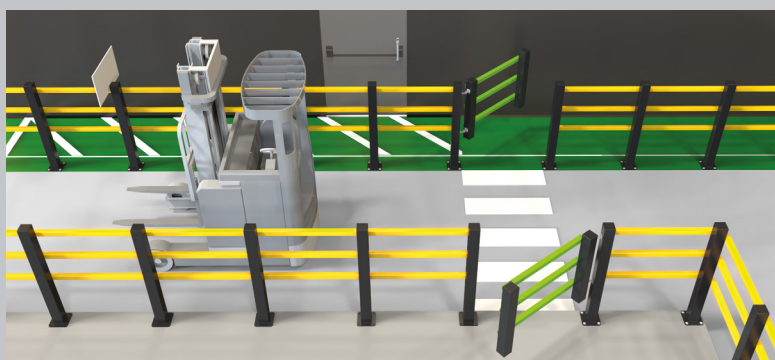
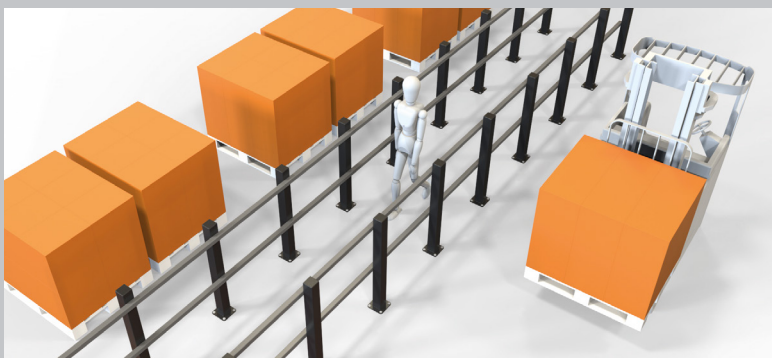
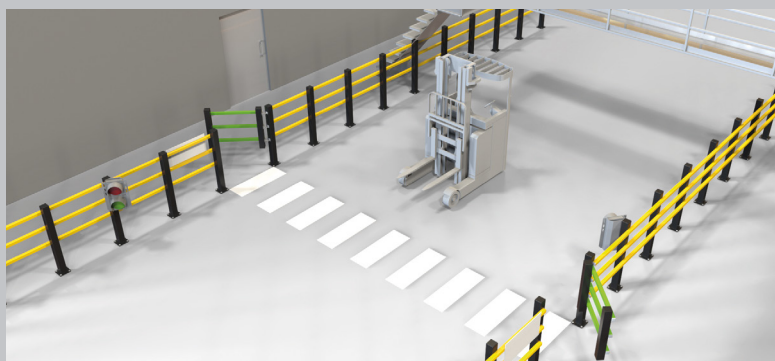
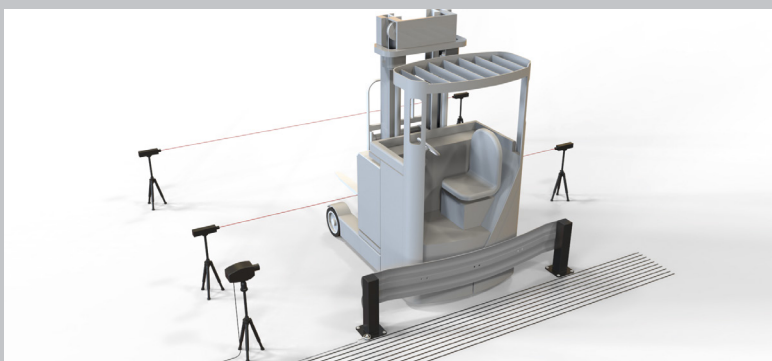


PAS 13:2017

Code of practice for safety barriers used in traffic management within workplace environments with test methods for safety barrier impact resilience



