

**10/16**

## **Ministry of the Environment Decree**

**concerning national choices for accidental actions, when applying standard SFS-EN 1991-1-7**

By decision of the Ministry of the Environment, the following is laid down under Section 117a of the Land Use and Building Act (132/1999), as it stands in Act 958/2012:

### Section 1

#### *Scope*

This Decree is applied in the selection of accidental actions and is used in conjunction with the latest version of standard SFS-EN 1991-1-7.

### Section 2

#### *Accidental action*

An accidental action, clause 2(2) of the standard, is considered a fixed action in those cases where the load is evenly distributed on the entire structure.

### Section 3

#### *Accidental design situations*

The designer of a structure shall devise a strategy such that neither the whole building nor a significant part of it will collapse if localised failure were sustained.

The adoption of this strategy shall provide a building with sufficient robustness to not succumb to various types of unspecified accidental actions.

The minimum period that a structure needs to remain intact following an accident should be that period needed to facilitate the safe evacuation and rescue of personnel from the building and its surroundings. Buildings used for handling hazardous materials, for providing essential services or for national security reasons may need to remain intact for longer periods.

The party engaging the building project is not permitted, without the consent of the relevant authorities, in accordance with clause 3.1(2), Note 4, of the standard, to agree to the use of lower values for accidental actions in individual projects other than those given in SFS-EN 1991-1-7 and in this Decree.

## Section 4

### *Accidental design situations — strategies for limiting the extent of localised failure*

The acceptable limit of ‘localised failure’, in accordance with clause 3.3(2), Note 2, of the standard, depends on the type of building:

1) In multi-storey buildings, the localised failure may not exceed 15% of the floor area or 100 m<sup>2</sup>/storey. The failure may occur in two adjacent storeys; or

2) If a column is damaged in hall-type buildings, the acceptable limit of localised failure is the length of the main girders supported by the column, multiplied by two times the distance between the main girders. If the main girders are on the external wall line, the acceptable limit of localised failure is the combined length of the main girders, multiplied by the distance between the main girders.

If the main girder of a hall-type building is an arch or similar structure that does not have separate columns, the extent of localised failure may be the length of the main girder, multiplied by two times the distance between the main girders. If the main girder is on the external wall line, the acceptable limit of localised failure is the length of the main girder, multiplied by the distance between the main girders.

If load-bearing walls form the vertical frame of a hall-type building, the localised failure may not exceed the length of the horizontal structures supported by the wall, multiplied by  $2H$ , where  $H$  is the height of the load-bearing wall.

In hall-type buildings, the failure may occur on one storey only.

## Section 5

### *Accidental design situations — use of consequences classes*

In the testing of accidental design situations to verify that a building or structure can remain intact, the Ministry of the Environment Decree concerning national choices for consequences classes, in accordance with standard SFS-EN 1990, shall apply. For the strategies for accidental design situations, in accordance with clause 3.4(1) of SFS-EN 1991-1-7, consequences classes CC2 and CC3 are divided into subclasses *a* and *b* based on the size of buildings and structures. The possible consequences are greater in subclass *b* than in subclass *a*.

## Section 6

### *Principles for ensuring the robustness of a building*

Sufficient robustness for a multi-storey building shall be ensured, in accordance with clause 3.3(2), Note 3 of the standard, by applying three-dimensional tying for additional integrity or designing alternative load transfer path.

The tying system shall be designed to increase the robustness and integrity of a building in the event of higher damage consequences.

Alternative load paths shall be designed so that a localised failure does not exceed the limits given in section 4.

When an alternative load path cannot be found or when such a method would lead to unreasonable structural solutions with regard to technical functionality, a method of designing key elements in accordance with clause 3.3(2)(a) of the standard may be used, thus considerably increasing the robustness of the building.

In the designing of key elements, in accordance with clause 3.3(2), Note 1, of the standard, accidental action  $A_d$  shall be determined by carrying out a risk assessment and the grounds for

the values used shall be included and recorded in the design documentation. Alternatively, the values recommended in the standard may be used.

For buildings in consequences class CC3b, a systematic risk assessment of the building shall be undertaken, taking into account both foreseeable and unforeseeable hazards. If accidental actions can be determined by the risk assessment, they shall be taken into consideration in the design. Accidental actions include linear loads, concentrated loads, weight loads, deformations or deformation forces.

## Section 7

### *Principles for ensuring the robustness of a hall-type building*

Sufficient robustness of a hall-type building, in accordance with clause 3.3(2), Note 3, of the standard, shall be ensured so that a localised failure does not exceed the limits given in section 4. Localised failure is limited by means of structural measures.

For buildings in consequences class CC3b, a systematic risk assessment of the building should be undertaken, thereby taking into account both foreseeable and unforeseeable hazards. If accidental actions can be specified by risk assessment, they shall be taken into consideration. Accidental actions include linear loads, concentrated loads, weight loads, deformations or deformation forces.

## Section 8

### *Impact on supporting substructures*

The values given in Table 1 for actions due to impact shall be complied with, in accordance with clause 4.3.1(1) of the standard. The values given in the table do not apply to areas that are not accessible to vehicles.

