BUILDING RESEARCH JOURNAL
VOLUME 56, 2008 NUMBER 4

FIRE SAFETY REGULATIONS FOR HOUSING IN EUROPE COMPARED

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There is still broad variety of systems of technical requirements for buildings in the various European countries, despite the existence of the Construction Products Directive of the European Union and the development of Euro Codes. The goals and topics are quite similar, but detailed study reveals considerable variety of functional requirements, performance requirements, and specifications, with inconsistency within the requirements of some countries.

This article is based on the findings of comparative analysis of building regulations for housing in eight European countries, commissioned by the Dutch Ministry of Housing and intended to locate the Dutch Building Decree within the spectrum of regulations in other European countries. The project compares the systems of building control, the formulation of regulations, and the content of requirements for selected subjects and only for the domain of housing. Earlier (Visscher e. a. 2005) an article about the differences in the systems of formulation of regulations was published. This article focusses on the analysis of fire safety, which identifies several differences in both levels of requirements and strategies that may be significant in practice. It illustrates many impediments to harmonisation of the description of fire safety strategies.

Keywords: building regulations, fire safety requirements, performance requirements, Europe

1. Introduction

Protection of the health and safety of citizens was the earliest motive of legislation to safeguard the quality of the built environment. More recently, concern for energy conservation and the welfare of disabled people have also been translated into building regulations, but fire safety remains fundamental issue.

Internationally orientated research in the field of building regulation is scarce. Economic Commission for Europe (1985), Institute of Building Control (1997) and

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European Consortium of Building Control (2006) provide basic insight in the different systems in the European countries. The formulation of technical requirements was discussed in comparative analyses conducted from 1969-74 for the Building Research Station of the Department of the Environment in England by Atkinson e.a (1974). Meijer and Visscher (1998) undertook range of national and international projects on systems of technical building control that supported studies for the Dutch government in the search for alternatives. Sheridan (2001) analysed broad range of regulations and financial incentives to promote housing quality in European countries. Most recently, the Dutch Ministry of Housing, Physical Planning and Environment commissioned comparative study of technical requirements for dwellings and systems of implementation in Belgium, Denmark, England and Wales, France, Germany (State of Hesse), the Netherlands, Norway, and Sweden. The results were reported in Meijer, Visscher and Sheridan (2002), description and comparison of the systems of building control, and Sheridan, Visscher and Meijer (2003), comparative analysis of the technical requirements for some subjects selected by the Ministry. Selected sections of the Decree were transcribed to tables and requirements from other countries were incorporated in the same tables. The tables were used to construct topic-by-topic commentary that identified key features of each issue and, where possible, the highest and lowest levels of requirements amongst the countries studied.

Section of this paper outlines differences between selected European countries in approaches to regulation and in the formulation of fire safety requirements. Section analyses the differences in content and levels of requirements for fire safety. Section considers the harmonisation of requirements within European countries. Section presents general conclusions on the comparative study of fire safety regulations.

2. Systems and formulations of fire safety regulations

The systems of regulations in the eight European countries that have been analysed vary considerably (Visscher, 2005). For instance, in both the Netherlands and Sweden, there is inconsistency between topics in both the degree of detail, and the degree of prescription. There is also considerable variation in the degree of reliance on secondary sources, such as national standards, to interpret the requirements. Fire safety was one of the earliest issues addressed by building regulations and the variations between countries belie long tradition and practice. Mostly, the national approaches are similar if differently expressed, but there are some significant differences in levels of requirements such as travel distances and periods of fire resistance between neighbouring dwellings. Fire safety was by far the most challenging topic to analyse, due to the range of requirements and the importance of detail. It was also difficult to establish bases for evaluation due to differences in the description and application of requirements.

Scope of building regulations

Despite the length and complexity of the analysis undertaken, it does not yet represent complete account of fire safety controls on residential buildings for three reasons: 1) National building regulations do not encompass all the issues of fire safety and there is often further national legislation concerning high-risk accommodation or mixed-use buildings, and local bylaws, which address site-specific issues; 2) Controls on the management of buildings, including the licensing of certain types of premises; 3) Reliance on national standards for background information, but also in the Netherlands for the interpretation of strategic issues.