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Contents

Foreword	iii
Introduction	v
1 Scope	1
2 Normative references	2
3 Terms and definitions	3
4 Safety barriers used in traffic management within the workplace	6
5 Safety barrier design	13
6 Kinetic energy of vehicles	21
7 Methods of testing the force of impact that a safety barrier can withstand	26
Annexes	
Annex A (informative) Emergency exit routes dimensions	43
Annex B (informative) Guidance for typical vehicles in the workplace	44
Annex C (informative) Example of a test barrier report	45
Bibliography	46
List of figures	
Figure 1 – Example floor plan of a workplace	6
Figure 2 – Control measures for pedestrian routes, walkways and work area zones	8
Figure 3 – Example of control measures for vehicle routes	10
Figure 4 – Example of control measures for crossing points	11
Figure 5 – Example of control measures for critical structures and equipment	12
Figure 6 – Example of correct and incorrect safety barrier heights	13
Figure 7 – Ground level protection and dimensions	14
Figure 8 – Safety barrier colours	15
Figure 9 – A pedestrian safe zone and deflection zone	16
Figure 10 – Correct and incorrect safety barriers deformation and deflection zones	16
Figure 11 – Correct and incorrect examples of safety barriers next to structures including the deflection zone	17
Figure 12 – Hand rail height for pedestrians	18
Figure 13 – Safety barriers with smooth and sharp edges	18

Figure 14 – Correct and incorrect sized and positioned safety barriers	19
Figure 15 – Force on barrier in relation to the pull-out force of a fixture system	19
Figure 16 – Vehicle lined up at different angles to a safety barrier	22
Figure 17 – A vehicle in an aisle and the calculation of its maximum impact angle	23
Figure 18 – Vehicle impacting a safety barrier at 45 °	25
Figure 19 – Example of a bumper striker	27
Figure 20 – Example of a two-fork striker dimensions	28
Figure 21 – Example of a safety barrier drawing and specification sheet	29
Figure 22 – Example of a test barrier (using pendulum equipment) with lines marked on the ground to measure deflection	30
Figure 23 – Examples of where to impact safety barrier components ...	31
Figure 24 – Example of a pendulum using a bumper striker	32
Figure 25 – Example of pendulum test with the striker at 90 ° against the test barrier	33
Figure 26 – Example of pendulum impact test and cross section	35
Figure 27 – Example of a vehicle used in a vehicle impact test	36
Figure 28 – Example of a vehicle impact test preparation area	37
Figure 29 – Example of a vehicle impacting a test barrier	38
Figure 30 – Example of a sled and ramp	39
Figure 31 – Example of a ramp and sled impact test preparation area	40
Figure 32 – Example of a sled impacting a test barrier	41
Figure B.1 – Vehicle impact angles in particular aisle widths	44
Figure B.2 – Energy that is transferred to a safety barrier by vehicles at different angles	44

List of tables

Table A.1 – Widths of escape routes and exits	43
Table C.1 – Example test barrier report	45

Foreword

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Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is "should".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

The word “should” is used to express recommendations of this standard. The word “may” is used in the text to express permissibility, e.g. as an alternative to the primary recommendation of the clause. The word “can” is used to express possibility, e.g. a consequence of an action or an event.

Notes and commentaries are provided throughout the text of this standard. Notes give references and additional information that are important but do not form part of the recommendations. Commentaries give background information.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

0 Introduction

0.1 Background

Health and safety statistics show that approximately 50 people are killed each year and more than 5 000 injured in accidents involving workplace transport [1].

Each workplace is unique and likely to present different hazards and risks. However, a well-designed and maintained workplace with proper segregation of vehicles and people will experience fewer workplace accidents [2].

The most effective way of ensuring pedestrians and vehicles move safely around a workplace is to provide separate pedestrian and vehicle traffic routes and, where necessary, implement barriers, rails and signage to prevent pedestrians crossing at dangerous places and to direct them to safer crossing points [2].

There is a lot of information from safety organizations about workplace transport. The Health and Safety Executive (HSE) states that workplace transport means any vehicle or piece of mobile equipment used in any work setting [3]. Segregation of pedestrians and vehicles is advised but the way to achieve this can only be determined by assessing all of the site-specific issues and risks.

Warehousing and storage, a guide to health and safety (HSE) states [3]: “Warehouses should be designed and laid out to allow for the safe movement of goods, materials and people. Good design and layout can help reduce accidents, including those involving vehicles and people slipping and tripping.”

