PD CEN/TR 17143:2017



BSI Standards Publication

Intelligent transport systems - Standards and actions necessary to enable urban infrastructure coordination to support Urban-ITS

bsi.

Documents
Document Sharing Hub

Full document details: PD CEN/TR 17143:2017

National foreword

This Published Document is the UK implementation of CEN/TR 17143:2017.

The UK participation in its preparation was entrusted to Technical Committee EPL/278, Intelligent transport systems.

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

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

© The British Standards Institution 2017
Published by BSI Standards Limited 2017

ISBN 978 0 580 98376 4

ICS 35.240.60

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

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 October 2017.

Amendments/corrigenda issued since publication

Date	Text affected

Documents
Document Sharing Hub

Full document details: PD CEN/TR 17143:2017

TECHNICAL REPORT

RAPPORT TECHNIQUE

TECHNISCHER BERICHT

CEN/TR 17143

October 2017

ICS 35.240.60

English Version

Intelligent transport systems - Standards and actions necessary to enable urban infrastructure coordination to support Urban-ITS

Systèmes de transport intelligents - Normes et actions nécessaires pour permettre la coordination des infrastructures urbaines en faveur des STI urbains

Intelligente Verkehrssysteme - Notwendige Normen und Aktivitäten um die Koordination der urbanen Infrastruktur zur Unterstützung urbaner ITS zu ermöglichen

This Technical Report was approved by CEN on 18 September 2017. It has been drawn up by the Technical Committee CEN/TC 278.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

© 2017 CEN All rights of exploitation in any form and by any means reserved worldwide for CEN national Members.

Ref. No. CEN/TR 17143:2017 E

Documents
Document Sharing Hub

Full document details: PD CEN/TR 17143:2017

Contents

Page

European foreword 10
Introduction 11
1 Scope 13
2 Terms and definitions 15
3 Symbols and abbreviations 28
4 Summary of Remit to PT1701 33
5 Summary of situational factors affecting the study 34
5.1 The Commission Implementing decision on ITS in urban areas 34
5.2 Autonomous vehicles 34
6 Summary of Standards framework 36
7 Summary of Stakeholders and structuring 37
7.1 Stakeholders 37
7.2 Actors 38
8 Summary of panoptic 'across the board' Requirements 38
8.1 The panoptic context 38
8.2 EU-ICIP 38
8.3 Concept of Operations 40
8.4 Common meta-data registry 40
8.5 Vendor lock-in 42
8.6 Testing and Conformance 42
8.7 Standards procedures 42
8.8 Other panoptic recommendations 43
9 Summary of communications and security requirements 43
9.1 Communications and Security context 43
9.2 C-ITS Communications and Urban-ITS 44
10 Summary of MIS requirements 45
10.1 The MIS context 45
10.2 MIS and Urban-ITS 47
10.3 Approach taken 48
11 Summary of Traffic Management (TM) requirements 48
11.1 The TM context 48
11.2 TM and Urban-ITS 49
11.3 Traffic management Standards issues. 50
11.4 Exchange of data and information with third parties 50
11.5 Procurement and maintenance of the Urban-ITS solution for TM 50
12 Summary of Urban Logistics (UL) requirements 51
12.1 UL context 51
12.2 Urban Freight 52
12.3 Standardised data formats and standardised transaction profiles 52
12.4 Emissions monitoring and geofencing 52
12.5 Recommendations for Urban Logistics 53
13 Summary of architecture requirements 53
13.1 FRAME Architecture context 53

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

13.2 Coherence 53
13.3 Standards required in order to ensure homogeneity and support for Urban-ITS 53
13.4 Update and extension of the FRAME ITS architecture 54

Annex A (informative) Detailed Recommendations of CEN/TC 278/PT 1701 55
A.1 Background and Structure of this Annex 55
A.1.1 Background 55
A.1.2 Use Cases 55
A.1.3 Objectives for Phase 2 outreach 57
A.2 Key issues and summarised recommendations 59
A.2.1 Summarised recommendations 59
A.2.2 Phase 2 outreach 60
A.3 Revised High Level Priority Recommendations for CID Support 64
A.4 Revised Recommendations for other ESOs/Committees 68
A.5 Revised priority Recommendations for other support measures 70
A.6 Other supported Recommendations for CID support 72
A.7 Other Recommendations for CID support (unsupported by outreach feedback) 72
A.8 Recommendations withdrawn as a result of outreach feedback 73

Annex B (informative) Objectives, strategy, philosophy and process of the study 76
B.1 Foreword 76
B.2 Overview 76
B.3 Commission Implementing Decision 76
B.3.1 Overview 76
B.3.2 General requirements for the requested deliverables 78
B.3.3 Requirements to strengthen compatibility and coherence with existing standards and technical specifications 78
B.3.4 Specific requirements for the requested deliverables 79
B.3.5 Multimodal information systems 79
B.3.6 Traffic management, including access regulation 80
B.3.7 Urban logistics, including parking management 80
B.4 Remit to PT1701 81

Annex C (informative) Situational Factors affecting the study 83
C.1 Overview 83
C.2 Characterising Urban-ITS 87
C.3 Stakeholders and actors 92
C.3.1 Stakeholders 92
C.3.2 Actors 94
C.4 Mixed vendor environment 96
C.4.1 Introduction 96
C.4.2 Obligations and expectations of urban public bodies 98
C.5 Standards combinations 101
C.6 Cooperation 103
C.7 Barriers and constraints to the operation of the open single European market (OSEM) 103
C.7.1 Common issues 103
C.7.2 Political obstacles to OSEM 105
C.7.3 Commercial obstacles to OSEM 105
C.7.4 Technical obstacles to OSEM 106
C.7.5 Contending aspirations of Urban administrations and commercial freight operators 107
C.7.6 Vendor lock-in 107

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

C.8 Autonomous /automated vehicles 109
C.8.1 Context 109
C.8.2 Autonomous driving and mobility 109
C.8.3 Autonomous driving and connectivity 109
C.8.4 Autonomous driving and maps 110
C.8.5 Autonomous vehicles and safety issues 112
C.8.6 Autonomous vehicles and security 113
C.8.7 Take up of autonomous vehicles 113
C.8.8 Autonomous vehicles and associated standardizations 114
C.9 Issues associated with the introduction of Urban-ITS 118

Annex D (informative) Standards Framework 119
D.1 Extant Standards 119
D.2 Legacy systems and Standards 120
D.2.1 Context 120
D.2.2 Legacy system and standards benefits 121
D.2.3 Legacy Standards for general use 121
D.2.4 Legacy system and standards issues 147
D.2.5 Vendor lock-in 151
D.2.6 Transition and migration issues 151
D.2.7 Availability of data concepts 153
D.3 C-ITS as a tool to overcome silos 154
D.4 Organisation and interdependencies 157

Annex E (informative) Stakeholders and structuring 160
E.1 Key stakeholders 160
E.2 E.2 High level mapping for key identified stakeholders 160
E.3 Overall framework required for interoperability and interchangeability 161
E.3.1 Interoperability 161
E.3.2 Interchangeability 161
E.3.3 Intermodality 161
E.3.4 Multimodality 162
E.3.5 Sustainability 162
E.4 Systems and devices that could take advantage of common structuring and implementation guidelines 168
E.4.1 Benefits of a common reference data model/ Meta-data registry 168
E.4.2 Benefits of data exchange profiles 169
E.4.3 Location determination and location referencing 170
E.4.4 Open urban data access portal 179
E.4.5 Structure of Public Transport Service related data 181
E.5 High level generic 'Concept of Operations' for city/administration support for Urban-ITS 187
E.5.1 General 187
E.5.2 Statement of the goals and objectives of the Urban-ITS 187
E.5.3 Strategies, tactics, policies, and constraints affecting the Urban-ITS 188
E.5.4 Organisations, activities, and interactions among participants and stakeholders for Urban-ITS 191
E.5.5 Clear statement of responsibilities and authorities delegated for Urban-ITS 192
E.5.6 Equipment required for Urban-ITS 192
E.5.7 Operational processes for the Urban-ITS 193
E.5.8 Role of the jurisdiction in Urban-ITS 195
E.5.9 Role of the Urban-ITS prime service provider 196
E.5.10 Role of the Urban-ITS application service provider 197
E.5.11 Role of the Urban-ITS user 197

Documents
Document Sharing Hub

Full document details: PD CEN/TR 17143:2017

E.5.12 EGeneric characteristics for all instantiations of the Urban-ITS application service domain 198
E.6 Standards requirements 198
E.7 Identifying standardisation gaps 198
E.8 The process of consensus 199

Annex F (informative) Panoptic (Multi-category) requirements 201
F.1 Panoptic (Multi-category) requirements — Objectives, summary and scope addressed 201
F.1.1 Objectives 201
F.1.2 Summary 201
F.1.3 Scope 201
F.1.4 Stakeholder engagement 201
F.1.5 Common/Interoperable data 201
F.1.6 Multimodality 202
F.1.7 Creation of (multimodal) transport datasets 202
F.1.8 Multiple means of communication 202
F.1.9 Creation of urban-interurban interfaces 203
F.1.10 Use of open standards, architectures and specifications 204
F.1.11 Enable rather than prescribe or proscribe 204
F.1.12 Obtaining consistency across the European Community, and across wider domains 204
F.1.13 Objectives of EU-ICIP 207
F.1.14 Organization of an EU-ICIP Guide 209
F.2 Panoptic (Multi-category) requirements — Relevant business/service areas and applications identified with key stakeholders 210
F.3 Panoptic (Multi-category) requirements — Gap and overlap analysis involving European and international SDOs and their relevant deliverables 210
F.3.1 Panoptic (Multi-category) requirements — Standards to achieve objectives 210
F.4 Panoptic (Multi-category) requirements — Potential revision of existing standards, new standards development and international harmonisation tasks based on gap/overlap results 214
F.5 Panoptic (Multi-category) requirements — Roadmap with targeted deliverables and concrete actions to speed up deployment of Urban-ITS 214
F.6 Funding issues 214

Annex G (informative) Multimodal Information Services (MIS) 215
G.1 MIS Objectives, summary and scope addressed 215
G.1.1 General 215
G.1.2 Stakeholder engagement 217
G.1.3 Common/Interoperable data 217
G.1.4 Multimodality 218
G.1.5 Flexible Transport Services 220
G.1.6 Creation of (multimodal) transport datasets 220
G.1.7 Multiple means of communication 221
G.1.8 Creation of urban-interurban interfaces 221
G.1.9 Use of open standards, architectures and specifications 222
G.1.10 Enable rather than prescribe or proscribe 225
G.2 MIS Relevant business/service areas and applications identified with key stakeholders 225
G.2.1 MIS Business service area 225
G.2.2 MIS Applications (Use Cases) information layers and data types 226
G.2.3 MIS Use Cases context 226
G.2.4 MIS Use Cases 228

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

G.3 MIS Gap and overlap analysis involving European and international SDOs and their relevant deliverables 254
G.3.1 MIS-0001 Gaps- MIS planned data retrieval 254
G.3.2 MIS-0002 Gaps - MIS real-time data capture 255
G.3.3 MIS-0003 Gaps - MIS planned data processing 255
G.3.4 MIS-0004 - Gaps - MIS real-time data processing 256
G.3.5 MIS-0005 Gaps - MIS actual trip plan provision 256
G.3.6 MIS-0006 Gaps - MIS information structuring 258
G.3.7 MIS-0007 Gaps - MIS information dissemination 258
G.3.8 MIS-0008 Gaps - MIS query structuring 258
G.3.9 MIS-0000 Gaps - user support 258
G.4 MIS Potential revision of existing standards, new standards development and international harmonisation tasks based on gap/overlap results 258
G.4.1 MIS planned data retrieval UC-MIS- 0001 258
G.4.2 MIS real-time data capture UC-MIS- 0002 259
G.4.3 MIS operational raw data provision UC- MIS-0002-1 259
G.4.4 MIS planned data processing UC-MIS-0003 259
G.4.5 MIS scheduled trip plan provision UC-MIS-0003-1 260
G.4.6 MIS planned data updating UC-MIS-0003-2 260
G.4.7 MIS real-time data processing UC-MIS-0004 260
G.4.8 MIS real-time data updating UC-MIS-0004-1 261
G.4.9 MIS Actual Trip Plan Provision UC-MIS-0005 261
G.4.10 MIS Dynamic Car-pooling UC- MIS-0005-1 261
G.4.11 MIS Driver Guidance UC-MIS-0005-2 261
G.4.12 MIS Information Structuring UC-MIS-0006 262
G.4.13 MIS Information Dissemination UC-MIS-0007 262
G.4.14 MIS Query Structuring UC-MIS-0008 262
G.4.15 to topology-related concepts i.e. 'origin/destination', a specific location (e.g. stop point), line, etc.; 262
G.4.16 User Support 263
G.5 MIS Roadmap with targeted deliverables and concrete actions to speed up deployment of Urban-ITS 263
G.6 Funding issues 263

