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MODACCESS SUBPROJECT

– DELIVERABLE REPORT –

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Responsible partner:	Frensistemi srl
Contributors:	Questionnaire and WP13 partners

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SECTION I – DELIVERABLE SUMMARY

Deliverable Title	
Deliverable ID , associated WP & Subproject	D46 <i>MODACCESS / WP13</i>
Type of Deliverable	Report
Input / Starting stage	<i>Deliverable, partners input Others MODURBAN Subproject, WP13 members, PIS Questionnaire</i>
Output / Final stage	<i>Requirements and List of Relevant Standard for PIS devices</i>

Lead partner(s)	
Achievement to date (%)	100 %
Expected date of achievement	Postponed to End February
Type of exploitation	<i>Basic input for the D47 (WP13)</i>
Exploitation potential	
Expected budget	<i>See relevant table (wp13 costs)</i>
Actual costs	<i>See relevant table (WP13 costs)</i>
Expected costs to completion	
Protection	<i>Not Relevant</i>
Protection date	<i>Not Relevant</i>

IP's	Partners, (type, identification, date)
Pre-existing Know-How	Not Relevant
Exploitation Rights	Not Relevant

Associated Risk analysis	Type, solution envisaged, action, actors	Actual Reduction
Before start		
During task implementation		



Deliverable Title
<p><u>Deliverable Abstract</u> Preliminary analysis of the relevant standards and requirements for the functionalities of the PIS devices installed on board both for metros and trams, with special attention to the emergency events. Identification of:</p> <ul style="list-style-type: none"> - Common Basic Set of PIS on board devices and related pictograms both for metros and trams - Main Functionalities of the PIS on board devices, that compose the common basic set, in standard service events and in emergency events
<p><u>Associated Milestone (if relevant):</u> Analysis of Questionnaire on Existing PIS Applications and Systems For Urban Guided Rail and Driverless Vehicles</p>

Contribution to MODURBAN Objectives as mentioned in the Description of Work		
<i>Objective Definition</i>	<i>Comments</i>	<i>Quantification</i>
Objective 1 -		
Objective 2 –		
Objective 3 ...		
Objective 4 ...		

SECTION 2 – DELIVERABLE DETAILED DESCRIPTION

SCOPE OF THE DOCUMENT

This document concerns a preliminary analysis of the relevant standards and requirements for PIS devices installed on board both for metros and trams. The starting points for the definition of the main standards and requirements are the following:

- Preliminary Questionnaire about PIS, sent to the European mass transit Operators in the period July – November in 2005
- Possible useful information coming from the other actual European projects.
- Survey of the international associations for standardization

Even if the compiled gathered Questionnaires are few and owing to this they can not represent a real statistic, however by their analysis it has been possible to define a common basic set of on board PIS devices, with related pictograms, for metros and trams and their functionalities required by the Operators, in standard service events and in the emergency. According to these results it has been carried out a survey of the international railways standards applicable to the common basic set.

MODURBAN Overview

MODURBAN is the short form of *Modular Urban Guided Rail System*. It is a 50% EU funded Integrated Project.

It is the first of its kind on a truly European level in the area of joint, pre-competitive Research. It brings together all major rail industry suppliers and all major European rail operators. The project officially started on January 1st 2005 and will last four years.

The main target of the MODURBAN project is to design, develop and test an innovative and open common core system architecture and its key interfaces (this covers Command Control, energy saving and access subsystems), paving the way for the next generations of urban-guided public transport systems. This approach will be applied to both new lines as well as the renewal and extension of existing lines and will encourage cost effective migration from driver to driverless operation. It will also avoid the risk of new rolling stock and subsystems being built from unproven prototype sub-assemblies.

MODURBAN is composed by six Subprojects:

- MODONBOARD: Onboard Intelligent Interfaces
- MODWAYSIDE: Way-side Intelligent Interfaces
- MODCOMM: Communication Systems
- MODACCESS: Passenger + Access related items
- MODENERGY: Energy Savings related aspects
- MODSYSTEM: System Approach for functional and technical prescription, Global Risk Assessment

For further information on the MODURBAN development and current activities, please visit the official website www.modurban.org or contact Bernard von Wullerstorff (UNIFE) by e-mail at bernard.von.wullerstorff@unife.org.

MODACCESS Subproject

The MODACCESS sub project addresses 3 different categories of issues, somewhat independent but all three contributing to the same aim: improving both the ease and the quality (safety, cost...) of the access function for the passenger, the operator and the industrial access systems supplier. It therefore aims to design, develop and validate:

- System Critical Passenger Information and Interaction
- Door Systems especially on Automatic Operated Trains
- Platform Screen Doors

The research tasks associated with this sub project will especially focus on:

- Warning cases like degraded mode and emergencies and means to monitor situation (video surveillance...)
- Definition of the units, video aids and the functions of passenger information system in order to provide information easy to understand for the EU citizen everywhere in Europe.
- This is a very important part of the MODACCESS work, because EU citizens have different language, different behaviour that causes dissimilar reactions in the same critical conditions; so the format, colour, language, graphic and acoustic signal are of particular importance.
- Doors functions especially in the absence of personnel on board
- Modules definition and interfaces, applicable to all parts of the MODACCESS functions and closely interrelating with the other MODURBAN subprojects
- Platform screen doors functions, implementation and critical interfacing/communicating with other safety systems

1 LINKS WITH OTHER EUROPEAN OR NATIONAL PROJECTS

We started from Table 1 of Annex I - “Description of Work” of MODURBAN Project to have an overview of the main outputs coming from other European projects and which are expected to be used as inputs for the MODURBAN Subprojects. Only LibeRTin and STAR are directly related to the MODACCESS Subproject. We founded opportune to take into account MODTRAIN/MODLINK, Operega, Game, as well.

Related Projects	Project Status	Main Relevant Outputs	MODURBAN Subproject(S) Concerned	Internet
UGTMS	Finished	Functional requirement specifications for train protection (FRS)	MODONBOARD, MODWAYSIDE, MODCOMM, MODSYSTEM	http://ugtms.jrc.cec.eu.int/
LibeRTin	Ongoing	Recommendations for future LRT harmonization	ALL	http://www.libertin.info/
MODTRAIN	Ongoing	SRS for critical onboard interfaces in mainline railway sector	MODONBOARD	http://www.modtrain.com/
Tr@nsITS	Finishing	Prospectives for new IT systems in urban transport	MODCOMM, MODSYSTEM	http://www.uitp.com/transits/
MORANE	Finished	FRS for railway communication systems	MODCOMM	http://gsm-r.uic.asso.fr/morane.html
ERTMS	Finished	Functional requirement specifications for train protection (FRS), system requirement specifications (SRS), included in the relevant TSI's	MODONBOARD, MODWAYSIDE, MODCOMM, MODSYSTEM	http://www.ertms.com/
SAMRAIL	Finished	Railway safety recommendations	MODSYSTEM	http://samnet.inrets.fr/
SAMNET	Finished	Network of actors (Universities, Research Centres, etc.) implied in railway safety	MODSYSTEM	http://samnet.inrets.fr/
Euro-Interlocking	Ongoing	FRS for railway interlocking	MODWAYSIDE	http://www.euro-interlocking.org/
EURNEX	Ongoing	Network of excellence	MODSYSTEM	http://www.eurnex.net/

Table 1 Overview of the main outputs coming from other projects.

1.1 LibeRTiN (Light Rail Thematic Network)

LibeRTiN is a project funded by the European Commission aimed at contributing to lifting obstacles to the establishment of a truly European Internal Market for Light Rail Transit (LRT) Systems. When the Description of Work for MODURBAN was drawn up, LibeRTiN was ongoing, but has now been completed. The main goal of LibeRTiN was to help plan a cost-effective and reliable European light rail sub-system. Project support was given by light rail operators and manufacturers and related rail associations, UITP (International Association of Public Transport) and UNIFE (Association of the European Railway Industries).

