BS EN 13200-7:2014

BSI Standards Publication

Spectator facilities

Part 7: Entry and exit elements and routes

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National foreword

This British Standard is the UK implementation of EN 13200-7:2014.

The UK participation in its preparation was entrusted to Technical Committee B/552, Spectator facilities.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Foreword

This document (EN 13200-7:2014) has been prepared by Technical Committee CEN/TC 315 “Spectator facilities”, the secretariat of which is held by UNI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2014, and conflicting national standards shall be withdrawn at the latest by September 2014.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This European Standard (EN 13200), with the general title *Spectator facilities*, is divided into different parts:

— EN 13200-1, *Spectator facilities — Part 1: General characteristics for spectator viewing area*;

— CEN/TR 13200-2, *Spectator facilities — Layout criteria of service area — Part 2: Characteristics and national situations*;

— EN 13200-3, *Spectator facilities — Part 3: Separating elements — Requirements*;

— EN 13200-4, *Spectator facilities — Part 4: Seats — Product Characteristics*;

— EN 13200-5, *Spectator facilities — Part 5: Telescopic stands*;

— EN 13200-6, *Spectator facilities — Part 6: Demountable (temporary) stands*;

— EN 13200-7, *Spectator facilities — Part 7: Entry and exit elements and routes* [the present document];

— prEN 13200-8, *Spectator facilities — Part 8: Safety Management*;

— prEN 13200-9, *Spectator facilities — Part 9: Communications systems in spectator facilities*.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This European standard has been prepared in order to specify the general design criteria for entry and exit systems (including entry and exit elements and routes) used in spectator facilities under normal and emergency conditions.

Within this European Standard, minimum and recommended values for dimensions are occasionally presented. It should be recognized that these values are to be considered as values that in part, recognize different national requirements as a basic provision. The provision and nature of facilities for persons with special needs will invariably impact upon spectator facilities. Special needs embraces spectators with learning difficulties, impaired hearing, impaired vision, mobility impairment, children and elderly people.

Attention is drawn to the fact that in certain countries additional requirements may be applicable due to existing national regulations.

1 Scope

This European Standard specifies safety and design characteristics of entry and exit elements of passage that are used in spectator facilities, either singularly or in combination, to provide a route.

2 Normative references

The following referenced documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 81-70, *Safety rules for the construction and installations of lifts — Particular applications for passenger and good passengers lifts — Part 70: Accessibility to lifts for persons including persons with disability*

EN 115 (all parts), *Safety of escalators and moving walks*

EN 12193, *Light and lighting — Sports lighting*

EN 13200-1:2012, *Spectator facilities — Part 1: General characteristics for spectator viewing area*

ISO 7001, *Graphical symbols — Public information symbols*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in EN 13200-1:2012 and the following apply.

3.1
entry capacity
number of spectators who can enter the facility in a fixed interval of time

3.2
entry elements
individual components of the entry system that provide for the passage of spectators

3.3
entry route
combination of elements that provides for the passage of spectators from their point of entry to the viewing accommodation

3.4
exit capacity
number of spectators to exit the facility in a specified interval

3.5
exit elements
individual components of the exit system that provide for the passage of spectators

3.6
exit route
combination of elements that provides for the passage of spectators from their viewing accommodation to a final exit from the facility

3.7
landing
level surface at the head, foot or between flights of stair ways or ramps

3.8
access control element
mechanical or electronic device, including those for people with special needs, which can control count and record of spectator entry

3.9
point of entry
location at which a spectator first passes through an access control element

3.10
turnstile
mechanical and or electronic device with revolving arms which allows singular passage, including counting

Note 1 to entry: A turnstile is not always an appropriate entry device for a person with special needs.

3.11
concourse
circulation area with access to and from the spectator viewing accommodation which can serve as a meeting area for spectators for purposes of refreshment and entertainment

Note 1 to entry: Direct access to toilet facilities may also be provided.

3.12
passageway
access route to a sector or block

Note 1 to entry: A passageway, on level ground, slope or stair, includes vomitory and gangway.

3.13
stairway
succession of steps including any landing at the head and foot of the steps or between flights that enables pedestrian passage between levels

3.14
rate of passage
number of persons per meter width per minute that can pass through the specified element of an entry or exit route

3.15
flow capacity
number of spectators that can safely pass through a given width of a space in a specified time

3.16
ramp
slope designed to enable the passage of a pedestrian or wheel chair user from one level to another

3.17
place of safety
place where a person is no longer in danger from fire or other emergencies

3.18
final exit
termination of an escape route from a building or facility giving direct access to a place of safety

3.19
vomitory
element of passage that provides entry to or exit from the viewing area

3.20
circulation
free movement of spectators within a spectator facility

3.21
external perimeter barrier
barrier which separates the external area from the spectator's service area

3.22
queue pre-selection device
element that directs a spectator towards a specific passageway or route

3.23
refuge
area separated from fire by fire-resisting construction of at least 90 min

Note 1 to entry: It is a temporarily safe space for people with special needs to wait for an evacuation lift or assistance up or down stairs.

3.24
risk assessment
overall process comprising a risk analysis and a risk evaluation

Note 1 to entry: Risk analysis is a systematic use of available information to identify hazards and to estimate the risk. Risk evaluation is a procedure based on the risk analysis to determine whether the acceptable level of risk has been achieved.

3.25
free flow exit system
unobstructed exit route that provides means for spectators to reach, from the viewing area exits, the final exit from the facility or a place of safety in case of an emergency

4 Entry and exit — General characteristics

4.1 General

The movement of spectators within a facility is characterized by their ingress, the nature of the event and their egress upon conclusion of the event.

An exceptional occurrence can initiate a full or partial emergency evacuation.

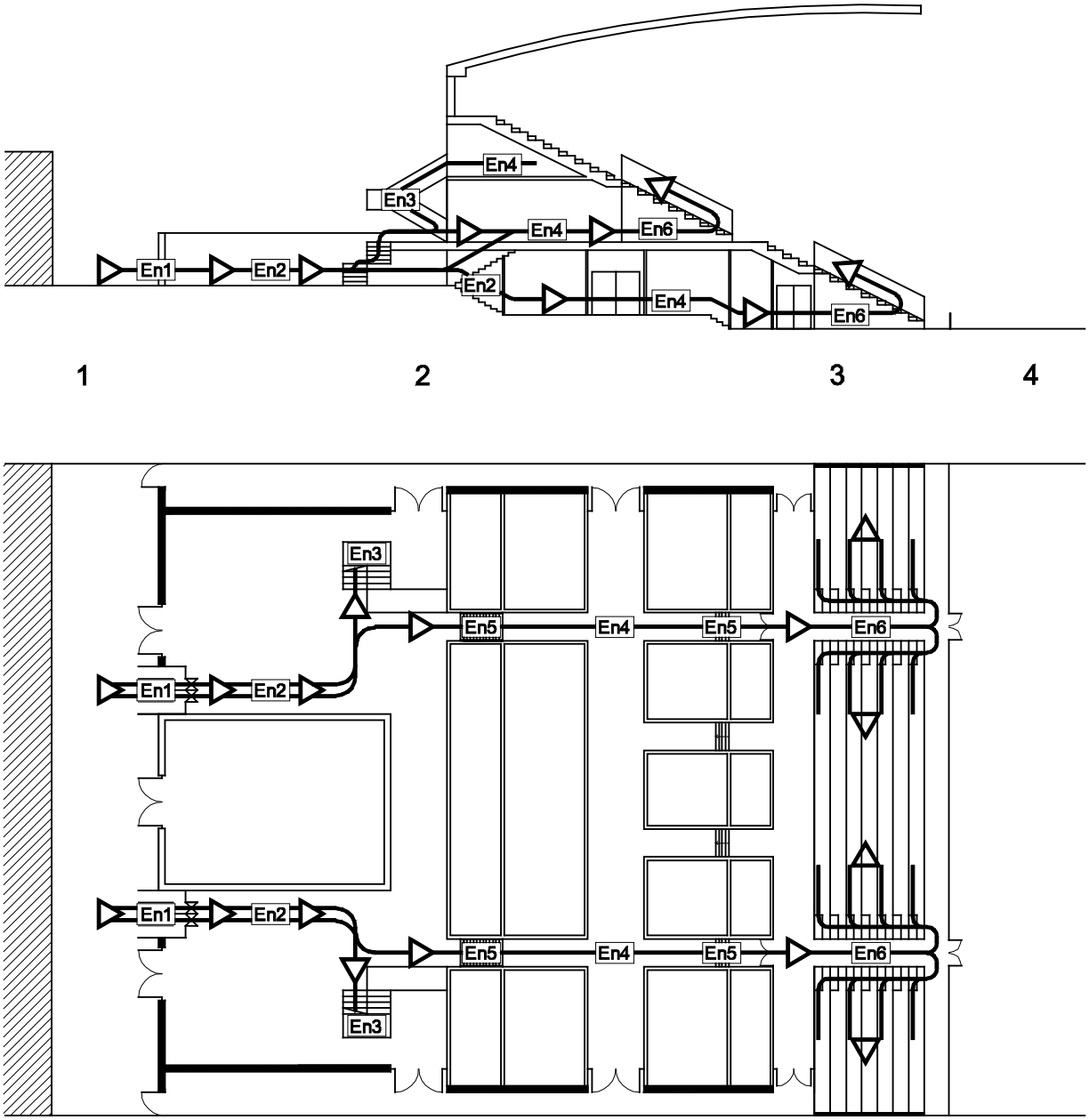
Spectator movements will occur in the areas schematically indicated in Figure 1 and Figure 2 as:

