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Fire safety engineering — Survey of performance-based fire safety design practices in different countries

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Fire safety engineering — Survey of performance-based fire safety design practices in different countries

Ingénierie de la sécurité incendie — Recensement des pratiques nationales sur la conception de la sécurité incendie fondée sur la performance

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 92, *Fire safety*, Subcommittee SC 4, *Fire safety engineering*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

Since the 1980s, performance-based fire safety design (P-B FSD) have been increasingly popular in many countries. In recent years, the trend has been accelerated by factors such as the emergence of large-scale buildings, diversification of building uses, desire for cost-effective construction and development of new building technologies. However, building control has been traditionally carried out based on prescriptive building/fire regulations and it is unlikely that this conventional system will be changed in the future for the majority of conventional types of buildings.

Since building designs by the P-B FSD method and by prescriptive building/fire regulations are very different, the buildings designed by the P-B FSD method do not smoothly fit into the conventional building control system. Various efforts are underway to devise a new system to control P-B FSD designs but there is a long way to go. Also, it is not clear how widely and in what practical situations the P-B FSD approach is used, and what fire safety engineering (FSE) tools are used in different countries.

It is the mission of ISO/TC 92/SC 4 to promote P-B FSD, and therefore SC 4 is concerned with how it can effectively assist in the establishment of systems for P-B FSD and, more specifically, what documents SC 4 can produce to benefit the development of P-B FSD. For this purpose, it is first necessary to understand the current state and environment of P-B FSD, particularly the legal, administrative and human environment.

This document is a summary of the results of a questionnaire survey conducted as the first step to better understand the actual situation of P-B FSD in different countries.

Similar surveys have already been conducted: twice by CEN/TC 127, *Fire safety in building*, in 2001 and 2017[2], for countries in Europe and several other countries; as well as other surveys with a similar interest[3][4]. Some results of these surveys are cited in this report as notes.

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Fire safety engineering — Survey of performance-based fire safety design practices in different countries

1 Scope

This document is a summary of the results of a questionnaire survey, which was conducted to gather information on the current state of performance-based fire safety design (P-B FSD) practices in various countries.

The questions include what types of buildings and areas of fire safety systems are being applied, what are the legislative environments in terms of acceptance of P-B FSD, and what documents are needed/desired from ISO/TC 92/SC 4 if the countries/regions wish to adopt P-B FSD.

2 Normative references

There are no normative references in this document.

3 Terms, definitions and abbreviated terms

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1 Terms and definitions

3.1.1
authority having jurisdiction
AHJ
authority including national and local governments, committees, officials and other organizations/persons that has jurisdiction

3.1.2
certifier
organization/person to certify buildings and their components that comply with performance-based criteria

3.1.3
peer review
evaluation by third-party authority or engineer in the same field to comply with performance criteria

3.1.4
performance-based fire safety design
P-B FSD
design that is engineered to achieve specified fire safety design objectives based on performance criteria

3.1.5
private certifier
accredited non-governmental *certifier* (3.1.2)

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3.1.6
regulatory review
assessment conducted by the *authority having jurisdiction* (3.1.1) to determine if fire safety design complies with performance criteria

3.2 Abbreviated terms

P-B FSD	performance-based fire safety design
FSE	fire safety engineering
CFD model	computational fluid dynamics model
2001-MS	member states of the EU at the year 2001
N-MS	member states of the EU after the year 2001
2016-MS	member states of the EU at the year 2016 ("2001-MS" + "N-MS")

4 Method of survey

The questionnaires were distributed to all the members of ISO/TC 92/SC 4 through the Secretariat of SC 4 during 7 to 10 October 2016. The selection of appropriate responders was left to the discretion of the mirror committee of each country/region. The expected typical responders were architects, fire safety engineers, building officials, etc.

The completed questionnaire was returned by 13 countries before 9 October 2016. Three responses were subsequently added. Finally, the number of countries that responded was 16, of which 8 are European countries.