Fig. 1 illustrates all topics investigated by the LibeRTiN Project. Those in red were investigated in detail. Many of these topics offer relevant output to MODACCESS, particularly in connection with WP13. They are:

- Information Systems
- Fire Safety
- Emergency Brakes, Emergency Equipment
- Safety of Energy Supply Systems
- Derailment and Ride Quality

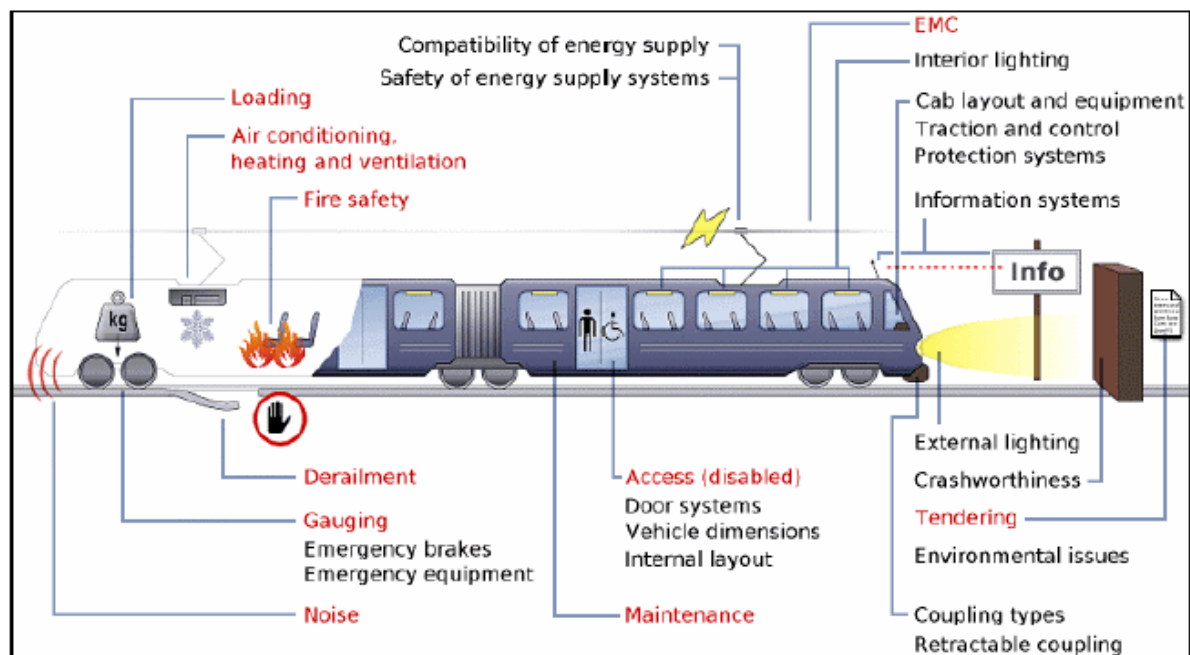


Figure 1 Main topics (shown in red) investigated by the LibeRTiN project.

Information Systems

Improving passenger information was a goal in the project for increasing public use and decreasing system difficulties. Research on information systems was divided into two categories: static and dynamic.



Static, or visual, information, provided inside and outside vehicles and in stations and at stops, includes system maps, line diagrams, time tables, signs and pictograms, line and route indications, etc.

Dynamic, or visual/audio, information, provided inside and outside vehicles and in stations and at stops includes next stop information, confirmation of stop request, waiting time until next vehicle, recorded voice messages and “on-line” communication between driver/control and passengers (PA systems), etc.

Information can also be arranged for operational purposes and critical safety circumstances such as communication between staff, vehicle and control room, which occurs through radio or phone devices.

Fire Safety

Initial research and discussion was focused on the project standard prEN45545. Unfortunately, this standard does not take light rail systems and tramways into consideration. The project asked CEN to add or amend a specific category covering the majority of Light Rail Systems called “Vehicles with no on-board fuel supply, with easy passenger evacuation and good communications equipment...”.

Emergency Braking

Emergency braking is an important safety element for LRV’s, as well as a high cost issue because of operators’ varying design specifications. Project work in this area entailed checking that the new standard prEN 13452, which addresses mass transit systems, ensuring that it included related operator and association views and ideas.

Emergency Equipment

Research here involved evaluating LRV vehicle operation in conditions such as long tunnel sections, street running or running on segregated track. The Project strived in setting the same requirements for all EU LRT in order to achieve the same level of passenger and driver safety in cases of possible accidents or other dangerous situations throughout the European Union.

The project foresaw major difficulties in achieving this goal due to the fact that many LRT systems are also running on public roads and therefore have to follow road regulations, which are often established nationally.

Safety of Energy Supply Systems

Safety of the energy supply systems is important to conventional railways. Therefore it is covered by a large number of standard, which include some that consider light rail systems.

However, the project found it important to point out the two differences between LRT and conventional railways:

1. LRVs generally operate at a relatively low voltage, typically not exceeding 1 500 V, except for dual mode Tram Train operation.
2. Access to LRT tracks on most tramway systems by people and road vehicles puts the passengers at greater risk.

The project considered both overhead electrification and conductor rail pick-up because LRT and light metros use both.

Derailment Prevention and Ride Quality

The main focus involving derailment prevention and ride quality was to specify a vehicle-track interface using standard vehicle designs. No consensus was provided on how ride quality or track quality should be determined for light rail vehicles. Some questions were raised about necessary specifications for track quality on light rail network consequently considering imposed dynamic loading assessing whether wheel profile practices. Primary German regulations on wheel-rail interface and track geometry were translated into English. However, cultural differences and the acceptance of “foreign” applications made it difficult to arrive to common conclusions.

The report “LiberTiN Final Public Report, February 2005”, was consulted.[LiberTiN, 05]

1.2 MODTRAIN (Innovative Modular Vehicle Concepts for an Integrated European Railway System)

MODTRAIN stands for Innovative Modular Vehicle Concepts for an Integrated European Railway System, and as Integrated Project (6th Framework integrated project) it is the first of its kind in the area of joint European railway research. The project officially started on 1st February 2004 with a total project duration of four years and is currently ongoing. MODTRAIN will define and prove the necessary functional, electrical and mechanical interfaces and validation procedures to deliver the range of interchangeable modules, which will form the basis for the next generation on intercity trains and universal locomotives.

The technical and scientific work of the project will address four principle elements, which are structured as their own Subprojects:

- MODBOGIE: Running gear;
- MODCONTROL: Control and monitoring system;
- MODPOWER: On-board power system;

- MODLINK: Man-machine and train-to-train interfaces.

In particular, the MODLINK - EUPAX area Work Package 9 (Passenger & Crew Information Interfaces) and Work Package 10 (Safety Alarm Information Systems) are suitable for collecting results on passenger alarm analysis, standard and aspects related to MODURBAN Work Package 13.

MODLINK, Modular man-machine and train-to-train interfaces

MODLINK is the largest of the four MODTRAIN subprojects. The objective of MODLINK is to develop and test modular and harmonized improved technical solutions as essential contribution to a competitive European rail system on three major working areas:

- EUCAB: integration of a working train cab & man machine interface;
- EUPAX: development of an interoperable passenger and crew HMI concept;
- EUCOUPLER: development of an inter-train data transmission link from different operators.

MODLINK therefore consists of these three work packages EUCAB, EUPAX and EUCOUPLER corresponding to the main fields of activities "Driver Interface", "Passenger/crew interface", "Train-to-train high capacity data interface". The development and integration activities in the three working areas will result in full size functional mock-ups. Industrial design features, functions and components with interchangeable modules will be demonstrated as integrated solutions for European harmonization.

The Tasks from MODLINK Workpackages 9 and 10 are listed below:

Work Package 9 – Passenger & Crew Information Interfaces

- Task 9.1 Analysis of passenger and crew requirements (“basic needs” and “nice to have”), incorporating the method of “user platforms” – Questionnaire for the Operators
 - Task 9.1.1 Review of international documents (UIC, TSI, EN, National standards, safety requests)
 - Task 9.1.2 Survey on existing process lines crew & passengers are involved regarding safety – Analysis of the Questionnaire results
- Task 9.2 System Requirements Specification
- Task 9.3 General System Architecture as synthesis of the interpretation of users and operators

- Task 9.4 Research of today PIS's and operators grading in terms of acceptance and costs/economy review of international and national documents, identification of obstacle for an European harmonized PIS
- Task 9.5 Improve the ergonomics of the interfaces between on board equipment and passengers
- Task 9.6 Elaboration of solutions for a passenger & crew Information Interface concept
- Task 9.7 Identification and validation of selected critical components and/or architectures
- Task 9.8 Specification of standards, preparation of the next project-phase

In particular, Report 4 of Task 9.5 furnishes ergonomic considerations for safety related facilities and information visualization. The report also provides indications and reference standard, with special attention given to indications for passengers with reduced ability.[PELLEGRINI, 05]

Work Package 10 – Safety Alarm Information Systems

- Task 10.1 Identification of the areas of safety and security for which alarms and passenger-orientated operation. Report 1 on survey with conclusions
- Task 10.2 Analysis of passenger requirements by involvement of the "user platform"
- Task 10.3 Review of international documents (UIC, TSI, EN, national standards)
- Task 10.4 Analysis of existing solutions: systems, technical realization, problems
- Task 10.5 Research on technology available today and future trends
- Task 10.6 Elaboration of solutions for the structure of a concept able to get standardized taking care of existing and future standards in railways communications
- Task 10.7 Ergonomics of window & door escape facilities
- Task 10.8 Identification and validation of selected critical components and or architectures
- Task 10.9 Specification of harmonization, standardization proposals, description of objectives and basic work-programme for next development- and demonstration phase

In particular, Report 2 of Task 10.3 reviews all national and international standards and standards regarding Safety Alarm Information Systems [PELLEGRINI, 04].

2 EUROPEAN-WIDE STANDARD AND RECOMMENDATIONS REGARDING CPIIS

This chapter presents standards related to Critical Passenger Information and Interaction Systems (CPIIS), which are currently active in Europe (see par. 2.2). These standards can be useful as references when considering system specifications aboard Metro, LRV and Tram. These standards have been gathered in an effort to harmonize solutions for existing CPIIS on urban guided rail and driverless vehicles, according to European Directives on Interoperability (EC 96/48, EC 2001/16).