The movement of goods and materials involves the use of a wide range of vehicles and accounts for a large proportion of accidents in the workplace. It is important to have a safe system of traffic management, including methods and procedures for arrival, reception, unloading, loading and movement of vehicles within the workplace. People and vehicles should be segregated as far as is “reasonably practicable”.¹⁾

Mixing vehicles and pedestrians increases the risk of potential accidents, so it is imperative that steps are taken to minimize the associated risks by applying the following:

- Separate pedestrian activities from areas where vehicles are operating, where reasonably practical.
- Define, designate and clearly mark pedestrian routes and crossing places.
- Use protective barriers and traffic management procedures to control the movement of vehicles and pedestrians.

PAS 13 outlines the current good practice traffic management procedures for a workplace and provides a standard for the safety barriers within them.

Frequently asked questions after determining the requirement for pedestrian and vehicle segregation include:

- What type of protection or safety barrier is to be used?
- When is a vehicle barrier, pedestrian barrier or white line used?
- Is the current protection or safety barrier fit for purpose?

PAS 13 provides recommendations for these questions and give further understanding on how the selected protection may be rated and meet a specification and a performance rating by use of a test method. The test method element of the PAS describes dynamic impact tests and barrier performance measurement.

¹⁾ Health and Safety Executive, ALARP “at a glance”, 2014, www.hse.gov.uk/risk/theory/alarpglance.htm.

0.2 Main clauses

This PAS is divided into four main clauses that describe the testing and implementation of safety barriers, and best traffic management practices.

- 1) Clause 4: Safety barriers used in traffic management within the workplace**
 - How safety barriers can be used to assist in the safe management of workplace traffic.
- 2) Clause 5: Safety barrier design**
 - Principles of safety barrier design for individual applications and environments.
- 3) Clause 6: Kinetic energy of vehicles**
 - How to calculate the impact kinetic energy of vehicles in a workplace. Once this potential energy is determined, safety barriers that withstand the impacts of specific vehicles can be selected.
- 4) Clause 7: Methods of testing the force of impact that a safety barrier can withstand**
 - How to test, measure and rate a safety barrier for use within a workplace environment, with clear pass or fail criteria.

1 Scope

This PAS gives recommendations for the impact resilience, dimensions and positions of safety barriers in the workplace, and guidance on how to manage the risks associated with vehicles within the workplace, and specifies the criteria for testing the impact resilience of a barrier.

It is applicable to safety barriers used where there is a risk of collision between workplace vehicles or machinery and pedestrians. It is intended to be used by those who are concerned with selecting the appropriate safety barrier for their workplace to protect personnel, vehicles and structures, those who want to apply traffic management procedures and those who test and measure the performance of safety barriers.

It may also be of interest to manufacturers and distributors of safety barriers.

This PAS does not cover:

- highways and public environments;
- an installation specification or installation guide for safety barriers;
- safety barriers when working at height regulations.

Traffic and pedestrian routes do not cover stairs, staircases and fixed ladders.

2 Normative references

The following 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.

BS 5080, *Structural fixing in concrete and masonry – Method of test for tensile loading*

BS EN 1672-2, *Food processing machinery – Basic concepts – Hygiene requirements*

3 Terms and definitions

For the purpose of this PAS, the following terms and definitions apply:

3.1 arrest

barrier stopping and containing a striker without failure

3.2 catastrophic failure

failure of a barrier to arrest a striker, or structural failures within the barrier, fixture systems and structural components assessed via visual analysis

NOTE Examples include fixture systems pulled out of the substrate, sheared fixture systems, and sheared structural components. Catastrophic failure excludes sacrificial parts.

3.3 competent person

person with sufficient experience, knowledge and training to perform the task

3.4 critical structures and equipment

structurally integral parts of a workplace

NOTE Examples include building columns, walls, racking, doors, machinery, sprinkler systems, shelving, etc.

3.5 crossing point

location within the workplace environment where a pedestrian may move across a vehicle area

3.6 deflection

movement occurring in barriers during impact

3.7 deflection zone

area identified to allow barrier deformation without impinging on pedestrian safe zone

3.8 desire line

naturally-preferred route a pedestrian takes across a workplace environment

3.9 end post

first and last posts in a run of barriers

3.10 engineering drawing

technically-detailed graphic depiction of a barrier

3.11 environment

“off-highway” work areas that are not on the road

NOTE This includes any “off-highway” workplace such as factories, warehouses, airports, logistic centres, etc.

