Standards Catalogue and future developments

Contents

1 Introduction

1.1 About this document

1.1.1 This document has been prepared under the Transport Direct initiative for the UK's Department for Transport, Local Government and the Regions (DTLR) by Curtis+Cartwright Consulting Limited, with the assistance of independent consultant Peter Warman.

1.1.2 It presents a catalogue of standards and standard-like initiatives relevant to Transport Direct and an analysis of the areas in which standards are inadequate to support the successful development of the Transport Direct concept.

1.1.3 **This document has no statutory or other force**. It has been prepared purely as an informative collection of information regarding standards which may be of relevance to those undertaking, or planning to undertake, activities related to Transport Direct. Any standards policy that may emerge within Transport Direct, at the national level or otherwise, will do so only after a due process of development and consultation.

1.2 The Standards Catalogue

1.2.1 The Standards Catalogue is presented in three annexes.

- Annex A provides a summary of the specific activities underway in the key committees of the main relevant standards bodies, including CEN (the European Standardisation Committee) and ISO (the International Standards Organisation).

- Annex B provides an overview of the large number of general-purpose technology standards/initiatives which may have a role in Transport Direct.

- Annex C describes individual transport-related standards/initiatives relevant to Transport Direct, in the form of a 'data sheet' for each standard.

1.2.2 In each of these areas, the aim has been to give only a basic level of information about individual standards, to the point where the interested reader can determine whether seeking further information is worthwhile. To assist this:

- contact points have been provided, as far as possible, for each relevant standard/initiative, in Annexes A-C;

- Section 2 of this document provides an index of applicable standards by area and by likely degree of influence;

- Section 3 of this document provides a number of 'views' of the Standards Catalogue, indicating how the standards/initiatives relate to each other.

1.2.3 Additional commentary is provided concerning the completeness or otherwise of the standards available to Transport Direct, specifically highlighting activities that DTLR might undertake to fill any standards gaps and to facilitate the effective uptake of appropriate standards among UK stakeholders.

1.3 Scope of the Catalogue

Application areas

1.3.1 The main areas for the delivery of Transport Direct, and the main context of this document, are the following:

> - the sharing of information concerning travel between operators and users;
> - sources of input information, including operations of transport networks and fleets;
> - dissemination of information via a range of media including publicity, signage, broadcasting and internet;
> - transaction mechanisms associated with the journey including ticketing, reservations and e-commence;
> - infrastructure mechanisms which are likely to play a major part in facilitating Transport Direct, such as communications networks.

Types of 'standard'

1.3.2 The term 'standard' is widely used but may, in practice, cover a range of concepts. For the purposes of this paper we have deliberately taken a very broad approach to the term, considering the following:

> - formal standards developed by standardisation committees, including, BSI, CEN, CENELEC, ETSI, IEC, ISO, ITU and their predecessors;
> - *de facto* standards, that is specifications and protocols that have achieved widespread acceptance, and to which there is market pressure for developers to conform;
> - widely-accepted 'frameworks' of standards and/or specifications that represent consensus positions for particular areas;
> - recommended approaches and 'best practice' guides applicable to a community;
> - research and development projects which have as a key aim the production of a specification which might feed into standards etc.

1.3.3 In this document, the term 'standard' refers loosely to any or all of these concepts.

1.4 Sources for this document

1.4.1 This document has been developed on the basis of:

> - corporate knowledge, understanding and records;
> - publicly available information sources;
> - advice from a limited number of contacts with whom the catalogue has been discussed;
> - feedback from stakeholders contacted as part of the validation exercise;
> - review by DTLR on interim reports.

1.4.2 The authors would like to thank all those that have assisted in the development and validation of information presented herein.

1.5 Structure of this document

1.5.1 This document is structured as follows:

- Section 2: Application of the Standards to Transport Direct;
- Section 3: Perspectives on the Standards Catalogue.
- Section 4: Assessment of gaps in standards provision;
- Section 5: Standards development;
- Annex A: Formal standards initiatives;
- Annex B: Catalogue of generic standards;
- Annex C: Initiatives involving standards;
- Annex D: Acknowledgements;
- Annex E: Gap analysis - methodology and findings.