Annex H (informative) Traffic Management (TM) 264
H.1 TM Objectives, summary and scope addressed 264
H.1.1 Traffic management: principles and historical evolvement 264
H.1.2 Spheres of activities and problem scenarios 265
H.1.3 Solution strategies and processes 267
H.2 TM Relevant business/service areas and applications identified with key stakeholders 267
H.2.1 Impact facilities of Traffic Management 267
H.2.2 TM infrastructure as a toolbox 268
H.2.3 Use Cases as a tool to describe the business in the TM-domain 271
H.2.4 TM process model as a reference model for TM Use Cases 272
H.2.5 TM Use Cases 274
H.3 TM Gap and overlap analysis involving European and international SDOs and their relevant deliverables 287
H.3.1 Problems in the TM domain related to the lack of standards 287
H.3.2 Interoperability requirements in the TM-domain 288
H.3.3 Use Case based gap and overlap analysis 290
H.4 TM Potential revision of existing standards, new standards development and international harmonisation tasks based on gap/overlap results 291

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

H.4.1 Preliminary observation ... 291
H.4.2 TM Architecture recommendations ... 292
H.4.3 H.4.3 Traffic management domain specific recommendations ... 292
H.5 TM Roadmap with targeted deliverables and concrete actions to speed up deployment of Urban-ITS ... 293
H.6 TM Funding issues ... 293

Annex I (informative) Urban Logistics (UL) ... 294
I.1.1 General ... 294
I.1.2 Stakeholder engagement ... 294
I.1.3 Common/Interoperable data ... 295
I.1.4 Multimodality ... 295
I.1.5 Creation of (multimodal) transport datasets ... 295
I.1.6 Multiple means of communication ... 295
I.1.7 Creation of urban-interurban interfaces ... 295
I.1.8 Use of open standards, architectures and specifications ... 296
I.1.9 Enable rather than prescribe or proscribe ... 296
I.2 UL Relevant business/service areas and applications identified with key stakeholders ... 296
I.2.1 Urban freight consolidation centres ... 296
I.2.2 UL Business service area ... 310
I.2.3 UL Applications (Use Cases) ... 311
I.3 UL Existing CEN/TC 278 working groups involved and co/cross working arrangements ... 379
I.4 UL International/European harmonisation requirements ... 380
I.5 UL Gap and overlap analysis involving European and international SDOs and their relevant deliverables ... 380
I.5.1 UL--0110v1 Provision of relevant traffic information- congestion; green wave; etc. data ... 380
I.5.2 Delivery vehicle realtime mapping/route optimisation ... 380
I.5.3 Vehicle access management and monitoring ... 381
I.5.4 Vehicle Speed Monitoring ... 381
I.5.5 Urban Consolidation Centres (UCC) ... 381
I.5.6 Oversize Management ... 381
I.5.7 Emissions monitoring ... 382
I.5.8 Low Emission Zones- Data Formats ... 382
I.5.9 Cross Border Enforcement ... 382
I.5.10 Charging alternatively fuelled vehicles on streets ... 382
I.6 UL Potential revision of existing standards, ... 382
I.6.1 Weigh in motion ... 382
I.6.2 Vehicle parking facilities ... 382
I.7 UL Roadmap with targeted deliverables and concrete actions to speed up deployment of Urban-ITS ... 383
I.8 UL Funding issues ... 384

Annex J (informative) Communications and Security (CS) issues for Urban-ITS ... 385
J.1 Communications objectives, summary and scope addressed ... 385
J.1.1 Stakeholder engagement ... 385
J.1.2 Cooperative-ITS and Urban-ITS ... 385
J.1.3 Common/Interoperable data ... 387
J.1.4 Multimodality ... 390
J.1.5 Creation of (multimodal) transport datasets ... 390
J.1.6 Multiple means of communication ... 390
J.1.7 Creation of urban-interurban interfaces ... 390

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

J.1.8 Use of open standards, architectures and specifications 391
J.2 Hybrid C-ITS communications 398
J.2.1 General 399
J.2.2 Hybrid communications Types 400
J.2.3 IP for end-to-end communications 400
J.2.4 Non-silo approach of hybrid communications 401
J.2.5 Hybrid communications : example 402
J.2.6 Hybrid Communications – multiple paths 403
J.2.7 Hybrid Communications – Path selection 404
J.2.8 Hybrid Communications – Collect ITS-station capabilities 405
J.2.9 Hybrid Communications – Collect layer information 406
J.2.10 Hybrid Communications – Communication profile selection 407
J.2.11 Hybrid Communications – Flow Transmission 408
J.2.12 Hybrid Communications – Path and Flow management 409
J.2.13 Hybrid Communications – Application layer 410
J.2.14 Hybrid Communications – Standards 410
J.3 Security objectives, summary and scope addressed 410
J.3.1 Introduction 410
J.3.2 C-ITS security 411
J.3.3 EU-US Task Force HTG6 412
J.4 Enable rather than prescribe or proscribe 414
J.5 Relevant business/service areas and applications identified with key stakeholders 414
J.6 Other gap and overlap analysis involving European and international SDOs and their relevant deliverables 414
J.6.1 Business service area(s) (Use Cases) 414
J.6.2 Other applications 414
J.6.3 Working groups involved and co/cross working arrangements 414
J.6.4 International/European harmonisation requirements 415
J.7 Other gap and overlap analysis involving European and international SDOs and their relevant deliverables 415
J.7.1 Other standards requirements to achieve objectives 415
J.7.2 Other existing Standards 415
J.7.3 Other Gap Analysis 415
J.7.4 Other requirement for new Standard(s) 416
J.8 Funding issues 416

Annex K (informative) Urban-ITS Architecture aspects (UA) 417
K.1 UA Coherence of Use Cases with FRAME Architecture 417
K.2 UA Gap analysis between Use Cases and FRAME Architecture 417
K.3 UA Standardisation needs and international harmonisation issues 418
K.3.1 UA Background 418
K.3.2 UA Standardisation 419
K.3.3 UA Harmonisation 420
K.4 UA Actions required to speed up deployment of Urban-ITS 421
K.4.1 Enhancing tools to assist ITS deployments 421
K.4.2 Stakeholder engagement 423
K.4.3 Common/Interoperable data 423
K.4.4 Multimodality 423
K.4.5 Creation of (multimodal) transport datasets 423
K.4.6 Multiple means of communication 423
K.4.7 Creation of urban-interurban interfaces 423
K.4.8 Use of open standards, architectures and specifications 423

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

K.4.9 Enable rather than prescribe or proscribe 423
K.5 UA Identified resources of expertise (individuals, organisations) to participate in this work 423
K.6 UA Consideration of optimum internal organisation to most effectively address these issues 424
K.7 UA Funding issues 424
K.8 Requests for support actions 424

Annex L (informative) Other identified issues for Urban-ITS (beyond span of CID) 425
L.1 Background 425
L.2 The population is trending to cities 425
L.3 Autonomous/Automated vehicles 426
L.4 Transmodel, DATEX II and associated standards 426

Annex M (informative) Use Cases Collated 428

Annex N (informative) References 527
N.1 Standards 527
N.2 Legislation and Regulations 537

Annex O (informative) Principal existing ITS Standards 539

Annex P (informative) Outreach Responses; Outreach contacts, contributors, and effects on Recommendations 569
P.1 Organisations and individuals consulted during the preparation of the interim and final reports 569
P.2 Organisations and individuals circulated with the Interim Report for comments and prioritisation 571
P.3 Feedback from outreach following circulation of interim report 572
P.3.1 Overview 572
P.3.2 Outreach feedback in relation to the priority areas identified at the Outreach meeting 575
P.3.3 Projects recommended, but under the lead of existing initiatives of CEN/TC 278 or other ESOCs 587
P.3.4 Outreach feedback to PT1701 recommendations 587
P.4 Collated outreach responses to individual recommendations 594
P.4.1 Standards Policies - Urban-ITS (and general) 594
P.4.2 Panoptic-Across the Board 599
P.4.3 Multimodal Information 601
P.4.4 Traffic Management 605
P.4.5 Urban Logistics 608
P.4.6 Architecture 609
P.4.7 Recommendations for standards deliverables from other CEN Committees/ other ESO's / recognised standards Issuers 610
P.4.8 Recommendations for other associated support measures and policies 613
P.5 Other Feedback received 616
P.6 Revised High Level Priority Recommendations for CID Support 622
P.7 Revised Recommendations for other ESOs/Committees 626
P.8 Revised priority Recommendations for other support measures 629
P.9 Other supported Recommendations for CID support 630
P.10 Other Recommendations for CID support (unsupported by outreach feedback) 630
P.11 Recommendations withdrawn as a result of outreach feedback 631

Bibliography 634

Documents
Document Sharing Hub

Full document details: PD CEN/TR 17143:2017

European foreword

This document (CEN/TR 17143:2017) has been prepared by Technical Committee CEN/TC 278 “Intelligent transport systems”, the secretariat of which is held by NEN.

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

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

Documents
Document Sharing Hub

Full document details: PD CEN/TR 17143:2017

Introduction

Cities are home to over 70 % of the EU population and account for some 85 % of the Union's GDP. Most journeys begin and end in cities. In many urban areas, however, increasing demand for urban mobility has created a situation that is not sustainable: severe congestion, poor air quality, noise emissions and high levels of CO_2 emissions. Urban congestion jeopardises EU goals for a competitive and resource-efficient transport system.

With its declared 'Urban Mobility Package', the Commission reinforces its supporting measures in the area of urban transport by:

— sharing experiences, show-casing best practices, and fostering cooperation,

— providing targeted financial support,

— focusing research and innovation on delivering solutions for urban mobility challenges.

In accordance with Article 8 of Directive 2010/40/EU of the European Parliament and of the Council of 7 July 2010 on the framework for the deployment of 'Intelligent Transport Systems' in the field of road transport and for interfaces with other modes of transport, the Commission may request the European standardisation organisations (ESOs) to develop necessary standards to provide interoperability, compatibility and continuity for the deployment and operational use of ITS. Such standards are scoped by Articles 2, 3, 4 (1), and Annex J of Directive 2010/40/EU [2] to specific priority areas and priority actions in the field of ITS. (Annex J also stresses the need for urban and interurban interfaces for data exchange, and the interoperability and compatibility between the urban and European ITS architectures.)

Within the overarching ITS objectives set by Directive 2010/40/EU [2], the urban dimension has its own needs envisioned in the Action Plan on ITS (2008) [33] and the Action Plan on Urban Mobility (2009) [38]. In 2010, the European Commission set up an Expert Group on Urban-ITS, with the participation of representatives of local authorities and their main partners, from the fields of research, industry, transport authorities and operators, standardisation bodies, etc. This 'Expert Group on Urban-ITS' developed guidelines on the deployment of key applications of Urban-ITS (namely: multimodal information, smart ticketing, traffic management and urban logistics), collected a number of best practices and reflected upon the need for further standardisation in the domain of Urban-ITS. The 'Expert Group on Urban-ITS' recommended better integrating the urban dimension within European standardisation activities and focusing standardisation efforts on multimodal information services including new mobility services, traffic management including access management, and urban logistics including reservation of loading bays. The standardisation efforts should cover existing gaps, upgrade and complement existing standards and ensure the establishment of the needed urban-interurban interfaces.

The EC Communication "Against lock-in: building open ICT systems by making better use of standards in public procurement" [41] points to the benefits of using standards and open specifications to avoid vendor lock-in of technological solutions, and promote the deployment of more cost-effective solutions. Its accompanying 'Staff Working Document' "Guide for the procurement of standards-based ICT – Elements of Good Practice" [42], lists a number of examples of open specifications in the transport domain, but also shows a lack of common standards for ITS.