3.12 fixture system

system that anchors or fixes a barrier to the floor

3.13 floor plan

graphic representation of a workplace showing pedestrian and vehicle zones, structures and equipment

3.14 high-speed camera

specialist camera for photographing high-velocity impacts

3.15 impact angle

specific angle of approach between a vehicle and barrier

3.16 kinetic energy

energy an object possesses due to its motion

NOTE Measured in joules (J) or Newton metres (Nm).

3.17 load cell

device to measure and display force

NOTE For example a display of the force measured on the fixture systems during an impact test.

3.18 loading and unloading zone

area within a workplace where items are placed on or taken for the purpose of transfer

3.19 manual and non-motorized vehicle

hand-powered machinery in a workplace

NOTE Examples includes vehicles, hand pallet trucks, warehouse carts, roll cages and platform trucks, etc.

3.20 mid-post

post connecting two aligned rails

3.21 pedestrian

person moving and located within and around the workplace environment

3.22 pedestrian buffer zone

defined zone between pedestrian walkway and traffic route

3.23 pedestrian safe zone

area in workplace where traffic is not permitted, such as walkways or work areas

3.24 personnel

all people within the workplace

NOTE Examples includes pedestrians, vehicle drivers, people in work area zones, etc.

NOTE Examples includes mass and height of a striker.

3.25 rail

component, generally horizontal in alignment, that is connected between two or more posts

3.26 raised kerb

elevated edge that can be used for traffic or pedestrian guidance

3.27 sacrificial part

part designed to fail in a safe and controlled manner

3.28 safety barrier

workplace protection item

NOTE Examples include hand rails, pedestrian barriers, guard rails, traffic barriers, crash barriers, vehicle barriers, racking barriers and bollards.

3.29 safety net

protection item placed around a test barrier to capture flying debris following striker impact

3.30 scales

accurate and approved calibrated weighing implement

3.31 segregation

separation of vehicles and pedestrians within a workplace

3.32 striker

object or vehicle that impacts a barrier

3.33 structure

integral support or framework of a building

NOTE For example walls, doorways, floors, columns, racking legs, etc.

3.34 target

visible position marked for impact on a test barrier

3.35 test area

location where performance measurements are made on test barriers

3.36 test barrier

safety barrier used specifically for test purposes

3.37 traffic management

procedures for the safe guidance of vehicles and protection of personnel within a workplace environment

3.38 vehicle

moving equipment within the workplace environment

NOTE For example cars, trucks, forklift trucks, mobile plant, cherry pickers, buses, wagons, etc.

3.39 velocity

object's speed, measured in mp/s (metres per second), and its moving direction

NOTE Examples of objects are strikers, workplace vehicles, etc.

3.40 walkway

route within the work environment specifically for the movement of pedestrians

3.41 work area zone

general area within a workplace where workers are present

3.42 workplace

general place of work

NOTE For example, warehouse, car park, factory, airport, etc.

4 Safety barriers used in traffic management within the workplace

4.1 General

NOTE Traffic management involves the safe movement of vehicles and pedestrians through and around the workplace. This clause provides recommendations on when and where to use safety barriers to effectively manage health and safety risks associated with workplace traffic.

