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AVAILABLE  
SPECIFICATION

**IEC**  
**PAS 62267**

Pre-Standard

First edition  
2005-12

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**Railway applications –**

**Automated Urban Guided Transport (AUGT)  
safety requirements**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**RAILWAY APPLICATIONS –  
AUTOMATED URBAN GUIDED TRANSPORT (AUGT)  
SAFETY REQUIREMENTS**

FOREWORD

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A PAS is a technical specification not fulfilling the requirements for a standard but made available to the public.

IEC-PAS 62267 has been processed by IEC technical committee 9, Electrical equipment and systems for railways. It defines the essential safety requirements for an Automated Urban Guided Transit system (AUGT).

The text of this PAS is based on the following document:

This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document

Draft PAS	Report on voting
9/868/PAS	9/898/RVD

Following publication of this PAS, which is a pre-standard publication, the technical committee or subcommittee concerned will transform it into an International Standard.

This PAS shall remain valid for an initial maximum period of three years starting from 2005-12. The validity may be extended for a single three-year period, following which it shall be revised to become another type of normative document or shall be withdrawn.

## INTRODUCTION

This Publicly Available Specification is a generic guideline providing recommendations which can help transport authorities and authorities having jurisdiction to define appropriate and safe Automated Urban Guided Transport (AUGT) requirements for their specific application, taking into account that the requirements are determined by their own specific risk analysis, as is required in the life-cycle RAMS process according to IEC 62278 with respect to the different risk acceptance principles in the world.

The recommendation of this PAS for the definition of global and generic safety requirements is based on the experience coming from proven solutions throughout the world.

Due to the diversity of possible technical solutions that may be adopted in different circumstances, the requirements defined by this PAS should be considered as minimum requirements. Each technical solution chosen or aspects of a particular topographic, environmental, social or legal consideration may generate their own additional safety requirements. It is expected that hazard analysis is carried out to establish any such additional requirements.

Therefore, the PAS does not prescribe specific equipment or means necessary to mitigate the various hazards. Rather, it prescribes a list of foreseeable hazards to be followed, as a minimum, in the mandatory and comprehensive safety analysis of each project with respect to the driver and staff functions replaced by automated equipment. Additionally, it describes possible and proven solutions that may be considered in the comprehensive safety analysis of each project.

However, the PAS does not take into account all different hazards that may arise from the large number of different applications used in the world. Also, this PAS cannot describe completely all the safety measures needed for each specific application.

Moreover, the PAS does not necessarily require choosing a safety measure for each possible hazard where the associated risk is already considered tolerable. As stated in IEC 62278, it is the responsibility of the transport authority in agreement with the authority having jurisdiction and with respect to their specific risk acceptance principles and legal requirements, to decide on the tolerability of each hazard and on the implementation of a specific safety measure.

It has to be taken into account that the PAS is basically a specification related to railway applications. To avoid contradictions with all other standards, even non-IEC standards, which are relevant in the field of railway applications including civil engineering, no values or considerations which obstruct existing standards in their field of application are given. Specific values or considerations are only used if they are exclusively used for AUGT purposes. If values are used, then their derivation and its basis are provided in the informative annexes.

NOTE WG 39 of TC 9 wishes to publish the state of its document reflecting the situation at June 2005. Attention is drawn to the fact that this document is incomplete. Consequently, the recommendations described in the present PAS are subject to changes by WG 39.

## RAILWAY APPLICATIONS – AUTOMATED URBAN GUIDED TRANSPORT (AUGT) SAFETY REQUIREMENTS

### 1 Scope

This Publicly Available Specification covers general high-level safety requirements for all types of automated urban guided transit systems with independent self-propelled trains operating on an exclusive guideway.

This PAS deals with safety requirements needed to compensate for the absence of the driver or attendant staff who are typically responsible for the activities mentioned in Table 1. Table 1 describes the relationship between the grade of automation and basic system functions.

The requirements are restricted to the transit system as defined in Clause 5 and to Driverless Train Operation (DTO) and Unattended Train Operation (UTO) modes of operation as defined in 3.2 (see the shaded areas in Table 1).

**Table 1 – Grades of automation**

Basic functions of train operation		On-sight train operation	Non-automated train operation	Semi-automated train operation	Driverless train operation	Unattended train operation
		TOS	NTO	STO	DTO	UTO
		GOA0	GOA1	GOA2	GOA3	GOA4
Ensuring safe movement of trains	Ensure safe route	x (points command/control in system)	S	S	S	S
	Ensure safe separation of trains	x	S	S	S	S
	Ensure safe speed	x	x (partly supervised by system)	S	S	S
Driving	Control acceleration and braking	x	x	S	S	S
Supervising guideway	Prevent collision with obstacles	x	x	x	S	S
	Prevent collision with persons on tracks	x	x	x	S	S
Supervising passenger transfer	Control passengers doors	x	x	x	x	S
	Prevent person injuries between cars or between platform and train	x	x	x	x	S
	Ensure safe starting conditions	x	x	x	x	S

Basic functions of train operation		On-sight train operation	Non-automated train operation	Semi-automated train operation	Driverless train operation	Unattended train operation
		TOS	NTO	STO	DTO	UTO
		GOA0	GOA1	GOA2	GOA3	GOA4
Operating a train	Set in/set off operation	x	x	x	x	S
	Supervise the status of the train	x	x	x	x	S
Ensuring detection and management of emergency situations	Perform train diagnostic, detect fire/smoke and detect derailment, handle emergency situations (call/evacuation, supervision)	x	x	x	x	S and/or staff in OCC
NOTE x = the responsibility of operations staff (may be realised by technical system); S = shall be realized by technical system.						