Documents
Document Sharing Hub

Full document details: PD CEN/TR 17143:2017

The 'Expert Group on Urban-ITS' recommended involving local authorities and experts with specific urban knowledge in the ITS standardisation process. Therefore, the European standardisation organisations are invited to liaise with relevant bodies representing urban mobility and interested in Urban-ITS, such as standardisation coordination groups and organisations, local standardisation frameworks, experts and stakeholder platforms, cities and regions associations, user associations, transport operators and service provider's representatives. The resultant Project Team (CEN/TC 278/PT 1701) therefore comprises a mix of standardisation experts and experts from within or associated with Urban administrations, and organisations such as POLIS, and, importantly is linked to a wider outer network of experts, largely associated with Urban administrations, with whom it will consult and seek opinion and feedback to its initial proposals. The composition of the project team, in accordance with CEN project team selection procedures, was dependent on, and limited by, those who responded to the call for experts. While it was hoped that many Urban Administrations would be inclined to apply, applications were limited by the fact that public sector applicants could not be recompensed for their time costs. PT1701 have therefore worked to create contacts from other Urban Administrations to review and comment on its work (and acknowledge the help received from the European Commission in this respect), and the Interim Report is being used as a key outreach tool to achieve this participation and feedback.

The European Commission is in the final stages of processing and publishing a "COMMISSION IMPLEMENTING DECISION" (CID) on a standardisation request to the European standardisation organisations as regards Intelligent Transport Systems (ITS) in urban areas in support of Directive 2010/40/EU of the European Parliament and of the Council of 7 July 2010 on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport." [1] The measures provided for in this Decision are in accordance with the opinion of the Committee established by Article 22 of Regulation (EU) No 1025/2012 [43].

In this Decision, the European Committee for Standardisation (CEN), the European Committee for Electrotechnical Standardisation (CENELEC) and European Telecommunications Standards Institute (ETSI), hereafter referred as the ESOs (European standardisation organisations), are requested to draft new European standards and European standardisation deliverables in support of the implementation of Article 8 of Directive 2010/40/EU[2] for multimodal information, traffic management and urban logistics in the Urban-ITS domain. The CID[1] is required to be supported by a list of targeted standards to be developed as a priority. And it is within this context that this pre-study has to identify the (high level) requirements, identify available standards, and thereby identify the 'gaps' where the EC should target financial support in order to obtain/accelerate the provision of the Standards necessary to fill these gaps in order to enable efficient Urban-ITS to be instantiated.

The requested European standards and European standardisation deliverables shall be developed to be consistent and compliant with the requirements of the Delegated Acts adopted by the Commission under Directive 2010/40/EU[2], in particular the specifications for the provision of EU-wide real-time traffic information services adopted on 18 December 2014 [44], and the specifications for the provision of EU-wide multimodal travel information service [46].

This pre-study report is therefore designed to assist the European Commission to target where to provide such financial support for standards development in the areas of 'Multimodal Information Systems', 'Traffic Management', and 'Urban Logistics'.

Documents
Document Sharing Hub

Full document details: PD CEN/TR 17143:2017

1 Scope

The scope of this project is to undertake a pre-study providing stakeholder mapping, framework identification, gap analysis and identification of standards and related actions required to address the urban infrastructure aspects: the provision of

a) multimodal information services;

b) traffic management;

c) urban logistics,

that are required to support the provision of Urban-ITS.

Specifically, the scope of this pre-study is to produce a technical report that will (by December 2015), for each area, specifically address the standardisation requirements to meet the following technical challenges:

— stakeholder engagement;

— common/interoperable data;

— multimodality;

— creation of (multimodal) transport datasets;

— multiple means of communication;

— urban logistics management;

— creation of urban-interurban interfaces;

— use of open standards, architectures and specifications;

— enable rather than prescribe or proscribe.

It is the intention that, while the formal deliverable of this pre-study will be a technical report, that the project team will also identify areas for draft 'New Work Item Proposals' (and justifications) for work items to fill the identified gaps, where those gaps can be filled by Standards deliverables, and that the pre-study will also consider and make recommendations for any other support measures that are considered important or essential in order for the successful implementation, management and support of Urban-ITS in an environment where this is an administration controlled and led activity and not a community-wide managed or controlled activity.

The pre-study report, in addition to its submission to the European Commission, shall be in a format suitable for adaptation to a European standardisation deliverable on Use Cases addressing the three areas of this request and highlighting their possible interdependencies. Specifically, a gap analysis identifying additional requirements and priorities for:

d) Architecture: high level proposals outlining the parameters for a European standardisation deliverable for Urban-ITS architecture integrating the three areas of this request and highlighting connexions or interfaces with surrounding ITS applications as well as compatibility or coherence with existing standards, technical specifications, data models.

Documents
Document Sharing Hub

Full document details: PD CEN/TR 17143:2017

e) Multimodal Information Services: Standardisation deliverables in support of new mobility services, such as car sharing, car-pooling, public bike sharing services, park & ride, bike & ride, etc. Alternative fuel infrastructure, including information on location and availability of stations, charging models and capacity at stations, (integrated) payment schemes, etc. A European standardisation deliverable on reference data model, common data dictionary and metadata structure for multimodal information services.

f) Traffic Management: Standardisation deliverables in support of European standards for: a set of traffic management measures (encompassing the necessary infrastructure / static road data, dynamic road status data, traffic data or traffic control data, weather data), a set of traffic re-routing, traffic prioritisation and access regulation measures including intersections management (supplemented by vehicle identification data). In particular, the different types of road user charging models set up in various cities as well as the modalities of shared use of dedicated lanes by different types of vehicles (e.g. freight, public transport, emergency vehicles) should be considered. European standards or European Standardisation deliverables on reference data model, common data dictionary and metadata structure for traffic management including access regulation.

g) Urban Logistics (Including parking management): Standardisation deliverables in support of European standards for: Intelligent parking for light vehicles, commercial vehicles and trucks. The option of extending existing technical specifications or profiles regarding parking or adapting them to the needs of the urban areas should be considered; loading bays information and reservation services for specific freight vehicles and logistic sectors. Standards and specifications proposed will need to address both infrastructure and vehicles (including vehicle and/or load identification where relevant). Moreover, the use of alternatively fuelled vehicles for urban logistics, and the options of their charging (e.g. during loading/unloading at the specific bays) should also be looked into. A European standardisation deliverable on reference data model, common data dictionary and metadata structure for urban logistics including parking management.

For each of the identified areas, issues to be addressed by the pre-study, as defined by the Terms of Reference, are:

h) Identify key stakeholders;

i) High level mapping for key identified stakeholders for later participation in deliverables specification and development;

j) Identifying the overall framework required for interoperability and interchangeability, particularly in respect of central communications architectures and centre-to-field communications (and providing use-case examples);

k) Identifying the systems and devices that could take advantage of common structuring and implementation guidelines;

l) Identifying barriers and constraints to the operation of the open single European market;

m) Identifying transitional and migration issues;

n) Providing a high level generic Concept of Operations for city/administration support for multimodal travel, traffic management and urban logistic aspects of Urban-ITS;

o) Identifying standards requirements to assist/guide/support cities and administrations to provide support for Urban-ITS such as:

Documents
Document Sharing Hub

Full document details: PD CEN/TR 17143:2017

— Information level (standards and support measures for defining the meaning of data and messages);

— Application standards (to define the rules and procedures for exchanging information data);

— Communications transport standards (to provide specifications for common rules and procedures guidelines that cities and administrations may wish to consider adopting to exchange application data between point 'A' and point 'X' on a network);

— Subnetwork standards (to define the rules and procedures guidelines that cities and administrations may wish to consider adopting for exchanging data between two 'adjacent' devices over some communications media) Identifying existing standards and widely used technical means (such as DATEX II, XML, FTP, SNMP, SMTP, TCP, UDP, PPP, Ethernet, ASN.1, UTMC, OCA etc.);

p) Identifying standardisation gaps and providing a list of potential work items to be developed during the early tenure of the Standardization Request (CID) to support and enable cities and administrations to effectively implement Urban-ITS and to enable the functioning of the Single European open market in the Urban-ITS sector;

q) Identifying any other measures that would be a prerequisite to/or priority for the implementation of Urban-ITS to enable multimodal travel, traffic management and urban logistic aspects.

2 Terms and definitions

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

2.1
abstraction
essential characteristics of an entity that distinguish it from all other kinds of entities; an abstraction defines a boundary relative to the perspective of the viewer

[SOURCE: ISO 19501]

2.2
action
specification of an executable statement that forms an abstraction of a computational procedure

[SOURCE: ISO 19501]

Note 1 to entry: An action typically results in a change in the state of the system, and can be realized by sending a message to an object or modifying a link or a value of an attribute.

2.3
actor
entity that actively participates in the Use Cases that describe how services are to be delivered

[SOURCE: ISO 14817]

Documents
Document Sharing Hub

Full document details: PD CEN/TR 17143:2017

2.4
aggregation
special form of association that specifies a whole-part relationship between the aggregate (whole) and a component part

[SOURCE: ISO 19501]

2.5
analysis
part of the software development process whose primary purpose is to formulate a model of the problem domain (analysis focuses what to do, design focuses on how to do it)

[SOURCE: ISO 19501]

2.6
architecture
organizational structure and associated behavior of a system

Note 1 to entry: An architecture can be recursively decomposed into parts that interact through interfaces, relationships that connect parts, and constraints for assembling parts.

Note 2 to entry: Parts that interact through interfaces include classes, components and subsystems.

[SOURCE: ISO 19501]

2.7
association
semantic relationship between two or more classifiers that specifies connections among their instances

[SOURCE: ISO 19501]

2.8
attribute
feature within a classifier that describes a range of values that instances of the classifier may hold

[SOURCE: ISO 19501]

2.9
bike & ride
cycle parking facilities at PT nodes

2.10
boolean
enumeration whose values are true and false

[SOURCE: ISO 19501]

2.11
car sharing
several persons share a car (not necessarily at the same time), includes commercial short period car-rental services

Documents
Document Sharing Hub

Full document details: PD CEN/TR 17143:2017

2.12
car-pooling
also known as ride-sharing, lift-sharing, (or confusingly car-sharing in UK), is simply the sharing of car journeys so that more than one person travels in a car

2.13
class
description of a set of objects that share the same attributes, operations, methods, relationships, and semantics

Note 1 to entry: A class may use a set of interfaces to specify collections of operations it provides to its environment

[SOURCE: ISO 19501]

2.14
classification scheme
scheme for the arrangement or division of objects into groups by functional area

[SOURCE: ISO 14817]

2.15
collaboration diagram
representation that shows interactions organized around the structure of a model, using either classifiers and associations or instances and links

Note 1 to entry: Unlike a sequence diagram, a collaboration diagram shows the relationships among the instances. Sequence diagrams and collaboration diagrams express similar information, but show it in different ways. See: sequence diagram.

[SOURCE: ISO 19501]

2.16
Commission Implementing Decision (CID)
Article 291 of the Treaty on the Functioning of the European Union allows the Commission to adopt implementing measures for a legal act when uniform conditions of implementation are necessary

Note 1 to entry: The basic legal act shall explicitly confer on the Commission the power to adopt implementing acts. The end result of this process is a "Commission Implementing Decision"

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

2.17
comitology
EU process by which EU law is modified or adjusted and takes place within "comitology committees" chaired by the European Commission

Note 1 to entry: The official term for the process is committee procedure. Comitology committees are part of the EU's broader system of committees that assist in the making, adoption, and implementation of EU laws. The comitology system was reconfigured by the Lisbon Treaty which introduced the current Articles 290 and 291 TFEU. Whereas Article 291 TFEU provides for a continuation of implementation of EU law through comitology, Article 290 TFEU introduced the delegated act which is now used to amend or supplement EU legislation, whereas beforehand this was also done through comitology.

Note 2 to entry: Council of the European Union can confer such powers on the Commission. However, the Commission shall act in conjunction with committees of representatives of member states who often have the power to block the Commission and refer the matter to the Council.

Note 3 to entry: It is the confusing number of committees that gave rise to the term “comitology”.

Note 4 to entry: After years of complaint by Parliament, a significant reform placing Parliament and Council on an equal footing was to be introduced by the Constitutional Treaty. In 2006 a new procedure, the regulatory procedure with scrutiny, was introduced, to be used when non-essential elements of EU legislation adopted under the co-decision procedure required amendment or supplementation.

2.18
controlled units
Field devices, e.g. Traffic Signal Controller or Traffic Sensors

2.19
data
representations of static or dynamic objects in a formalized manner suitable for communication, interpretation, or processing by humans or by machines

[SOURCE: ISO 14817]

2.20
data concept
any of a group of data dictionary structures defined in this International Standard (i.e., object class, property, value domain, data element concept, data element, data frame, message, interface dialogue, association) referring to abstractions or things in the natural world that can be identified with explicit boundaries and meaning and whose properties and behaviour all follow the same rules

[SOURCE: ISO 14817]

2.21
data concept instance
individual occurrence of a data concept

[SOURCE: ISO 14817]

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

2.22
data dictionary
an organized and constructed (electronic data base) compilation of descriptions of data concepts that provides a consistent means for documenting, storing and retrieving the syntactical form (i.e., representational form) and the meaning and connotation of each data concept

[SOURCE: ISO 14817]

2.23
data element
data concept; some single unit of information of interest (such as a fact, proposition, observation, etc.) about some (entity) class of interest (e.g., a person, place, process, property, concept, association, state, event) considered to be indivisible in a particular context

[SOURCE: ISO 14817]

Note 1 to entry: A data element is represented by an object class, a property of the represented object class and a value domain.