— viewing area;

— services area;

— external area.

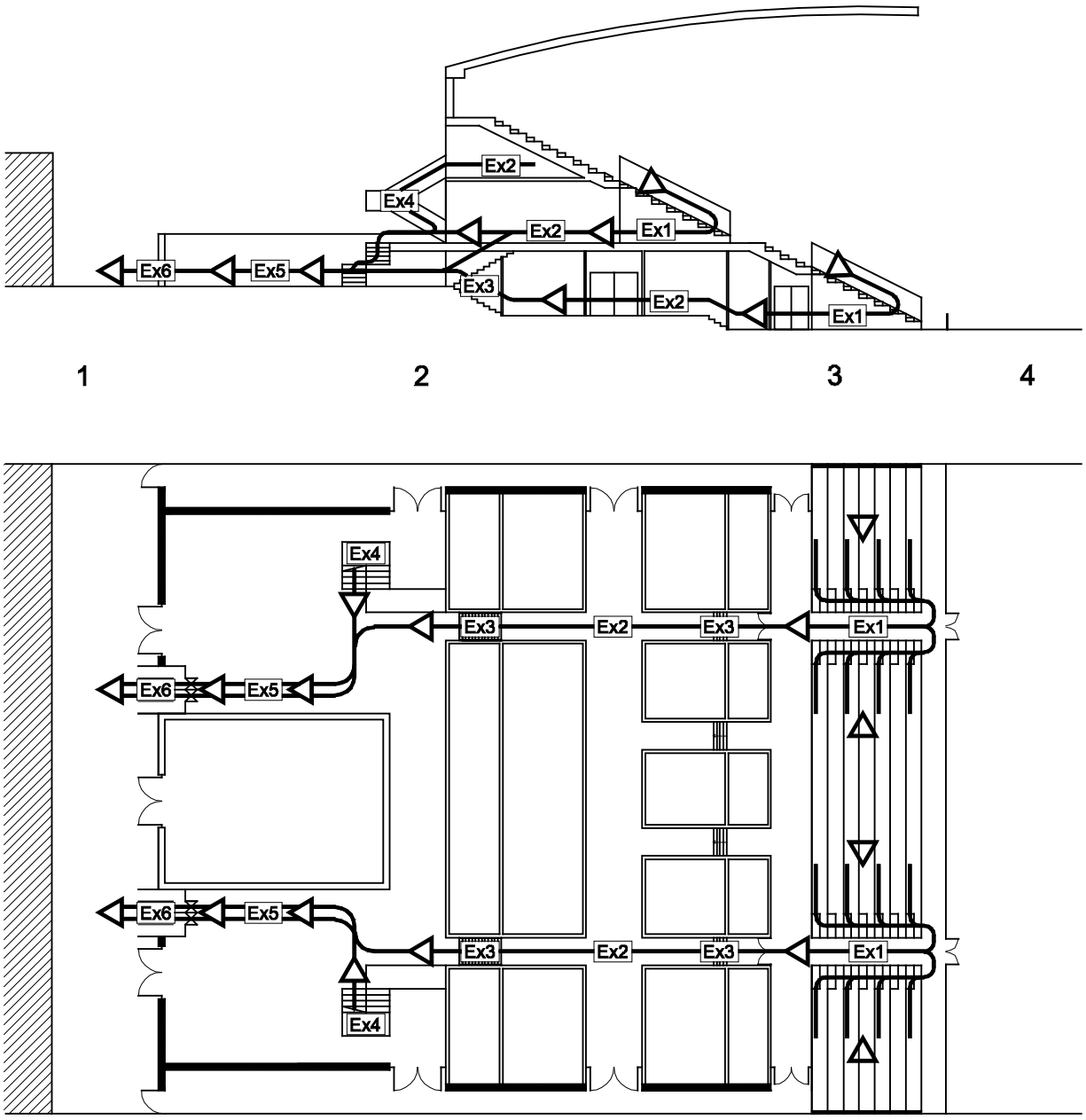
The areas are defined in EN 13200-1 (see 3.3, 3.4 and 3.18).



Key

1 external area
2 services area
3 viewing area
4 activity area
En1 entry point
En2 horizontal outside routes
En3 vertical outside routes
En4 horizontal inside routes
En5 vertical inside routes
En6 vomitories

Figure 1 — Entry system



Key

1 external area
2 services area
3 viewing area
4 activity area
Ex1 vomitories
Ex2 horizontal inside routes
Ex3 vertical inside routes
Ex4 vertical outside routes
Ex5 horizontal outside routes
Ex6 exit point

Figure 2 — Exit system

Ingress routes leading to viewing areas and egress routes leading to final exits shall be designed to enable spectators to move safely and comfortably. The design and safety management of these routes shall ensure that a spectator is able in cases of emergency to reach a place of safety following the shortest route within time required by this European Standard and by the appropriate risk assessment for emergency evacuation.

The emergency exit route shall be designed not to have obstacles for spectators' evacuation and shall not pass through crowded areas.

In general, the flow capacities of the individual elements that comprise the route shall be taken into account necessarily recognizing the characteristics of each element that need to be considered. For example, the configuration of a stair instead of a level passageway will affect the rate of passage.

It is necessary that all exit and entry routes, including the elements that constitute them, do not converge in the primary movement direction. Convergence is not solely defined by dimension.

Entry and exit routes shall not have neither narrowings nor protrusions on the walls up to an height of 2,00 m.

The primary components of an ingress route will be entry elements, level walkways and probably stairs and ramps.

Additional elements that can be present in ingress routes are:

— queuing areas to enter the facility;

— doors and gates;

— devices to count spectator ingress and possibly egress;

— access control elements or systems;

— elevators, escalators and stair lifts;

— vomitories.

In considering the movement of spectators to and from service areas and concourses, both interior and exterior analyses similar to those applicable to their ingress and egress will be required.

Service areas, with the facilities they provide, directly and indirectly, may be part of the escape routes of the spectators. Consequently, there is a need to avoid the placement of any physical obstacles to the exit flows of spectators from the viewing areas.