This PAS does not specifically look at security issues. However, aspects of safety requirements may apply to assuring security within the transit system.

NOTE The definitions of “security” and “safety” are given in IEC 62278.

The application of this PAS is subsidiary to the responsibility of the transport authority in accordance with its respective supervisory body and specific laws and decrees applicable to the transport system location.

The application of this PAS must take account of

- social risk acceptance in different cultures or different national legal regulations (for example, SHOREI, BOStrab) or principles (for example, GAME, ALARP, MEM);
- laws and decrees in different states;
- special or different requirements coming from the authority having jurisdiction or from an independent assessor in charge of the specific project;
- the responsibility for “safe operation” by the transport authority.

This PAS does not apply to the following types of transportation systems, unless specifically required by the system owner.

- Automated People Movers (APM) operating entirely inside a privileged environment such as an airport, a commercial centre, a leisure resort;
- amusement rides and roller-coasters, generally featuring a single station so that passengers board and alight the system at the same location;
- Intercity and mainline train services, generally operating in a rural environment on part of their routes;
- cable-driven systems;
- systems featuring electronically guided vehicles (with optical sensors, or magnetic sensors, or similar devices/systems).

The PAS is not concerned with risk arising during work for construction, installation, modification and dismantling of the system.

This PAS is not concerned with pre-existing DTO or UTO systems (for definitions, see 3.2) that were designed before this PAS took effect.

In the case of upgrading an existing transit system to a DTO or UTO system, the risks associated with the existing system are outside the scope of this PAS. However, the risk assessment process described herein may be relevant, and its application is at the discretion of the safety authority having jurisdiction.

In the case of extending or modifying an existing DTO or UTO system in operation, this PAS applies only if the change is significant as determined by the safety authority having jurisdiction; but the risks due to the relationship with the unchanged parts of existing systems (rolling stock, traction power supply, signalling, platforms) shall be taken into account.

## 2 Normative references

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

IEC 62278, *Railway applications – Specification and demonstration of reliability, availability, maintainability and safety (RAMS)*

## 3 Terms, definitions and abbreviations

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

### 3.1 Transportation systems

#### 3.1.1 Automated Urban Guided Transport (AUGT)

metropolitan scale urban system featuring DTO or UTO, as defined below, with self-propelled vehicles mechanically guided on a guideway, which is separated from general road and pedestrian traffic, operating in an urban environment, and open to the general public without restrictions:

- a) systems accepting exclusively automated trains are called “closed systems”;
- b) systems accepting a mixed traffic of automated trains and conventional trains (i.e., manually operated or semi-automated) are called “open systems”

#### 3.1.2 Automated People Movers (APM)

See ASCE (American Society of Civil Engineers) standard 21: Automated People Movers – Part 1.

### 3.2 Grades of automations

#### 3.2.1 On-sight Train Operation (TOS)

operation in which the driver (i.e. the train operator) has full responsibility and no technical system is required to supervise his activities

#### 3.2.2 Non-automated Train Operation (NTO)

operation in which the driver (i.e., the train operator) is in the front cabin of the train observing the guideway and stopping the train in case of a hazardous situation. Acceleration and braking are controlled by the driver in conformance with wayside signals or cab-signalling. The

signalling system and any associated wayside system supervise the activities of the driver; however, with respect to the signals and the speed, this supervision may be discrete, semi-continuous or continuous. Safe departure of the train from the station, including door closing, is the responsibility of the operations staff whether onboard the train or on the station platform

### **3.2.3 Semi-automated Train Operation (STO)**

operation in which the driver is in the front cabin of the train observing the guideway and stopping the train in case of a hazardous situation. Acceleration and braking is automated and the speed is supervised continuously by the system. Safe departure of the train from the station is the responsibility of the operations staff, whether on board the train or on the station platform

### **3.2.4 Driverless Train Operation (DTO)**

operation in which additional control and detection systems are needed compared with STO because there is no driver in the front cabin of the train to observe the guideway and stop the train in case of a hazardous situation.

An operations staff person is necessary onboard. Safe departure of the train from the station, including door closing (open point), can be the responsibility of the operations staff or may be done automatically

### **3.2.5 Unattended Train Operation (UTO)**

operation in which additional control and detection systems are needed compared to DTO because there is no on-board operations staff person necessary.

Safe departure of the train from the station, including door closing, is done automatically

### **3.2.6 Automated transit system**

DTO or UTO mode

### **3.2.7 Conventional transit system**

TOS, NTO or STO mode

## **3.3 Vehicles**

### **3.3.1 independent train**

train which is constructed (designed) for independent train operation

### **3.3.2 dependent train**

train which is designed for operation with other traffic

### **3.3.3 passenger cabin**

part of a train which is used for the transport of passengers

### **3.3.4 passenger transfer door**

train door which provides the passenger transfer between the passenger cabin and the platform in the stations. It could also be used as an emergency exit in cases of hazardous situations, when the status of the passenger cabin changes into an unsafe status

### **3.4 Guideway**

#### **3.4.1 independent guideway**

guideway which is independent from other traffic on account of its location or its form of construction. Level crossings (as defined in 5.3) may be part of an independent guideway

#### **3.4.2 dynamic envelope**

space around the track which is required as safe room for the train during motion

#### **3.4.3 safety space of guideway**

space beside the track, which persons can occupy without danger of being struck by passing trains

### **3.5 Station**

#### **3.5.1 platform**

area of station which is built for passenger transfer between train and station

#### **3.5.2 waiting area**

area of platform, which is safely separated from the dynamic envelope of moving trains and where persons should wait for approaching trains