Description of requirements

The particular nature of the research contract with the Dutch Ministry of Housing, Physical Planning and Environment influenced the scope of the analysis, because it defined the selection of topics for analysis and required the analysis to be based on the Dutch Building Decree. It is intended that each requirement of the Building Decree should be an unambiguous legal statement that is measurable and verifiable but at the same time, the expression of requirements should minimise constraints on design freedom and innovation. Each clause is introduced by functional description, which expresses the intention of the subsequent performance requirements. Where relevant, performance requirements identify limit values, which indicate the minimum acceptable level of performance, and determination methods, usually by reference to standards of the Dutch Standardisation Institute (NEN). The application of requirements and any variable limit values are indicated by means of navigation table. This is demonstrated in the following example. Article 2.91 comprises functional requirement, which is elaborated in six further articles. The application or requirements in the Building Decree is identified in terms of 'user functions' such as 'living', which may be roughly translated as housing. Unfortunately, the project contract prescribed selection of sections from the Building Decree that did not include all the strategies relevant to fire safety. Although the interrelationships of certain strategies are important, the analysis nonetheless gives good indication of approaches and levels of requirements in each country, and raises issues for the methods to be used in the comparative analysis of fire safety regulations. It brings into focus the degree of prescription that masquerades as 'performance-based requirements'.

Description of requirements

Comparisons were complicated by some difficult aspects of the Building Decree: limited explanation of the strategies that underlie the requirements; use of specialised terminology with insufficient definition or explanation of its interpretation in terms

of spatial conditions; the formulation of requirements followed by qualifying conditions or exemptions; and the generic description of 'user functions' to describe the application of requirements, which generates long-winded descriptions. However, the greatest impediment to understanding the requirements was the Building Decree's reliance on secondary literature. Although it has guidance notes, which offer some clarifications, secondary sources are essential to the interpretation of requirements. For example, the requirements for resistance to spread of flame across the enclosure of fire compartment refer to national standard (an NEN), which does not specify conditions, such as the distance of openings from party walls, but gives method to calculate fire radiation at particular points on façades. Examples of practical solutions are given in further guidance (an NPR), including the size of windows related to the distances between facades.

The tasks of the designer of buildings and the designer of building regulations should be complementary, but each has different perspective on information about fire safety. Ideally, designers would develop proposals for buildings by considering the possible sources of fire, the nature of occupancy, and the requirements for escape from different places around the building. Their approach to design would be informed by set of strategic principles, from which detailed tactics could be deduced. However, it is probably just as common for designers to apply the requirements of building regulations to already-developed designs. In either case, there is design that can be tested against the demands of fire safety.

In contrast, building regulations must provide information that is capable of being applied in many different situations. Unless there is demonstration of the application of fire safety requirements to variety of plan configurations, the information is essentially generic and requires degree of interpretation in practice. Guidance can supply such interpretation and can also have an educational role in describing the rationale that underlies the requirements.

The most notable contrast to the Building Decree is the explicit, informative approach in England and Wales which means that the Approved Document can be used as basic design tool that can be understood by designers with relatively little reference to secondary texts or recourse to specialist advisors (Visscher, 2005). The requirements are presented together with guidance in Approved Document Fire Safety, which includes: information about the principles and assumptions that underlie the requirements; description of parts of buildings using everyday language; definitions of specialised terminology; diagrams to demonstrate the application of requirements to common configurations in buildings; discussion of detailed implementation, including diagrams to illustrate key conditions; separate sections, where appropriate, for domestic and non-domestic buildings, including differentiated requirements for houses and flats or maisonettes, for different heights of houses and blocks of flats, and for house conversions.

This bucks trend to increasingly inaccessible information, which often accompanies the introduction of performance-based approach, which is exemplified in the 2002 revision to the building regulations in Hesse (Germany). For instance this, unlike the previous revision, does not specify appropriate periods of fire resistance

for elements of construction. It also does not identify any secondary sources to interpret the requirements.

England and Wales is unusual amongst the countries studied in explaining the underlying assumptions of requirements. For instance, Approved Document B, paragraph 3.3, states:

"*The provisions for means of escape for flats and maisonettes are based on the assumption that: a. the fire is generally in dwelling; b. there is no reliance on external rescue (e.g. by portable ladder); c. measures in Section (B3) provide high degree of compartmentation and therefore low probability of fire spread beyond the dwelling of origin, so that simultaneous evacuation of the building is unlikely to be necessary; and d. although fires may occur in the common parts of the building, the materials and construction used there should prevent the fabric from being involved beyond the immediate vicinity (although in some cases communal facilities exist which require additional measures to be taken)*."