Overcrowding of the service areas during the event, particularly where located in the vicinity of exits from the viewing accommodation, should be prevented. Should overcrowding be observed in any area, appropriate management procedures should be put in place.

Egress can occur under normal and emergency conditions, through the exit system. Egress routes will comprise of similar elements to those present in ingress routes together with additional elements that can accommodate bulk egress.

The primary components of an egress route will be level walkways and probably stairs and ramps.

Additional elements that can be present in egress routes are:

— doors and gates;

— elevators, escalators and stair lifts;

— vomitories;

— emergency evacuation routes;

— emergency exits;

— final exits;

— place of safety.

Standard elevators shall not contribute to an emergency egress route. Escalators shall be locked in a stationary mode and their contribution to emergency egress shall be risk assessed.

Under emergency conditions, the primary objective of the system of exit routes shall be to allow the occupants of the structure to reach a place of safety by the risks deriving from the spread of fire, power failure or other situations that may create panic and other types of emergencies, waiting for help.

The necessary capacity of an emergency egress route is defined by the appropriate interval for all spectators and event staff using that route to reach a place of safety from their viewing position or workplace. A risk assessment is necessary to ascertain the appropriate interval.

In order to determine the time taken by individual spectators to reach their place of safety from the viewing position the characteristics of their exit route need detailed consideration. Travel distance, confluence of flows, up and down stair elements, inclined walkways and the type of event will affect travel times.

In the case of disabled spectators, refuge areas shall provide accommodation for a predetermined number of people in wheelchairs whose evacuation from the refuge area can be safely progress.

Egress times of evacuation from the viewing area, provided in EN 13200-1:2012, Annex E, can be a starting point in any risk assessment.

In some instance, particularly for outdoor facilities, emergency evacuation through the Activity Area (field of play) may form part of an emergency egress route of an emergency evacuation.

4.2 Entry and exit for emergency services and accredited categories

The location of spectator facility or of a sport complex shall provide for the ready access of rescue vehicles to approach and manoeuvre, besides ensuring evacuation towards adjacent areas.

The external area shall enable rapid evacuation.

Car parks and public transport locations shall not impede spectator egress.

It is necessary to provide alternative entrances and exits for the emergency vehicles and personnel assigned to them.

The access for emergency vehicles shall be secured at all times.

A suitable area to allow air ambulances to land shall be designated for major events.

Additional dedicated entry and exit points may be required for media vehicles and other services (cleaning, catering, maintenance, etc.). Suitably accredited persons (i.e. regulatory officers, competitors, venue personnel, etc.) may require dedicated entry and exit points.

5 Entry

5.1 General

Spectators shall be provided with clear and consistent information on all aspects of entry.

All entrances and entry routes shall be clearly signposted and for use during non-daylight hours be adequately lit. Turnstiles, entry points and information points shall be numbered, readily identifiable and ideally provided with tactile aids for sight-impaired or blind spectators.

Advance information in braille could be given on the tickets for sight-impaired spectators.

Disabled persons shall rely on clear and early notification of facilities and access routes to a greater extent than the non-disabled.

5.2 Factors affecting the entry capacity

The main factors affecting the rate of entry are:

— number and dispersal of access control elements and points of entry;

— security arrangements at points of entry;

— adequacy of directional information and communications;

— means of entry e.g. cash payment, ticket or voucher;

— profile of spectator body;

— division of entry categories, e.g. adult, juvenile, senior citizen, or family;

— design and condition of turnstiles/ point of entry;

— capabilities of access control elements operators.

The rate at which spectators pass through each access control element can vary and the value adopted shall be established from the existing record. Where no existing record is in place the value shall be established through a test procedure.

5.3 Calculating an entry capacity

For the purpose of calculation and in order to ensure that spectators are admitted at a rate which is compatible with dispersal arrangements for them inside the facility, the setting of an appropriate ingress interval after consideration of the factors listed in 5.2 is necessary.

5.4 Spectator ingress

5.4.1 Basic principle

The basic principle with regard to ingress is to ensure that the rate of spectator arrival does not result in congestion prior to entering to the facility.

5.4.2 The need to count

Spectators entering all sections of the facility including suitably accredited persons and lounge areas and disabled viewing areas should be accurately counted at their time of entry. Numbers require to be controlled in order to ensure that overcrowding does not occur. This applies even if entry to the event is by ticket only.

Each section of spectator accommodation shall be served by metered access control elements or other means of establishing spectator numbers in the section in order to prevent overcrowding.

Where one section of a facility is served by a bank or banks of turnstiles, the metering system shall be capable of recording an overall total of spectators entering that section. This total shall be readily available at all times in order that appropriate action can be taken once a pre-determined figure, for example 90 % of the total capacity, has been reached. This enables the management to anticipate the time it will take for the remaining people outside the facility, if any, to be admitted before the start of the event. The prevailing rate of admission may not suffice to allow those queuing outside the facility to enter before the start of the event. In such circumstances, wherever possible, extra access control elements shall be opened to cope with the demand. If this is not possible, consideration shall be given as to whether or not the start of the event should be delayed.

5.5 Design of entrances and entry routes

The design of entrances and entry routes shall provide for the following:

— a count of spectator ingress;

— control spectator ingress;

— access of spectators with special needs.

Entrances to each part of the spectator facilities shall, wherever practicable, be designed and located so as to uniformly and appropriately distribute ingress and to prevent local crowd pressures building up outside the facilities.

If viewing areas are divided into blocks, for instance for supporters of home and visiting teams, separate entrances and exits as well as separate concourses shall be provided, especially for high risk events.

Walls, fences and gates shall not provide the opportunity for hand or foot-holds which might assist climbing and shall be regularly inspected.

The installation of closed circuit television shall be considered to assist in the monitoring of crowd densities outside the facility and throughout the ingress/egress routes.

The design of a turnstile and its housing shall allow the operator to see and communicate clearly with entrants.

Entry routes shall not be obstructed. Amenities such as refreshment kiosks, programme kiosks or toilets shall be located away from the immediate area of the turnstiles and entry routes.

Entry and exit routes are often common to each other and in such cases, the considerations which apply to entry routes therefore apply also to exit routes.

In case of failure of electrical power supply, the access control elements shall operate correctly without interruption, e.g. by a power stand by unit, emergency backup generator or equivalent.

Separately designated entry points for people with special needs with a designated setting down bay are appropriate in zones where large rates of ingress are present. Doors to a designated entrance shall be

accessible to wheelchairs users, families with pushchairs or prams and individuals with limited physical dexterity. Revolving doors are not considered accessible. The recommended clear width of an external doorway that provides entry for wheelchair users is 900 mm. Entrance doors shall incorporate visibility glazing from a height between 500 mm and 1 500 mm above floor level. There shall be a level landing in front of and behind each dedicated entrance of at least 1 500 mm x 1 500 mm, clear of any door swings, and provide a surface that does not impede the movement of wheelchairs.

Sufficient queuing areas shall be provided at entry points in order to avoid congestion.

5.6 External perimeter barrier and passageways

5.6.1 General

A delineation of the area before a point or points of entry is beneficial in ensuring individual access and can be achieved with queue pre-selection devices.

5.6.2 Queue pre-selection devices

Queue pre-selection routes provide for orderly queuing and in certain cases shall be provided. Queue pre-selection devices aim at directing spectators to the entry passageway in an orderly way, preventing any excessive pressure being applied to the people at the front of the queue and onto the access control system.

To prevent an entire queue being directed towards the entry passageway, a queue where deemed necessary shall be forced to change direction by 90° at least once.

A return route for spectators who are not authorized to enter shall be included in the design process.

The queue pre-selection devices, suitably fixed to the ground, shall be not less than 1,1 m in height, the upper part of which shall be rounded.