#### **3.5.3 passenger transfer area**

area of platform, directly adjacent to the dynamic envelope which is intended for the for the passage of passengers during transfer between waiting area and train; the area in which boarding and alighting occurs

#### **3.5.4 platform track**

To be defined

### **3.6 Technical systems**

#### **3.6.1 Automated Train Control (ATC) system**

system for automatically controlling train movement, enforcing train safety, and directing train operation. ATC includes automatic train protection and may include automatic train operation and/or automatic train supervision

#### **3.6.2 Automated Train Protection (ATP) system**

safety-related subsystem within the automatic train control system that maintains safe route, protection against collisions and excessive speed and other hazardous situations

#### **3.6.3 Automated Train Operation (ATO) system**

subsystem within the automatic train control system which performs any or all of the functions of speed regulation, programmed stopping, door control, performance-level regulation or other functions otherwise assigned to the train operator

### 3.6.4 Automated Train Supervision (ATS) system

subsystem within the automatic train control system that monitors trains, adjusts the performance of individual trains to maintain schedules, and provides data to adjust service to minimize inconvenience otherwise caused by irregularities

## 4 Methodology

The methodology used for deriving the safety requirements given in this PAS is based on the principles of the first steps described in the life-cycle phase of IEC 62278 (Figure 1).

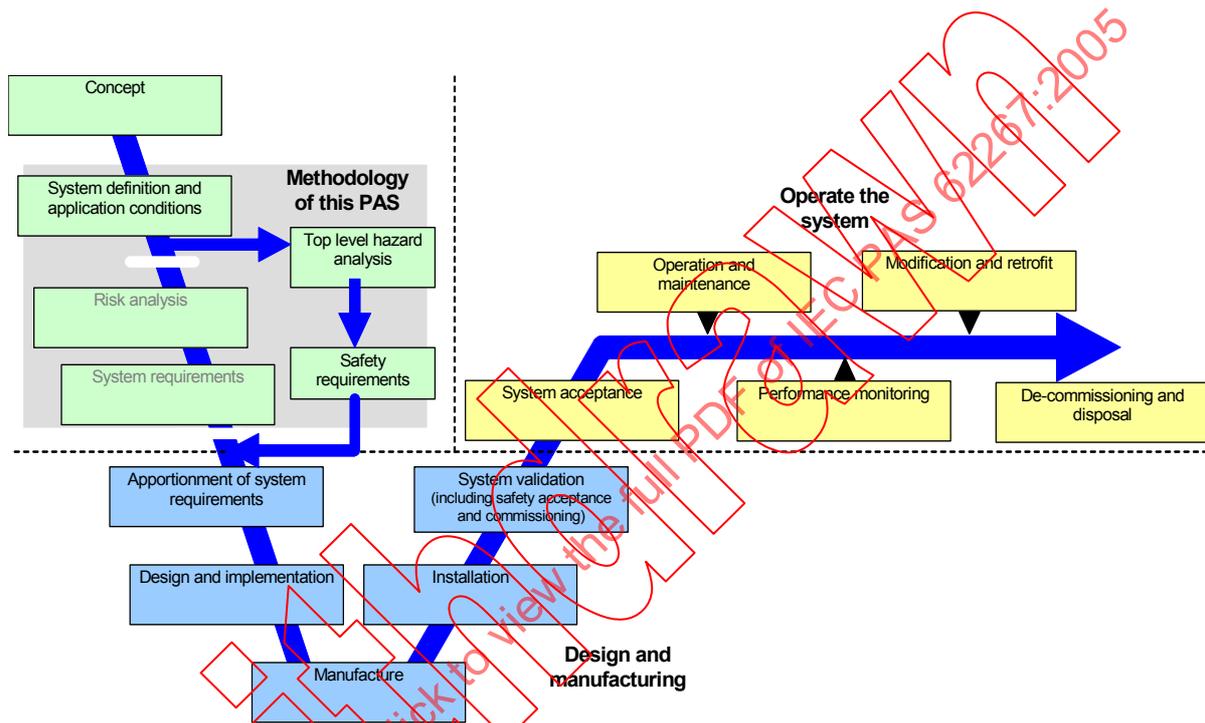


Figure 1 – Description of the life-cycle phase

### 4.1 System definition and application conditions

The elements, the transit system, the boundaries and the application conditions of the system are defined in Clause 5. The basic functions of train operation, no matter what grade of automation applies, and the functions to be covered by a system for DTO and UTO are defined in Table 1.

### 4.2 Top-level hazard analysis

- a) Identification of hazardous situations taking into account all safety-related functions to be covered by the system if there is
  - no train driver in the front train cabin (DTO);
  - no operational staff necessarily onboard trains (UTO)
- b) Identification of safeguards which are able to compensate for the absence of train driver with corrective actions and measures.

### 4.3 Safety requirements

The safety requirements for each safeguard are described in Clause 7.

NOTE This PAS does not state the choice of corrective action or the acceptable level of residual risk. This should be done for the specific application under the responsibility of the authority having jurisdiction, in a way which

- a) allocates the hazards of the specific application and required risk reduction with respect to the specific safety culture and accepted residual risk;
- b) defines the quality of safeguards by describing safety-related requirements and functions embedded in the overall functionality of the specific system;
- c) assigns Safety Integrity Levels (SIL) to the defined safeguards and their functions.

## 5 System description

AUGT is a system which

- transports passengers from one station to another;
- uses automated self-propelled trains;
- runs on an exclusive guideway;
- allows train operation independent from other traffic;
- provides conditions of safe train movement.

Based on this basic system description, the following subsystems can be defined.