This investigation focused on passenger alarm devices and interfaces presented in the questionnaire, which are activated in typical, as well as, emergency situations (see chap. 3).

Typical service events are those considered in the questionnaire sent to operators:

- Train is approaching a station;
- Door opening;
- Train is at standstill in a station for boarding passengers;
- Door closing;
- Train is leaving a station.

Emergency situations are those considered in the questionnaire sent to operators:

- Activation of passenger emergency handle;
- Activation of emergency Exit device;
- Fire on board;
- Main electrical supply failure;
- Accident;
- Train blocked on the track.

2.1 Passenger Alarms and Man Machine Interfaces

According to the results extracted from the few compiled received questionnaires, as just mentioned, the following group of devices are defined as Common Basic Set of On-Board Devices for Metro LRV and Tram.

- External Display;
- Internal Display;
- PA Loudspeakers;

- Driver Cab Intercom;
- Emergency Egress Device;
- Passenger Emergency Handle;
- Manual Fire Extinguisher;
- Emergency Lighting System;
- Acoustic Alarms;
- Passenger Alarm to Ground;
- Crew HMI for PIS;
- Video Surveillance.

A cross-matrix is presented in Table 2, containing the above devices with standards which can be useful as references. The standards are listed by organisation UIC, ISO, EN and IEC.

Table 3 presents the same information as Table 2, but the standards are grouped by functionality: Safety, Environmental, Ergonomic, Operational (RAM), Connectivity.



DEVICES	UIC	ISO	EN	IEC
External Display	UIC 176		EN 50128*, EN 50155 EN 13149, ENV 12694	IEC 61508* IEC 62061
Internal Display	UIC 176		EN 50128*, EN 50155 EN 13149, EN 12694	IEC 61508* IEC 62061
PA Loudspeakers	UIC 568	EN ISO 9921	EN 50128*, EN 50155, EN ISO 9921	IEC 61508* IEC 62061
Driver Cab Intercom	UIC 568	EN ISO 9921	EN 50128*, EN 50155, ENV 13149, EN ISO 9921	IEC 61508* IEC 62061
Emergency Exit Device	UIC 560, 564-1		EN 50128*, EN 50155	IEC 61508* IEC 62061
Passenger Alarm Emergency Brake	UIC 541-5		EN 15327-1, EN 50128*, EN 50155	IEC 61508* IEC 62061
Manual Fire Extinguisher			EN 50128*, EN 50155, EN 45545	
Emergency Lighting System	UIC 555		EN 50128*, EN 50155 EN 13272, EN/IEC 60598-2-22	IEC 61508* IEC 62061 EN/IEC 60598-2-22
Acoustic Alarms		ISO 7731	EN 50128*, EN 50155 EN 45545	IEC 61508* IEC 62061
Passenger Alarm to Ground Control Centre			EN 50128*, EN 50155 EN 13149	IEC 61508* IEC 62061
Crew HMI for PIS			EN 50128*, EN 50155 EN 13149, ENV 13093	IEC 61508* IEC 62061
Video surveillance	UIC 176		EN 50128*, EN50155	IEC 61508* IEC 62061

Table 2 International standards and specifications that should be considered for Common Basic Set devices in Guided Rail Public Transport.

(*) = Only in case of safety (SIL1 – SIL4) requirements for Software

DEVICES	Safety				Environmental				Ergonomic				Operational (RAM)				Connectivity			
	UIC	ISO	EN	IEC	UIC	ISO	EN	IEC	UIC	ISO	EN	IEC	UIC	ISO	EN	IEC	UIC	ISO	EN	IEC
External Display	176		13149	61508 62061			50155		176						50128*, 50155		176			
Internal Display	176		13149	61508 62061			50155		176						50128*, 50155		176			
PA Loudspeakers	568	9921	9921	61508 62061			50155		568	9921					50128*, 50155		568			
Driver Cab Intercom	568	9921	9921, 13149	61508 62061			50155		568						50128*, 50155		568			
Emergency Exit Device	560, 564-1			61508 62061			50155								50128*, 50155					
Passenger Alarm Emergency Brake	541-5			15327 -1 62061			50155					541-5			15327-1, 50128*, 50155					
Manual Fire Extinguisher			45545				50155								50128*, 50155					
Emergency Lighting System	555		13272	60598 -2-22 61508 62061			50155		555		13272				50128*, 50155	60598- 2-22				
Acoustic Alarms	564-2	7731	45545	61508 62061			50155				7731			7731	50128*, 50155					
Passenger Alarm to Operations Control Centre (OCC)			13149	61508 62061			50155								13149, 50128*, 50155					
Crew HMI for PIS			13149	61508 62061			50155				13093				13149, 50128*, 50155					
Video surveillance				61508 62061			50155		176						50128*, 50155					

Table 3 International standards and specifications that should be considered for Common Basic Set devices in Guided Rail Public Transport. Standards are divided for Functional Requirements Areas

(*) = Only in case of safety (SIL1 – SIL4) requirements for Software

2.2 Standards Abstracts

In the following are reported the abstracts and descriptions of the standards presented in the cross-matrix, as memorandum:

EN 13272: “Railway applications - Electrical lighting for rolling stock in public transport systems”

This European Standard specifies the design criteria of electrical lighting illumination levels in the interiors of public transport railway rolling stock for all operating conditions. The design of the lighting system shall take into account the tasks that are to be performed in the given area, as well as meeting safety requirements. In addition to providing task-related illumination levels, the design of the lighting should, wherever possible, provide a pleasing visual environment

EN 13149-1:2004 Public transport - Road vehicle scheduling and control systems - Part 1: WORLDFIP definition and application rules for onboard data transmission

This document specifies the choice and the general applications rules of an onboard data transmission bus between the different equipment for service operations and monitoring of the fleet. This applies to equipment installed onboard buses, trolleybuses and tramways only as part of a bus fleet operation. It excludes tramways when they are operated as part of a train, subway or metro operation. The equipment includes operations aid systems, automatic passenger information systems, fare collection systems, etc. The equipment directly related to the functioning of the vehicle (driver dashboard, engine management, brake systems, door opening systems, etc.) are excluded from the scope of the present document and are dealt with in other standardization bodies. Two alternative transmission buses will be accepted. This document refers to the so called WORLDFIP bus. A second set of documents will be published for the second solution (so called CAN). There is no ranking between the two solutions and the selected bus system, between the two standardized alternatives, shall be subject to an agreement between each transport operating organization and its equipment providers. The present document refers to the so-called OSI transmission model and covers OSI layers 1,2,7, the other layers are not used in our applications. The present document covers the link between equipment inside a single vehicle. Although it could be applied to multiple vehicles, this application is not explicitly covered by this document. The present document is the first part of a set of standards, related to the onboard transmission bus, which will comprise, for each allowed transmission bus, the following set of documents: a) choice of the bus and general applications rules (EN 13149-1) b) cabling specifications (EN 13149-2) c) messages content specifications (prCEN TS 13149-3)

EN 13149-2:2004: “Public transport - Road vehicle scheduling and control systems - Part 2: WORLDFIP cabling specifications”

This document defines the cabling specifications for an onboard data transmission bus between the different parts of equipment for service operations and monitoring of the fleet. This document is applicable to equipment installed onboard buses, trolley buses and tramways only as part of a bus fleet operation. This equipment includes operations aid systems, automatic passenger information systems, fare collection systems, etc. Equipment directly related to the functioning of the vehicle (e.g. driver dashboard, engine



management, brake systems, door opening systems) are excluded from the scope of this document and are dealt with in other standardisation bodies. This document is not applicable to tramways operated as part of a train, subway or metro operation. Two alternative transmission buses will be accepted. This document refers to one of them (known as WORLFIP and specified in EN 50170). A second set of standards will be published for the other solution (so called CAN). The selected bus system, between the two standardised alternatives, shall be subject to an agreement between each transport operating organisation and its equipment providers. This document covers the link between equipment inside a single vehicle. Although it could be applied to multiple vehicles, this application is not explicitly covered by this document. This document is the second part of a set of standards related to the onboard transmission bus, which will define the following aspects for each allowed transmission bus: choice of the bus and general applications rules (EN 13149-1) cabling specifications (EN 13149-2, this document) message content specifications (prCEN TS 13149-3, under development)

EN 13149-4:2004: Public transport - Road vehicle scheduling and control systems - Part 4: General application rules for CAN open transmission buses

This document specifies the choice and the general application rules of an onboard data transmission bus between the different equipment for service operations and monitoring of the fleet. This applies to equipment installed onboard buses, trolley buses and tramways only as part of a bus fleet operation. It excludes tramways when they are operated as part of a train, subway or metro operation. This equipment includes operation aid systems, automatic passenger information systems, fare collection systems, etc. The equipment directly related to the safety-related functioning of the vehicle (propulsion management, brake systems, door opening systems, etc.) is excluded from the scope of the present document and are dealt with in other standardisation bodies. For the described application two bus systems are standardised. Part 1 to part 3 describes the WORLDFIP bus system and part 4 to part 6 describes the CAN open bus system. There is no ranking between the two bus systems. This document covers the link between equipment inside a single vehicle. Although it could be applied to multiple vehicles, this application is not explicitly covered by this document. Part 4 of this document specifies the CAN open-based network. This specification describes the general architecture in terms of hierarchical layers according to the ISO reference model for Open Systems Interconnection (OSI) specified in ISO 7498. Part 5 of this document specifies in detail the connectors and the connector pin assignment and the cabling. Part 6 of this document specifies in detail the application profiles for the virtual devices in public transport.