Requirements and guidance in other countries can mostly be understood from the main documentation which is freely available (as opposed to national standards which are only available for sale), but generally, there is much less supporting information than in England and Wales. Of the other countries studied, only Norway includes diagrams in the main documentation, in the Guidebook to the Technical Regulations.

Application of requirements

International comparison was complicated by differences in the application of requirements, with differing criteria and classifications of buildings. Often, it was possible to identify the highest and lowest levels of requirements overall, but for some topics, the only practicable method of analysis was to consider the requirements that would apply to certain types and sizes of building. For instance, fire-resistance of structure is examined with reference to two-storey houses and to blocks of flats with differing numbers of storeys. Product standards were not explored in the analysis, but it is worth noting that until the harmonised European standards for testing are adopted, there may be differences between countries in the constructions that satisfy the same requirements for fire resistance. There are three common bases for the classification of buildings, by function, typology, and height. There are relatively few instances where the application of requirements for dwellings is related to floor area.

Countries vary in the ways in which they differentiate between requirements for living accommodation and other functions. In some cases, such as France, there is dedicated legislation for residential buildings. More commonly, fire safety regulations make special mention of dwellings, with sub-sections for dwellings and other buildings for certain issues, but not for others. In the Netherlands, the application of requirements is identified in 'navigation' tables. Belgium is unusual in having requirements which are applied without differentiation of function, but do not apply to single-family houses.

Some countries have clearly different requirements for flats and houses; some also differentiate between detached and joined single-family houses; others have combined requirements for flats and houses, but with differences related to height.

One might anticipate that the fire safety classification of buildings would clearly relate to fire-fighting equipment and the time it would take to evacuate the building, but there is considerable variation in the classification of buildings by height. The upper limit of the first safety class varies from 4.5 in England and Wales, to 28 in France. There is similar variation in the highest safety class, with tall buildings classified either directly (for instance in France, as buildings over 50 tall), or by implication (for instance in Sweden, as buildings with three or more storeys). In Belgium, the only classification of buildings is by height, with differing requirements for low, medium and tall buildings.

3. Comparisons of levels of requirement for fire safety in different countries

There is considerable similarity between countries in the four primary strategies that are common to all, or almost all, of the countries studied:

– stability in case of fire (fire resistance of structure);
– limitation of spread of fire (compartmentation);
– escape routes; and
– limitation of the development of fire (spread of flame, characteristics of internal and external surfaces).

However, there are notable differences in the application and levels of requirements, as well as in the description and detail of requirements. The lack of any requirements for single-family houses in Belgium is probably easiest to understand as political, non-interventionist policy. Similarly, the Netherlands has no longer controls the fire resistance of doors on escape routes, as the result of an inquiry into Market Forces, Deregulation and Legislative Quality (MDW) which decided that performance requirements for fire safety were too rigorous.

It is more difficult to understand why levels of requirements should vary. For instance, each country specifies periods of fire resistance to protect the stability of elements of structure but there are varying levels of requirements related to height. Presumably, periods of fire resistance are calculated to provide sufficient time for escape and fire-fighting, or based on empirical study and it would be interesting to know but probably impossible to discover why France has lower levels of requirements than other countries for both single family houses and blocks of flats. Further research might consider whether there is any correlation between the rate of death and injury in fires and the levels of requirements for fire resistance.

Each country, apart from France and Germany (Hesse) has some requirements for the compartmentation of residential buildings. Only the Netherlands additionally uses the concepts of ‘sub-fire compartments’ and ‘smoke compartments,’ but in practice, the strategic requirements in the Netherlands are similar to those in Den-

mark, England and Wales, Norway and Sweden. In each country any self-contained dwelling, whether it is house or flat, must form fire compartment. For flats, the wall onto the escape route protects it from fire that starts in flat, but the degree of protection varies: for instance, in the Netherlands the entrance door to flat need not be self-closing, unlike other countries. There are no specific requirements for the compartmentation of individual flats in Belgium. Neither France, or Germany (Hesse) use the term 'compartmentation' in relation to dwellings, but have requirements for the fire resistance of walls and floors between flats without controlling the fire resistance of entrance doors to flats. Compartmentation or fire-resisting construction is required to separate the functions in mixed use buildings in several countries, and in this situation France requires fire resistant doors between occupancies, but there is no specific mention of this issue in Belgium, Denmark, or Norway.