### 5.1 Station

Locality which allows passenger access to the system by transfer from the public environment to the trains (i.e., boarding and alighting activity).

The subsystem station is divided into a number of areas as shown in Figure 2 and defined below.

- The waiting area (which is defined as safe under the circumstances of escape in the case of the emergency purposes of this PAS) is by definition outside the transport system and therefore it is not covered within the scope of this PAS.
- The passenger transfer area (platform edge zone) which must ensure a safe passenger transfer between station and train.
- The platform track which is used by moving trains to ensure transport.

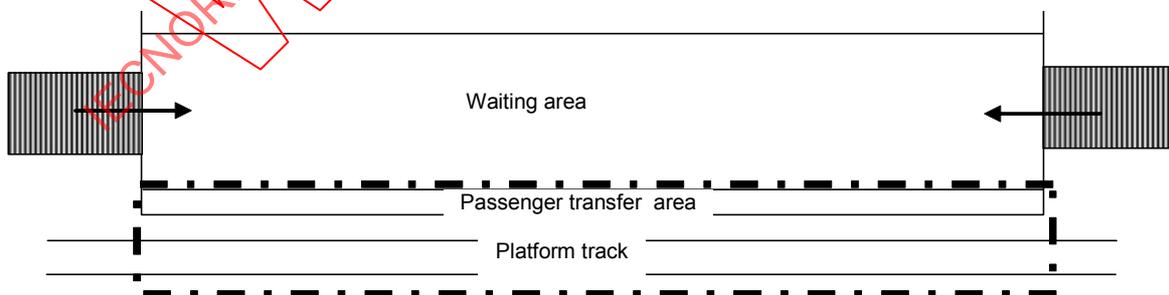


Figure 2 – Areas of subsystem station

### 5.2 Train

The system element which operates within the guideway and, under regular conditions, moves along the guideway and stops in the stations for passenger transfer.

The train can be a

- single vehicle;
- composition of single vehicles, forming a unit, which can not be decoupled in regular operation;
- composition of single vehicles or of multi-vehicle units which can be decoupled in regular operation.

The subsystem train is divided into

- the passenger cabin (compartment) which is defined as a safe area if
  - a safe train movement is provided;
  - adequate safeguard is provided against external events impacting on the train, for example, an obstacle on the guideway, on the platform, etc., adequate safeguard against internal hazardous events impacting on passengers, for example, fire;
- the staff (drivers) cabin when included;
- passenger/transfer doors;
- other train doors or additional emergency exits if provided.

The train itself with its drive, bogies, passenger cabin is defined as safe if the general requirements for mechanical and electrical train construction are fulfilled and safe guiding of wheels is provided. This is not within the scope of this PAS.

The train subassemblies comprising the propulsion/braking system, bogies and guidance equipment, signalling system, mechanical and electrical aspects of the passenger compartment, communications systems, and other such elements of the train subsystem are not part of the scope of this PAS. However, functional design requirements for the train subassemblies may be dictated or influenced by the safety requirements contained in this PAS.

### 5.3 Guideway between stations

The subsystem guideway (see Figure 3) is divided into

- the construction (bridge, tunnel verge, track), which is defined as safe if the requirements for safe buildings (static system) and safe guiding of wheels are fulfilled, which is not within the scope of this PAS and defined as outside the system;
- the clearance of guideway which means the space above the track which is required as safe space for the train during motion;
- the safety space of the guideway including emergency exits, if the construction of the guideway is laid out for specific rescue reasons, and which is not within the scope of this PAS and is defined as being outside the system.

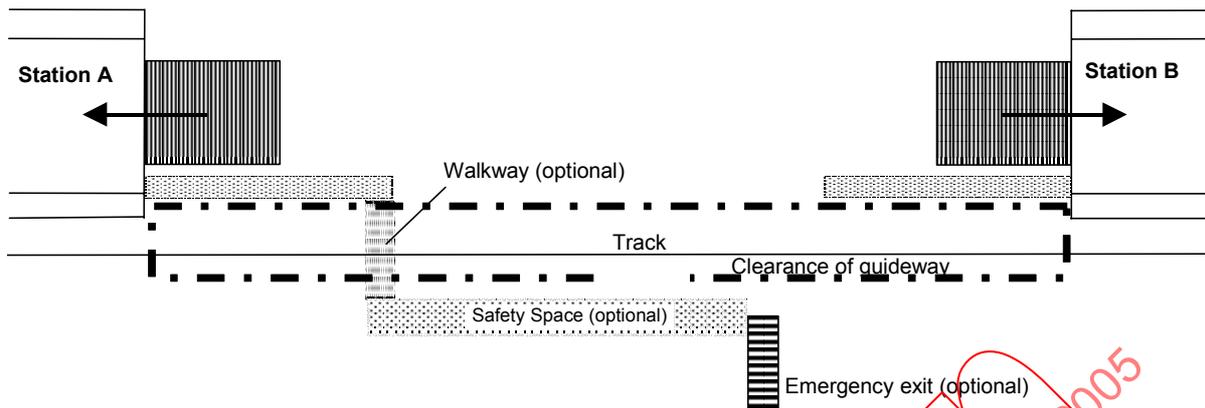


Figure 3 – Guideway

A special type of guideway is a level crossing, which can be used alternately by moving trains or other non-automated traffic which crosses the guideway at a prescribed location (level crossing) and with complete traffic crossing control and supervision.

Level crossings are within the scope of this PAS (see Figure 4).