EN 13149-5:2004 Public transport - Road vehicle scheduling and control systems - Part 5: CAN open cabling specifications

This document specifies the choice and the general application rules of an onboard data transmission bus between the different equipment for service operations and monitoring of the fleet. This applies to equipment installed onboard buses, trolley buses and tramways only as part of a bus fleet operation. It excludes tramways when they are operated as part of a train, subway or metro operation. This equipment includes operation aid systems, automatic passenger information systems, fare collection systems, etc. The equipment directly related to the safety-related functioning of the vehicle (propulsion management, brake systems, door opening systems, etc.) is excluded from the scope of the present document and are dealt with in other standardisation bodies. For the described application two bus systems are standardised. Part 1 to part 3 describes the WORLDFIP bus system

and part 4 to part 6 describes the CAN open bus system. There is no ranking between the two bus systems. This document covers the link between equipment inside a single vehicle. Although it could be applied to multiple vehicles, this application is not explicitly covered by this document. Part 4 of this document specifies the CAN open-based network. This specification describes the general architecture in terms of hierarchical layers according to the ISO reference model for Open Systems Interconnection (OSI) specified in ISO 7498. Part 5 of this document specifies in detail the connectors and the connector pin assignment and the cabling. Part 6 of this document specifies in detail the application profiles for the virtual devices in public transport.

EN 60204-1: Safety of machinery - Electrical equipment of machines

Part 1: General requirements

Applies to the electrical and electronic equipment of industrial machines. Promotes the safety of persons who come into contact with industrial machines, not only from hazards associated with electricity (such as electrical shock and fire), but also resulting from the malfunction of the electrical equipment itself. Addresses hazards associated with the machine and its environment.

CEN/TS 13149-6:2005 Public transport - Road vehicle scheduling and control systems - Part 6: CAN message content

This Technical Specification specifies the choice and the general application's rules of an onboard data transmission bus between the different equipment for service operations and monitoring of the fleet. This applies to equipment installed onboard buses, trolley-buses and tramways only as part of a bus fleet operation. It excludes tramways when they are operated as part of a train, subway or metro operation. This equipment includes operation aid systems, automatic passenger information systems, fare collection systems, etc. The equipment directly related to the safety-related functioning of the vehicle (propulsion management, brake systems, door opening systems, etc.) are excluded from the scope of the present standard and are dealt with in other standardisation bodies. For the described application two bus systems are standardised. Part 1 to part 3 describe the WORLDFIP bus system and part 4 to part 6 describe the CAN open bus system. There is no ranking between the two bus systems. This Technical Specification covers the link between equipment inside a single vehicle. Although it could be applied to multiple vehicles, this application is not explicitly covered by this standard. Part 4 of this European Standard specifies the CAN open-based network. This specification describes the general architecture in terms of hierarchical layers according to the ISO reference model for Open Systems Interconnection (OSI) specified in ISO 7498. Part 5 of this European Standard specifies in detail the connectors and the connector pin assignment and the cabling. Part 6 (this document), which will be published as a Technical Specification specifies in detail the application profiles for the virtual devices in public transport.

EN ISO 15006:2004 “Road vehicles. Ergonomic aspects of transport information and control systems. Specifications and compliance procedures for in-vehicle auditory presentation”

This International Standard establishes ergonomic specifications for the presentation of auditory information related to transport information and control systems (TICS) through

speech or sounds. It applies only to the use of auditory displays when the vehicle is in motion. It presents a set of requirements and recommendations for in-vehicle auditory messages from TICS, and provides message characteristics and functional factors for maximizing message intelligibility and utility while helping prevent auditory or mental overload.

EN 45545 (series): “Railway applications - Fire protection on railway vehicles”

This series of European Standards consists of:

- Part 1: General;
- Part 2: Requirements for fire behaviour of materials and components;
- Part 3: Fire resistance requirements for fire barriers and partitions;
- Part 4: Fire safety requirements for railway rolling stock design;
- Part 5: Fire safety requirements for electrical equipment including that of trolley buses, track guided buses and magnetic levitation vehicles;
- Part 6: Fire Control and management systems;
- Part 7: Fire safety requirements for flammable liquid and flammable gas installations.

EN 50126-1:1999: “Railway applications - The specification and demonstration of Reliability, Availability, Maintainability and Safety (RAMS) -- Part 1: Basic requirements and generic process”

This European Standard: defines RAMS in terms of reliability, availability, maintainability and safety and their interaction; defines a process, based on the system lifecycle and tasks within it, for managing RAMS; enables conflicts between RAMS elements to be controlled and managed effectively; defines a systematic process for specifying requirements for RAMS and demonstrating that these requirements are achieved; addresses railway specifics; does not define RAMS targets, quantities, requirements or solutions for specific railway applications; does not specify requirements for ensuring system security; does not define rules or processes pertaining to the certification of railway products against the requirements of this standard; does not define an approval process by the safety regulatory authority. This European Standard is applicable: to the specification and demonstration of RAMS for all railway applications and at all levels of such an application, as appropriate, from complete railway routes to major systems within a railway route, and to individual and combined sub-systems and components within these major systems, including those containing software; in particular: to new systems; to new systems integrated into existing systems in operation prior to the creation of this standard, although it is not generally applicable to other aspects of the existing system; to modifications of existing systems in operation prior to the creation of this standard, although it is not generally applicable to other aspects of the existing system at all relevant phases of the lifecycle of an application; for use by Railway Authorities and the railway support industry. NOTE: Guidance on the applicability is given in the requirements of this standard

EN 50155:2001 “Railway applications. Electronic equipment used on rolling stock”

Railway equipment, Railway vehicle components, Electronic equipment and components, Electronic engineering, Railway vehicles, Control equipment, Railway applications.

This European Standard: defines RAMS in terms of reliability, availability, maintainability and safety and their interaction; defines a process, based on the system lifecycle and tasks within it, for managing RAMS; enables conflicts between RAMS elements to be controlled and managed effectively; defines a systematic process for specifying requirements for

RAMS and demonstrating that these requirements are achieved; addresses railway specifics; does not define RAMS targets, quantities, requirements or solutions for specific railway applications; does not specify requirements for ensuring system security; does not define rules or processes pertaining to the certification of railway products against the requirements of this standard; does not define an approval process by the safety regulatory authority. This European Standard is applicable: to the specification and demonstration of RAMS for all railway applications and at all levels of such an application, as appropriate, from complete railway routes to major systems within a railway route, and to individual and combined sub-systems and components within these major systems, including those containing software; in particular: to new systems; to new systems integrated into existing systems in operation prior to the creation of this standard, although it is not generally applicable to other aspects of the existing system; to modifications of existing systems in operation prior to the creation of this standard, although it is not generally applicable to other aspects of the existing system at all relevant phases of the lifecycle of an application; for use by Railway Authorities and the railway support industry. NOTE: Guidance on the applicability is given in the requirements of this standard

EN/IEC 60598-2-22:1999: “Luminaires - Part 2-22: Particular requirements – Luminaires for emergency lighting”

Specifies requirements for emergency lighting luminaires for use with tungsten filament fluorescent and other discharge lamps on emergency power supplies not exceeding 1 000 V.

EN ISO 9921:2003: “Ergonomics – Assessment of speech communication”

This standard specifies the requirements for the performance of speech communication for verbal alert and danger signals, information messages, and speech communication in general. Methods to predict and to assess the performance in practical applications are described and examples are given.

ENV 13149-3: “Public transport - Road vehicle scheduling and control systems – Part 3:WORLDFIP message content ”

ENV 13998:2001: “Public transport - Non interactive dynamic passenger information on ground”

IEC 61508: “Functional safety of electrical/electronic/programmable electronic safety-related systems”

This standard covers all safety-related systems that are electromechanical in nature (i.e. electromechanical systems, solid-state electronic systems and computer-based systems). The standard consists of the following parts:

Part 0: Functional safety and IEC 61508

Part 1: General requirements

Part 2: Requirements for E/E/PE safety-related systems

Part 3: Software requirements

Part 4: Definitions and abbreviations

Part 5: Examples of methods for the determination of safety integrity levels

Part 6: Guidelines on the application of IEC 61508-2 and IEC 61508-3

Part 7: Overview of techniques and measures

IEC 62061: “Safety of machinery - Functional Safety of safety-related electrical, electronic and programmable electronic control systems”

One of the daughter standards for IEC 61508 is IEC 62061, a single-part standard with annexes, directed specifically at the machinery sector. It is applicable to safety-related electrical, electronic and programmable electronic (E/E/PE) control systems on machines or combinations of machines working together. This standard differs in many ways from the existing BS EN 954-1 standard, especially inasmuch as it is only concerned with E/E/PE control systems and it is risk-based. That is, it requires the user to specify a level of risk reduction based on a risk assessment (which may be based on quantitative or qualitative methods). The level of risk reduction is defined as a figure for permitted dangerous failures of the safety system. The risk assessment is used to indicate a safety integrity level (SIL) that defines a level of performance in terms of permitted dangerous failures per hour (DFH).