The design forces for building structures given in Table 1 for the category of traffic may be multiplied by a reduction factor taken from Figure 1 as a function of distance  $d$  and the maximum permitted speed of the vehicle  $v_0$ , provided that the maximum speed limit is less than 80 km/h. Distance  $d$  is measured from the structural member to the centreline of the nearest trafficked lane. The design forces shall meet, at the least, the requirements for the category of traffic *courtyards and parking garages* in Table 1. The values for the reduction factors for speeds between 40 km/h and 80 km/h can be obtained by linear interpolation. The reduction factors given in Figure 1 can be applied when the downward slope between the centreline of the nearest trafficked lane and the point of impact, measured perpendicularly to the lane, is no more than 1:5. The effect of slopes steeper than this and the effect of upward slopes, as well as the effect of rails and other measures to avoid impact, shall be specified for the individual project, in accordance with clause 4.3.1(1), Note 2, of the standard.

Table 1. Indicative equivalent static design forces due to vehicular impact on supporting structures over or adjacent to roadways.

Category of traffic	Force $F_{dx}^a$ [kN]	Force $F_{dy}^a$ [kN]
Motorways, country roads and main roads with a maximum speed limit of $v \geq 80$ km/h	1100	550
Streets and main roads with a maximum speed limit of $50 \text{ km/h} \leq v < 80$ km/h	825	410
Streets and main roads with a maximum speed limit of $v < 50$ km/h	550	275
Courtyards and parking garages that are: accessible to passenger cars and delivery vans <sup>b</sup> accessible <sup>b</sup> to lorries <sup>c</sup>	25	25
	75	75

<sup>a</sup> x = direction of normal travel, y = perpendicular to the direction of normal travel.  
<sup>b</sup> If the horizontal distance from the structure to the edge of the courtyard area planned for vehicular traffic is at least 2.0 m, it is not necessary to design the structure for vehicular impact.  
<sup>c</sup> The term 'lorries' refers to vehicles with maximum gross weight of more than 3.5 tonnes.

When distance  $d$  is so great that the reduction factor obtained from Figure 1 is zero, it is not necessary to design for actions due to vehicular impact.

It is not necessary to consider actions due to vehicular impact on structures in consequences class CC1, in accordance with clause 4.3.1(1), Note 3, of the standard.

When designing building structures adjacent to roadways, in accordance with clause 4.3.1(2) of the standard, it is assumed that  $F_{dx}$  and  $F_{dy}$  do not act simultaneously. The value for adequate clearance to avoid impact on building structures is 6.0 m, in accordance with clause 4.3.2(1), Note 1, of the standard. For lower clearances, the equivalent static design forces given in Table 2 for actions due to impact are used.

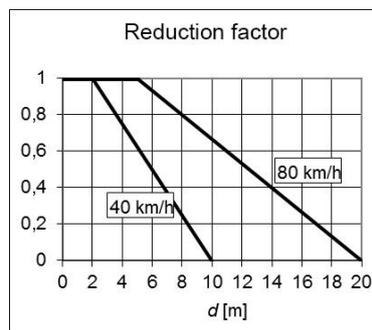


Figure 1. Reduction factor for design forces for building structures in the category of traffic *Roads in urban area*.

A reduction factor  $r_F$  is not applied to the category of traffic *Courtyards and parking garages*, in accordance with clause 4.3.2(1), Note 3, of the standard.

In determining the value of force  $F$  for accidental actions due to impact from forklift trucks, in accordance with clause 4.4(1) of the standard,  $W$  is the sum of the net weight and hoisting load of a loaded truck, unless a more accurate method is applied. Force  $F$  is applied at a height of 0.75 m above floor level.

Table 2. Indicative equivalent static design forces for building structures due to impact on superstructures.

Category of traffic	Equivalent static design force $F_{dx}$ <sup>a</sup> [kN]
Motorways, country roads and main roads	500
Country roads in rural area	375
Roads in urban area	250
Courtyards and parking garages	75
<sup>a</sup> x = direction of normal travel.	

The horizontal static equivalent design forces parallel or transverse to the railway due to impact caused by the derailing of rail traffic running under or adjacent to a Class A structure, in accordance with clause 4.5.1.4(5) of the standard can be reduced so that  $F_{dx} = F_{dy} = 0$ , when  $d > 20$  m. In other cases, the values are determined for the individual project. When distance  $d$  is greater than 5 m, no requirements are specified for Class B structures, in accordance with clause 4.5.1.5(1) of the standard. In other cases, the values are determined for the individual project.

## Section 9

*Annex A: Design for consequences of localised failure in buildings from an unspecified cause*

Annex A is not applied.

This Decree enters into force on 1 January 2017.

This Decree shall apply to projects initiated after the Decree enters into force.

This Decree repeals the National Annex to standard SFS-EN 1991-1-7 concerning the application of Eurocodes in building construction, issued by the Ministry of the Environment on 5 November 2010.

In Helsinki on 7 November 2016

The Minister of Agriculture and the Environment Kimmo Tiilikainen

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