2.24
data element concept
data concept; an expression of the inherent concept embodied in a data element without regard to the value domain(s) by which it can be physically represented

[SOURCE: ISO 14817]

Note 1 to entry: A data element concept is represented by an object class and a property of that object class.

2.25
data frame
data concept; grouping of data elements primarily for the purpose of referring to the group with a single name, and thereby efficiently reusing groups of data elements that commonly appear together (e.g. ASN.1 SEQUENCE, SEQUENCE OF, SET, SET OF or CHOICE) in a message specification

[SOURCE: ISO 14817]

Note 1 to entry: This data concept type may be used to specify groups of data elements for other purposes as well.

2.26
data model
description of the organization of data in a manner that reflects an information structure

[SOURCE: ISO 14817]

Note 1 to entry: See also information model.

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

2.27
meta-data registry
store of data, characterized in a consistent manner, as determined according to the provisions of this International Standard, used for a specific purpose (in this case ITS) data concept

[SOURCE: ISO 14817]

Note 1 to entry: The data registration process provides a determination of the ITS data dictionary items accepted into the 'ITS Meta-data registry'. The meta-data registry contains not only data about data concepts in terms of their names and representational forms but also substantial data about the semantics or meaning associated with the data concepts. A meta-data registry may contain data that assists information interchange and re-use, both from the perspective of human users and for machine-interpretation of data concepts. The 'ITS Meta-data registry' is comprised of items only from ITS data dictionaries, showing their source; however, not all ITS data dictionary items shall necessarily be submitted for inclusion, or accepted, into the meta-data registry, or is comprised of directly submitted data concepts.

2.28
data registrar
organizational element or an individual appointed by ISO TC204 to undertake the day-to-day management of the meta-data registry process

[SOURCE: ISO 14817]

2.29
data registration process
process by which data is formally described and provided to an approved location in the meta-data registry

[SOURCE: ISO 14817]

Note 1 to entry: This process is effected under the control of a 'ITS Data Registrar', in accordance with the requirements of ISO 14817

2.30
data type
classification of the collection of letters, digits, and/or symbols used to encode values of a data element based upon the operations that can be performed on the data element

[SOURCE: ISO 14817]

2.31
datatype
descriptor of a set of values that lack identity and whose operations do not have side effects

Note 1 to entry: Datatypes include primitive pre-defined types and user-definable types. Pre-defined types include numbers, string and time. User-definable types include enumerations

[SOURCE: ISO 19501]

2.32
destination
end point of a journey

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

2.33
domain
area of activity or knowledge characterized by a set of concepts and terminology understood by practitioners in that area

[SOURCE: ISO 19501]

2.34
driver
person/control system who drives (is in direct physical control of) a vehicle

2.35
event
specification of a significant occurrence that has a location in time and space

[SOURCE: ISO 19501]

Note 1 to entry: an event is an occurrence that can trigger a transition.

2.36
fare
amount paid for conveyance in a vehicle, usually predetermined

2.37
framework
stereotyped package that contains model elements which specify a reusable architecture for all or part of a system. Frameworks typically include classes, patterns or templates

[SOURCE: ISO 19501]

2.38
generalization
specialization/generalization relationship in which an object class of a specialized element (child) is substituted for a generalized element (parent)

[SOURCE: ISO 14817]

2.39
identifier
means of designating or referring to a specific data concept instance

[SOURCE: ISO 14817]

2.40
information
that which informs; viz. the meaningful interpretation of data (values attributed to parameters, and knowledge) which signifies understanding of real things or abstract concepts; information is conveyed either as the content of a message or through direct or indirect observation of something; commonly data that has been processed so that it is human readable or meaningful to a receiving system

Note 1 to entry: Information can be encoded into various forms for transmission and interpretation (for example, information may be encoded into a sequence of signs, or transmitted via a sequence of signals). It can also be encrypted for safe storage and communication.

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

2.41
information model
graphical representation that logically organizes various data concepts by depicting key relationships among the data concepts

[SOURCE: ISO 14817]

EXAMPLE An information model might specify that a Vehicle may be described by a variety of properties, such as: Make, Model, Year, and Vehicle Identification Number. Likewise a collision might be described by properties such as Time of Occurrence, Severity, and Number of Vehicles Involved. Finally, the model might depict that a collision has a many-to-many relationship to a vehicle.

Note 1 to entry: This document uses the term information model in order to reflect the fact that relationships give the data a context and thereby transforms data into information. Some groups use the term data model. See also data model.

2.42
instation
back office or central computing system responsible for sending/receiving data from outstations and processing said data

2.43
Intelligent Transport System(s)
ITS
transport systems in which advanced information, communication, sensor and control technologies, including the Internet, are applied to increase safety, sustainability, efficiency, and comfort

2.44
interchangeability
capability to exchange devices of the same type on the same communications channel and have those devices interact with others devices of the same type using the same (usually) standards-based functions; or, having a choice of the mode of transport means

2.45
intermodal(ity)
sequential change of transport means in order to achieve a journey

2.46
interoperabile/interopeability
property of a product or system, whose (communication-) interfaces are completely understood, to work with other products or systems, present or future, without any restricted access, nor complex additional implementation requirements

2.47
JAVA
general-purpose computer programming language that is concurrent, class-based, object-oriented,[12] and specifically designed to have as few implementation dependencies as possible

2.48
journey
movement from a ‘start point’ to a ‘destination’ using one or modes of transport

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

2.49
message
data concept; grouping of data elements and/or data frames, as well as associated message metadata, that is used to convey a complete unit of information

[SOURCE: ISO 14817]

Note 1 to entry: For the purposes of this document, a message is an abstract description; it is not a specific instance.

2.50
message
specification of the conveyance of information from one instance to another

[SOURCE: ISO 19501]

2.51
message instance
occurrence of a message containing the actual values for the data elements and, in some cases, data about the message

[SOURCE: ISO 14817]

2.52
meta
word denoting a description that is one level of abstraction above the concept being described

[SOURCE: ISO 14817]

2.53
meta attribute
any documenting characteristic of a data concept

[SOURCE: ISO 14817]

2.54
metaclass
class whose instances are classes

[SOURCE: ISO 19501]

2.55
meta-data
data that defines and describes other data

[SOURCE: ISO 14817]

2.56
metamodel
model that defines the language for expressing a model

[SOURCE: ISO 19501]

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

2.57
multimodal(ity)
ability to make a journey by more than one transport means

2.58
multimodal information services (MIS)
provision of information to assist travellers to make journeys using a choice or and/or multiple modes of transport to achieve a journey in an efficient and pleasant manner

2.59
name
indexical term used by humans as a means of identifying data elements and other data concepts

[SOURCE: ISO 14817]

2.60
object
entity with a well-defined boundary and identity that encapsulates state and behavior. State is represented by attributes and relationships, u is represented by operations, methods, and state machines. An object is an instance of a class

[SOURCE: ISO 19501]

2.61
object class
data concept; construct used to represent any kind of object (also referred to as an entity) within a ITS information environment

[SOURCE: ISO 14817]

2.62
outstation
communications device, normally installed in the field, designed to manage the data transmission from the controlled units to the Instation

2.63
parameter
any defined and constant factor in the operation of a system, or definition of an object

2.64
passenger
person travelling in a vehicle who is not in direct physical control of the vehicle; often (but not always) associated with the payment of a fare to a transport provider

2.65
park & ride
transport system designed to encourage drivers to park their cars outside the city and use public transport to travel into the city

2.66
peri-urban
urban transition zone where urban and rural uses mix and often clash

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

2.67
point of origin
start point of a journey

2.68
property
data concept; documenting characteristic of an object class used to group and differentiate individual objects

[SOURCE: ISO 14817]

2.69
repository
facility for storing object models, interfaces, and implementations

[SOURCE: ISO 19501]

2.70
reuse
use of a pre-existing artefact

[SOURCE: ISO 19501]

2.71
scenario
specific sequence of actions that illustrates behaviors. A scenario may be used to illustrate an interaction or the execution of a Use Case instance

[SOURCE: ISO 19501, see interaction]

2.72
semantics
meaning, including concept(s), associated with a given data concept

[SOURCE: ISO 14817]

2.73
sequence diagram
diagram that shows object interactions arranged in time sequence. In particular, it shows the objects participating in the interaction and the sequence of messages exchanged

Note 1 to entry: Unlike a collaboration diagram, a sequence diagram includes time sequences but does not include object relationships

[SOURCE: ISO 19501]

2.74
specification
declarative definition of what something is or does

[SOURCE: ISO 19501, amended]

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

2.75
state machine
behaviour that specifies the sequences of states that an object or an interaction goes through during its life in response to events, together with its responses and actions

[SOURCE: ISO 19501]

2.76
start point
origination point of a journey

2.77
sustainable/sustainability
capacity to endure; it is how biological systems remain diverse and productive indefinitely; within the context of Urban-ITS it is to achieve successful achievement of a journey with minimum impact on the environment; or, in terms of the provider of the transport means, to provide transport means that have minimum adverse effect on the environment

2.78
syntax
structure of expressions in a language and the rules governing the structure of a language

[SOURCE: ISO 14817]

2.79
TEN-T
transport infrastructure policy that connects the continent between East and West, North and South

Note 1 to entry: This policy aims to close the gaps between Member States' transport networks, remove bottlenecks that still hamper the smooth functioning of the internal market and overcome technical barriers such as incompatible standards for railway traffic.

2.80
Transmodel
European reference data model for public transport which constitutes an offer to public transport companies and other providers of services related to the process of passenger transportation (planning, operation and information), to suppliers of software products supporting these processes, to consultants and other experts acting in the field of public transport in the widest sense; the reference data model, developed at conceptual level, can support the development of software applications, their interaction or combination in an integrated information system, the system‘s organisation and information management which rules the utilisation of the existing telematics environment in a company (or group of companies) running computer applications supporting the different functional areas of public transport

2.81
transport means
any single transport mode or combination of transport modes used to achieve completion of a journey

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

2.82
transport mode
method or way of transport or travelling (vehicle class or type; walking, swimming etc.); All modes of transportation have 6 subsystems: Propulsion, Suspension, Control, Guidance, Structural, and Support

2.83
traveller
person or object who undertakes a 'journey' from a 'start point' to a 'destination' using one or modes of transport

2.84
trip
outward and return journey, usually pre-planned, from a 'start point' to a 'destination' using one or modes of transport, and usually with the intention of returning to the start point of the journey at some point in time

2.85
type
stereotyped class that specifies a domain of objects together with the operations applicable to the objects, without defining the physical implementation of those objects. A type may not contain any methods, maintain its own thread of control, or be nested. However, it may have attributes and associations

[SOURCE: ISO 19501]

2.86
Urban-ITS
use of ITS to enable and support efficient and sustainable transport systems in the urban environment; including services such as multimodal information systems, multimodal transport systems, environmental management control systems for transport and traffic, traffic management, and supporting new modes of transport designed especially for the urban context

2.87
Use Case
specification of a sequence of actions, including variants, that a system (or other entity) can perform, interacting with actors of the system to achieve an objective

[SOURCE: ISO 19501]

2.88
Use Case diagram
diagram that shows the relationships among actors and Use Cases within a system

[SOURCE: ISO 19501]

2.89
vehicle
any conveyance in or by which people or objects are transported

2.90
value domain
data concept; expression of a specific and explicit representation of some information about something of interest within the ITS domain

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

[SOURCE: ISO 14817]

2.91
view
projection of a model, which is seen from a given perspective or vantage point and omits entities that are not relevant to this perspective (i.e. does not necessarily describe the whole system)

[SOURCE: ISO 19501]

2.92
WGS84
Earth-centered, Earth-fixed terrestrial reference system and geodetic datum. WGS84 is based on a consistent set of constants and model parameters that describe the Earth's size, shape, and gravity and geomagnetic fields