ISO 17398: Safety colours and safety signs

Classification, performance and durability of safety signs

ISO 17398:2004 specifies requirements for a performance-related classification system for safety signs according to expected service environment, principal materials, photometric properties, means of illumination, fixing methods and surface. Performance criteria and test methods are specified in ISO 17398:2004 so that properties related to durability and expected service life can be characterized and specified at the time of the product's delivery to the purchaser. ISO 17398:2004 does not cover electrical power supplies, their components or electrically powered elements. It also does not cover properties of illuminating components, but the photometric properties for the particular types of safety signs are covered.

ISO 3864-1: Graphical symbols -- Safety colours and safety signs

Part 1: Design principles for safety signs in workplaces and public areas

ISO 3864-1:2002 establishes the safety identification colours and design principles for safety signs to be used in workplaces and in public areas for the purpose of accident prevention, fire protection, health hazard information and emergency evacuation. It also establishes the basic principles to be applied when developing standards containing safety signs. ISO 3864-1:2002 is applicable to workplaces and all locations and all sectors where safety-related questions may be posed. However, it is not applicable to the signalling used for guiding rail, road, river, maritime and air traffic and, generally speaking, to those sectors subject to a regulation which may differ. It is important to note that the colours represented in the electronic file of ISO 3864-1:2002 can be neither viewed on screen nor printed as true representations. Although the copies of ISO 3864-1:2002 printed by ISO have been produced to correspond (with an acceptable tolerance as judged by the naked eye) to the colour requirements, it is not intended that these printed copies be used for colour matching and it is necessary to refer to the colorimetric and photometric properties specified in ISO 3864-1:2002. References are also provided from colour order systems for information.

ISO 7731:2003: “Ergonomics – Danger signals for public and work areas – Auditory danger signals”

This standard specifies the physical principles of design, ergonomic requirements and the corresponding test methods for danger signals for public and work areas in the signal reception area and gives guidelines for the design of the signals. It may also be applied to other appropriate situations. ISO 7731:2003 does not apply to verbal danger warnings (e.g. shouts, loudspeaker announcements). ISO 9921 covers verbal danger signals. Special regulations such as those for a public disaster and public transport are not affected by this International Standard

UIC176 (O): ”Specifications for passenger information displayed electronically in trains”

This standard applies to:

- a) newly conceived rolling stock after 01.01.2001;
- b) rolling stock built before 01.01.2001, in the case of heavy revisions and if investments are justified.

Other standards in this set are: UIC440 (OR), UIC580 (OR). This standard is an extension of UIC580.

Contents:

- to furnish info on itinerary in a visual form;
- useful data in case of unexpected events (delays, accidents) transmitted in an essentially auditory manner;
- services offered on the train;

- tourist and promotional information.

Languages:

It is suggested to use another language (one best-known by passengers) besides those languages of the countries crossed during travel.

A European Offer within the Interoperability Frame:

Until a homogenous passenger information system is possible, it is necessary that every vector is prevalently set up with homogenous and compatible copper wiring according to the necessary technical conditions and endowed with the corresponding equipment (for international trains).

The regulations of this standard are equally applicable to the international high velocity lines.

The technical conditions necessary in order to obtain a reliable and functioning passenger information system are defined in UIC556.

The electronic passenger information system must be applied primarily to the international trains travelling on the main tracks, trying to offer a homogenous service to the clientele, regardless of the different multinational equipment in circulation.

Central Command of the Passenger Information System (SIV/PIS):

The Information System is controlled in a central server area or in a special vector, conceived for the BUS driving device and in accordance with UIC556, or in any vector properly equipped in a way so as to be used automatically or manually.

The Personnel Interface must be devised avoiding initials and must be based on pictograms. If it's installed on the electric apparatus locker, it must conform to standard 550-1.

To pilot the Passenger Information System during travel, the computer uses internal train information that concerns the trip underway, centralised commands and speed, beyond the GPS system.

It is preferred that the man-machine interface be installed in the attendants' reserved compartment (at the head of the train) and is protected against theft and vandalism.

The PIS/SIV is activated before passengers board the train.

Compartment in unexpected situations:

The PIS/SIV is equipped with an auto control mechanism that guarantees an automatic reaction in unexpected situations so as to avoid the diffusion of incorrect information onscreen. Once the system is activated it reacts automatically and intervention of the attendant is requested only in cases of system failure.

All unexpected events must appear on the HMI of the server along with countermeasures needed so that the personnel can correctly react.

The PIS diagnostic information must appear on the central server according to the expected formalities in UIC557.

UIC 413 (O): “Measures to facilitate travel by rail”

In leaflet UIC 413, pictograms, along with other types of orientation information listed below, must be provided on the inside of the train in order to assist passengers. Pictograms indicating escape routes are also listed, but no mention is given about the visibility of the lighted symbols.

Measures for passenger information and orientation

- Foreseen orientation panels
- Maps (overall floor plans)
- Panel indicators (information support) for reaching desired destination
- Location panels (confirmation of destination);
- Written regulations (comportment, prohibitions, etc.)
- Pictograms
- Texts
- Information support
- Colours
- Lights, lighting, and lighted signs

UIC 440 (OR): “Public-address systems in coaches (RIC), 4th edition, December 2001”

This leaflet sets out guidelines so that information may be given over the public-address system on scheduled long-distance passenger trains in a standard and user-friendly way, and defines the characteristics of public-address equipment in order to facilitate its use on international services.

UIC541-5 (OR): “Brakes - Electropneumatic brake (ep brake) - Electropneumatic emergency brake override (EBO)”

Premise

The Electropneumatic (EP) and Alarm Inhibitor (SAFI) Braking Systems are two systems whose functions are interlaced by the control command organs.

Definitions of emergency and alarm brakes:

“The emergency brake is a secure brake which applies maximum force in a short period of time, starting from the head vehicle. It is guided by voluntary action of the driver, as well as by security automatism”.

“The alarm brake is commanded by an alarm signal arriving from the vector which sent the signal. Its characteristics can be different from those of the emergency brake. Its scope is to provoke an arrest and alert the driver”.

UIC 555 (OR): Electric lighting in passenger rolling stock

UIC 555 furnishes specifications for lighting systems in cars and foresees lighting of possible obstacles, as well as escape route floor lighting in case of general lighting system failure. The following points are the primary points of the emergency system in question.

Emergency lighting

- Definition: Emergency lighting is the minimum that allows passenger circulation inside the vehicle and towards vehicle exits clearly ensuring the recognition of obstacles and floor surfaces.
- In case of emergency, emergency lighting must have at least a 5-hour autonomy
- Obstacle lighting and path evacuation lighting (on floor):
 - 5 lux minimum
 - For good visibility uniform track lighting on evacuation path <1/10 maximum brightness must not exceed 1 metre in length (see Table 2)
- Lights must not be glaring (direct or indirect)
- (R) To guarantee battery autonomy for emergency lighting, it is advised to turn off the following devices:
 - Fresh air ventilators, immediately, or after one minute max
 - Reading lamps after a max of 10 minutes.
 - Half of general lighting after approximately 30 minutes.
- Emergency lights fed directly by battery: max 2 individual converters for 2 lights
- Two separate electrical circuits for each emergency light
- In order to evaluate the autonomy and capacity of the necessary batteries, use the performance of a new battery as a base.

UIC 560 (OR): “Doors, footboards, windows, steps, handles and handrails of coaches and luggage vans”

UIC requirements that concern the operation of electric door opening/closing mechanisms and passenger safeguard while using them are included in UIC leaflet 560. The following points extracted from UIC 560 are relative to entrance doors and closing mechanisms.

This leaflet contains all provisions relating to doors, footboards, windows, steps, handles and handrails of coaches and luggage vans running freely in international traffic.