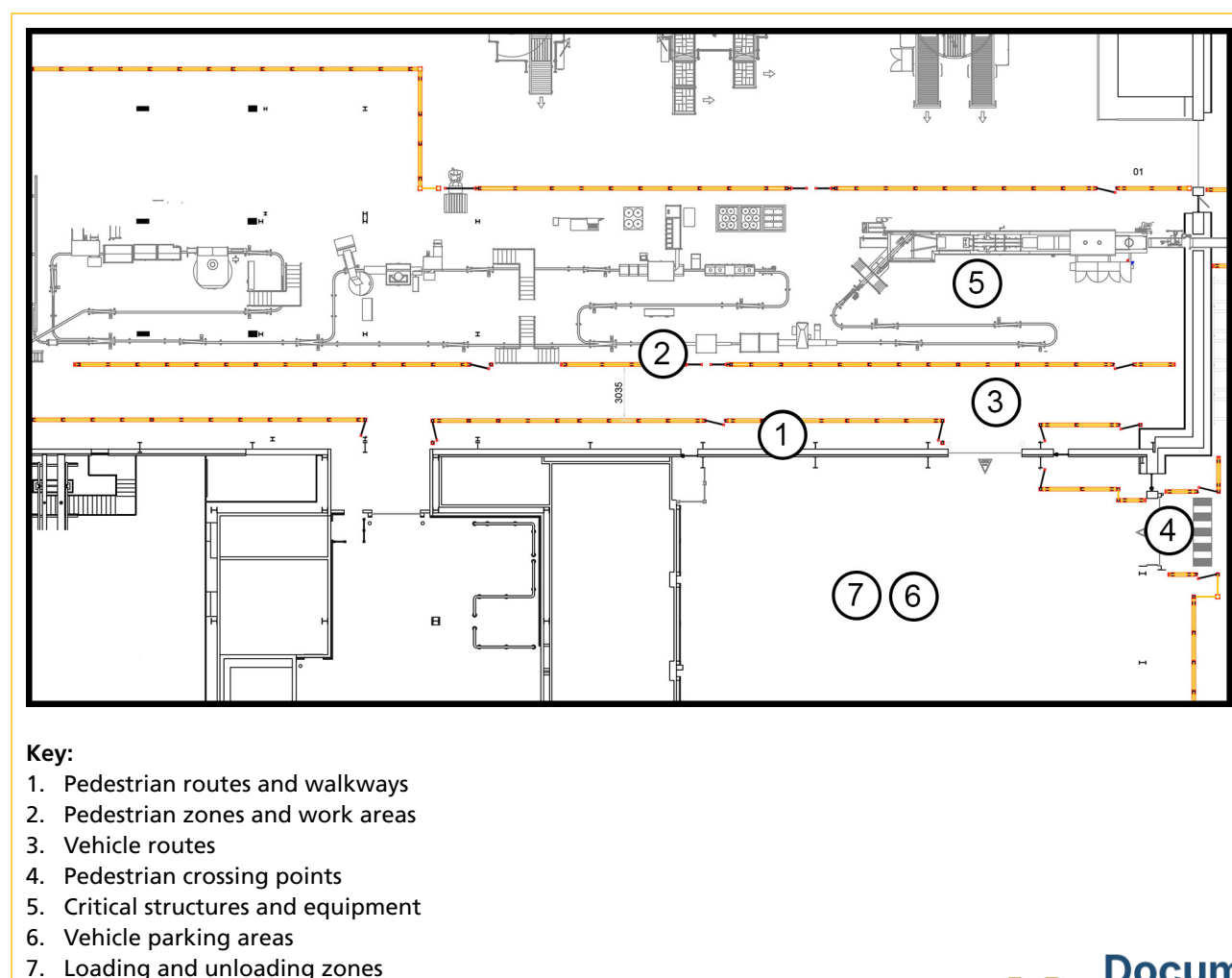
4.2 Assessing risks using a work area plan

A floor plan of the workplace should be drafted to include the following:

- a) pedestrian routes and walkways;
- b) pedestrian zones and work areas;
- c) vehicle routes;
- d) pedestrian crossing points;
- e) critical structures and equipment;
- f) vehicle parking areas; and
- g) loading and unloading zones.

NOTE An example is given in Figure 1.

Figure 1 – Example floor plan of a workplace



NOTE The floor plan allows evaluation of each element for risks, and to assess:

- a) the severity of the risks;
- b) whether existing control measures are effective;
- c) the action to take to control the risks; and
- d) the urgency required to control the risks.

4.3 Control measures

Control measures should be ranked and implemented using the following hierarchical list:

- a) eliminate the hazard;
NOTE It is most efficient to eliminate hazards when a workplace is first planned out.
- b) substitute with something safer;
NOTE For example automated equipment.
- c) isolate the hazard from pedestrians;
NOTE For example segregate vehicles and pedestrians.
- d) improve the workplace design and layout around vehicles and critical structures;
- e) use engineering controls such as speed limiters on vehicles;
- f) install administrative controls;
NOTE For example, signs and marked areas.
- g) use personal protective equipment (PPE);
NOTE For example, high-visibility clothing.
- h) information/instruction/training for both pedestrians and plant operators.