The greatest diversity in strategies lies in the provision of means of escape. Although there are some requirements for two independent escape routes, several countries allow rescue as second route, and all allow single escape route in various circumstances. The only absolute requirements for two independent escape routes are for tall buildings, in Belgium (buildings with floor of top storey 25 m), and Denmark (lower edge of rescue opening 23 m). In France, second stairway is optional even in category buildings (top floor 28 50 m). Relaxations allowing alternative routes usually depend on the height of buildings, but some are also related to the protection of stairways or to travel distances. Rescue is allowed as an alternative route from dwellings in blocks of flats, in Denmark, France, Germany (Hesse), Norway, and Sweden. None of the countries requires protected escape route from upper storey bedrooms in two-storey houses. None takes account of fire starting (or being started) in the hallway of dwelling, or corridor outside dwelling, so that the first stage of escape is blocked. The issues of maximum travel distances, and the number and location of exits are common to most countries, but expressed quite differently. The requirements are probably mostly clearly explained in England and Wales, where diagrams are used to demonstrate various conditions. Each country limits horizontal travel distances in common escape routes, but only Belgium, England and Wales, Germany (Hesse), and the Netherlands address travel distances within flats or maisonettes. Comparisons require particular care due to differing start or finish points, and there are qualifying conditions for some of the requirements (see Figure 1). Limits on travel distances from dwelling entrances to stairway fall into two categories: relatively short distances for blocks with single, central stairway, and much longer distances for corridor or balcony access. The lowest standard is in Sweden, which has single recommendation, 30 m.

Each country limits characteristics of internal surfaces of stairways or escape routes, in terms of surface spread of flame and rate of heat emission when burning. Some also have requirements for rooms. There are more requirements for ceilings and walls than for floors. Different testing and classification systems mean that it is not possible to compare the specified levels of requirements. Although England and Wales states that the upper surfaces of floors and stairs "do not play an important part in fire spread in the early stages of fire that are most relevant to the safety

of occupants," each of the other countries has requirements for floor surfaces, at least in escape routes. Only Denmark and England and Wales have requirements for the internal surfaces of private areas of single-family housing and only the Netherlands limits the rate of smoke production of surfaces.

All countries have some limitations on characteristics of external surfaces of façades, but there is considerable variation in the scope of requirements. Some distinguish different levels of requirements for parts of façades related to: the height of the façade; the height of buildings; the distance of the façade from boundary; or the classification of the building. There are few requirements to limit the vertical spread of flame between storeys. Norway is alone in allowing reduced levels of requirements for external surfaces that are related to access for fire services. The Netherlands is unusual in differentiating between external surfaces on certain categories of escape routes and other parts of the building: other countries do not deal with the protection of buildings *from* neighbouring buildings.

Differences in classification systems and reliance on secondary sources to explain such systems, make it difficult to compare levels of requirements for characteristics of external surfaces. The analysis did not discuss limits on the size or location of unprotected areas of façades, such as windows, because there are no requirements in the Building Decree, but this is clearly significant strategy in some countries, including Denmark, and England and Wales. Also, we were not asked to analyse the section that contains requirements for external spread via roofs.

Some other strategies are included in the Dutch Building Decree that are uncommon or unknown in other countries. Only England and Wales, the Netherlands, and Norway have requirements for fire or smoke detectors and alarms in general needs housing. However, this does not necessarily represent an enhanced standard, for in the Netherlands, an escape route may pass through living room if an additional alarm is provided, instead of through separate circulation route. Instead of requirements for the fire resistance of doors on escape routes, the Netherlands requires mains-wired smoke alarms. It seems peculiar to prejudice the success of sub-fire compartmentation and smoke compartmentation and it is difficult to support the argument that early warning is an appropriate substitute.

Tall buildings

The comparative analysis encountered relatively few requirements specific to tall buildings. In part, this was because the research contract did not require the analysis of requirements for fire fighting. It also appears that very little special provision is made for tall buildings in the Netherlands. In the documentation studied, only Belgium, England and Wales, and France specified higher levels of requirements for the fire resistance of elements of structure and compartments in tall buildings, such as 15 storey blocks of flats (see Table 1). France has consistently lower levels of requirements for fire resistance than other countries, at all heights, but it has separate legislation for buildings over 50 tall, which was not analysed.