The width of passageway between two queue pre-selection devices shall be at least 0,60 m and should allow for any queuing spectator to readily leave the queue in case of need. Consideration shall be given to push chairs, prams and wheelchair users.

Queue pre-selection devices shall be designed to safely resist to a horizontal static load of 0,8 kN/m at the height of 1,1 m.

5.6.3 Access control elements and entry points

The design of new facilities shall provide entry points separated from the final exit of the facility.

The number of available points of entry shall be sufficient to allow for all spectators to enter the facility within an interval to be determined by the nature of the event to be held in the venue.

At least two passages with turnstiles, each with a minimum width for passage not less than 0,6 m, shall be provided for each sector.

The number of entry points located along the external perimeter barrier of the facility shall be proportional to the capacity of the sector to which they give access.

In order to complete ingress in not more than one hour before the start of the event, the ingress rate of one passage shall be 750 spectators/h as a maximum value. A value of 660 spectators/h is a recommended value.

A turnstile shall allow single transit only and where applicable should be provided with a system for the visualization of the name corresponding to the ticket. The design of the delimitation of the facility and of the

sectors within it shall not interfere in any way with the functionality and dimensioning of exit routes and of entry routes for emergency vehicles.

6 Spectator circulation, routes and areas

6.1 General

Entry and exit elements and materials that comprise circulation routes shall comply with applicable European and National legislation.

Primary circulation routes within the facility that are used by spectators with special needs shall be carefully planned to enable the safe ingress and egress of both non-disabled and disabled spectators.

6.2 Circulation - General

Circulation routes provide the means for spectators to enter, depart from and to move within the facility under both normal and emergency conditions.

As a necessary function of a spectator facility, circulation routes shall be planned and managed to ensure safety.

Safe circulation is achieved by:

— physical means, i.e. primarily good design and construction, reinforced by technical aids and clear signs;

— clear signs that are essential in enabling spectators to orientate themselves;

— human resources, i.e. primarily good stewarding, reinforced by technical aids, communications, maintenance and good housekeeping.

Certain events can attract higher numbers of children, semi ambulant people or people unfamiliar with the general layout of the spectator facilities.

Conditions can vary considerably at a facility depending on the type of sport or event being staged, planning and management should also take into account the fact that circulation routes and circulation areas in general function differently according to the nature of the event, the numbers and the categories of spectators attending the event.

The spectator profile shall also be taken into account in the adoption of appropriate rates of pedestrian flows.

6.3 Creating a balanced system

All parts of the circulation system shall be compatible and combine to form a balanced whole. A given route shall preferably provide for continuous flow.

NOTE Circulation cannot be planned or managed simply by ensuring that individual sections of facilities such as stairways, concourses or gangways, are satisfactory in themselves. The inter-relation of these and other components is critical.

6.4 Multifunctional circulation areas

Circulation areas, wherein spectators both gather and pass through, need to serve a variety of purposes at different times.

Concourse areas in stands may form part of the ingress and egress systems and will frequently also provide access to catering outlet and toilets. Holding areas where spectators can gather to eat and drink and/or view television monitors shall also be necessarily considered.

6.5 Zoning of circulation routes

New facilities shall be planned such that there are continuous circulation routes around spectator accommodation linked to both entry and exit routes.

6.6 Design of circulation routes and areas

6.6.1 Maintaining safe conditions

Circulation routes and areas shall be kept unobstructed where there is a direct movement of spectators, be free of trip hazards, and have slip resistant floor surfaces in accordance with appropriate standards.

6.6.2 Design

Circulation routes shall be designed to be barrier free and provide the appropriate level of fire resistance.

6.6.3 Width

For new constructions: circulation routes, including stairways and gangways shall be a minimum of 1,2 m wide.

The recommended minimum width of a ramp shall be 1,5 m.

6.6.4 Headroom

Headroom within the premises shall conform to national building regulations. A minimum headroom requirement of 2,20 m shall apply through the spectator facility.

6.6.5 Signs

Circulation routes and areas shall be identified by clear signs, illuminated where necessary. Symbols shall conform to ISO 7001. Exit signs shall take the form of a pictogram and be supplemented by text bearing the words “Exit” or “Fire Exit”.

6.6.6 Lighting

Circulation routes and areas shall be well lit by natural and/or artificial light under both normal and emergency conditions.

Lighting shall conform to EN 12193.

NOTE For emergency lighting, see EN 1838.

6.7 Provision of clear information

Spectators shall be provided with clear, consistent information on all aspects of entry and exit. Wherever practical, the following measures shall be considered:

a) All entrances and entry routes shall be clearly signposted and, where necessary, adequately lit. Signage shall take into account spectators with special needs.

b) All turnstiles and entry points shall be numbered. These numbers shall be identifiable, and shall be recorded in all documentation relating to the facility, including facility plans and contingency plans.

c) Clear ground plans showing all entrance points shall be displayed at strategic points outside the facility, ideally so that people approaching the ground can decide which entrance to use as early as possible.

d) Disabled people rely on clear and early notification about the facility and access routes more than the nondisabled. It is recommended that signage whether permanent or provided by the management on an event basis, shall be based upon information design that meets the standards of design for all and take the abilities of various users into account. Measures taken can be e.g. tactile information, acoustic information, etc.

On access and exit routes signs shall be:

— of a size appropriate to the distance of vision (size of text and pictograms);

— provided with the information that shall be presented with adequate colour-contrast;

— non-reflective;

— located in expected positions;

— preferable be illuminated;

— repeated along the route to reassure spectators that they are moving in the right direction.

6.8 Circulation – Within the facility

The circulation of persons within a facility includes both horizontal and vertical movements and can incorporate both pedestrian and mechanically assisted movement. If a facility is to host a variety of events, the circulation routes need to recognize this factor. In addition, audience profiles will differ resulting in varying rates of passages that require to be recognized in the planning of an event.

Egress following an event or during an emergency evacuation will provide the most significant one way flow. The contraflow design requirement will be a function of the nature of the event and the spectator facilities that are serviced by the route. For example, a walkway connecting spectator accommodation with a concourse providing refreshments, toilet facilities, betting windows may need to be designed for a contraflow firstly with a dominant flow towards the concourse and also a balanced contraflow.

In order to provide for satisfactory circulation the design shall provide elements that allow a uniform rate of passage throughout the route.

6.9 Passageways

Passageways serving an entry or exit route shall be not less than 1 200 mm.

The maximum rate of passage in a level passageway shall be taken as not more than 82 persons/m/min. This rate of passage will exhibit erratic movement with frequent stoppages; the appropriate rate of passage shall be selected to accord with the expected spectator profiles.

Horizontal circulation routes shall be accessible for all spectators. Corridors and passageways need to be wide enough to allow wheelchair users to manoeuvre, for other wheelchair users to pass and, where necessary, to turn through 180°.

Doors in passageways are required to have glazing panels to the same specification as entrance doorways and have a preferred door leaf clearance of 900 mm.

6.10 Ramps

National regulations are likely to apply a maximum gradient of a ramp and the location of horizontal distance between landings.

In the absence of national legislation, the following characteristics shall apply:

— Ramps providing a similar vertical rise to a stair occupy approximately five times the floor space.

— In new build facilities or in major developments of existing facilities, it is recommended that small changes of level shall be avoided as far as possible. Ramps shall be provided to overcome any small changes of level or divisions between the structure and the routes for the emergency services or the area surrounding the venue.

— If the width of a ramp exceeds 1 500 mm consideration shall be given as to the provision of handrails. Individuals can have a weakness on either side. This leads to a requirement for support on both sides of any ramp.

— A ramp surface shall be slip resistant, especially when wet, and of a colour that contrasts visually with the landings.

— The frictional characteristics of the ramp and the landing surfaces shall be similar.