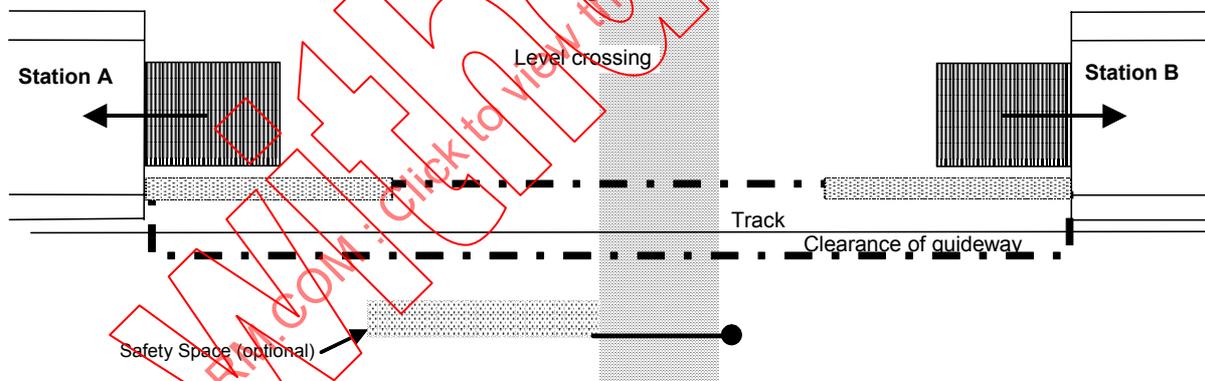
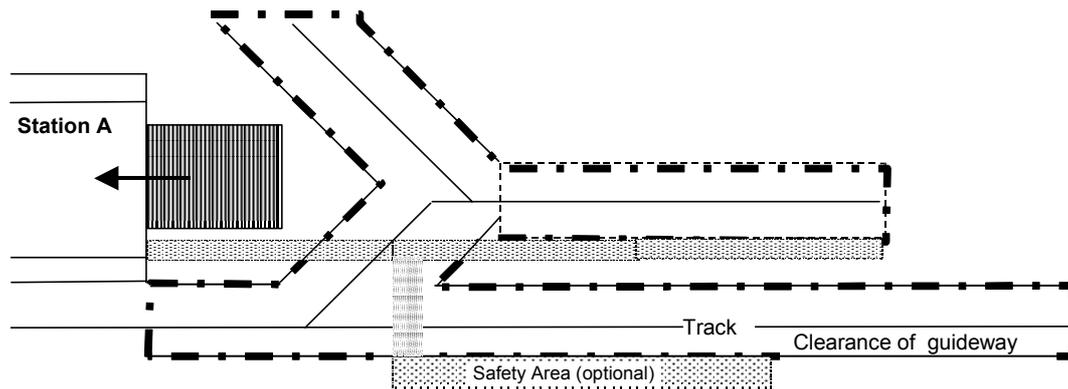


Figure 4 – Guideway with level crossing

A special type of fully automated guideway (Figure 5) is a storage area, which can be used

- for storing trains, which are not in use for passenger service; or
- for receiving trains out of passenger service and dispatching trains into passenger service.



**Figure 5 – Guideway and storage area**

#### 5.4 Safe train movement

The following basic functions which ensure safe train movement and are typical to STO train control systems consisting of the following are outside the scope of this PAS.

- Setting routes and ensuring safety of routes.
- Transmitting movement instructions to train.
- Supervising technically the movement of trains and controlling deviations from the safe state.

#### 5.5 Limits of the system

The following items are included in the system:

- train as defined in 5.2;
- service vehicles;
- platform edge interface;
- right of way:
  - clearance of guideway (automated section):
    - passenger service track;
    - siding track;
    - depot track;
  - emergency walkway and safety areas;
  - level crossing;
- equipment rooms;
- control centre;
- traction power along the guideway.

In particular, the following subsets are excluded:

- stations (except for transfer area on the edge of the station platform) and the associated lifts, escalators;
- tunnels, bridges, structures;
- areas where trains cannot be operated automatically (for example, the workshop);
- power distribution system.

## **6 Hazard analysis**

Hazards covered by this PAS are those associated with the items of 6.5.

### **6.1 General**

All terms and abbreviations used in the risk analysis are defined in IEC 62278.

### **6.2 Type of persons exposed to hazards**

#### **6.2.1 Passengers**

People using the system.

Passengers may have different levels of awareness, mobility and capacity to react to hazardous situations.

#### **6.2.2 Staff**

Persons who are involved in the train operation process as employees of transport authority or employees of other involved entities.

Note that there are different types of staff:

- operational staff;
- maintenance staff;
- rescue staff;
- external staff (maintenance and cleaning).

#### **6.2.3 Public**

Persons who are outside the system and may be affected by the hazardous situations of the system.

### **6.3 Material to be protected**

#### **6.3.1 Train**

#### **6.3.2 Buildings**

#### **6.3.3 Belongings of passengers**

#### **6.3.4 Animals**

The risk should be addressed.

### **6.4 Interaction with systems which are defined as safe and are outwith the scope of this PAS**

As a basis of hazard analysis, first of all, those hazards shall be identified by comparison with NTO and STO, which exist due to the fact that

- in DTO, there is no driver in the front cabin of the train;
- in UTO, there is no operational staff necessarily present in the train.

Secondly, it shall be verified additionally which consequences are given under the circumstances of DTO and MTO for systems which are defined as safe before (for example, safe guiding of the train, safe bridges, safe routes).

The basic requirement is that a transport system for DTO and UTO shall at least be operated with the same safety level as any conventional system. (The safety quality is the result of the realization of technical and functional requirements and operational rules.)