The questionnaire is given in Annex A. There are 17 questions, which are classified into 4 sections:

— subjects of P-B FSD (see 5.3);

— societal and regulatory systems for P-B FSD (see 5.4);

— design fires and scenarios, criteria and calculation methods (see 5.5);

— the reasons why P-B FSD is not being adopted (see 5.6).

In general, the subjects of P-B FSD are buildings. Nevertheless, aircrafts, ships, trains and other types of built environments such as tunnels are included in the questions.

5 Results of survey

5.1 General

The results of the survey are summarized in 5.2 to 5.6.

The completed questionnaire was returned by 16 countries, of which 11 countries responded with a single answer while the other 5 countries (Canada, Germany, Spain, Sweden and the USA) responded multiple times. The questionnaire answers are wrapped up by each country in the case that two or more responses were received in a same country. The answers are not exactly the same even from the same country. In addition, different countries use different terminology. This is thought to be partly because some countries consist of local governments which retain high level of independence in autonomy and jurisdiction and partly because the responders' familiarity with the issues will not always cover all the local rules and conditions. Remarks are included for the relevant answers.

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The countries/regions that responded to the questionnaire and the number of responses from each are as follows:

—	Austria (EU)	1
—	Canada	2
—	China	1
—	France (EU)	1
—	Germany (EU)	2
—	Hungary (EU)	1
—	Japan	1
—	Republic of Korea	1
—	Netherlands (EU)	1
—	New Zealand	1
—	Russian Federation	1
—	Slovakia (EU)	1
—	Spain (EU)	10
—	Sweden (EU)	2
—	Turkey	1
—	United States of America (USA)	3

5.2 Usage of P-B FSD to actual buildings (answers to Q1)

Q1. Is P-B FSD already being used for actual buildings in your country/region?

Figure 1 shows that P-B FSD is being used in most of the 16 countries with two exceptions: Slovakia and Turkey.

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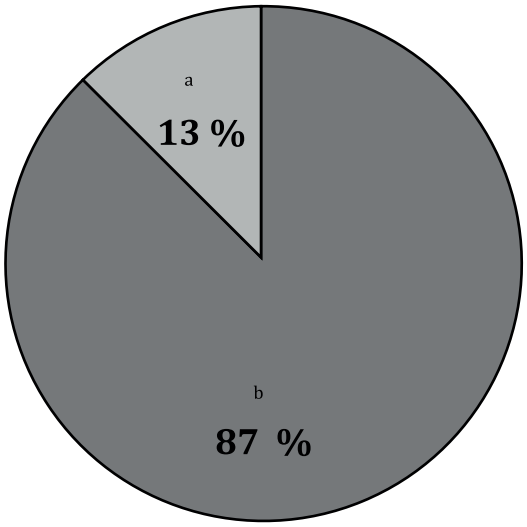

Key

a No, 2: Slovakia and Turkey.

b Yes, 14: Austria, Canada, China, France, Germany, Japan, the Republic of Korea, Hungary, New Zealand, the Netherlands, the Russian Federation, Spain, Sweden and the USA.

Figure 1 — Q1. Is P-B FSD already being used for actual buildings in your country/region?

NOTE In CEN's survey report[2], there is no direct question as Q1, but on the related question "4.5 Alternative approval system or derogation" it is said that alternative and derogation are accepted in most of 2016-MS, although "able to accept by regulatory system" and "being actually accepted" are not necessarily exactly the same.

5.3 Subjects of P-B FSD (answers to Q2 to Q4)

Q2. What are typical types of facilities/uses to which the P-B FSD approach is applied?

Figure 2 shows that every kind of built environment can be a subject of P-B FSD in most countries. However, P-B FSD tends to be applied mostly to high-rise buildings and various large-scale projects, while applications to residential and educational buildings are relatively few. This can suggest that the existing building and/or fire codes have not been able to catch up with the speed of change of height, size, occupancy condition, etc., while several types of buildings (e.g. residential buildings) are relatively simple so still tend to be constructed in a traditional way or omitted from the enforcement of rigorous provisions.

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