3 Symbols and abbreviations

2G	GSM mobile communications networks
3G	UMTS mobile communications networks
4G	E-UTRAN/LTE mobile communications networks
5G	Next generation mobile communications networks
AASHTO	American Association of State Highway and Transportation Officials
ACC	automated cruise control
ADAS	advanced driver assistance services
ADR	Accord européen relatif au transport international des marchandises Dangereuses par Route /European Agreement concerning the International Carriage of Dangerous Goods by Road
AID	Application ID
AGORA	Implementation of Global Location Referencing Approach (Name of a European project 2000–2002) (ImplementAtion of Global lOcation Referencing Approach : C stands for “compact”)
Alert-C	Advice and Problem Location for European Road Traffic, Version C.
AMPQ	advanced message queuing protocol
ANPR	Automatic Number-Plate recognition
ANSI	American National Standards Institute
APEC	Asia-Pacific Economic Cooperation (forum)
APS	assisted parking system
ASCII	American standard code for information interchange
API	application program interface
APS	assisted parking systems
ASN.1	Abstract Syntax Notation.1 (ISO 8845,8825)
ASP	application service provider
ATM	asynchronous transfer mode
AVMS	automated vehicle monitoring systems
B2B	business to business
B2C	business to consumer
B2G	business to government
BER	basic encoding rules (ASN.1)
BSA	basic set of applications (C-ITS)
BSMD	bounded secure managed domain
BSS	Binnenstadservice.nl
CA	certification authority
CACC	cooperative adaptive cruise control

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

CALM	communications access or land mobiles
CAM	Cooperative Awareness Message
CCTV	closed circuit television
CEN	European Committee for Standardisation
CENELEC	European Committee for Electrotechnical Standardisation
Cf.	compare
CID	Commission Implementation Decision (previously called a 'Mandate')
C-ITS	Cooperative-ITS (cooperative intelligent transport system(s))
C-ITSS	Central ITS-station
CENELEC	European Committee for Electrotechnical Standardisation
CIDCR	Central ITS Data Concept Registry
COMEAP	Committee on the Medical Effects of Air Pollutants
CONOPS	CONcept of OPerationS
CORBA	common object request broker architecture
CSV	comma separated values
CVRIA	connected vehicle reference implementation architecture (USA)
DAB	digital audio broadcasting
DATEX	DAta EXchange
DATEX II	Data Exchange 2
DENM	Decentralised Environmental Notification Message
DG	directorate general
DMB	digital multimedia broadcasting
DRT	demand responsive transport
DTM	dynamic traffic management
DVB	digital video broadcasting
EBSF	European Bus System of the Future (project)
EC	European Commission
ECJ	European Court of Justice
EDI	electronic data interchange
EDIFACT	Electronic Data Interchange For Administration, Commerce and Transport
EDPS	European Data Protection Supervisor
EMS	Express Mail Service
EN	European Norm (Standard)
EPR	endpoint reference
ERA	European Railway Agency
ESO	European Standards Organisation
ESOC	European Standards Organisation/Committee
ETS	emissions trading system
ETSI	European Telecommunications Standards Institute
E-UTRAN	Evolved Universal Terrestrial Access Network
EU	European Union
EU-ICIP	EUropean ITS Communications, Information and Protocols
F2V	field to vehicle
FCD	floating car data
FDDI	fibre distributed data interface
FLC-CIC	Freight land conveyance - content identification and communication
FRAME	FRamework Architecture Made for Europe
FTP	file transfer protocol
FTS	Flexible transport service
GDF	geographic data file
GDP	gross domestic product
GIS	Geographic information systems (ISO 19101)
GML	geographic mark-up langage

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

GNSS	global navigation satellite system
GPRS	general packet radio service
GPS	Global Positioning System (US GNSS system)
GS1	Global Standards One
GSM	Global systems mobile
GSMA	GSM Association
GTFS	general transit feed specification
HD	high definition
HDLC	High-level Data Link Control
HMI	human machine interface/interaction
HTG	Harmonisation Task Group
HTTP	hypertext transfer protocol
I2I	infrastructure to infrastructure
I2V	infrastructure to vehicle
I2F	Infrastructure to field
IATA	International Air Transport Association
IBEC	International Benefit Economy Co-operation
ICRW	intersection collision risk warning
ICT	information and communications technology
ID	identity
IEC	International Electrotechnical Commission
IEE	Institute of Electrical Engineers
IEEE	Institute of Electrical and Electronic Engineers
IETF	Internet Engineering Task Force
IFOPT	Identification of Fixed Objects in Public Transport
IPITA	Integrated Proactive Intermodal Travel Assistant
IOPTA	Interoperable Public Transport Applications
IP	internet protocol (IPv4, IPv6)
IPITA	integrated proactive intermodal travel assistant
IPX	internetwork packet exchange
IPC	International Post Corporation
IPR	intellectual property rights
IR	implementation rules
IRI	international resource identifiers
IRU	International Road Transport Union
ISO	International Standards Organisation
ITE	Institute of Transportation Engineers (USA)
ITS	Intelligent Transport System(s)
ITU	International Telecommunications Union
IVERA	Initiatiefgroep VERkeersregeltechnici Nederland. Astrin
JWG	joint working group
KAR	Korte Afstand Radio (short distance radio)(Netherlands)
KPI	key performance indicator
LBCC	London Boroughs Consolidation Centre
LCRW	longitudinal collision risk warning
LDM	local dynamic map
LKA	lane keeping assistant
LIDAR	Light Detection And Ranging
LLC	logical link control (OSI)
LoS	level of service
LR	location referencing
LRM	location reference method
LRS	location referencing system

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

LTE	long term evolution
MAC	media access control (OSI)
MIB	management information base
MIS	Multimodal Information Services
MMTIPS	Multimodal travel information and planning services
MQTT	message queuing telemetry transport
MS	Member State
MSEU	Member State of European Union
MVB	multifunction vehicle bus (UIC)
MVE	mixed vendor environment
NEMA	National Electronics Manufacturers Association
NaPTAN	National Public Transport Access Node
NEN	Nederlands Normalisatie-instituut
NeTEx	Network Timetable Exchange
NFS	network file system
NLPG	National Land and Property Gazetteer (UK)
NO2	nitrogen dioxide
NOx	generic term for the mono-nitrogen oxides NO and NO2 (nitric oxide and nitrogen dioxide)
NTCIP	National Transportation Communications for ITS Protocol (USA)
NWIP	new work item proposal
OBE	on-board equipment
OCA	Open Traffic Systems City Association
OCR	optical character recognition
OCIT	Open Communication Interface for Road Traffic Control Systems
OEM	original equipment manufacturer
OICA	Organisation Internationale des Constructeurs d'Automobiles
OMG	object management group
OMMS	onboard multimedia system (UIC)
OMTS	onboard multimedia and telematics subsystems (UIC)
OSEM	open single European market
OSI	open systems interconnection
OTS	object transaction service
P&R	park and ride
PC	personal computer
PDC	personal digital cellular
PDE	portable data collection equipment
PER	packed encoding rules) (ASN.1)
PHS	personal handset system
P-ITSS	Personal ITS-station
PM10	particulate matter up to 10 micrometers
POI	point of interest
POLIS	Promotion of Operational Links with Integrated Services
POM	process oriented methodology
PPP	point-to-point protocol
PSAP	public service answering point
PSF	Physical Storage Format
PSV	public service vehicle
PT	1) project team (2) public transport
PTI	public transport information
Pt-2-Pt	Point-to-point
QoS	quality of service
RDC	radio data communication

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

RDS	radio data system
RDS-TMC	radio data system - traffic message channel
REST	representational state transfer
RFID	radio frequency identification
RFQ	request for quotations (IETF)
R-ITSS	Roadside ITS-station
RPC	remote procedure call
RTF	rich text format
SA	Service Agreement (EC/CEN)/ Support Action
SAE	Society of Automotive Engineers
SAP	service access protocol
SDO	standards development organisation
SID	service ID
SIRI	speech interpretation and recognition interface
SLA	service level agreement
SLI	service level indicator
SME	small or medium sized enterprise
SPX	sequenced packet exchange
SMTP	simple mail transfer protocol
SNMP	simple network management protocol
SOA	service oriented architecture
SOAP	simple object access protocol
SP	service provider
SPaT	Signal Phase And Timing
SQL	Structured query language
STOMP	streaming text orientated messaging protocol
SVG	scalable vector graphics
TAWG	the TPEG application working group
TCA	Transport Certification Australia
TCC	traffic control centre
TCN	train communication network
TCP	transmission control protocol
TCP/IP	transmission control protocol/internet protocol
TI	traveller information
TIC	traffic information centre
TIS	traveller information systems
TISA	Traveller Information Services Association
TLS	Technischen Lieferbedingungen für Streckenstationen
TLV	type, length, value
TM	traffic management
TMC	traffic management centre
TMP	traffic management plan
TMS	traffic management system
TN-ITS	Transport Network ITS Spatial Data Deployment Platform (INSPIRE)
TPEG	transport protocol experts group
TS	Technical Specification
TSS	traffic signal systems
UA	Urban-ITS architecture
UC	Use Case
UCC	urban consolidation centre
UDP	user datagram protocol
UDDI	universal description discovery and integration (OASIS:XML)
UITP	Union International des Transports Public

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

UL	urban logistics
ULEZ	urban low emission zone
UML	universal modelling language (ISO 19501)
UMTS	Universal Mobile Telecommunications System
UN/LOCODE	United Nations location code
UNECE	United Nations Economic Commission for Europe
UPU	Universal Postal Union
USDoT	United States Department of Transportation
UTC	urban traffic control
UTMC	Urban Traffic Management Control
V2I	vehicle to infrastructure
V2V	vehicle to vehicle
V2X	vehicle to any
VERA	Video Enforcement for Road Authorities (EC Cross Border Enforcement Directive)
V-ITSS	vehicle ITS-station
VMS	variable message sign
VRU	vulnerable road user
W3C	world wide web consortium
WAVE	wireless access vehicle environment
WIM	weigh-in-motion
WIM-O	weigh-in-motion-onboard
WIM-R	weigh-in-motion-roadside
WGS84	world geodetic system
WS	web service
WSDL	web service definition language
WTB	wire train bus (UIC)
WWW	world wide web
XML	eXtended Mark-up Language
XSD	XML Schema Definition

4 Summary of Remit to PT1701

Within the contexts described in Section 4, the remit to CEN/TC 278/PT 1701 is to undertake a PRE-STUDY - *"Standards and actions necessary to enable urban infrastructure coordination to support Urban-ITS*", the pre-study to identify standards requirements, and identify resources required to develop them.

The requirements on the PT and the instructions to the PT were comprehensive and are detailed in Annex B.4.

The summary of the remit to PT1701 can of course be gleaned from the Scope of the project (4. Above).

In essence, the key factors being to identify what Standards and associated measures are likely to be required to assist Urban Administrations to implement Urban-ITS; what standards are already in place that can assist with this objective, and thereby identify what gaps (and overlaps) exist, and which of these would be enabled or significantly benefit from assistance under the CID.

The project team itself comprised a broad mix of experience comprising: Urban administrations; practitioners and advisers to Urban Administrations etc.; professional standards developers/ITS industry; automotive industry.

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

And the PT was given a specific remit to outreach to Urban Administrations, both in identifying the gaps, and in validating the result of the interim work.

The PT comprised experts from Belgium, France, Germany, Netherlands, Norway, United Kingdom.

5 Summary of situational factors affecting the study

5.1 The Commission Implementing decision on ITS in urban areas

The COMMISSION IMPLEMENTING DECISION *on a standardisation request to the European standardisation organisations as regards Intelligent Transport Systems (ITS) in urban areas in support of Directive 2010/40/EU of the European Parliament and of the Council of 7 July 2010 on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport* [1] focuses on three areas of Urban-ITS, namely:

— multimodal information services;

— traffic management including access regulation;

— and urban logistics including parking management.

In order to enable ITS connectivity (avoiding silos or lock-in effects) the ESOs shall demonstrate how the three areas above mentioned are linked together within a broader Urban-ITS architecture, and accommodate their relationships and interfaces with other related ITS applications (not directly in the scope of this request).

The work shall recommend the necessary organisational arrangements supporting an effective cooperation and good coordination across ITS standardisation initiatives and working groups, keeping in mind the need to address the variety of users' needs (from consumers to operators and providers), the ranges of environments (including urban-interurban interfaces), and the different types of vehicles or modes of transport or mobility services (including for mobility impaired) related to the three areas above-mentioned.

For this purpose, the PT shall demonstrate how it has engaged appropriate (urban) experts and stakeholders throughout the whole process (planning, standard making, deployment). The diversity of local situations and policies should be considered.

5.2 Autonomous vehicles

Although not specifically mentioned in the remit to the Project Team, it would be wrong not to address the topical subject of autonomous vehicles. It is now clear that there is heavy investment in this area, and most of the technical hurdles are likely to be overcome within the next couple of years, and a paradigm of so called ‘autonomous vehicles’ is now a potential reality. PT1701 shall then consider, how does this affect the pre-study on Urban-ITS?