### **6.5 Identification of hazardous situations**

The list in Annex A identifies only top-level hazards due to the absence of a driver or on-board staff in accordance with the basic functions defined in Table 1 which require technical solutions.

### **6.6 Corrective actions**

A list of possible corrective actions is given in Table B.1.

## **7 Safety requirements and corrective actions**

Safety requirements given in this PAS are supplementary to the safety requirements for a conventional transit system.

A hazard analysis for the specific application shall be performed. Table 2 gives a minimum set of top-level hazards to be considered for DTO and UTO aspects.

Subsequent subclauses describe some of the possible corrective actions against the given hazards.

The choice of the corrective actions shall be based on the risk tolerability criteria for the specific application.

There are four kinds of safeguards used to mitigate hazardous conditions.

- a) Prevention of accident through the application of equipment and facilities designed to avoid hazardous situations (for example, platform screen).
- b) Detection of hazardous situations and avoiding an accident.
- c) Provision of warning information for passengers or other persons (for example, warning means, announcements such as "mind the gap").
- d) Performance of operational procedures (rules).

**Table 2 – Minimum set of top-level hazards (under consideration)**

Basic function to be replaced drivers responsibility by system	Hazardous situation	Possible corrective action	Description*
Supervising guideway to prevent collisions with persons on track	Person in station at platform edge	Full platform doors	1
		Half-height platform doors	2
		Platform fences	3
		Warning line	4
		Detection devices	5
		Staff surveillance	6
		Emergency stop switch (possibly including traction power off)	7
		Public address system	8
		Rules	9
	Person in station in platform track	Rules	10
		Warning/line	11
		Staff surveillance	12
		Emergency stop switch (possibly including traction power off)	13
		Detection devices	14
		Half-height platform doors	15
		Full platform doors	16
		Platform fences	17
		Public emergency call system	18
	Person leaving platform area (towards track between station) at the platform end	Platform end door detection	19
		Full-height platform end door	20
		Rules	21
		Platform end warning line	22
		Staff supervision	23
		Emergency stop switch (possibly including traction power off)	24
		Detection devices	25
		Half-height platform end doors	26
		Platform end walls	27
		Platform end fences	28
		Public emergency call system	29
		Public address system	30
	Person leaving platform area (towards track between stations) from the platform track	Platform track intrusion detection	31
		Half-height platform doors	32
		Full platform doors	33

Basic function to be replaced drivers responsibility by system	Hazardous situation	Possible corrective action	Description*
		Rules	34
		Warning line	35
		Staff surveillance	36
		Emergency stop switch (possibly including traction power off)	37
		Detection device	38
		Platform fence	39
		Public emergency call system	40
		Public address system	41
	Train approaching staff already being in track-bound safety area between stations	Training and education for staff	42
		Avoiding automated train operation during works	43
		Staff communication equipment	44
	Train approaching unauthorized person already being on track between stations	Segregated guideway	45
		Laws and regulations	46
		Avoiding undetected entering from train	47
		Avoiding undetected entering from neighbouring stations	48
	Train approaching passengers to track in evacuation situation	Rules	49
		Staff communication equipment	50
		Train stopping device by OCC Switch-off of power supply if necessary (Safe door alarm handling)	51
		Safe walkway	52
Supervising passengers transfer and control passenger doors	Entrapment and drag	Safety devices on passenger transfer doors	53
		Public address system Public emergency call system Doors closing announcement Audio and visual warning	54
		Emergency stop on board	55
		Emergency stop switch (possibly including traction power off) on platform	56
		Rules	57
		Staff surveillance	58

Basic function to be replaced drivers responsibility by system	Hazardous situation	Possible corrective action	Description*
Supervising passengers transfer to prevent persons injuries between cars or between platform and train	Fall of passenger from the platform between cars of train	Barrier between cars of train	59
		Barrier on the platform edge in the alignment of the gap	60
		Wayside detection device	61
		Half-height platform doors	62
		Full platform doors	63
		Platform fence	64
		On-board detection device between cars of train	65
		Staff surveillance	66
		Marks of train doors areas on the platform	67
		Refuge under the platform	68
	Fall of passenger between cars and platform edge	Design rules: maximum gap	69
		Gap filler on board	70
		Gap filler on the platform	71
		Detection system on board	72
		Detection system on the platform	73
		Staff surveillance	74
		Refuge area under the platform	75
		Emergency stop on board	76
		Emergency stop switch (possibly including traction power off) on platform	77
		Public communication equipment Doors closing announcement Audio and visual warning	78
Supervising guideway to prevent collision with obstacles	Obstacles on guideway	Obstacle detection device on board	79
		Rules (inspection train with staff monitoring)	80
		Segregated guideway	81
		Intrusion detection device on guideway	82
		Emergency stop device on board	83
Ensuring detection and management of emergency situations	Fire/smoke in train	Fire smoke detection on board	84
		Emergency call device	85
		Emergency stop device on board	86
		Fire smoke detection on way side	87
		Evacuation rescue plan	88

Basic function to be replaced drivers responsibility by system	Hazardous situation	Possible corrective action	Description*
		Automatic fire extinguisher on board	89
		Automatic fire extinguisher on the platform	90
		Ventilation system on board	91
		Ventilation system in the tunnel	92
	Derailed train	Derailment detection system	93
		Emergency stop device on board	94
		Public emergency call device	95
		Rules (evacuation rescue plan)	96
	External event (flash flooding, flooding, earthquake, etc.)	Specific design	97
		Rules (evacuation rescue plan)	98
		Laws, regulations and procedures	99
		Training and education for staff	100
		Specific detection devices (water, wind, snow, frost, earthquake)	101
		Monitoring by OCC	102
		Public emergency call device	103
	System failure	Automatic train testing and diagnostic	104
		Manual rescue	105
	Security incident	Supervising passengers behaviour	106
		Emergency call response management	107
		Emergency rescue plan	108
	Self evacuation	Emergency call response management	109
		Detection of the doors opening	110
		Rules	111
Supervising passengers transfer to ensure safe starting conditions			112
Operating the train/set in set off operation			113
Operation the train/supervising the status of the train			114

\* Temporary numbering of description

A corrective action may introduce new hazards. Those new hazards shall also be considered in the hazard analysis.