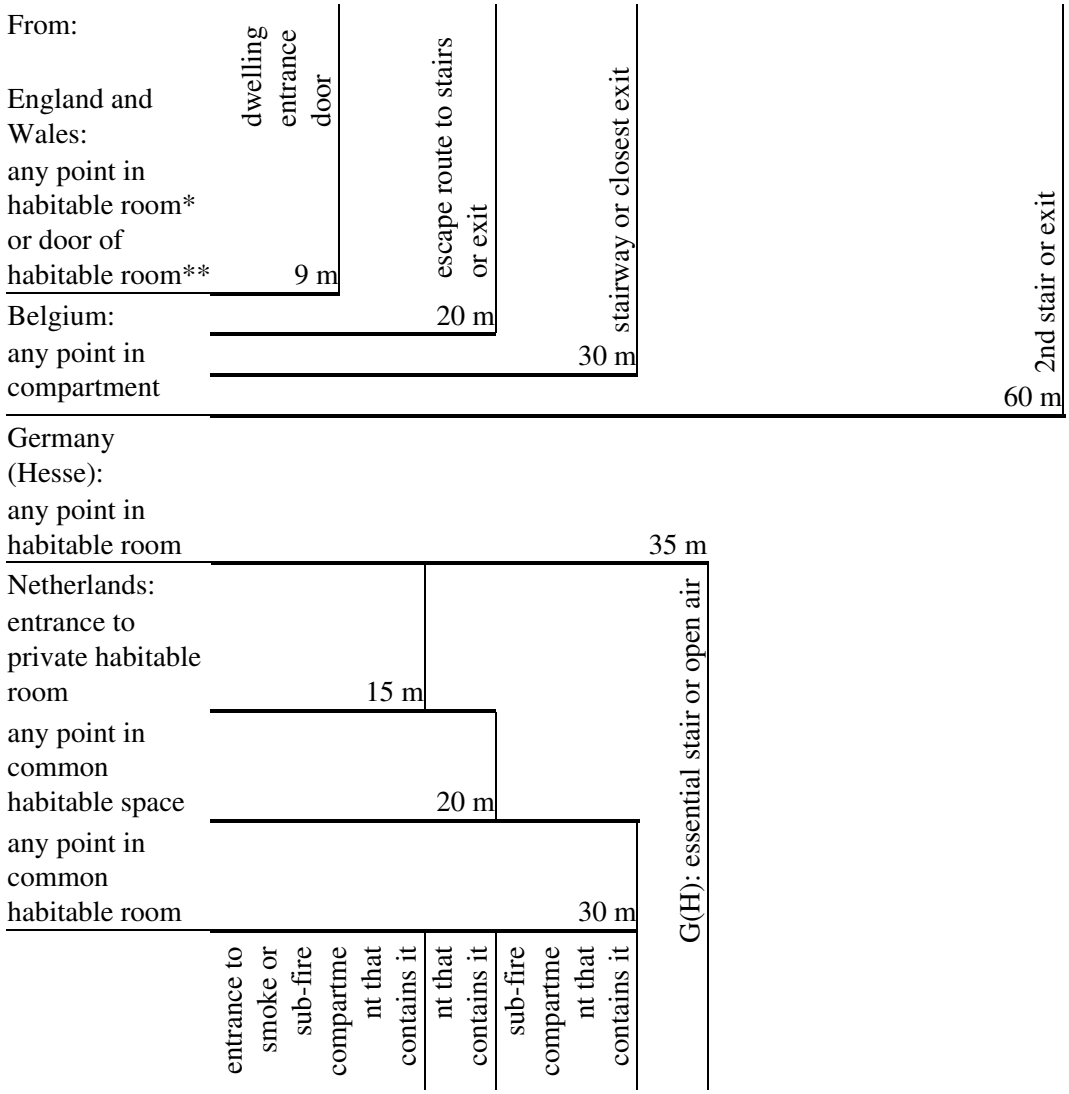

Figure 1 Differences in description of travel distances from within dwellings in blocks of flats or maisonettes
* If hallway protected by 30 minute fire-resisting construction, self-closing FD20 fire doors
** If cooking facilities are remote from entrance and do not prejudice escape route. Both apply only to flats with a floor > 4.5 m above ground level

Explosions or catastrophic collisions

None of the fire safety regulations addressed the issue of explosions or catastrophic collisions, but this may be considered in requirements for structure, and comparative analysis should be made of provisions concerning disproportionate collapse.