Entrance doors – General provisions

- General description of door components:

- The inside surfaces of doors in the side walls must bear the following inscription:

“Ne pas ouvrir avant l’arrêt du train”;

“Nicht öffnen, bevor der Zug halt“;

“Do not open before the train stops“;

Entrance doors – General provisions for entrance doors with automatic opening control

- Entrance doors must be locked mechanically when closed;

- However, the automatic opening command must not become operative until the door has been unlocked

- (R) The door may be unlocked either manually or by an electric command from a push button or handle;

- If the release of the lock by electric command or by automatic opening command fails, it must be possible to unlock and open the door manually;

- Safety of electric door-command systems: If locking is by an electric command it must function in such a manner that – when the speed exceeds 5 Km/h – under normal runner conditions at least two separate failures must occur before the particular entrance door opens accidentally (except failures that are improbable in actual conditions); (R) In order to guarantee this, it is recommended to use modern failure detection methods either continuously or during normal maintenance work;

- Entrance doors must close automatically when the speed of the train exceeds 5 km/h

- Protection against the risk of jamming

- When the doors close there must be no risk of jamming, injury to person or damage to luggage. If the closing doors encounter an obstacle:

- either the door must reopen automatically and reclose after approximately fifteen seconds

- or closing must be halted for approximately ten seconds

- or the closing pressure measured at the edge of the door must be less than 150 N;

Entrance doors – Provisions for folding hinged entrance doors

- The inner door must be secured by a guard against unintentional opening. It should also be provided with an idle stroke.

- The end position shall be marked as follows: “ouvert – fermé, offen – Zu, open – closed”

Similar requirements are given for other types of entrance doors (sliding – plug, swing – plug, side loading doors of luggage vans, side loading doors of dining cars)

Special provisions to ensure safe closing

- The closing devices must be designed and maintained in a state which ensures safe performance of their function during normal service.
- In particular, the fixed parts (latch) and moving parts (pivot pins, hinged pivot pins) of locking devices must always have sufficient overlap.
- Door-closing mechanisms must be so designed that self-locking closure is ensured. This state must also be maintained during normal service.

UIC 564-1 (OR): “Coaches - Windows made from safety glass”

A safety exit must be planned in case the internal doors of the wagon don't allow passengers a quick passageway. A possible solution is to furnish the compartment with a hammer for smashing the windows. A solution that was proposed and has already been adopted in the transportation sector is represented by an automatic window-breaking device, however it is not taken into consideration by the UIC.

UIC564-2 (OR): “Regulations relating to fire protection and fire-fighting measures in passenger carrying railway vehicles or assimilated vehicles used on international services”

This leaflet prescribes fire alarms in cabs, kitchens, and heating locations. For fires found in these areas, automatic activation systems and/or manually-activated, gas fire-prevention systems are required. All fire extinguisher installation rules are prescribed.

UIC564-2 contains UIC directives on fire protection aboard trains. The directives primarily regard instructions on vector construction materials which must be tested for their reaction to fire. UIC supplies minimum specifications on fire resistance test results, leaving railway network managers free to use their own methods or those expected from their national standards.

Here are some points on the standard including general directives on fire protection and other particulars:

Fire Protection – general directives

Realisation of passenger materials and internal construction concerning fire resistance must first of all prevent any possible fire propagation.

(R) It is recommended that all materials have low heating power.

Materials used in any situation respond to existing standards on fire protection, applied by owner networks with instructions to adopt on verifying criteria.

Reaction to fire of materials to be used must be tested by the network as well as by other organizations that the network recognises.

These tests must be effected according to methods in use by the owner network or according to national standards of the network. Results must be at least equivalent to A or B class test method demands described in the annexes.

The methods described in clause. 3 of the standard must be used as a base for formulating a verdict starting with mutual criteria on material reaction to fire. Networks can adapt these methods for their own use or search for

equivalencies between results that these methods produce and those obtained based on their personal methods.

The use of asbestos is prohibited.

In order to test the fire reaction of materials used to make seats, another fire test must be effected according to methods indicated in the annexes.

Fire protection – Material reaction to fire

Materials must be fire resistant based on tests listed in the annexes on the present standard.

Fire protection – Particular directives

Vectors must be built in such a way that inflammable materials (powder, grease, and rubbish) can be removed during maintenance procedures

Directives that concern walls within the vector:

Walls with closed doors that separate heating motors or electrical elements with more than 500 W voltage from passenger compartments, must have at least a 15 minute fire resistance, conforming to test methods from ISO 834, and prevent smoke passage and thermal radiation in neighbouring vectors.

Directives concerning monitoring and fire extinguishing systems:

Heat monitoring systems must be present in heating motor compartments giving information that can be seen in the personnel area.

Fire extinguishers must be installed in one adequate place in the heating motor areas and they must be furnished with dispatch manual activation

Directives concerning the use of liquefied gas (GPL):

In areas where liquefied gas is foreseen (kitchens and heaters), directives in annexes 1 and 2 must be followed. Instructions on conduct in case of fire, given in annex 2, must be inserted in the three UIC languages.

Different directives:

Rubbish bins, ashtrays and napkin holders must be made of metal and equipped with a metal cover or placed in a way as to prevent fire propagation. All internal elements in fireproof wood must be protected by fireproof varnish. In case of fire, doors on vectors in use must be manually open able (without tools) from the inside and outside. Directives on security exits with which to comply are leaflets UIC 560 and UIC 564-1.

Fire fighting products

Fire extinguishing novices for the environment (ex. HALON) must not be used in cars occupied with passengers.

It is necessary to instruct personnel on fire extinguisher use and execute periodical call backs.

Fire Extinguishers:

Every car must be equipped with at least one fire extinguisher. Sleeper-cars and restaurant cars must have two fire extinguishers.

UIC 565-3 (OR): “Indications for the layout of coaches suitable for conveying disabled passengers in their wheelchairs”

This leaflet contains basic indications for the design and layout of coaches specially adapted for the conveyance of disabled passengers in their wheelchairs. Depending on requirements, all or part of the leaflet may be taken into account in the design of such coaches.

UIC 568 (OR): “Loudspeaker and telephone systems in RIC coaches. Standard technical characteristics”

The leaflet defines the basic conditions for the installation into the RIC coaches of the public loudspeakers and the telephone for on board communication.

3 Modalities and Concepts for Emergency Situations

3.1 UITP: Preventing and Combating Fires in Metro Systems

This is an official position of UITP [UITP 03], the International Association of Public Transport. UITP has over 2 000 members in 80 countries throughout the world and represents the interests of key players in this sector. Its membership includes transport authorities, operators, both private and public, in all modes of collective passenger transport, and the industry. UITP addresses the economic, technical, organisation and management aspects of passenger transport, as well as, the development of policy for mobility and public transport world-wide.

Fire protection has three main goals: the protection of people, passengers, personnel and local residents; the protection of property, and the protection of the environment. It also includes all the technical and organisational measures, and all the precautions rolled out to prevent a fire from jeopardising humans, equipment and facilities. Fire protection encompasses all metro facilities, rolling stock and infrastructures (tunnels, stations, and various equipment) as well as procedures and organisation.

UITP recommendations

1) Owing to its specific characteristics, the metro poses particular risks and requires specific solutions. The risks found within metro systems are specific. Essentially, they stem from the high level of traffic and passenger numbers, conditions relating specifically to transportation in tunnels, and the system’s confinement within an enclosed space from which evacuation is difficult and whose emergency exit routes might become filled with toxic gases and thick smoke. In addition, the oldest networks are faced with dangers related to the cohabitation of installations and equipment whose designs, ages and conditions vary. These dangers differ from those encountered in other transport modes, particularly road and rail transport:

- Unlike road transport, metro systems do not carry the hazardous materials responsible for most disasters in recent years. Metro journeys are short and interspersed by stations

that can be used to evacuate passengers and as access points for the emergency services.

- - Unlike heavy rail, metro systems do not carry freight, and the crossing of tracks – the source of many accidents in rail networks – is very rare if not nonexistent.

Furthermore, the unified command structure found in metro networks facilitates the training of actors and the organisation of the emergency services.

For these reasons, it is not appropriate to apply to metro the same rules developed for other transport modes. Instead, specific rules must be developed for underground sections.

However, the specific characteristics of metro systems must not stop lessons being drawn from disasters that occur in these sectors, particularly as regards aspects involving dysfunctional emergency systems.

2) Fire safety objectives must be determined with the authorities and evaluated while taking account of the problem's different aspects. Metro safety objectives cannot be defined only by the network managers, but should be drawn up and selected alongside the authorities who define objectives and priorities.

These objectives and priorities must be defined while taking account of the problem's various aspects: protection of people, assets and service quality, not to mention technical and economic constraints.

3) A global safety concept must be developed. For a long time, all networks used standards as the basis for defining their policies on fire safety. Today, there are a lot of such standards. These are useful, but also have their limits and are certainly not satisfactory. Alongside them, a "safety concept" must be developed that, in the case of each network, determines:

- how to avoid fires and stop them from starting,
- how to detect them,
- how to contain them by sealing off and protecting vulnerable points,
- how to ensure passenger safety,
- finally, how to control fires.

This safety concept, whilst possibly using technical solutions that vary from one network to another depending on their technical characteristics, environment, constraints and material, is based on common principles: it takes into account the components of the transport system (tunnel, track, cable, rolling stock, personnel, passengers, etc.) and is based on a delicate and detailed analysis of the risk and dangers.