2 Application of Standards to Transport Direct

2.1 About Transport Direct

2.1.1 The Transport Direct initiative is the UK Government's 'umbrella' framework to facilitate the delivery of travel-related Information Society services. As currently envisaged, Transport Direct will involve two core activities:

> - provision of information prior to, during and after travel (including aspects such as journey planning, real-time information on available travel modes, lost property, complaints etc);
>
> - the selection, reservation, booking and issue of tickets (or other travel permits), covering all aspects of a journey (including aspects such as multimodal journeys, seat/slot reservation and car parking).

2.1.2 Transport Direct is an inclusive initiative. In principle it covers:

> - all transport modes (walk/cycle, car, bus, coach, rails, air and ferry);
>
> - all stakeholders which participate in the travel experience (network operators, fleet operators, information service providers, retailers of travel services/systems, and travellers themselves);
>
> - all information delivery mechanisms (PCs, kiosks, mobile devices using WAP/GPRS/3G, digital TV).

2.1.3 UK Government cannot develop an all-embracing 'Transport Direct System'; it has neither the skills, nor the resources, nor indeed the access to private information to do so. Rather, UK Government will, through Transport Direct, encourage current and future participants in the travel sector to align the information aspects of their operations so as to deliver the overall vision. In practice this means that:

- **policymakers** in the public and private sectors will need to set policy guidelines at business, technical and operational level;

- **those acquiring and implementing systems** will need to respond to the vision of policymakers and developments by competitors/partners, aiming to position themselves to play their full part in the future of Transport Direct;

- **systems developers**, who will need to respond to the demands of users by building systems to deliver aspects of the vision.

2.1.4 Many different types of organisation will be involved in the delivery of Transport Direct services. There is no definitive operations model, but Figure 2-1 shows some of the key Transport Direct roles, in a highly simplified diagram. On the left hand side, a traveller uses a travel service which employs vehicles and networks. On the right hand side are the Transport Direct systems covering data collection, retail and information services, and traveller systems.

Figure 2-1: A very simple operations model for Transport Direct
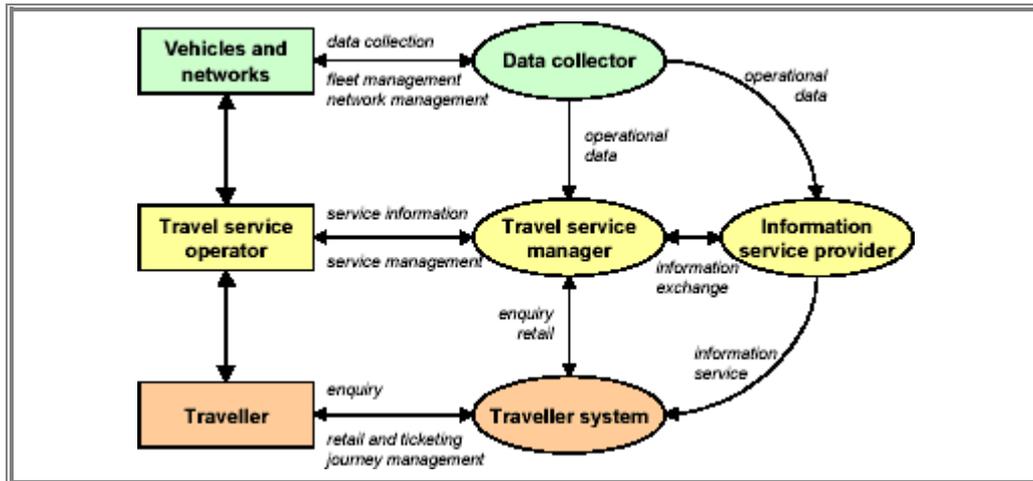
2.1.5 Of course, a single organisation might fulfil one or more of the roles identified in the model; thus, a bus company that collects data from buses and provide information to travellers via website or kiosk fulfils all the roles. And of course this diagram hides a wide range of technical factors - for instance, pre-trip planning from a home PC over the internet is very different from in-trip traveller support of real-time information through onboard display systems.

2.2 The role of standards

2.2.1 In a case, like Transport Direct, in which a large number of disparate organisations and systems need to work effectively together, it can be highly beneficial to adopt a suitable set of open standards to facilitate interworking:

> - they may be cited as policy requirements by **policymakers**, as an instrument of (national, community or company) policy, in order to establish a common baseline for many systems working together;

> - they may be cited as system requirements by **those acquiring and implementing systems**, who will review and select standards in line with both policy and systems needs;

> - they may be implemented by **systems** developers, who will make use of the technical details, making choices on any options offered (in discussion with clients).

