joists and wall studs in assemblies whose cavities are completely filled with insulation (Annex C) After char depth exceeds 25 mm charring rate reduces to the $\beta_n = k_s \cdot k_n \cdot \beta_0$ $t > t_a$
Status of the proposal (Finished/in progress)	finished
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	No
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	SGS research project "Behavior of light timber-framed buildings exposed to fire European Union, OP RDI project No. CZ.1.05/2.1.00/03.0091 – University Centre for Energy Efficient Buildings
References (background information)	KUKLÍK, P., DUFKOVÁ, M., RADA, V.: „Fire tests of light timber framed buildings“ magazine Stavebnictví 01-02/14 RADA, V.: Fire Resistance of Timber Framed Houses, Thesis, 2013

New Eurocode

Proposals for improvement of Eurocodes based on local/European projects	
Eurocode: New Eurocode in preparation concerning structures that incorporate FRP	
Country	Italy
Proposers	Emidio Nigro, Antonio Bilotta, Giuseppe Cefarelli
Subject	Flexural resistance of FRP reinforced concrete slabs and beams in fire
Clause No.	…
Reasons for improvement	Several building codes are currently available for the design of concrete structures reinforced with fiber-reinforced polymer (FRP) bars. Nevertheless, there is little information provided about structural behavior in case of fire and no reliable design methods are available for FRP reinforced concrete (RC) members in fire. The contribution will be useful for WG4 - European Committee CEN 250
Proposed Changes	Guidelines for the calculation of the resistant bending moment of FRP-RC members exposed to fire in compliance with the provisions of Eurocodes, in order to contribute to a draft of Eurocode for FRPs in Structures.
Status of the proposal (Finished/in progress)	Finished
Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)	No
Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)	"MIUR-PRIN 2006", entitled "*Effects of high temperatures on the performances of concrete slabs reinforced with FRP bars or grids".* Italian National Project
References (background information)	E. NIGRO, G. CEFARELLI, A. BILOTTA, G. MANFREDI, E. COSENZA (2011). *Fire resistance of concrete slabs reinforced with FRP bars. Part I: experimental investigations on the mechanical behavior*. Composites. Part B, Engineering, vol. 42, p. 1739-1750 E. NIGRO, G. CEFARELLI, A. BILOTTA, G. MANFREDI, E. COSENZA (2011). *Fire resistance of concrete slabs reinforced with FRP bars. Part II: experimental results and numerical simulations on the thermal field*. Composites. Part B, Engineering, vol. 42, p. 1751-1763 NIGRO E., CEFARELLI G., BILOTTA A., MANFREDI G., COSENZA E. (2012). *Performance under fire situations of concrete members reinforced with frp rods: bond models and design nomograms*. Journal of Composites for Construction, vol. 16, p. 395-406

	NIGRO E., CEFARELLI G., BILOTTA A., MANFREDI G., COSENZA E. (2012). *Behaviour of FRP reinforced concrete slabs in case of fire: theoretical models and experimental test*. Advances in Structural Engineering, vol. 15, p. 637-652 NIGRO E, CEFARELLI G, BILOTTA A, MANFREDI G, COSENZA E (2013). *Adhesion at high temperature of FRP bars straight or bent at the end of concrete slabs. Journal of Structural Fire Engineering* E. NIGRO, G. CEFARELLI, A. BILOTTA, G. MANFREDI, E. COSENZA (2014) G*uidelines for flexural resistance of FRP reinforced concrete slabs and beams in fire* Composites. Part B, Engineering – vol. 58 p. 103–112

References

EN 1990, Eurocode 0, Basis of structural design, CEN, Brussels 2002, Amendment A1:2005, CEN, Brussels 2005.

EN 1991-1-2, Eurocode 1, Actions on structures, General actions, Part 1-2, Actions on structures exposed to fire, CEN, Brussels 2002.

EN 1992-1-1, Eurocode 2, Design of concrete structures, Part 1-1, General rules and rules for buildings, CEN, Brussels 2005.

EN 1992-1-2, Eurocode 2, Design of concrete structures, Part 1.2, General rules, Structural fire design, CEN, Brussels 2005.

EN 1993-1-1, Eurocode 3, Design of steel structures, Part 1-1, General rules and rules for buildings, CEN, Brussels 2005.

EN 1993-1-2 Eurocode 3, Design of steel structures, Part 1-2: General rules, Structural fire design, CEN, Brussels 2005.

EN 1993-1-5, Eurocode 3, Design of steel structures, Part 1-5, Plated structures, CEN, Brussels 2005.

EN 1993-1-8, Eurocode 3, Design of steel structures, Part 1-8, Design of Joints, CEN, Brussels 2005.

EN 1994-1-1, Eurocode 4, Design of composite steel and concrete structures – Part 1-1: General rules and rules for buildings, CEN, Brussels 2005.

EN 1994-1-2, Eurocode 4, Design of composite steel and concrete structures. Part 1.2: General rules, Structural fire design, CEN, Brussels 2005.

EN 1995-1-1, Eurocode 5, Design of timber structures, Part 1-1, General rules and rules for buildings, CEN, Brussels 2005.

EN 1995-1-2, Eurocode 5, Design of timber structures, Part 1.2, General rules, Structural fire design, CEN, Brussels 2005.

EN 1996-1-1, Eurocode 6, Design of masonry structures, Part 1-1, General rules and rules for buildings, CEN, Brussels 2005.

EN 1996-1-2, Eurocode 6, Design of masonry structures, Part 1.2, General rules, Structural fire design, CEN, Brussels 2005.

EN 1999-1-1, Eurocode 9, Design of aluminium structures, Part 1-1, General rules and rules for buildings, CEN, Brussels 2007.

EN 1999-1-2, Eurocode 9, Design of aluminium structures, Part 1.2, General rules, Structural fire design, CEN, Brussels 2007.

Fransen J.M., Vila Real P., Fire design of steel structures, ECCS 2011, ISBN978-92-9147-099-0 .

Moore D., Lennon T., Bailey C., Wang Y., Thomas Telford, 2007, Designers' Guide to EN 1991-1-2, EN 1993-1-2 and EN 1994-1-2: Handbook for the Fire Design of Steel, ISBN 0727731572.

Performance-based structural fire safety design, Rautaruukki Oyj. Kaikki oikeudet pidätetään, Pub. 020 59 11, 2008, 7 p.

REGULATION (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:088:0005:0043:EN:PDF

Suomen Rakentamismääräyskokoelma.Rakennusten paloturvallisuus. Määräykset ja ohjeet, 2002. Ympäristöministeriö 2002. (E1 Finnish National Building Code. Fire Safety of Buildings. Requirements and Guidelines 2002. Ministry of Environment 2002.) in Finnish.

Wald F., Evaluation of fire resistance by calculation, *Prokazování požární odolnosti statickým výpočtem*. Praha: ČVUT v Praze, 2010, s. 16-44. ISBN 978-80-01-04509-1, in Czech.

Wang Y., Burgess I., Wald F., Gillie M., Performance Based Fire Engineering of Structures CRC Press 2012, ISBN: 978-0-415-55733-7.