Table 1. Comparison of minimum periods of the fire resistance or fire retardance, vertical load-bearing elements of structure

	Single-family house	**Blocks of flats**		
	2 storeys	**3 storeys**	**8 storeys**	**15 storeys**
Belgium *AR du 07-07-1994* modified by *AR du 19-12-1997*	— (no requirements for single-family dwellings)	60 (BB top floor 10 m)	60 120 in basements (BM top floor 10 25 m)	120 (BE top floor 25 m)
	KEY: BB: batîments bas 10 (low buildings); BM: batîments moyens 10 25 (medium height buildings); BE: batîments élevés 25 (tall buildings).			
Denmark *Building Regs. for Small Dwellings BR-S 98* (1998); *Building Regs.* (1995)	BD 30 (fire retarding)	BS 60 (load-bearing structures up to top floor, with top storey floor 12 m)	BS 60 (top 12 m) BS 120 (load-bearing structure, storeys supporting top 12 m)	
	KEY: BD: fire–retardant; BS: fire-resistant			
England and Wales *Approved Document Part Fire Safety* (2000)	30 60 (walls separating buildings) (ground, upper storeys; with top floor 5m)	60 (ground, upper storeys; with top floor 18 m)	90 (ground, upper storeys; with top floor 30 m);	120 (ground, upper storeys; with top floor 30 m);
		60 (basement 10 m), 90 (basement 10 m)		
France *Arręté du 31.1.1986*	15 (category 1)	30 (category 2)	60 (category 3)	90 (category 4)
	KEY: *Category 1:* 2 storey detached houses, semi-detached houses, terraced houses with independent structure; storey terraced houses; *Category 2:* 2 storey detached, semi-detached or terraced houses with independent structure, storey terraced houses without independent structure, 4 storey blocks of flats or storey if top floor in duplex accessed at 4th storey; *Category 3:* Lowest floor of highest dwelling 28 m, accessible to rescue and fire fighting appliances; *Category 4:* Buildings with lowest floor of highest dwelling 28 50 above ground; accessible to rescue and fire fighting appliances; access to protected stairs max 50 from appliance route.			
Germany Hesse *Hessische Bauordnung* (1993, amended 1994)	— (no requirements for categories A, B)	F30-A or F60-B (category E)	F90-B (category G)	more stringent requirements may be applied (buildings with storeys 22m)
	KEY: Materials: A: non-combustible; -B: combustible. F30, F90: fire-retardant; F90: fire-resistant. Building categories: A: detached residential building, weekend or holiday house, containing maximum dwellings, usually 2 floors; B: residential building, weekend or holiday house, not class A, containing maximum dwellings, 5.85 height of highest storey; C: other buildings with habitable rooms, not class A, 5.85 m; D: residential building, weekend or holiday house, not class or B, containing maximum dwellings, 7 m; E: Building, not class A-D, 7 m; F: Building, not class A-E, 14 m; G: Building, not class A-F, 22 m. NB: 2002 revision does not specify periods of fire resistance and uses slightly different building classes.			
Netherlands *Bouwbesluit* 2001	30	60	90	
Norway *Guidebook to the Technical Regulations* (1997, amended 1999)	R 30 (fire class 1)	R 60 (fire class 2; including 1st basement)	R 90 (fire class 3; including 1st basement)	
	KEY: R: fire resistance for loadbearing capacity. Fire classes are based on the potential consequences of fire, in terms of life, health, community interests and environment: fire class 1: minor consequences; fire class 2: medium consequences; fire class 3: serious consequences; fire class 4: very serious consequences			
Sweden *Boverkets Byggregler (BBR-94: 3) BFS 1993:57* (1997)	R 15 (class Br3)	R 60 (class BR1, 4 storeys; including topmost basement)	R 90 (f 200 MJ/m^2) (class Br1; including topmost basement)	
	KEY: R: fire resistance for loadbearing capacity. = fire load intensity. Building classes: *Class Br1:* buildings where fire entails high risk of injury to people (general recommendations suggest this means buildings of 3 storeys); *Class Br2:* moderate risk of injury (2-storey buildings for 2 apartments, with habitable rooms or workrooms on the attic storey; *Class Br3:* other buildings (other dwellings).			