Autonomous driving will in time become a feature of future mobility solutions. It is significant that the Silicon Valley giants Google, Apple and Tesla are making investments to become significant actors in this field, and are either already offering a form of automated driving, or developing them.

The role of the autonomous vehicle will be mixed, and will change over time. But many of the concepts being studied by PT1701 could be effected, at least in part, by autonomous vehicles. In metro systems and guided pathway systems, largely at airports, autonomous vehicles have been in use for many years, and their span of use has moved from just moving passengers between terminals, to moving passengers from cars to terminals, and from moving passengers from other

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

transport modes to the airport. In recent years, metro systems around the world have been introducing driverless trains However, the current emphasis is on driverless road vehicles, and here the paradigm is quite different from that for guided pathway systems.

Continuous communications form an integral part of autonomous driving. At the moment Apple and Google are relying on WiFi, but the automotive manufacturers, supported by US DoT are combining this with 5.9 GHz communications, and, because of the need to support multiple media and switch from one to another, the ISO 21217 communications air-interface for land mobile architecture, or something similar, will become the accepted norm.

Autonomous driving can only be successful with highly developed and continuously updated maps. The map required for an autonomous vehicle will be far more precise and accurate than maps used today because it is presenting -continuously updated- detailed information about the world to the car.

Security will be a key factor for autonomous vehicles. Currently the research vehicles can be effectively secured and operated in a closed environment. In an open road situation with many autonomous vehicles, this will not be possible. In the Urban-ITS paradigm, where dial-up services may call a driverless pod or taxi, the threat of hacking - making the pod not arrive or the taxi take the passenger to a different destination (even kidnap the occupant), or even deliberately crash the vehicle, - is a major issue of concern. Annex J.3 of this pre-study addresses these security issues for Urban-ITS, and its exposition is equally apposite for the autonomous vehicle paradigm.

The introduction and take-up of this enhanced connected/autonomous paradigm will be dependent on a number of factors:

— Technical capability;
— Legal and regulatory framework;
— User acceptance.

It is now reasonably clear that the remaining technical issues relating to autonomous vehicles will quickly be solved. However, legislation and regulations are currently focussed around control of the vehicle and 'the driver'. In order for autonomous vehicles to be allowed on the roads, the legislative and regulatory regimes will have to be revised, and just what revision is needed will not be clear until some of the remaining technical issues are solved. That will happen soon, but changing regulations and getting legislative change is not a rapid process, and is likely to take many years. In the meantime, autonomous vehicles will require to be under the control of a supervising driver who is able to overrule and take control at any time. (For example autonomous 'platooning' is already available as 'adaptive cruise control' with the vehicle automatically maintaining position behind the preceding vehicle, but with the ability of the driver to override at any time).

This clearly limits the near term use of any autonomous features that would be in the Urban-ITS paradigm, such as autonomous driverless 'pods' or taxis providing on-demand mobility services in the urban context.

The third factor to consider, especially in Europe, will be that of user acceptability. The speed at which European vehicle users will adapt to autonomous vehicles, and the proportion of the population that will ever want to hand over this control of the vehicle, remains an unanswered question, and will certainly be one that will require some time both for the user community to adapt, and may, in democratic regimes, also affect the speed at which legislative change progresses, because of resistance from the electorate.

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

At the recent TU-Auto conference in Stuttgart (Automotive Europe 2015: Telematics Autonomy Mobility) the independent consultant Holger Meinel, stated from the floor that a recent study cited showed that, while 90% of Brazilians want to have a self-driving car, only about a third of all Germans and just a bit more than a quarter of Japanese feel the same way. This suggests that many consumers in markets where self-driving cars will no doubt first be launched still need to be convinced.

Turning back to this pre-study, the remit to PT1701 has been directed to focus its work on standards deliverables that can be finalised within the three-year span of the CID mandate, and to focus on early measures to assist Urban Administrations to implement Urban-ITS, but PT1701 recognises that the integration of autonomous vehicles into the ITS and Urban-ITS environment is a major issue, well beyond the scale and remit of this PT, but one that needs a project team to study at an early stage, and makes a recommendation to create a project team to address this issue.

Within the PT1701 pre-study, the emphasis has been on creating, obtaining and using data to enhance multimodal information services, traffic management and urban logistics. As such Urban-ITS information exchanges will form a major contribution to the operation of autonomous vehicles in urban domains. But the emphasis of ITS/Urban-ITS or for that matter Cooperative ITS, is the availability of relevant information on which to base decision making. The issue of whether that decision is made by a system or a human operator is important, but it is secondary to the provision of data in order to make such decisions. Thus the pre-study encompasses the use of autonomous vehicles (autonomous decision making) to potentially provide the services described in the Use Cases, but do not take into any account additional information requirements (if any) for autonomous vehicles, as any such additional requirements are not yet identified/characterised, but a project team should be funded to investigate these issues at an early stage.

See Annex C.8 for more detailed consideration of these issues

6 Summary of Standards framework

The framework of existing standards relevant for Urban-ITS is provided in Annex D. (Principal existing ITS standards are shown in Annex O).

Urban-ITS is considered a new paradigm, and ITS considered paradigm of the future, but in practise, ITS standards have been developed since 1991 (date of CEN/TC 278 formation), and to some extent, ITS is endemic in everyone's vehicles already. Full ITS-station communications are not yet embedded but the US Government has determined that C-ITS technology will be required in US vehicles. In Europe, eCall becomes mandatory for new vehicle types in 2018; remote tachograph reading has passed through the EU parliament, and remote weigh-in-motion legislation is following; and regulation for C-ITS in EU will inevitably follow. Not because of political aspirations, but the simple safety of life issues.

ITS standards have been published since the formation of CEN/TC 278 in 1991, and ISO TC204 in 1993, and more latterly by ETSI, since 2006.

Urban-ITS is considered a new paradigm, and in terms of its demands for interoperability of data, and consideration of the multimodality options for travellers, indeed, does represent a new paradigm, but the building blocks for Urban-ITS, have been layered into place over more than 20 years. This is both a good and bad thing,

It is a good thing in that ITS, Cooperative-ITS, Urban-ITS, become possible, and is only possible, because of these building blocks, but a bad thing because, to date, most ITS have been developed in a go-it-alone, 'silo' approach.

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

Researchers, developers and implementers, have worked hard over a quarter of a century to achieve their developments and successful systems, and are reluctant to change to benefit some other users somewhere else. Indeed, changing the attitude of these communities is a greater challenge than making the necessary technical changes. So, as of today, we sit with similar but different data concepts that are not interoperable; with different meanings for the same term, and different terminology for the same thing.

To achieve the interoperability/multimodality required to achieve Urban-ITS; availability, comprehension, and re-use, of data, and common definition of terminology, is essential.

— Here the 'achievements' of standards for public transport, vehicle identification, fee collection, freight movement, traffic information, traffic management, while probably genuinely major achievements in their context at the time, are largely not interoperable, indeed, often not even aware of each, others existence in many cases, buried, as they are, deeply, within their own limited short term paradigms.
— CEN/TC 278 has published more than 140 standards deliverables, and ISO TC204 more than 250 standards deliverables, concerning aspects of ITS.
— Some standards, indeed many standards, particularly CEN and ITS standards, that in general are application focussed, particularly in their currently isolationist context, can continue to be developed in isolation, but can only gain the benefit of cooperative systems if data can be shared (in protected form).
— The Urban-ITS paradigm is indeed a societally constrained sub-context of the overall ITS paradigm, within travellers and cargo move within the urban environment, in a societally efficient and sustainable fashion.
— The framework of the main existing standards, relevant for Urban-ITS, is provided in Annex D. A full list of principal ITS Standards is given in Annex O.
— The most significant of these Standards that has implication and potential benefit for the Urban-ITS paradigm include Transmodel, IFOPT, SIRI, NeTEx, DATEX II, TPEG, and the CALM architecture and related Standards supporting ITS-station communications, and generic standard approaches to modelling and interoperability such as UML, XML, ASN.1.
— See Annex D for detail of these extant standards.

7 Summary of Stakeholders and structuring

7.1 Stakeholders

Urban-ITS "Stakeholders" can be viewed as four categories of stakeholder, comprising those who:

— *Want* Urban-ITS, such as 'Urban administrations' and in many cases, 'Public Transport Authorities';
— *Use* Urban-ITS, such as travellers, freight shippers, road operators, transport operators, etc.;
— *Govern* Urban-ITS, usually National and/or Regional Governments, the EU, (and perhaps indirectly those who create standards);
— *Make* Urban-ITS, such as system and component suppliers, communications and infrastructure providers.

Service providers fall into any combination of the categories "Want", "Make", "Govern" and "Use", depending on what they do. All stakeholders will have different expectations for what the services that ITS can provide will mean to them and their organisations. See Annex E for greater detail.

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

7.2 Actors

An actor is someone, or something that actively contributes to the provision and operation of a service and in so doing may be a beneficiary of the service. The actual benefit will be different for each actor, and for some the benefit may be indirect, or something that is done for others. The following are examples of the benefits:

— The *road network manager* – is able to reduce congestion, which may be one of their KPI's, or it may help them to fulfil a policy objective of national, regional or local government;
— The *traveller* – benefits from being able to complete their journey in a safe, efficient, and comfortable manner;
— The *freight shipper* – is able to make money out of moving goods either because that is their business or as part of a manufacturing or distribution process.

The Use Cases that PT1701 produces all involve what the object oriented modelling community would call 'actors'. Annex E to this report provides a list of the principal actors, that may be required in order to implement Urban-ITS.

8 Summary of panoptic 'across the board' Requirements

8.1 The panoptic context

PT1701 makes recommendations to assist the three sectors, identified in the remit to PT1701, as the three key areas to enable Urban Administrations to implement Urban-ITS, but the greater impact of the work of PT1701 will be those recommendations that help to pull existing systems out of their silos and enable them to migrate to the interoperable paradigm of Urban-ITS. But although the pre-study was directed to consider three aspects of Urban-ITS, PT1701 has been careful to consider these in the context of the interoperable Urban-ITS paradigm and careful not to create three new 'silos' by only dealing with these issues independently.

As such, many of the most significant recommendations of PT1701 are not those that improve technical support within existing paradigms, but those which have cross boundary impact and enable existing applications to support the urban-ITS paradigm, and introduce new criterion that are not constrained by legacy.

The Annexes to this pre-study contain analysis and consideration of the key components that will enable Urban-ITS.

Regarding panoptic requirements, Annex B (Situational Factors affecting the study), Annex E (Stakeholders and structuring), and Annex F (Panoptic (Multi-category) requirements) carry the detailed panoptic results of this pre-study, and, particularly Annex E.3 considers the "Overall framework required for interoperability and interchangeability", and E.4 considers "Systems and devices that could take advantage of common structuring and implementation guidelines".

In summary, the key panoptic conclusions of PT1701 are as follows:

8.2 EU-ICIP

(HLR1e) Regardless of the standards that are developed as a result of this pre-study, or other demands of the marketplace to enable Urban-ITS, (or whatever measures prise existing 'silo' developed systems into the interoperable world), we have learned that awareness and communication are key factors in developing interoperable systems. Systems developers, standards developers, unless for specific market interest to lock a market, do not define their systems to be 'silos', they generally do this because, like most people these days, they work

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

under pressure, and this is the easiest solution. It is easier to define a new data concept than to hunt for an existing data concept in another standard that could be used (and thus enable re-use and interoperability). Where, indeed, would they start to look? Would they be expected to search through the 400-500 ITS standards developed by SDOs around the world? *It is not going to happen.*

If Urban-ITS were simply a local issue involving local assets and services, differences between instantiations would be of lesser significance. However, travellers, vehicles of all descriptions, and passenger service vehicles (from the local bus to the intercity train), move not only within conurbations, but between them, and between countries and states. Therefore, some level of consistency is essential. Further, as described at some length in Annex C.4, to achieve efficiency in a mixed vendor environment, open standards are required.

CEN/TC 278/PT 1603, with the remit to provide outreach for PT1602's "Roles and Responsibilities in Cooperative-ITS" quickly established that, once you moved away from standardisation specialists, and into the offices of implementers, engineers and administrators, there was a poor understanding of ITS standards, or even the reasoning behind their need.

PT1701 is of the opinion that it is essential to also make guidance, information and support available to those who will have to make use of or require compliance to these standards. A guide and support framework is needed to assist the introduction and instantiation of Urban-ITS in a reasonably consistent manner.