## 7.1 General requirements

Generally, any message and reaction from an automatically acting protection device from the functions described below shall remain till it is deliberately reset by an authorized person following confirmation that the reason for the danger does not exist any longer (to be considered).

## 7.2 Safety of passengers on platform

One of the basic functions related to the platform is to prevent a train from striking a person on the track. In a non-DTO/UTO system the basic functions will be fulfilled by the train driver within the limits of his ability to react.

Therefore, for DTO/UTO systems, there should be special features in the stations which ensure that persons are not endangered by moving trains. This objective is considered to be fulfilled when there are either

- a) enclosed platforms having platform edge screens with integral platform doors, as described in 7.2.1; or
- b) open platforms with detection systems which respond automatically when a person is detected in a hazardous location as described in 7.2.2; or
- c) open platforms minimum requirements, including equipment to warn the passengers of the hazards at the platform edge and to provide the means for passengers or staff to stop trains as described in 7.2.3.

In addition to these features, communication equipment should be provided on the station platform, as described in 7.2.4.

Measures to ensure the safety of persons entering the guideway between stations from the platform track or end of the platform are described in 7.6.

### 7.2.1 Enclosed platforms

A platform is considered enclosed when screens along the platform edge with doors installed integrally to their construction (platform doors) are provided to form a continuous barrier wall and provide an enclosed safe area on the platform.

An enclosed platform avoids the hazardous situation of a passenger or an object entering the guideway (platform track) from the platform and shall provide safe passage between the platform and a train, only when a train is stopped in the station and both the train doors and platform doors are open.

#### 7.2.1.1 Full-height platform screen

Full-height platform screens shall form a barrier wall the height of which is equal to, or greater than, that of the train doors. The platform doors shall be installed at the platform edge on the guideway side (trackside) of the screen and shall have a clear opening height equal to, or greater than, that of the train doors.

Requirements for full-height platform screens and full-height platform doors are as follows.

- a) The platform doors shall be coordinated with the train doors to automatically open/close for passenger transfer when the train stops in a position properly aligned with the platform doors – otherwise, the doors shall remain closed and locked.
- b) The platform doors shall be wider than, and provide unobstructed access to, the clear opening of the vehicle doors, in accord with the intended stopping accuracy of the trains.
- c) The platform doors shall remain closed and locked until the train has reached the prescribed stopping position and shall open only if an adequate minimum width-of-passage is provided for passengers.
- d) The detection that the platform doors are closed and locked shall be performed in accordance with the principle of maintaining a continuous closed-circuit current or an equivalent fail-safe measure.
- e) The platform door controls shall be so designed such that it is possible to
  - 1) close the doors and remove them from operation via remote control, but only if it is verified that the doors are physically closed and locked; and/or
  - 2) close the doors and remove them from operation from a local control panel at the door location, only if it is verified that the doors are physically closed and locked.

However, whether the removal from operation is performed remotely or locally at the doors, the passengers must be able to easily recognize that the doors have been removed from operation.

- f) The gap between the train and the platform screens shall be small enough for a person not to be trapped between the vehicle and the platform screens. Alternatively, if the gap is large enough for a person to reach the gap and be physically trapped between the vehicle and the platform screens, the presence of the person between the vehicle and the platform screens shall be detected and the doors prevented from closing.
- g) The platform doors shall be provided with protective devices which prevent injuries to passengers if they are caught between the door leaves as they are closing.
- h) If a train fails to align properly with the platform doors when it stops in the station in such a way that automatic opening of the doors is not permitted by the control system and an emergency evacuation from the train is required, there shall be provisions to allow the passengers to evacuate from the train to the platform.

To enable this, a train evacuation procedure must be performed (see the future 7.3.6), and the passengers shall be able to open manually the platform doors, the emergency exit doors installed in the platform screen, or the platform end doors.

#### **7.2.1.2 Partial-height platform screen**

Partial-height platform screens shall form a barrier wall, the height of which is no less than the local building requirements for fences or pedestrian safeguards.

Requirements described in 7.2.1.1 for full-height platform screens shall generally apply also to partial-height platform screens.

In addition, platforms with partial height platform edge screens may also have emergency stop and traction power cut-off equipment, as described in 7.2.3, if considered necessary as a result of the specific hazard analysis.

#### **7.2.2 Open platform with detection systems**

For an open platform, the hazardous situation of a passenger or an object entering the guideway (platform track) from the platform shall be detected and shall immediately initiate the stopping of the train.

In addition, if considered necessary as a result of the specific hazard analysis, the following may be applied:

- warning means and/or barriers, emergency stop and traction power cut-off equipment which are described in 7.2.3;
- intrusion detection systems as described in 7.6.

#### **7.2.2.1 Platform track detection system**

For the track area that can be reached from the platform, provision shall be made which immediately initiates stopping trains with automatically acting equipment if persons are in an unsafe situation on the platform track.

If the guideway area can be reached from the platform and if there is a risk that a person could inadvertently touch elements that provide traction power, then provision shall be made to switch off the traction power system in that zone if persons are in an unsafe situation on the platform track.