Emphases peculiar to one country

Despite the independent development of fire safety regulations, there are very few instances of emphases peculiar to only one country. However, these few examples raise some interesting questions. For instance, the predominance of single-family houses in England and Wales, coupled with the age of the housing stock, probably explains the inclusion of section on attic conversions, but it isn't clear why there is no explicit mention of the issue in other countries. It may be that escape within dwelling from third storey room is not perceived as particular risk, or because it is not politically acceptable to control the interiors of single-family houses, except where they affect their neighbours. Of the countries studied, only the Netherlands controls the smoke production of internal surfaces, particularly the walls and ceilings of escape routes. Other countries do not address the limitation of smoke production but requirements to limit spread of flame would often serve the same purpose, with the use of materials of limited combustibility. The primary strategy in most countries is to keep escape routes clear of smoke, by limiting the ingress of smoke with smoke control doors and smoke ventilation.

The Netherlands appears to be unique in specifying the sub-division of fire compartments into smoke compartments, but apart from specifying periods of resistance to smoke leakage between smoke compartments and enclosed rooms, details are given by reference to national standard. It is not possible to tell from the Building Decree whether there is significant difference between the practical implementation of its requirements for smoke compartmentation and requirements in some other countries to limit smoke leakage at doorways or for fire dampers operated by smoke detectors. In contrast to the Netherlands, Belgium only addresses the issues of fire and not smoke, to the extent that the word 'smoke' does not appear in the annexes giving the requirements.

4. Harmonisation of fire regulations in Europe

CEN completed approval of harmonised system to classify the reaction to fire performance of construction products in 2002, but there is no harmonisation of the description of fire safety strategies. The project revealed considerable variation in strategies, tactics, and terminology. Without common framework of strategies and tactics, it was difficult to confirm the absence of requirements, and without common terminology or criteria, it was difficult to compare levels of requirements. More importantly, this indicates that designers may find it difficult to understand the requirements of different countries and that the formulation of model European building code for fire safety is worthwhile ambition. The Construction Products Directive did not aim to harmonise the basis of fire safety regulations but, as Deakin (1 comments, it might be hoped that the production of system of European testing and classification would foster agreement on objectives, functional statements and performance requirements. As yet, there is no evidence of any such harmonisation.

Important issues for harmonisation include the classification of buildings and the description of parts of buildings, which are used to describe the application of requirements. It should be possible, in code describing requirements for housing and for mixed use buildings, to establish common terminology in series of annotated diagrams of typical configurations of blocks of flats, or single-family houses, without threatening the independence of designers or opportunities for innovation.

It would also be helpful to specify the assumptions and constraints that underlie strategies and to describe the relationships, inter-dependencies, or equivalences of certain strategies. This is probably the most difficult aspect of harmonisation, for it may call into question the advisability of certain policies. For instance, it is questionable whether one escape route plus the alternative of rescue through window is always less safe than two escape routes, or whether the Dutch specification of smoke detectors compensates, as intended, for the absence of requirements for the fire resistance doors on escape routes.

5. Conclusions

There are differences in the regulation of fire safety between the countries studied, which made it difficult to compare levels of requirements, but the project identified some significant differences in strategies and differing levels of requirements. The process of comparative analysis revealed that some systems were easier to use than others. The formulation of regulations as brief functional requirements elaborated by official guidance, and available on-line (like in England and Wales, and Norway) means that the principle requirements for fire safety in housing are freely available and can be readily understood from the official guidance. This contrasts with less accessible systems of functional or performance requirements which rely on secondary sources for detailed interpretation, whereby instead of consulting single document, designers and contractors must buy national standards or independent guidance, or rely on consultants. The evident variety of functional requirements, performance requirements, and specifications indicates the practical difficulty of adopting in full performance-based approach, but also suggests reluctance to abandon established practice. Apart from tests for characteristics of construction products, there is no harmonisation of fire safety requirements in Europe. There is clear need for the harmonisation of terminology to describe the context for application of requirements, and of the strategies and tactics of fire safety.

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