6.11 Stairways

6.11.1 General

In the absence of national legislation, the following characteristics shall apply:

— Stairways (including steps) within an entry or exit route shall be not less than 1 200 mm in width.

— The maximum rate of passage on a straight stair shall be taken as not more than 66 persons/m/min; this rate of passage will exhibit erratic movement with frequent stoppages. The appropriate rate of passage shall be selected to accord with the expected spectator profiles; an individual will have some choice of walking speed at roughly one third of the maximum capacity of the stairway and have a virtually unrestricted choice of walking speed at one-fourth maximum capacity or less.

— Stairways and walkways are frequently linked within an entry or exit route. In such a case any stairway will require to be approximately 30 % wider than the narrowest walkway within the route.

— If the width of a stair exceeds 1 800 mm consideration shall be given as to the provision of handrail.

— Queuing at the head of a stair is a hazard and the design of the stair head shall provide a uniform pedestrian flow onto the stair.

NOTE The rate of passage adopted may need to recognize a number of factors which will result in a reduced value being adopted (e.g. an upstairs flow may require 53 persons/m/min).

6.11.2 Stepped access and stairs for people with special needs

People with impaired sight risk tripping or losing their balance if there is no warning that steps or stairs provide a change in level. The risk is most hazardous at the head of a flight of steps when a person is descending. The warning shall be placed sufficiently in advance of the hazard to allow time to stop and not be so narrow that it might be missed in a single stride.

A tactile surface hazard warning shall be provided at top and bottom landings of a stair or a series of flights to give advance warning of a change in level.

People who have physical difficulty in negotiating steps and stairs need the help of a handrail that can be easily gripped, is comfortable to touch and, preferably provides forearm support.

6.12 Escalators

The treads of escalators forming part of an entry or exit route shall preferably possess a width that allows for two persons standing side by side.

Escalators shall not be used in calculating the emergency evacuation capacity. Their use as a down stair in a stationary mode introduces a hazard due to variable riser heights and appropriate management measures are required.

Appropriate management measures may be taken to prevent public use by barriers or stewarding.

Escalators, their operation and necessary maintenance shall be in accordance with EN 115 (all parts).

6.13 Lifts

Passenger lifts for people with special needs shall be in accordance with EN 81-70.

Lifts have limitations with regard to transportation of bulk arrivals or bulk departures; however, their provision is essential to assist the vertical movement of ambulant disabled persons and persons in wheelchairs.

Lifts shall not be used in calculating the emergency evacuation capacity, except if suitable fire rated lifts are used.

Wheelchair users need sufficient time and space to manoeuvre into a lift and need to be able to reach controls both within and without of the lift. For the benefit of people with visual impairments, a tactile indicator on, or adjacent to, lift buttons shall be provided to confirm the floor level selected. Lift buttons shall contrast tonally with the control panel which shall also contrast with the wall. Audible indicators shall also be provided to waiting persons of the arrival of a lift and to inform passengers of the storey reached. Mirrors within the lift or areas adjacent to the lift can present a hazard for persons with visual impairments. Acoustically reflective surfaces can cause discomfort for persons with hearing impairment.

Platform lifts are only acceptable for a vertical distance not greater than 2 m unless within a proprietary lift enclosure. The provision of a fold down seat for ambulant disabled use is beneficial. The rated speed of a platform lift should not exceed 0,15 m/s.

6.14 Concourses

The essential elements of a concourse are schematically illustrated in Figure 3.

The provision of refreshments together with an area occupied by essentially a static crowd and an area that provides a thoroughfare are the primary elements.

The capacity of a concourse coupled with the spectator body that it serves is the most significant factor with regard to its design and management.

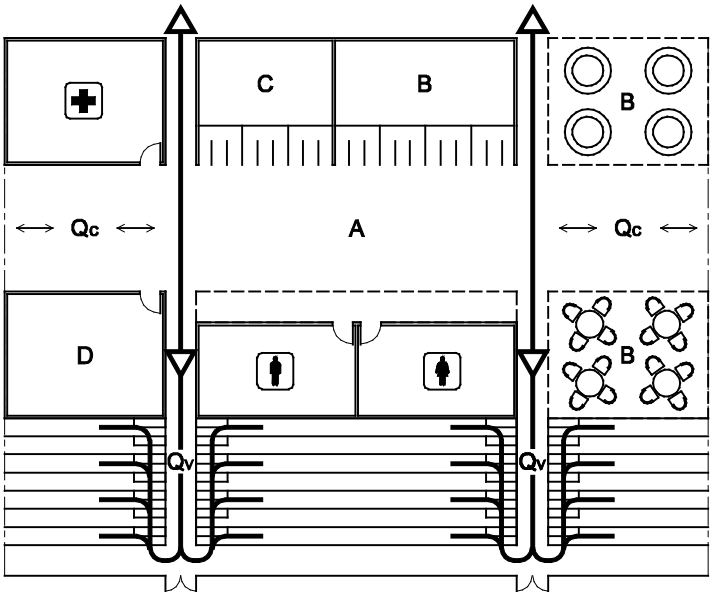
Circulation and movement routes within a concourse need to be considered in the presence of an essentially static crowd comprising of spectators making use of the facilities.

A concourse may provide an element of an exit route. The potential of a large space to create crowd pressures on other elements of passage needs to be considered.

A fire safety risk assessment for a concourse needs to be undertaken on an event basis.

Closed circuit television is of particular benefit for maintaining appropriate standards of comfort, safety and security of a concourse.

The design of refreshment facilities, including self service outlets, within concourses shall allow for people with special needs to visit them independently or with companions.



Key

A primary circulation area

B social area

C kiosk

D shops

Q_c predicted spectator flows from circulation routes

Figure 3 — Concourse area

6.15 Vomitories

Vomitory design incorporates a number of factors. The fundamental parameters that dictate the design solution are the width of the vomitory coupled desired egress interval coupled with the characteristics of the confluent flows into the mouth of the vomitory.

The characteristics of the confluent flows will be determined by the layout of the viewing accommodation that is served by the vomitory. The characteristics of a given flow will necessarily incorporate the duration of the individual flows and a flow capacity.

— Management should ensure that no spectators or non-essential staff are allowed to stand in vomitories during an event. Similarly, during ingress and egress, stewards should position themselves to ensure the unimpeded passage of spectators. This is essential towards the end of an event (or significant part of an event) in order to prevent overcrowding and not to impede those spectators who wish to leave.

— It is recommended that vomitories are clearly identified both internally and externally and on all site plans so that resources can be quickly directed to wherever they may be required.

7 Egress and emergency evacuation

7.1 Basic design principles

It is generally recognized that a period of considerable risk to crowd safety is during at the bulk departure of spectators from the facility. It is important, therefore, to provide exit systems capable of accommodating safely the passage of people within an acceptable period of time and to avoid congestion.

Smooth, unimpeded flow through an exit route is best achieved by ensuring that the exit system does not narrow along its length.

Additionally, in controlling the crowd flow at the beginning of the route, that is, within the viewing accommodation, it is vital to ensure that people enter the exit system at an acceptable rate.

In order to achieve this, the flow through the first element of the exit route from the spectator accommodation shall be no greater than through any subsequent element.

7.2 Exit capacity

When assessing the capacity of exit systems and emergency evacuation systems, four factors shall be considered:

a) the clearway widths of each part of the exit or emergency exit route;

b) the rate of passage of people through the exit, or emergency exit system;

c) the egress time;

d) the emergency evacuation time.

7.3 Exit route

The minimum width of an exit route shall be 1,2 m.

Doors providing passage from executive boxes and some hospitality areas may form part of exit systems in spectator facilities. In these locations, the minimum width of an exit door should not be less than 0,9 m.

7.4 Rates of passage

The rate of passage through an element of an entry or exit forms a fundamental part of the calculation of the capacity of both exit and emergency evacuation systems.