4) Analysis of the fire dangers and risks must be included from as early as the network design stage and continued through its maintenance and operation. Analysis of fire dangers and risks provides the basis of fire prevention. This analysis must be made from as early as the equipment and system design stage in order to prevent fires from starting and controlling their spread (for example, by reducing the fire loads of materials used). However, it must also be present at the maintenance and operational stage. It calls for a re-assessment of functions neglected by standardisation, for example regular track and equipment cleaning. These analyses must be based on recognised methods like Preliminary Danger Analysis (PDA) and Preliminary Risk Analysis (PRA). They may also be supplemented to good effect by full-scale trials. For this to happen, collaboration with manufacturers and infrastructure builders is essential.



5) Relations with external actors (fire, ambulance, etc.) must be prepared in meticulous detail. In the event of fire, numerous actors from outside the network will be called upon to intervene in order to facilitate the evacuation of people and deal with the fire and its consequences: fire brigade, ambulance service, etc. Interventions by such services must be prepared and coordinated. Lines of command must be clearly defined. Staff called upon to intervene must be trained for this type of action. They must be familiar with the locations, possess a map of the installations, and have equipment at their disposal which is compatible with the equipment used by the network. All this information must be compiled together within safety intervention plans that are adapted to the context and furnished to all actors likely to have to intervene in the event of a fire.

6) Safety policy – a matter for staff as well as passengers. Safety is the concern for everyone. Reactions from staff and passengers in the initial moments of a fire are crucial. Many disasters are made worse by poor decision-making, or by passengers being unfamiliar with the tunnel and then heading in the wrong direction, pushing one another and being trampled to death underfoot, to name but a few of the consequences. High quality passenger information and signposting is vital. An equally vital element is training for staff, who must be able to take the right decisions in the opening minutes of a fire and provide the correct guidance. In order to optimise staff reactions, the procedures to apply will be defined, training courses organised and regular drills staged with the fire services.

7) No smoking - enforced and complied with throughout the system. Anything that might cause a fire to start underground must be eliminated. For this reason, smoking poses a serious danger and so the majority of networks have chosen to address this problem by banning smoking among staff and passengers. Measures must be taken to ensure proper compliance with this ban throughout the network.

8) Systematic feedback from experiences must be organised. Experience shows that there are generally precedents for the events causing disasters. Each fire must be the object of an in-depth analysis of causes and consequences that also proposes recommendations. When a risk is detected, the right action must be taken to ensure that it can never become the source of a fire. In this vein, fire safety must not be set in stone, but must be constantly adapted in line with the latest data. Even though some metro systems have recorded deaths and material damage as a result of fires, these are nevertheless small in number (33 serious fires between 1970 and 2003, all networks combined). Metro is the safest mode of urban transport.

3.2 Example of Emergency Evacuation Procedures

One procedural example for evacuation could be taken from standards on fire prevention written by the National Fire Protection Association, USA. Although standard NFPA [NFPA, 03] deals predominantly with fire safety, it also provides requirements for general emergency situations. The main characteristics of this standard are:

- at every station, the platform level has to be provided with sufficient exit capacity to enable complete evacuation within 4 minutes to the next level;
- station evacuation time must not exceed 6 minutes; in case of three level stations, this requirement can usually not be fulfilled. NFPA 130 allows a relaxation of this

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- requirement under certain conditions, in particular if it can be demonstrated that a tenable environment can be maintained until the station is completely evacuated;
- the maximum distance to an emergency exit in the tunnel must not exceed 381 m; alternatively, in the case of twin single track tunnels, cross passages with a distance of 244 m have to be provided, if the abovementioned distance is exceeded.

Furthermore there are detailed stipulations with respect to emergency evacuation, in particular:

- tunnel ventilation and station smoke extract systems;
- emergency lighting;
- Rolling Stock;
- depots and workshops;
- fare gates;
- emergency communication.

Tunnel Evacuation Concept

In an emergency it must be the first objective to bring any affected train to the next station. In case this is not possible, trains need to be evacuated. NFPA 130 does not specify whether detrainment of passengers in the tunnel should be via side walkways or via trackway.

It is proposed to specify emergency evacuation via trackbed through front/end doors of the trains, for the following reasons:

- it allows a controlled evacuation;
- the trackbed provides a much wider evacuation route than a walkway of usual width and has therefore a higher capacity;
- elderly persons and/or small children would greatly reduce the max. evacuation speed on the walkway and possibly lead to panic;
- wheelchair users/PSN (People with Special Needs) can more easily be evacuated via the trackbed;
- in case of fire, air quality and temperature on the trackbed are much better than on the walkway (downstream of the fire and/or before tunnel ventilation is fully operational);
- the walkway should be reserved for access of rescue personnel.

In special situations, the maintenance walkway may be used for emergency evacuation, e.g. when the train is very close to or partly inside the station and detrainment via the trackbed would actually take longer than via the walkway.

Station Evacuation

In addition to the detailed requirements regarding station evacuation stipulated in NFPA 130, the following aspects should be specified to be incorporated into the design:



- a hazard analysis should be prepared and continuously updated; if time and resources allow, such a hazard analysis can already be done during the concept design stage;
- escalators in single entrance stations should be provided with an escalator sprinkler system;
- for the evacuation of PSN, special protected lobbies shall be provided at suitable places, where PSN can wait safely until they are evacuated by rescue personnel;
- a CFD (Computational Fluid Dynamics) analysis simulating the worst case scenarios for station smoke extract systems shall be performed; In any case, safe evacuation of the station within the timeframe stipulated by NFPA 130 must be possible.

4 Conclusion

This chapter has been updated according to the comments of the WP20 MODSYSTEM meeting on 10th January 2006.

List of common basic set for PIS devices and pictograms are reported. Moreover a list of safety related PIS devices and pictograms have been added in order to take care of special requirements coming from driverless applications. For these latter issues the analysis carried out in MODLINK – MODTRAIN project has been taken into account.

4.1 Common Basic Set of PIS On Board Devices

According to the analysis presented in this deliverable the common basic set of PIS on-board devices for Metro and Tram is composed by the following devices:

- External Display;
- Internal Display;
- PA Loudspeakers;
- Driver Cab Intercom;
- Emergency Handle for Passenger;
- Manual Fire Extinguisher;
- Video Surveillance with live transmission to Operations Control Centre;
- Emergency Lighting System;
- Push Buttons for Door Opening
- Bells or other Acoustic Alarms.
- Windowpane Smashing Tool

4.1.1 Common Basic Set of PIS On Board Pictograms

In relation to the common basic set of PIS on board devices it has been possible define also a common basic set of PIS on board pictograms, that is composed by the following pictograms:

- Emergency Handle Devices;
- Fire Extinguisher;
- Panels Indicating the Stations on Route;

4.2 Common Basic Set of PIS On Board devices and Pictograms Related to the Driverless Trains

In the following paragraphs there are listed the PIS devices and pictograms that could be taken in consideration for the driverless vehicle. These devices and pictograms represent an integration of the questionnaire result, because the majority of the Operators that compiled the questionnaire have not driverless vehicles.

In the following paragraphs there are listed also the international norms that could be used as reference for the devices and pictograms implementation. The abstract of these norms is reported in par. 2.2.

4.2.1 Floor Path Lighting

Floor path lighting is useful in indicating the right way to a train exit in a situation of low visibility (e.g. a lighting system failure or in the presence of smoke) and guiding passengers out of the train when an evacuation is in effect (EN 13272, UIC 555).

Position Requirements

In case of an emergency, floor path lighting on coaches shall be present on doorsteps and at any change in floor level (EN 13272).

Usability Requirements

For good, uniformed visibility, track lighting on the evacuation path with < 0.1 lm shall not exceed 1 m in length (UIC 555).

Visibility Requirements

Obstacle lighting and path evacuation lighting (on floor) shall be green and shall guarantee an illuminance of at least 5 lux (UIC 555).

4.2.2 Emergency Escape Pictograms

In case of emergency, the closest exit should be easy for passengers to identify and to understand. Lighted escape pictograms can be useful for this purpose (EN 13272, ISO 3864-1, ISO 17398, UIC 413).

Position Requirements

Pictograms that indicate the emergency exit shall be placed in all passenger areas and shall indicate the direction of the closest exit door in respect to the middle of the coach.

Usability Requirements

Lighted pictograms that indicate the emergency exit shall conform graphically to ISO norms in effect (ISO 3864-1, ISO 17398) (arrow and figure designed in white with green background); only those pictograms indicating working doors shall be on.

Visibility Requirements

The system shall be visible from a 5 m distance.

4.2.3 Emergency Call System for Passenger

An emergency call system shall be useful in allowing passengers to contact the train guard when help is needed, allowing the assistance request to occur in a timely manner (such as

communicating that there is a locked door or that a passenger has suddenly become ill). For this reason, and for the eventual need to receive instructions in an emergency, the device shall be connected with the train guard via a full duplex link.

Position Requirements

At least one emergency call system should be present in every passenger room or compartment. However, if a coach has only one or two passenger rooms, there shall be at least two systems per coach.

The emergency call system should be positioned between 800 mm and 1200 mm above floor level in order to give proper accessibility to all passengers.