4.4 Reviewing control measures

Controls should be continually reviewed to determine whether:

- a) the control measures are effective;
- b) there have been any changes to the environment;
- c) the controls have created any new problems;
- d) the procedures are being followed correctly;
- e) there have been improvements to health and safety; and
NOTE For example, accidents and near misses have been reduced.
- f) there are lessons to be learnt from accident, incident and near miss reports and have these been applied.

4.5 Pedestrian routes, walkways and work area zones

4.5.1 Assessing and evaluating

The current pedestrian traffic routes and walkways should be assessed and evaluated as follows:

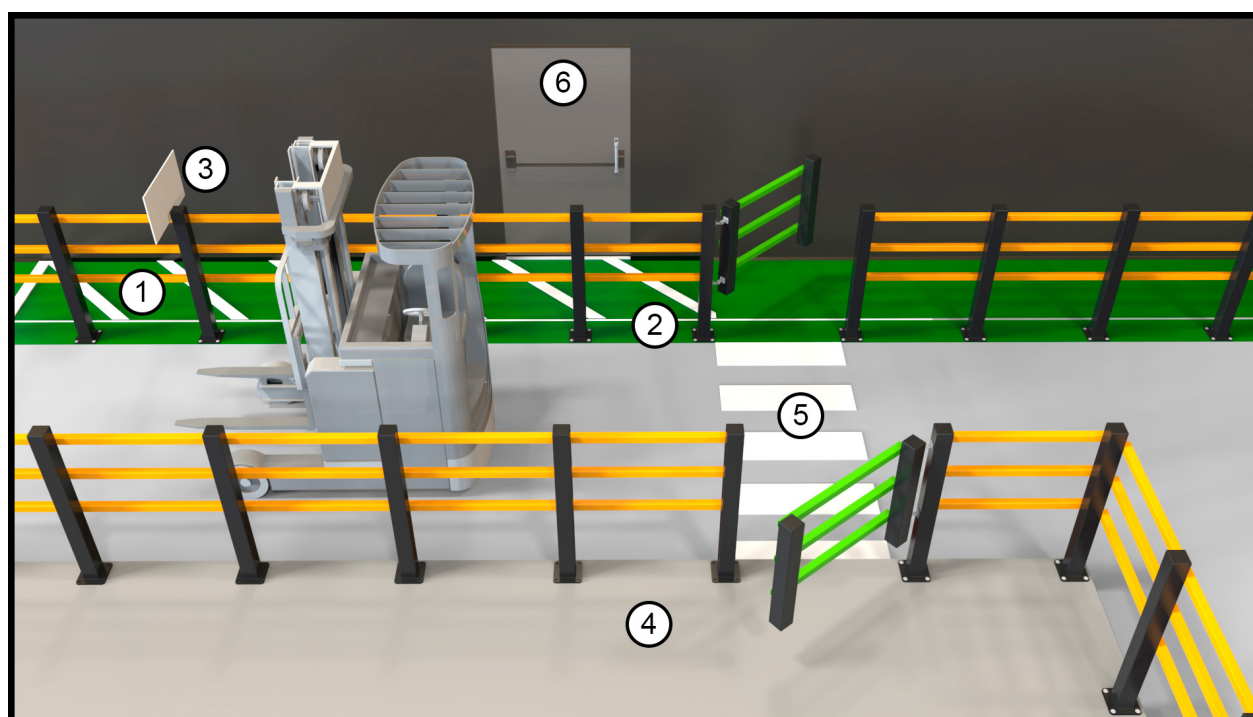
- a) Do the pedestrian routes correspond to the desire lines?
- b) Can the pedestrian routes be placed where no vehicle traffic occurs?
- c) Are walkways wide enough for pedestrian and wheelchair accessibility?
NOTE 1 See 5.9 and Table A.1 when assessing the minimum width of a pedestrian walkway that is leading to an emergency exit.
NOTE 2 Walkway widths may be subject to regional variations in building regulations.