Factors affecting the rates of passage may include the following:

a) the crowd profile of the spectator body such as the presence of children, elderly persons or people with special needs and slow walkers;

b) the location and level of use of commercial, catering or other spectator facilities situated along the exit route;

c) the design and physical condition of the exit system; for example, the number of stairways, the quality of directional signs, lighting levels and underfoot conditions.

The rate of passage is necessary to determine the flow capacity of the specified element of an entry or exit route in a specified time.

The flow capacity of a given space of an entry or exit route is the maximum number of spectators who can be expected to pass through the space in a specified interval.

Considering that the minimum width of an exit element of any evacuation route shall be 1,20 m.

The recommend maximum flow capacity for a width of 1,20 is as follows:

— on a stepped surface 79 people can reasonably exit in 1 min (equal to 66 persons per metre per minute);

— on a level surface 100 people can reasonably exit in 1 min (equal to 82 persons per metre per minute).

7.5 Egress time

It is emphasized that there is a difference between egress times and emergency evacuation times.

The egress time is the total time taken for all spectators, in normal conditions, to leave an area of viewing accommodation and enter into a free flowing exit system. It does not include the time taken to negotiate the entire exit route.

The recommended egress time is eight minutes for outdoor facilities. The level of risk present may necessitate a reduction or an increment of the recommended egress time.

In certain circumstances, it may be appropriate to apply a shorter egress time than 8 min; for example, if the design or management of the viewing accommodation is such that regular observation shows that spectators become agitated or experience frustration or stress in periods of less than 8 min.

It should also be recognized that in many circumstances spectators will willingly take longer than 8 min to leave; for example, in order to watch scoreboards, hear additional announcements or simply wait for the crowds to disperse. This practice shall not be considered a factor in the determination of the egress time.

The maximum allowable egress time together with the appropriate rates of passage is a reference to calculate the total width of the exits from the viewing area in normal conditions.

7.6 Design of exit systems

The design of exit systems shall take into account the following:

a) Movement:

Once spectators have passed into the exit system they shall be able to keep moving throughout its length.

b) Alternative exits:

In the event of an incident which renders an exit route unusable, spectators shall be able to use an alternative exit route or routes.

c) Direct exit routes:

Where there is a simple exit route; that is, a direct passage from the viewing area to the exit gate from the spectator facilities, every part of that route shall be able to accommodate the flow from the terrace or stand exit.

d) Complex exit routes, or networks:

For a more complex exit system which is less direct and/or offers a choice of alternative routes, the system shall be analysed in the form of a network. This is in order to check that the capacity of the exit route from the

viewing area is sufficient to ensure a free flow of spectators to the various exits from the ground. Where branching of routes gives spectators a choice of paths, the proportion of the crowd likely to use each path shall be assessed; for example, the exit closest to a railway or bus station may be likely to attract a higher proportion of spectators.

Facilities which have complex exit systems shall have clear, illustrative plans of the network system which serves each section, identifying the capacity of the routes within the system. These plans shall be kept with the drawings of the section of the ground to which they relate. Any changes to the ground which affect the entry/exit routes shall be identified on the network plan.

e) Number and disposition of exits:

In order to ensure a smooth unimpeded passage for spectators through an exit system, there shall be a sufficient number of exits in suitable locations (although no simple calculation of the number can be given which would apply to all situations). To avoid inconvenience and confusion, it is important that the exits are not inconveniently located or spaced too far apart.

f) Keeping exit routes clear:

Exit routes shall be kept clear of obstructions. Catering, sales or toilet facilities shall be located in such a way that neither they, nor any queue they attract, obstruct an exit route. Where exit routes pass through areas affected by vehicular movements, consideration shall be given to suitable methods of traffic control.

g) Signs:

All elements of the exit system shall be clearly signposted in accordance with ISO 7001.

Directional signs shall be provided to encourage crowds in any particular section to flow in one direction when leaving the ground and shall wherever practicable, provide information on the destination of the exit route (for example, 'Station', 'Town Centre' or 'Visitors' Coach Park') so as to provide confidence to people using them. Luminous signs can be beneficial.

7.7 Emergency evacuation time

There is a difference between egress times and emergency evacuation times.

The emergency evacuation time is a calculation which, together with the rate of passage, is used to determine the capacity of the emergency exit system from the viewing accommodation to a place of safety in the event of an emergency. The adopted time is referred to as the emergency evacuation time.

To get to a safe place as scheduled by the risk assessment, it may be necessary to integrate the exit from the spectators viewing area and the exit routes of the exit system designed for the exit of spectators in normal conditions, with emergency exits and routes.

These emergency exit elements and routes shall be identified by appropriate signs different from the normal exit signs to those of normal evacuation, should be fitted with suitable opening systems with centralized control or manually operated individually and always manned by dedicated personnel.

7.8 Design of emergency evacuation routes

Evacuation routes for use in emergencies may need to be provided in addition to normal exits. In all cases, the following points shall be considered:

a) there shall be more than one emergency evacuation route from a viewing area;

b) the system shall be designed in such a way that the loss of one emergency evacuation route does not prevent access to an alternative;

c) emergency evacuation routes shall discharge into a place of safety, preferably in the open air.

If the capacity of the exit route is considered insufficient for emergency evacuation purposes, the final capacity of the section served shall be reduced.

Where appropriate, the design of emergency evacuation routes should also take into account the needs of spectators with special needs.

Warning systems shall consist of an evacuation signal, announcements over the public address system, and also visual instructions on electronic scoreboards.

The fact that some people have a hearing impairment does not mean that they are necessarily completely insensitive to sound. Many people with severe impairments have enough perception of conventional audible alarm signals to require no special provision.

Alternative forms of alarm signal for people with special needs are paging systems, vibrating devices or sound signals broadcast within carefully selected frequency bands.

Designers are recommended to provide refuges of suitable area to accommodate known numbers of wheelchair users and to subsequently plan for their evacuation from upper or lower levels by means of suitable lifts or management procedures agreed with the local authority and fire service.

Evacuation lifts (as opposed to passenger lifts for access) reduce the need to provide physical assistance for the evacuation of disabled spectators by staircases.

Evacuation lifts shall be clearly indicated, with signs on every floor level.

A firefighting lift (which is provided principally for the use of the fire service in fighting fires) may be used for the evacuation of people with special needs.

7.9 Use of the activity area for emergency evacuation

In certain cases evacuation onto the activity area may form part of the emergency evacuation route, provided that it leads directly to an exit which itself leads to a place of safety.

In that case, the following requirements shall also be taken into account:

a) whether or not the emergency evacuation of spectators onto the activity area forms part of the agreed emergency evacuation plan, wherever there is a pitch perimeter barrier in front of spectator accommodation, other than in exceptional circumstances it shall possess a sufficient number of suitably designed gates or openings;

b) where the playing surface is made of synthetic materials, advice from the fire authority shall be sought to establish whether it can be properly considered as an emergency exit route in the event of a fire;

c) if the activity area is wholly surrounded by covered accommodation, with no breaks in the roofing, it may not be a suitable route for emergency evacuation in the event of fire. In such cases, advice from the fire authority shall be sought.

7.10 Provision of gates or openings in an activity area perimeter barrier

As previously stated, where a pitch perimeter barrier is in place in front of spectator accommodation, other than in exceptional circumstances it shall possess gates or openings allowing access onto the pitch or area of activity.

If a viewing area is divided by structural means, each division shall have sufficient gates or openings to evacuate/all the spectators in that division within the emergency evacuation time set for that part of the ground.

The magnitude and direction of spectator flows that could approach the gate need due consideration.

Such gates or openings shall:

a) be of minimum width 1,2 m;

b) align with radial gangways (where provided) and be not less than the width of those gangways;

c) be appropriately stewarded.