Usability Requirements

The emergency call system shall provide communication with the train guard via a full duplex link.

The emergency call system shall be equipped with a call button for contacting the train guard. This button shall be large, easy to push and indicated in Braille. Near the button there shall be a pictogram and multilingual writing, which describe the button function.

An acoustic signal shall confirm that the call has been forwarded.

The emergency call system's integrated loudspeaker shall satisfy the requirements for person-to-person communication (ISO 9921).

The emergency call system's integrated microphone shall be indicated by a pictogram.

The system shall be provided with a LED sign which indicates out-of-order status.

Visibility Requirements

The pictogram furnished with the emergency call system shall make it easy to identify.

4.2.4 Emergency Egress Devices

The Emergency Egress Device is a system (such as a handle) for passengers to open an egress door in case of automatic motion failure. The requirements listed below shall be met in order to make the emergency egress device clearly visible and easy for passengers to execute.

Position Requirements

An emergency egress device shall be placed on the right side of the egress door (the egress door facing the passenger) and shall be installed between 800 mm to 1 200 mm above floor level, allowing use by every type of passenger.

Usability Requirements

The emergency egress device shall be equipped with the appropriate protection so that it cannot be activated involuntarily.

Near the emergency egress device there shall be indications that render the involuntary activation protection easily removable. If written instructions are needed, they shall be as concise and schematic as possible in order to guarantee quick use of the system.

The emergency egress device activation shall not require the passenger to use force of more than 15 N or 150 Nm (EN 60204-1).

The emergency egress device activation system shall have an easy-to-use shape (UIC 541-5, UIC 560).

Visibility Requirements

The emergency egress device shall be easily identifiable from all areas of the coach that are within a 2 m distance.

The visibility of the emergency egress device shall be facilitated by the proper pictograms and yellow, lighted, emergency indications (EN 60204-1, ISO 3864-1), so that it can also be easily activated in critical conditions (such as poor lighting or smoke on board).

Pictograms shall be positioned near the emergency egress device between 850 mm and 1 250 mm above floor level, so that they are clearly visible by every passenger.

4.2.6 Safety Related Signs

Safety signs inside coaches are important because they inform passengers on proper conduct during normal and emergency situations and use of systems with which they interface.

Safety signs are intended as graphic support on walls of the coach which show written instructions or a stylized image (pictogram) that informs passengers on prohibitions, appropriate conduct in case of emergency or, when referring to a particular system, makes passengers aware of its presence and instructions for use.

The contained information can directly (pictograms relative to an automatic system, maps indicating a point of aggregation in case of emergency) or indirectly regard passenger safety (pictograms indicating directions, pictograms for temperature regulating systems). The lack of knowledge of such information can damage passengers in some way, especially during emergencies.

The instructions shall be given in pictogram form, and if written instructions are needed, they shall be as concise as possible in order to guarantee quick use of the system.

Position Requirements

The following indicating pictograms shall be present beside the relative system (UIC 413):

- Automatic doors
- Door closing
- Door opening
- Emergency call system button
- Passenger Alarm
- Extinguishers
- Direction indicators
- Prohibitions
- Areas for people with reduced mobility
- Aggregation point in case of emergency or various needs

An important step for guaranteeing passenger safety in emergency situations is passengers' clear knowledge of the layout of the coach. Therefore orientation indications (maps), warnings and advisories (prohibitions, proper conduct, etc.) are necessary (UIC 413). These panels shall be positioned appropriately in the vestibule.

Coaches equipped for wheelchairs shall have pictograms posted on the wall of the vestibule which indicate the position the wheelchair shall assume (with the passenger seated) in upward and downward slopes (UIC 565-3). These pictograms shall be placed under public warning and advisory signs cited above.

Visibility Requirements

A pictogram shall be visible from a 2 m distance.

Given the universality of pictograms, their use is preferred over multi-lingual instructions in as many situations as possible in order to guarantee more immediate comprehension.

When written instructions are necessary, they shall be brief and clear enough for immediate use and they shall be written in the railway operator's language, in English, and in at least one other European language; for international trains, instructions shall be translated in all languages of the countries crossed.

Colours used for pictograms shall be chosen so as to make them immediately identifiable. Therefore the colour range used shall be limited. A minimum number of colours shall be used for each pictogram and the represented image shall be intelligible (ISO 3864-1, ISO 17398).



4.3 Main PIS Functionalities in Typical Service Events

Typical Service Event	Main PIS Devices Related to the Typical Service Event	Main Functionalities
Train is approaching a station	Internal Display	Station name visualization
	PA Loudspeakers	Station name announcement, eventual connections
Door opening	Inside door opening devices	Activation of the door opening devices
Train is at a standstill in a station for boarding passengers	Video Surveillance Cameras and Rear Mirrors	Visualization of the alighting and boarding operation
Door closing	Passenger acoustic alarm or messages	Activation of buzzer or alarm or whistle
Train is leaving a station	Internal Display	Terminal Station name and Next Station name (after the train departure)
	PA Loudspeakers	Next Station name announcement, eventual connections (after the train departure)



4.4 Main PIS Functionalities in Emergency Events

Emergency Events	Main PIS Devices Related to the Emergency Event	Main Functionalities
Emergency Handle Activation by Passenger	Alarm in the driver cab or into the OCC	Alarm activation into the driver cab or into the OCC The Emergency Handle for passenger generally doesn't directly connected to the Emergency Brake (passenger can stop the train only when the train is stand still at the station)
Fire on board	Alarm in the driver cab or into the OCC Manual Fire Extinguisher	Alarm activation into the driver cab or into the OCC
Main Power Electric supply failure	Ventilation system Communication system (PA, radio, CCTV)	Alimentation of these devices by the auxiliary power system
	Emergency lights	Emergency lights activation supplied by vehicle batteries
Accident	PA loudspeaker Emergency Call Unit Radio	Communication devices available for the external Rescue Team and passenger or crew inside the train
	Power supply cutting device	Possibility to cut the power supply from the OCC or along the track
	Internal Emergency door opening device	Possibility to open the door by the passenger or crew inside the train
	External Emergency door opening device	Possibility to open the door by the external emergency rescue team
Train is blocked on the track	PA Loudspeakers	Activation of pre-recorded messages or live message by the driver or OCC

5 ACRONYMS

CAN	Controller Area Network
CCTV	Close Circuit Television
CFD	Computational Fluid Dynamics
CPIIS	Critical Passenger Information and Interaction System (<i>The information given by the PIS and the PIS interaction with the passenger, especially in emergency events</i>)
DFH	Dangerous Failures per Hour
EMC	Electromagnetic compatibility
FRS	Functional Requirements Specification
HMI	Human Machine Interface
LED	Light Emitted Diode
LRT	Light Rail Transit
LRV	Light Rail Vehicle
LVS	Low Voltage Supply
MVS	Medium Voltage Supply
NFPA	National Fire Protection Agency
OCC	Operations Control Centre
OSI	Open Systems Interconnection
PA	Public Address
PDA	Preliminary Danger Analysis
PIS	Passenger Information System
PRA	Preliminary Risk Analysis
PSN	Person with Special Needs
RAMS	Reliability, Availability, Maintainability and Safety
SIL	Safety Integrity Level
SRS	System Requirements Specification
TICS	Transport Information and Control System
TSI	Technical Specification for Interoperability
UITP	Union Internationale des Transports Publics (International Union of Public Transport)

REFERENCES

- [DETUNIFI, 04] DETUNIFI (P. F. Pellegrini, M. Tommasini, M. Marconi, G. Poli, G. Adembri, L. Nencioni, M. Johnson), 2004, “Review of International and National Documents on Safety Alarm Information Systems (SAS’s)” , MODTRAIN Project, Report 2 - Task 10.3 - WP10 EUPAX/MODLINK.
- [DETUNIFI, 05] DETUNIFI (P. F. Pellegrini, M. Tommasini, M. Marconi, G. Poli, G. Adembri, L. Nencioni, M. Johnson), 2005, “Ergonomic Improvements on Passenger Informatin Systems(PIS)” , MODTRAIN Project, Report 4 - Task 9.5 – WP9 EUPAX/MODLINK.
- [LIBERTIN, 02] Light Rail Thematic Network, 2002, “Draft Report on Topic Information Systems”, An EC Thematic Network Project, Competitive And Sustainable Growth Programme.
- [LIBERTIN, 02] Light Rail Thematic Network, 2002, “Fire Safety”, An EC Thematic Network Project, Competitive And Sustainable Growth Programme.
- [LIBERTIN, 05] Light Rail Thematic Network, 2005, “Final Public Report”, An EC Thematic Network Project, Competitive And Sustainable Growth Programme.
- [NFPA, 03] National Fire Protection Association (NFPA), 2003, NFPA 130, “Standard for Fixed Guideway Transit and Passenger Rail Systems”, 2003 Edition
- [UITP, 03] Union Internationale des Transports Publics, 2003, “Preventing and combating fires in metro systems” FOCUS - a UITP position paper, November 2003