If a person is detected, an alarm shall be automatically sent to the operations control centre.

The detection zone is the track area that can be reached from the platform and is defined as a result of the specific hazard analysis.

At a minimum, persons are considered to be endangered if they penetrate the detection zone, at least at the running surface height. For detection purposes of system with steel rails, it is assumed that persons fall onto the track in a way that their loads do not rest exclusively on the running rails.

The monitoring function of the platform track detection is considered to be fulfilled if an adequately defined test body is detected in the detection zone.

It is permitted to reset the platform track detection system from the OCC, but only if the OCC staff is able to verify, by observation of the platform track (see also the future 7.2.4.1), that a dangerous situation does not exist.

#### **7.2.3 Open platforms**

The equipment and means which may be considered include platform fences, warning means, emergency stop switches, traction power cut-off devices as described below, as well as various communication equipment (see 7.2.4).

##### **7.2.3.1 Platform fences**

Along the platform edge (for example, between train doors or between two cars) where a warning means is not applied, a physical barrier shall be installed which prevents a person from falling on to the platform track from the platform. The physical barrier may be in the form of a full- or partial-height fence, screen, or wall.

##### **7.2.3.2 Warning means**

Proven experience with automated systems suggests a warning such as a strip along the platform or other suitable means which are used to designate the area on the platform in which persons shall not stand while trains are moving.

In accordance with local regulations, the warning means should be adequate for the needs of sight- and hearing-impaired people.

### 7.2.3.3 Emergency stop switch

A good practice is to provide on the platform emergency stop switches accessible to passengers who see a person on the platform track. This emergency stop switch shall cause all trains in the vicinity of the station to come to an immediate stop, as well as the switching-off of traction power if there is a risk of a person touching system elements energized with traction power.

Emergency stop switches shall be clearly visible and its function identified.

### 7.2.3.3 Traction power cut-off

For the track area that can be reached from the platform, it is good practice to provide a traction power cut-off device with automatically acting equipment if there is a risk of a person touching system elements energized with traction power. This function can be accomplished from either the OCC, a manually activated device on the station platform, and/or automatically activated by the system.

### 7.2.4 Communication equipment

A good practice is to provide CCTV, emergency call device and public address system equipment for audio and visual communication between passengers and the OCC on each station platform, especially if there are no staff present on board or on the station platform.

All audio and visual communications equipment shall operate independently of traction power and shall be fully functional under the ambient conditions to which it may be exposed. All audio and visual communications equipment shall be powered by uninterruptible power for a time period as determined by an analysis in accordance with the hazard analysis.

#### 7.2.4.1 CCTV

Video surveillance should be provided by dedicated staff to observe the entire passenger transfer area, as well as the platform track in the case of open platforms with detection systems (7.2.1.2).

It is good practice to provide coloured display and a protection against vandalism.

The video monitors in the OCC shall be organized in a logical order with identifications displayed on each screen to orient the OCC staff and to facilitate identification of the image location.

It is good practice to record selected video images for a review after incidents with safety implications.

#### 7.2.4.2 Emergency call device

Equipment for voice communication between passengers on the station platform and the control centre shall be suitable for duplex emergency audio communications.

The emergency call device shall be clearly visible and its function identified.

Each emergency communication device shall automatically call control centre when activated. A display at the control centre shall identify the communicating emergency communication device and indicate whether there is any additional activated device. It is good practice to link this system with the CCTV system.

These emergency audio communications shall have priority over all other audio communications.

The person operating the emergency call device shall receive an audible indication that the device is calling.

It is good practice to provide protection against vandalism.

#### **7.2.4.3 Public address system**

Under consideration.

#### **7.2.4.4 Overriding control of train from OCC**

Under consideration.

### **7.3 Safety of passengers in trains**

#### **7.3.1 Train protection**

Under consideration.

#### **7.3.2 Passenger protection on transfer from train to platform**

Under consideration.

##### **7.3.2.1 Opening of doors under regular conditions**

Under consideration.

##### **7.3.2.2 Passenger transfer**

Under consideration.

##### **7.3.2.3 Closing doors**

Under consideration.

##### **7.3.2.4 Avoiding of negligent opening**

Under consideration.

##### **7.3.2.5 Opening for rescue in reasons of emergency**

Under consideration.

#### **7.3.3 Emergency stop demand**

Under consideration.

#### **7.3.4 Emergency call device**

Under consideration.

#### **7.3.5 Public address system**

Under consideration.

### **7.3.6 Evacuation plan for the rescue of passengers**

Under consideration.

### **7.3.7 Fire and smoke detection/protection**

Under consideration.

### **7.3.8 Manual operation**

Under consideration.

### **7.3.9 Foreseeable vandalism**

Under consideration.

## **7.4 Safety during passengers transfer**

Under consideration.

## **7.5 Safety of clearance of guideway**

Under consideration.

### **7.5.1 Obstacle and derailment detection**

Under consideration.

#### **7.5.1.1 Obstacle detection**

Under consideration.

#### **7.5.1.2 Derailment detection**

Under consideration.

## **7.6 Safety of persons entering guideway**

Under consideration.

### **7.6.1 General**

Under consideration.

### **7.6.2 Protection against moving train**

Under consideration.

### **7.6.3 Protection against electrocution**

Under consideration.

### **7.6.4 Fire and smoke protection**

Under consideration.

#### **7.6.5 Water-flooding protection**

Under consideration.

#### **7.6.6 Security and communication on the guideway**

Under consideration.

#### **7.7 Protection of the public**

Under consideration.

### **8 Verification**

Under consideration.

### **9 User information**

Under consideration.

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