Where gates are fitted, they should:

d) open away from spectators;

e) be kept unlocked;

f) only be fitted with catches that can be released from both sides;

g) be clearly marked and painted a different colour from the rest of the activity area perimeter barrier.

7.11 Exit doors and gates

Exit doors and gates shall meet the following requirements:

— Final exit doors and gates, unless secured in an open position, shall be staffed at all times while the facility is used by the public.

— No door or gate forming part of an exit route shall be locked or fastened in such a way that it cannot easily and immediately be opened by those using that route in an emergency.

— All final exit doors on a normal exit route shall be secured in the fully open position before the end of the event. When open, no door shall obstruct any gangway passage, stairway or landing.

— All exit doors and gates on an exit route shall always be capable of opening outwards so that crowds can escape in an emergency without obstruction. In situations where the opening of the doors or gates would cause an obstruction on a public highway, the doors or gates shall be re-sited (that is, put further back) within the exit route they serve.

— Where practicable exit doors and gates shall be sited adjacent to entrances. There should be no obstructions and no changes in level at exit doors.

— Sliding or roller-shutter gates shall not be used because they are incapable of being opened when pressure is exerted in the direction of crowd flow; in addition they have mechanisms or runways which are vulnerable to jamming.

— Reversible turnstiles and pass doors shall be provided in order to allow anyone to leave the spectator facilities at any time (including those ejected for breaching ground regulations). Such openings shall be limited to allow the passage of only one person at a time.

— Reversible turnstiles are not acceptable as a means of escape and shall not form any part of the normal or emergency exit system.

7.12 Electronic securing systems

Where they are in place, electronic securing systems on exit doors and gates shall meet the following requirements:

— No door or gate forming part of an exit route shall be locked or fastened in such a way that it cannot easily and immediately be opened by those using that route in an emergency. This applies equally to exit doors and gates that are electronically secured.

— All electronically secured doors and gates shall be staffed by stewards at all times when spectators are in the ground.

— The doors or gates shall be capable of being de-energized individually by the steward.

— The stewards shall be specifically authorized to open their gates without further instructions in the event of a sudden local emergency.

— Emergency telephones shall be provided for instant communication, directly between the stewards staffing the exit doors or gates and the operator of the control panel (see below). All such telephones shall be instantly accessible to the stewards without the use of a key.

— The operation of each door or gate shall be tested both electronically and manually immediately before each event and the result of each test recorded. The record shall include all tests, any faults found, and any opening of any door or gate while spectators are present in the ground.

— The control panel for the system shall be located in the ground's control point and shall be staffed continuously by a suitably trained and authorized person, who shall have no other duties.

— The emergency telephone in the control point shall be positioned so that the panel operator can answer it without having to leave his or her post.

— Each gate shall be clearly marked on both the inside and the outside with its identifying number. This identification shall correspond to the identification of the switch on the control which releases it.

— The doors or gates shall be designed so that, in the event of a power failure, they are automatically de-energized and capable of being opened manually.

— Electronically secured doors and gates shall ideally be monitored by a closed circuit television system (CCTV).

— Before approving an electronic securing system ground management in consultation with other interested authorities shall consider and take full account of hazards associated with such a system. In particular, they shall consider the possible consequences of a major emergency should spectators have to force the doors open themselves.

7.13 Emergency escape lighting

The primary purpose of emergency escape lighting is to illuminate escape routes and safety equipment.

The characteristics of facility and the risk assessment will determine the complexity of the emergency escape lighting required.

An emergency escape lighting system shall cover the following:

— exit doors;

— escape routes;

— emergency escape signs;

— intersection of corridors;

— outside final exit and on external escape routes;

— stairways;

— changes in floor level;

— toilets;

— fire alarm call points;

— firefighting equipment;

— lifts;

— equipment that would need to be shut down in an emergency.

It is not necessary to provide individual luminaries for each item above, but there shall be a sufficient level of light to allow them to be visible and usable. Lighting shall comply with EN 12193.

NOTE 1 To complement emergency escape lighting, people especially those unfamiliar with the facility, can be helped to identify exit routes by the use of way-guidance equipment.

NOTE 2 Way-guidance equipment usually comprise photo-luminescent material, lines of leds, or strips of miniature incandescent lamps, forming a continuous marked escape routes at lower level.

NOTE 3 These systems have proved particularly effective when people have had to escape through smoke, including for partially sighted people.

NOTE 4 They can be particularly useful in facility where they can be provided marked routes on floors and in multi-store premises they can direct people to escape routes which are seldom used.

7.14 Emergency Evacuation for people with special needs

7.14.1 Horizontal Escape

7.14.1.1 General

Traditional fire safety arrangements rely on the protection of escape routes, the provision of fire warning tones or signals, and the independent capability of people to use steps and stairs for egress.

This is inadequate for some people with special needs, but satisfactory assisted escape can be achieved in spectator facilities by the use of appropriate fire resisting construction incorporating measures to assist disabled spectators.

7.14.1.2 Refuges

Communication shall be possible from each refuge to venue control to prevent wheelchair users being left during an emergency.

A refuge can be provided by:

— a compartment of the building which is separated from the compartment containing the fire source;

— a protected lobby corridor or stairway, with sufficient space for wheelchair users to manoeuvre and wait to be evacuated, without having an adverse effect on the means of escape for able-bodied spectators.

A concourse in a non-combustible stand, with immediate access to escape stairs and evacuation lifts, could constitute an effective refuge. In such a case, potential fire sources, such as food kiosks, would have to be fitted with automatic fire shutters with at least half an hour fire resistance for both integrity and insulation. To avoid unnecessary risk, however, it is also recommended that clearly marked areas within the concourse are designated as refuges and are located away from any potential sources of fire and smoke.

7.14.2 Vertical Escape

7.14.2.1 Evacuation Lifts

The operation and necessary maintenance of lifts for people with special needs shall be in accordance with EN 81-70.

A lift provided for passenger use in the normal operation of the building may only be used for evacuation purposes if it is provided with the safeguards required for an evacuation lift.

In spectator facilities, therefore, evacuation lifts are likely to be a practical necessity to ensure rapid escape for people with special needs, particularly wheelchair users. Unlike a normal passenger lift, it is essential that a lift, which is to be used as a means of evacuation for people with special needs shall continue to operate with a reasonable degree of safety when there is a fire in the building.

A lift may fail. It is therefore necessary, having reached a refuge at an evacuation lift, that people with special needs can gain access to a stairway to be used as a last resort, should the conditions in the refuge become untenable. An evacuation lift with its associated refuge should therefore be located adjacent to a protected staircase designed such that wheelchairs and their occupants can be carried down, if necessary.

A firefighting lift (which is provided principally for the use of the fire service in fighting fires) may be used for the evacuation of people with special needs.

7.14.2.2 Stairs

Escape stairs which serve an area without a lift and provide access to that area shall comply with the requirements specified in European and National legislation for internal stairs. In particular, they shall have a maximum riser height of 170 mm.

In general, narrow staircases with tight turnings are deemed to be unsuitable for escape purposes. Staircases need to be of such a width that wheelchairs and their occupants can be carried down them, if necessary. The recommended minimum width is 1,20 m with a preferred width of 1,2 m, for any part of the escape system of a spectator facility. This is adequate to accommodate a standard tubular steel wheelchair. If the handrails project more than 100 mm then the minimum dimension shall be measured between the handrails.

7.14.2.3 Handrails

The design of handrails in escape stairs needs particular attention.

They shall be colour contrasted to their supporting walls, and on every level other than the ground/exit floor it is recommended that handrails are marked with arrows identifying the direction to the nearest exit storey.

Within a protected staircase, handrails shall be essentially continuous, and shall be of such a dimension and sufficiently clear of walls to allow a firm grasp.

7.14.2.4 Wheelchair Stair lifts

Where wheelchair stair lifts are deemed suitable for access, they shall not be used as a means of escape.