Such guidance, which we provisionally call the "European ITS Communications and Protocols" – (EU-ICIP, [there would be benefits keeping a similar sounding acronym to NTCIP]) would be designed to be an educational tool, created to assist planners, specification writers, and implementers in understanding the various EU-ICIP adopted standards and how to use them.

EU-ICIP would support a family of open (existent) standards, referencing both common communications protocols and data definitions, that in combinations enable Urban-ITS/ITS to function and be managed.

EU-ICIP would explain to and enable Urban Administrations, road authorities and EU Member states to understand the mesh of standards needed to attain their goals for Urban –ITS, and ITS in general, and provide guidelines to move from abstract architectural concepts to effective instantiation. It would provide EU and the member states with the basis for regulated requirements to achieve its political objectives, and effective instantiation of Urban-ITS in the context of a general ITS environment. The principles of EU-ICIP would be available and adoptable in the context of the wider global ITS community, although some constraints will be regionally appropriate, and the EU-ICIP will always have to be explicit about both global benefits and benefits/constraints as they affect the EU Member States.

EU-ICIP will provide to those outside of EU who wish to cooperate/integrate with the ITS environment in EU, with clear reference points of the standards compatibility/compliance required to achieve compatibility with EU systems. This need has been expressed to PT members by ministers and senior civil servants from countries such as Turkey, Israel, and the Russian Federation.

The proper use of EU-ICIP open-standards in an ITS deployment will allow future expansion of the system to benefit from true competitive bidding, as well as allowing other types of ITS to be added. EU-ICIP would embrace and recommend an entire family of standards designed to meet the communications and data needs of actors in the ITS environment (for example I2I (TMC<>roadside devices, TMC<>TMC, road operator<>emergency services<>jurisdiction etc.), V2V, V2I, I2V, etc.).

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

EU-ICIP would provide guidance, information and consistency for agencies implementing and operating Urban-ITS/ITS. EU-ICIP will assist interagency coordination and allows equipment of different types and different manufacturers to be mixed within the same or communicating systems.

Even in situations where EU-ICIP protocols cannot be initially implemented because of legacy or other similar problems, operating agencies will benefit from specifying that EU-ICIP recommendations be included in all future acquisitions and upgrades, to provide a better migration path to interoperability and an open market.

The objective will be to promote that all future devices will logically support the appropriate EU-ICIP protocols, at least as an option, and that manufacturers will seek to offer the appropriate EU-ICIP protocols in order to remain competitive in the market place, thus providing operating agencies with the mixed-vendor opportunities espoused.

PT1701 recommends that the CID supports a project Team to develop and publish EU-ICIP. (Guide: (Technical Report) EUropean ITS Communications, Information and Protocols {EU-ICIP}). (1.6.3; 2.2; Annex C.5; Annex A.2.2; D.2.6; D.2.7; F.1.12; F.1.13; F.1.14; F.3.1.1)

8.3 Concept of Operations

Annex E.5 provides description of a very high level "Concept of Operations" (CONOPS) from the perspective of the Urban Administration implementing/supporting Urban-ITS. This aligns with Recommendation HLRb-2. (see 1.8 and 2.5).

At the business level, and in addition to the EU-ICIP, it is necessary to provide advice and guidance to Urban Administrations to assist them to move from current organisations and practices into a multimodal business paradigm.

CONOPS is a document describing the characteristics of a proposed system from the viewpoint of an individual who will provide and/or use that system. It is used to communicate the quantitative and qualitative system characteristics to all stakeholders.[70]. CONOPS are widely used in the military, governmental services and other fields, and are considered highly appropriate for all areas of joint operations planning. Increasingly, CONOPS are used in ITS design to ensure that all relevant aspects of the system are being considered and controlled.

A CONOPS guide is needed to consider organisational, management, commercial issues and change management to provide a high level concept of operations (CONOPS) in the multimodal business paradigm.

See Annex E.5.

PT1701 recommends that CEN develop a guide (Technical Report) to provide advice and guidance to Urban Administrations to assist them to move from current organisations and practices into a multimodal business paradigm.

The guide to consider organisational, management, commercial issues and change management to provide a high level concept of operations (CONOPS) in the multimodal business paradigm.

8.4 Common meta-data registry

Closely linked with the requirement for the EU-ICIP to provide guidance and be a single source where systems implementers can see the interrelationships and standards needed, and linked with the need to provide a CONOPS to advise administrations regarding the Urban-ITS business

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

paradigm, much of the requirement for Urban-ITS centres on the common definition, sharing and use of common data.

In this interoperable world, data objects characterise only the data, not the use to which it is being put. Data concepts comprise constructs of a sequence of defined data objects which may themselves be considered as data concept objects because they are always or frequently used together. Data objects and data concepts should be unambiguously named and made available for reuse.

This approach will enable data reuse and data exchange in a connected world (where data may be used for purposes other than that for which it was originally designed, or even imagined that it may be used for) and enable the realisation, in this pre-study, of Urban-ITS and beyond.

It should be made clear that the meta-data registry is something different from locally maintained real-time databases that hold the current data. Those dynamic databases are hosted, created, and maintained, locally (usually at the 'city' or 'Urban Administration' level), and make dynamic data available to actors in the Urban-ITS paradigm.

The meta-data registry is required to ensure that each of the locally maintained databases are defined consistently using the same data definitions (meta-data). This is of course required because travellers, using whatever transport means, travel between Urban Administrations and therefore the data concepts used need to be consistent.

However, it is inadequate that the data object and data concept definitions are buried in Annex D of EN12345, or Clause 14 of ISO 98765. Who knows that they are there - other than the standards writers and a few early users? And what is the incentive to use these, as opposed to other, data definitions?

It is therefore essential that there is *one* data registry that makes the data definitions (meta-data) available to all Urban Administrations, and to all actors in the urban-ITS paradigm, across the EU.

All of this is well known to probably almost every reader of this document, so PT1701 is telling you nothing new. But it is the job of this pre-study to identify gaps, and until there is:

r) a funded and publicly and freely ITS meta-data registry;

s) standards developers are obliged to submit their data object and data concept definitions to the ITS meta-data registry as part of the standards approval;

t) data already defined in extant and used TS standards are uploaded into that meta-data registry;

u) standard data objects already defined for general ICT use outside of the ITS paradigm (for example time, day, date, etc.) uploaded into that meta-data registry;

v) Every entry in the ITS meta-data registry is assigned an unambiguous/unique Name,

it is the belief of the experts in this PT that unless the actions listed above are taken, Urban-ITS, as envisaged in the CID, will not be possible.

This report recommends that the EC, as a matter of urgency, makes call for, and offers financial support for, a project to establish such a meta-data registry/data dictionary.

And further, once the ITS meta-data registry is in place and populated there needs to be a major harmonisation exercise to identify duplications, and find a consensus route to migration to the use of agreed common data objects and data concepts in the future.

Documents
Document Sharing Hub

Full document details: PD CEN/TR 17143:2017

This report recommends that EC also provides support for consequential requirements (e.g. maintenance of common data registries).

In order to successfully achieve such migration, it has to be recognised, as stated above, that existing and used data objects and data concepts will not be discarded just in order to meet a new standard, unless it is mandated by legislation or regulation.

See also 2.13; (HLRk-1); Annex C.7.4; Annex D.2.6; Annex D.2.7; Annex E 3.1; Annex E.4.1;

Annex F.1.5; Annex G.3.3.2; Annex G.4.5; MIS0003-1v7;

Assuming the existence of a common meta-data registry/data dictionary, this Technical Report strongly urges the EC to make call and offer support for a Project Team for 'ITS Data Harmonisation'. (Annex D.2.6; D.2.7; F.1.5)

A harmonisation process that ensures at the least unambiguous naming, and leads to common data concept definitions for future systems. (HLRk-2; Annex D.1; D.2.7; Annex E.3.1)

It is recommended that the EC supports a process to regularly update the meta-data registry.

The pre-study makes 13 recommendations for support measures -measures that do not lead to a Standard, but that are important to enable Urban Administrations to implement Urban-ITS. Some of these measures are considered essential i.e. without which it will be difficult for Urban Administrations to successfully introduce Urban-ITS.

A list of these recommendations can be found in Annex A 5

8.5 Vendor lock-in

The remit to PT1701 included a pointer to the Communication *"Against lock-in: building open ICT systems by making better use of standards in public procurement"* [41]. Annex C.7.6 analyses these issues and makes recommendations to avoid this situation.

There is a need for a pan-European project to find a consensus solution for a combination of (probably existing) standards to avoid vendor lock-in for centre<>centre and centre<>field communications. (C.7.6)

8.6 Testing and Conformance

A mandatory test scheme is needed to verify conformance to communication/operational/performance requirements. This is often referred to as type approval or equipment certification. A strong industry consortium or government organization is needed to control and manage the process on a European level. It is suggested that Urban-ITS attaches to the overall C-ITS process aimed at the goal of conformance testing. It is recommended that a project team is formed to study conformance testing requirements specifically for Urban-ITS. See Annex J.1.2; J.3;

8.7 Standards procedures

When is a standard needed? and when is it an appropriate time to develop and publish a Standard? Recommendation RC_PL02- of this Technical Report advocates that all Urban-ITS standards deliverables are first published as "Technical Specifications". This enables much faster development and availability, but importantly enables specifications to be tested while the situation is still evolving, and if necessary enable revisions or improvements before a final standard is published. Of course it imposes migration responsibilities in the event of change, but it helps to provide a situation where standards deliverables are available at an earlier stage.

Documents
Document Sharing Hub

Full document details: PD CEN/TR 17143:2017

PT1701 recommends that the standards deliverables recommended in this Technical Report are first developed, approved and published as "Technical Specifications" (TS), and then, in most cases, reasonably swiftly tested and evolved into full Standards. (Annex E.7).

This Technical Report also recommends that CEN considers adopting a process where once a work item is created, the first approved deliverable can be published as a TS, and the same approved work item can enable the subsequent development as a full Standard. (This is already the case in ISO, but after publication of a TS, CEN currently requires the creation and approval of a new work item to develop the TS into a full Standard, which incurs delays). . (Annex E.7).

See Annex A.5 for a list of recommendations relating to Standardisation policies

8.8 Other panoptic recommendations

Interchangeability, within this context, having a choice of the mode of transport means, is more a design, investment and management issue than a standards issue. But the process of deciding if and when to interchange between transport means (bus to metro to train to tram; long-haul hydrocarbon based truck to non-emission last mile delivery) –'multimodality'- is only possible with the availability of dynamic data. In order to enable physical interchangeability, standardised physical interfaces are therefore required. (Annex E.3.2)

In order for data passed through a standardised interchangeable physical interface to be comprehensible and useable, data format and presentation standards are also required in order to achieve interoperability. (Annex D.2.7; Annex E.3.2; E.3.3)

Similarly, intermodality - the sequential change of transport means in order to achieve a journey -,is significantly enhanced and made more practical by the availability of dynamic data, (which similarly has to rely on data format and presentation standards in order to achieve interoperability.)(Annex E.3.3)

This study recommends that in all situations where document-type data is to be transferred, and there is not a particular bandwidth restriction, XML should be used as the standard transfer syntax according to ISO 8825-4. Annex D.2.3.1) and that ITS data/Urban-ITS data defined in standards or data-registries should be defined in ASN.1. (Note: this does not preclude that the data may additionally also be defined in other formats if local practices require this). (Annex D.2.3.2)

It is recommended that there is now an onus on standards developers to understand that their standards, and particularly foundation standards, need to be 'abstract' with regard to any particular application they are envisaged to serve, and that application standards need to specify their application specific issues within the application standard. (Annex C.5)

Further recommendations are made for a technical report for ITS terminology and the conceptualisation of how stakeholders could benefit by cooperation and interaction and a Technical Specification: Common methodology for the assessment and quantitative evaluation of proposed or instantiated Urban-ITS solutions and services. (Annex C.6).

9 Summary of communications and security requirements

9.1 Communications and Security context

Within the areas of modal transport systems and traffic management, and to a lesser extent urban logistics, the pre-study shows how the evolution of systems in isolation from each other have created so called 'silo's of application specific data and application specific protocols. If, as we have established, Urban-ITS requires data interoperability in order to function, then we have to find a migration path acceptable to all, to migrate to common interoperable data concepts.

Documents
Document Sharing Hub

Full document details: PD CEN/TR 17143:2017

Urban-ITS users, be they personal travellers(passengers), drivers both of public transport and private vehicles, who are also frequently users of Cooperative ITS, need to pass data wirelessly to and from each other, and the infrastructure. This will be achieved by using several, and multiple, wireless media.