4.5.2 Control measures for pedestrian routes, walkways and work area zones

4.5.2.1 Where vehicles and pedestrians cannot be segregated, pedestrian routes should have the following control measures, as shown in Figure 2:

- a) a walkway or pedestrian zone of a minimum width of 600 mm;
- b) wheelchair access of a minimum width of 1 200 mm;
- c) when a safety barrier is used, the maximum deflection of the barrier is added to the width of the pedestrian zone;
- d) pedestrian areas entirely free from vehicles;
- e) workplaces designed so there is no need for a vehicle to enter a pedestrian zone;
- f) clear markings and signs used to set vehicle and pedestrian areas apart;
- g) raised kerbs used to better define the traffic and pedestrian routes;
- h) coloured walkways used to better define pedestrian routes;
- i) an opportunity is provided to allow for the adjustment of vision when moving from one extreme of lighting to another, e.g. from outside to inside a building.

Figure 2 – Control measures for pedestrian routes, walkways and work area zones



Key:

1. Pedestrian walkway zone coloured green
2. Deflection zone added to the pedestrian zone marked with a white line
3. Signage to mark and identify separate pedestrian and traffic routes
4. Raised kerb to define traffic and pedestrian routes
5. Marked crossing point with a green pull gate and offset doorway
6. Entrance doorway

4.5.2.2 A safety barrier that conforms to the recommendations in this PAS (see **Clause 5**) should be used to segregate pedestrians and vehicles in the following circumstances:

- a) when motorized vehicles are in operation;
- b) when there is no raised kerb; or
- c) when the vehicle route is closer than 1 m to the pedestrian zone or walkway.

NOTE 1 *Markings such as white lines may be used for segregation in the following circumstances:*

- a) *when manual and non-motorized vehicles are in operation;*
- b) *when raised kerbs and vehicles routes are over 1 m away from the pedestrian zone or walkway.*

NOTE 2 *The 1 m area next to the pedestrian zone is called a pedestrian buffer zone.*

4.5.2.3 Pedestrian barriers should be used at entrance points to prevent pedestrians walking in front of vehicles.

4.5.2.4 Doorway entrances should never open up to a pedestrian crossing point.

NOTE 1 *This stops pedestrians walking straight into a vehicle route without thinking and looking.*

NOTE 2 *Green gates or markings help define exit points from pedestrian zones.*

4.5.2.5 Gates should open towards the pedestrian to create a pause in pedestrian movement before leaving the pedestrian zone.

4.5.2.6 Pedestrian routes should be planned to correspond to the natural desire lines across the site.

NOTE 1 *This encourages pedestrians to stay on the designated safe routes and avoid potentially hazardous shortcuts.*

NOTE 2 *Emergency exits may be designed to be directly opposite a pedestrian crossing point to enable a fast exit.*

4.5.2.7 When desire lines cannot be used, a safety barrier should be used to stop pedestrians taking shortcuts and ensuring they stick to the walkway.

NOTE *Strategically-placed mirrors can help pedestrians and vehicles see each other. Audible and/or visible warning devices, activated by movement, can help alert vehicle operators and pedestrians to each other's presence.*

4.6 Vehicle routes

4.6.1 Assessing and evaluating

Assessment and evaluation of vehicle routes should be carried out by:

- a) defining the pedestrian zones that are nearest to the traffic route; and
- b) reviewing the suitability of the traffic route.

4.6.2 Control measures for vehicle routes

Vehicle traffic routes should be, if possible:

- a) free from pedestrians;
- b) defined by safety barriers which are placed in position to guide vehicles;
- c) a one-way system designed/organized to minimize the need for reversing and with adequate passing space around stationary vehicles;
- d) wide enough for the largest vehicle that uses them;
- e) free from sharp or blind bends, as reasonably practicable;
- f) constructed from material able to safely bear loads that pass over them;
- g) free from steep slopes;

NOTE *If steep slopes cannot be avoided, the slopes are to be signposted.*
- h) well-maintained and free from obstructions; and
- i) marked with correct health and safety signage.

NOTE *Figure 3 shows an example of such traffic routes.*