Where installed in a stairway, which is also used as a means of escape, it is essential that the stairway width required for means of escape is maintained beyond the incursion into the stairway of any fixed part of the wheelchair stair lift, such as its carriage rail.

Elsewhere on an escape route, allowances may need to be made for the space taken up by other parts of the stair lift installation, such as its power unit and the lift itself, when in its closed position.

Annex A
(informative)

Access control elements - Product characteristics

A.1 Full Height Turnstiles

A.1.1 General

Bidirectional dual-rotor turnstiles (possibility of rotating both clockwise and anticlockwise).

A.1.2 Dimensional requirements

— Outer size on the ground no greater than 2 200 mm x 1 750 mm;

— total height not exceeding 2 250 mm;

— height guaranteed for the passage of users equal to or greater than 2 000 mm;

— minimum width for passage no less than 560 mm;

— lower arm (axis of arm) positioned not less than 200 mm and not more than 360 mm from the ground; distance between the axis of arms of the single rotor no greater than 235 mm.

A.1.3 Characteristics

Reliability: a turnstile should be tested to at least 1,5 million continuously operating cycles. Operating temperature range should be specified.

Strength: in the locked position a turnstile should be able to resist safely a horizontal imposed force of 0,8 kN/m^2 or a load on a single element of 0,8 kN/m.

NOTE The perimeter barrier including the point of entry needs to satisfy EN 13200–3, the access control element does not.

Operating modes can be as follows:

— always free;

— always locked;

— locked, but free in event of power failure;

— electronically controlled;

— electronically controlled but free in event of power failure.

A.1.4 Ergonomics

The turnstile should have the following traits: smoothness of movement, safety of users, accessibility and ease of return in the event of entry being denied.

A.1.5 Electric circuits

The power supply should be 230 VAG, and the logical voltage of electric circuits to control motion shall be 24 V; the turnstile should also have backup power capable of ensuring operations for at least 2 h.

A.1.6 Control system

The opening mechanism should be:

— complete with hydraulic shock-absorber and self-centring system, with an anti-runback device housed in the upper section of the turnstile;

— equipped with electronic control device (using chip, PLC – Programmable Logic Controller [1)] - or similar).

A turnstile should be worked via a manual push; permission to enter may be granted locally, using an optical scanner of any type, and remotely (via serial line RS 485 - Digital Serial Communication Methods for Computers and Devices [2)], Wi-Fi or another type).

Position sensing during rotation should be via magnetic sensors or micro-switches that should not be subject to wear and tear.

A turnstile should complete with power supply unit in the upper section.

If power is interrupted, the rotor may remain, on request, locked or free to rotate, or locked in one direction and free in another.

The mechanism, power supply and operating logic should be easy to inspect.

A.1.7 Functions

Direction of rotation:

The direction of rotation should be selected by the microchip logic depending on whether the freeing signal is given by the actuator (optical scanner or remote control) reserved for the direction of entry or that reserved for the direction of exit.

Once consent is given the barrier is pushed, turning for the first 45°, after which it will automatically return to the rest position. Once rotation begins in the desired direction, an anti-runback device should prevent rotation in the opposite direction until the barrier automatically returns to the rest position.

A.1.8 Time-out

A turnstile should be endowed with a device which, once permission to pass has been given, blocks rotation if this action is not begun within a given time. This period should be adjusted according to needs.

Reporting of completed rotation:

Once rotation is complete the logic should send a “rotation complete” signal to the scanner. Once it receives permission from the scanner for the passage in one direction, the logic may transmit a signal to block the scanner reserved for movement in the opposite direction. This signal should be removed only once rotation is complete or when the time-out function is activated.

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1) PLC: Programmable Logic Controller. Digital integrated circuit designed for specific tasks. PLCs are real time systems oriented in opposition to general-purpose computers.

2) RS-485: Digital serial communication methods for computers and devices. RS-485 is a standard communication system used in balanced digital multipoint systems. The RS-485 is defined in ETA-485 and CCITT V11 standardization.

A.2 Technical specifications for the supply of scanning equipment to control access via turnstile entrances

A.2.1 Control software

In order to prevent access to the facility by a persons without a valid ticket and to verify the number of spectators who have entered the venue in ingress, the control software and access management, should satisfy the following characteristics:

— allow real-time cross-checking between the access control system and ticket office system, for the cancellation of tickets not yet used, at the same time preventing the use of cancelled tickets;

— perform the real-time, online centralized management of entrance control equipment, ensuring immediate anti-pass-back (i.e. making it impossible to allow entry to more than one ticket having the same ID characteristics) in order to prevent access, including simultaneous access from different gates, of “clones” of the same ticket; tickets that have been “deactivated” following loss or theft shall not be accepted;

— allow interfacing with different ticket office systems;

— check the uniqueness of issued tickets; in other words, the system should not accept duplicated data from ticket office systems to which it is connected, and should report the anomaly;

— record all valid entries and all manual entries that may be effected by workers in order to check effectively and immediately the overall and actual number of entries;

— ensure rapid response times: with the whole system loaded response times between reading and enabling should not be more than 20 hundredths of a second;

— generate reports, statistics and queries on entry data;

— be able to manage and integrate different control equipment (e.g. full height turnstiles, tripods, wireless hand-held systems, etc.).

A.2.2 Server

The server should be configured so as to ensure service continuity, thus the hardware should, whenever possible, be offered with redundancy and have “hot-swap” functionality, i.e. be immediately replaceable without having to close down the server or suspend the service.

Essential properties:

— alternative power supply;

— backup supply system (UPS – Uninterruptible Power Supply) to ensure functioning in the event of power failure;

— static memory (disks) in configuration RAID 1 – RAID 5 (mirror + splitting);

— dual-net card;

— adequate size of dynamic memory (at least 1Gb of RAM – Random-Access Memory);

— latest-generation CPUs (Central Processing Unit[3)]) cooling system for forced circulation components (fans).

A.2.3 Scanning device for Turnstile/Cage

The gate scanner should be completely incorporated in the turnstile structure and be equipped with a scanning slot that can be inspected, be easy to maintain and clean and replaceable if it is damaged. It should be able to manage different technologies for reading the codes of entrance tickets, in particular:

— linear barcode scanner;

— bidirectional barcode scanners;

— the most common RFID TAG[4)] (Electronic circuit with antenna used in RFID identification) scanners on the market.

A manual Locking/Freeing device should be operational, worked by stewards using a key switch to disable or enable the gate as a result of unforeseen needs or the orders of the competent authorities in the event of safety problems.

Stewards should also free the gate manually to allow the entry of non-paying persons (e.g. children below the age of 6), with the recording and description of entry type entered in the Access Control Software.

Gate status (on, working, locked, offline, ready, etc.) should be available and visible, with warning devices such as LED displays, indicator lights and other display types, to the benefit of both stewards and users.

The turnstile should have a display visible to the gate steward to show the outcome of the access query:

— entrance granted;

— ticket type;

— entrance denied;

— reason for denial (ticket already used, on black list, for another zone, etc.);

— operating anomalies, e.g. user authorized but not passed;

— ticket holder’s data.

Internet connectivity should ensure adequate response times and standard cabling.

It should be possible to have Wi-Fi connectivity as an alternative (a solution enabling the simple management of possible portable entrance gates).

3) CPU: Central Processing Unit. The hardware that carries out the software instructions by performing arithmetic, logical and input/output operations within a computer.

4) A RFID Tag is an electronic circuit with one or more antennas that use RF waves to communicate an identifier. RFID tags can be categorized as:
— passive RFID Tags;
— Battery-Assisted Passive (BAP) RFID Tags or Semi-passive RFID tags;
— Active RFID Tags;
and are designed to be compliant with different standardizations (e.g. ISO/IEC 14443 series – ISO/IEC 15693 series).

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