Further, the security issues that face participants in urban-ITS service provision and use are similar/common to those facing C-ITS. And the solutions to both the use of wireless media, and security issues need to be common between Urban-ITS and C-ITS.

It turns out that the C-ITS architecture, security and protocols are not only essential in order for Urban-ITS to operate in the upcoming world of Cooperative-ITS, but provide an efficient migration path from current silos with their own definitions to the interoperable Urban-ITS paradigm, and provide solutions to security issues that have largely yet to be addressed in the Urban-ITS paradigm. See also Annex J which assesses these issues and makes a number of recommendations.

Cooperative-ITS is one of the essential advances of ITS facilitated by the European Commission. C-ITS is both a toolkit and technical platform for Urban-ITS.

(With C-ITS in this context, we refer to the complete definition from ETSI EN 302 665 and ISO 21217, and not the reduced V2V/V2I often referred by the car makers.)

9.2 C-ITS Communications and Urban-ITS

C-ITS in our Urban-ITS context covers travellers with the personal ITS-station, vehicles of various modes and types, roadside/depot/*outstation* functions, and central/back-office/*instation* functions.

This means that all data storage/data processing will per definition happen inside one of the four classes of ITS-station. The data sharing cloud functions as a 'Virtual Private Network' over the internet, or more precisely over IPv6, which is the new internet protocol.

Enabling and, where appropriate, applying the C-ITS paradigm for Urban-ITS will allow:

- interoperable communication over different bearers without having to specify these for each of the applications/Use Cases we define in Urban-ITS;
- security features that support cross-domain trust between all actors, at the same time as providing privacy support according to national/EU regulations;
- remote management possibilities that allow unattended Stations that may be remotely loaded with new services, and automatic configuration and maintenance;
- stations may also run locally determined ITS services side-by-side with the standardized Urban-ITS set, giving a high degree of local freedom to Urban Administrations to set their own policies.

Most of the C-ITS standards needed to support Urban-ITS are already available, but two areas need urgent attention:

- Setting common policies for Urban-ITS regarding the use of C-ITS. This is suggested to be done by a project that create and support a handbook include the following elements:
  - Best practices for the various roles of Urban-ITS (authorities setting policies, operators, implementers/suppliers),
  - Guide(s) showing how the different C-ITS standards may be applied,
  - Guide showing how to become part of the overall security hierarchy;

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

— A mandatory test scheme is needed to verify conformance to communication/operational/performance requirements. This is often referred to as type approval or equipment certification. A strong industry consortium or government organization is needed to control and manage the process on a European level. It is suggested that Urban-ITS attaches to the overall C-ITS process aimed at the goal of conformance testing. It is recommended that a project team is formed to study conformance testing requirements specifically for Urban-ITS;
— Defining the missing security standards regarding interfaces between roadside/personal/central ITS-stations, patterned on well-established vehicle ITS-station security standards.

It turns out that the C-ITS architecture, security and protocols are not only essential in order for Urban-ITS to operate in the upcoming world of Cooperative-ITS, but provide an efficient migration path from current silos to the interoperable Urban-ITS paradigm, and provide solutions to security issues that have largely yet to be addressed in the Urban-ITS paradigm. The concrete recommendations are handled largely in 1.5 and 1.10 above.

Details of the work of the project team in the area of communications and security can be found in Annex J.

The recommendations regarding communications and security can be found in Annex A

10 Summary of MIS requirements

10.1 The MIS context

In making a journey, a traveller may use one mode or a combination of transport modes. “Travellers” can comprise car drivers, freight drivers, passengers, cyclists, pedestrians, and potentially, in the future, the use of autonomous travel ‘pods’ or autonomously controlled taxis or similar. Multimodal Information Services (MIS) comprise the consideration of all modes in the urban area to give the traveller the choice of modes before and during their journey to enable an optimum travel experience.

Presently, the conventional urban public transport offering (buses, trams and metros) dominates the modes for which urban travel information is provided, but links have now to be made with trains, private cars, bicycles and walking and the so called ‘New Modes’ such as car sharing, car-pooling, bicycle sharing and flexible transport services.

There are a number of existing mature standards such as DATEX II for road data exchange, NeTEx and SIRI for public transport data exchange (based on the Transmodel reference data model), and ALERT C and TPEG for delivery of information. However, many of these standards overlap or are not harmonised and there are gaps, particularly in the coverage of the new modes.

The base of current standards for many multimodal information services, come from the ‘Public Transport’ sector (called ‘transit’ in many countries), and one of the core standardisation initiatives relevant to Urban-ITS in this area are the “Transmodel” series of Standards, including the associated NeTEx and IFOPT Standards. This work is undertaken by CEN/TC 278/WG 3.

This is already recognised in the European Commission “***Rolling Plan for ICT Standardisation 2016***” (DG GROW)

“3.4.5. Intelligent Transport Systems (ITS)
D. Proposed new standardisation actions
D.1 Standards developments

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

In the domain of public transport, and particularly with respect to multimodal information and smart ticketing, such a need for coherence will concern a broad set of standards and technical specifications, namely:

— Transmodel, the European Reference Data Model for Public Transport, CEN-TC278 ENV12896;
— IFOPT, (CEN/TS 00278207) a CEN Technical Standard defining a data model for the Identification of
— Fixed Objects in Public Transport (e.g. stop points, stop areas, stations, connection links, entrances, etc.);
— SIRI, (CEN/TS 00278181-1 to 5), a European CEN technical standard defining Service Interface for Real- Time Information relating to public transport operations;
— NeTEx, a prCEN/ Technical Standard currently in development. It is based on Transmodel, extended with additional concepts from IFOPT and SIRI. NeTEX is divided into three parts: Part 1 - Transport Network and Part 2 - Schedules Part 3 - Fares and data for AVL
— Standard supporting the emerging interoperable fare management (IFM) systems: Public Transport interoperability (IOPTA) standard *EN 15320* defining the functional system architecture and the application scenarios; the *EN 1545* standard describing the data elements and the *ISO EN 24014-1* standard, defining functional system architecture and the application scenarios."

Initiatives to extend and improve Transmodel are already overdue, and the Transmodel standards may need revising to better fit into the new "Multimodal Information Services" paradigm. Further attention and standards are needed in the area of location referencing. This work is considered essential by public transport experts to enable Urban-ITS to function efficiently, and this pre-study encourages CEN/TC 278/WG 3 to proceed with this work with as much urgency as possible, and recommends that EC funding is found to support project teams where this is deemed to be necessary.

PT1701 considered a value chain of the provision of a service from data collection (both scheduled and real-time), through collation and aggregation, to the provision of a service to the traveller. From the value chain, some 18 Use Cases were generated covering all aspects of MIS. These Use Cases each encompass the requirement, looked at the provision of covering standards, and hence identified the gaps, leading to recommendations for standardisation. The recommendations fell into 4 types: new standard development; standards update; standards harmonisation; and support actions. In total there are 32 recommendations generated from the MIS sector. (See Annex A)

As the urban area is presently predominately served by public transport, most of the recommendations fall into the area of public transport information modelling and service provision; hence the dominance of recommendations for updating and extending Transmodel, NeTEx and SIRI.

The development area for new MIS standards identified by PT1701 comprises 17 recommendations of which 8 are concerned with incorporating the new modes into the Transmodel standard reference data model, exchange formats and coherent with SIRI, NeTEx, DATEX II, and infrastructure model (GDF); a further 5 recommendations cover standards needed to cover gaps in current provision in data exchange and services for MIS; and the final 4 recommendations for new standards cover the assurance of data quality.

The requirements for standard updates area comprise 9 recommendations, 6 of which are to support updates and development in and support for Transmodel, 2 to develop links to geographic models linked to infrastructure and 1 to further develop quality procedures.

The requirements for standard harmonisation comprise 2 recommendations, both concerning the harmonisation across modes of existing location referencing standards. This is a major issue

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

with almost all application standards having their own location referencing methodology which inevitably are not in line with each other or the INSPIRE standards. Although these recommendations originate from the MIS studies, they are considered generally applicable across the whole Urban-ITS domain.

Finally, the requirements for support actions comprise 7 recommendations, 2 of which are concern development of NeTEx profiles, 3 address verification of standards compliance of data (both in data repositories and in data exchange files), and 1 provides for an urban meta-data registry. Lastly, there is a recommendation to financially and institutionally support the creation and existence of an organisation (strongly connected to stakeholder) in support those seeking to implement and deploy systems compliant with NeTEx, SIRI and Transmodel.

10.2 MIS and Urban-ITS

'Multimodal Information Services' (MIS), for the purposes of this study, comprise:

— information to travellers on all modes of transport in the urban area; choices before and during a journey;
— information to travellers on interurban transport that has a direct impact on a traveller's urban journey;
— modes of transport cover the conventional urban offering such as buses, trains, trams, metros, private cars, bicycles and walking, but also 'New Modes' such as car sharing, car-pooling, bicycle sharing and flexible transport services; in the future, the use of autonomous travel 'pods' or autonomously controlled taxis or similar; and
— enabling the Urban Administration to provide a balanced effective transport offering within the constraints of cost and policy.

"Travellers" can comprise car drivers, freight drivers, passengers, cyclists and pedestrians.

MIS enable the urban traveller:

— to make the optimum choice of mode, cost, route and timing to reach an intended destination; and,
— to choose to switch between modes during the trip to reach an intended destination optimally.

The scenario envisaged is that a traveller arriving in the urban area or already present, will have all the information to hand to make an optimum journey. This might include, for instance, travel by metro to a certain point where the traveller is directed and guided to the nearest bicycle sharing facility to continue, or complete their journey. Giving locations, availability and timetables is only part of the story; the traveller will also need information on the cost structures in an integrated way – will my ticket cover the whole trip using all modes?

Many public transport services operate on the basis of scheduled transport offer, but this information can change over one operational day, due to diverse circumstances, such as public transport disruptions but also traffic or road conditions. It is therefore envisaged that a traveller might plan a journey by choosing and using more than one mode, but also change modes during the trip as a result of information received during the trip.

There are a number of existing mature standards such as DATEX II for road data exchange, NeTEx and SIRI for public transport data exchange and Transmodel providing a reference data model, ALERT C and TPEG for delivery of information, however these standards can *overlap*, or are not sufficiently *harmonised* in some aspects, or show gaps. For example, they do not completely cover the new modes, i.e. services such as car sharing, car-pooling, bicycle sharing

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017

and flexible transport that now are gaining importance in the urban area. These new services have to be taken into account for real-time multimodal information and in particular for trip planning algorithms. It is vital that these new services are standardised in coherence with already existing standards.

10.3 Approach taken

The approach used in MIS was to consider a conventional value chain from the acquisition of data through the collation and validation of that data, to the building of an information message and finally the delivery of the message to the urban traveller. Requests can be made before the journey has commenced or during the journey as a result of changing circumstances or an additional request.

The data available from the modes falls into two distinct areas: *scheduled data* for each mode which details the intended offer the data related to an operational day, possibly modified by events occurring during an operational day as *real-time* data; and *real-time* data outside of the public transport domain can comprise at least:

— flow, speed and occupancy (stationary vehicles) data from an 'Urban Traffic Control '(UTC) system;
— the status of traffic signals and signing systems;
— weather and road surface conditions;
— incidents; and,
— the occupancy levels of car parking.

For each element in the value chain and for 'New Modes' of transport a number of 'Use Cases' were constructed. As a result of the stakeholder consultation and the knowledge of experts, the gaps between the existing standards and the requirements were identified resulting in 31 recommendations for standards and supporting actions.

The recommendations for Multimodal Information Systems are detailed in Annex G and Annex P.

11 Summary of Traffic Management (TM) requirements

11.1 The TM context

Traffic management encompasses a wide range of technologies and solutions used to detect, inform and control road users. Road users can include private cars and motorbikes, public transport buses, pedal cyclists, pedestrians, taxis and may include special provisions for vulnerable road users.

In the urban environment, traffic signals are considered the ubiquitous form of traffic management, but it is now more far reaching and includes message signs, CCTV, access control, selective vehicle priority, intelligent detection of vehicles and road users, enforcement technologies and urban tunnel management systems.

Within the Traffic Management domain there are currently very few Standards available to be used on a pan-European level. There are some very mature open regional specifications (for example OCIT/OTS and UTMC) and a number of supplier specific proprietary specifications are in use, and while some of these have been adopted by Urban Administrators, there are pitfalls associated with them. While DATEX II supports the traffic management service, it is designed for the one function of data exchange (for instance between TM Centres). This has made procurement of traffic management systems challenging often resulting in Urban Administrators developing their own specifications or relying on "outcome" based contracts.

Documents
Document Sharing Hub
Full document details: PD CEN/TR 17143:2017