2.2.2 Where appropriate, the use of standards can have a number of benefits:

> - using a standard obviates the need for many individual buyers of similar systems from 'reinventing the wheel' in their specifications;

> - it enables more thought to go into ensuring the adequacy of a specification;

> - it sets expectations for the supply market to develop their product strategy, and enables suppliers to focus on adding additional value;

> - it facilitates skills development among both suppliers and users;

> - it enables one organisation's systems to work with those of another;

> - it enables an organisation to buy subsystems from independent suppliers and connect them together with relative ease;

- it makes for a competitive supply market for components and services.

2.2.3 However, a standards approach may not always be appropriate. Circumstances where standards might be more a hindrance than a help include:

- cases where standards 'fossilise' and prevent dynamic and evolutionary development - particularly important to avoid in emerging business areas such as Transport Direct;

- cases where there are likely to be few systems acquisitions with the same feature;

- cases where there are no external boundaries, ie the system is both bought from, and bought by, a single organisation.

2.2.4 Standards take time to prepare and can impose additional costs to implement. For best results, mandating a standard must have sufficient benefit to convince all relevant stakeholders (ie policymakers, implementers and systems developers).

2.3 Transport Direct application areas

2.3.1 Transport Direct operates over a broad range of application areas within the travel/transport industry. Information regarding the standards relating to each application area may be of more or less relevant depending on the needs of the individual user. For example, a person designing a website for the dissemination of bus time tabling and ticket information would be interested in:

- standards relating to travel website design;

- possibly journey planner systems;

- dissemination of real time travel information;

- ticket booking/reservation/issue systems etc;

but *not* rail management applications etc.

2.3.2 The tables on the following pages are designed to highlight the standards most relevant to each application. The tables cover the following functional areas:

- Asset Management (Table 2-1), addressing car, bus and rail management as well as network management systems;

- Transport Management Systems (Table 2-2), addressing transport information database systems, transport data exchange systems real time travel information systems and journey planner systems;

- Travel Information Dissemination (Table 2-3), addressing travel website design, in-vehicle TTI system design and digital broadcasting and dissemination of travel information.

2.3.3 Some level of guidance has been provided on the scope of key relevant standards. This is not, however, a complete or comprehensive list. It does not, for instance, include all general 'infrastructure' standards (such as communications standards), and nor does it include all associated projects or detailed CEN/ISO work items. In many cases, however, the standards in these lists will refer out to more specific standardisation activities; for instance UTMC, RTIG, VDV et al all incorporate references to the Internet Protocol suite of standards.

Table 2-1: Applicability of standards in the Asset Management area		
Application area	**Standards**	**Nature of Applicability**
Car park management	UTMC	Developing standards for the urban transport environment
Bus management	ATCO-CIF	General purpose bus time table data exchange standard
	TransXchange	Standard set to supersede ATCO-CIF
	RTIG	Incorporates the use RTI into areas such as bus management
	VDV	German best practice body for public transport and freight
Rail management	RSP	A body to improve retail and ticketing within the rail industry
	RJIS-CIF	National rail information system for timetable, fare and reservation data
	UIC	A body that prepares standards to facilitate international rail travel
	VDV	German best practice body for public transport and freight
Transport management systems (local/national)	Code of Practice for Traffic Control and Information Systems	Roadside traffic control and information systems that convey messages to road users
	Transmodel	Addresses data dictionary and conceptual models for integrated information systems
	KAREN	An EU framework for ITS solutions
	UTMC	A set of standards for the urban traffic management and control environment
Application area	Standards	Nature of Applicability
	TCC	Coordinates travel information relating to English trunk roads
	TIH	Provides communications system for the dissemination of TTI

	Interconnectivity and Interfaces	General IT data exchange standards such as FTP, HTTP and CORBA
	ISO/CEN	International standardisation bodies that include the transport and travel sectors
Transport management systems (international)	DATEX	A data exchange standard
	Transmodel	Addresses data dictionary and conceptual models for integrated information systems
	TRIDENT	European project to extend DATEX, including internet technologies
	KAREN	An EU framework for ITS solutions
	Interconnectivity and Interfaces	General IT data exchange standards such as FTP, HTTP and CORBA
	ISO/CEN	International standardisation bodies that include the transport and travel sectors
	TCIP	Data exchange standards within the US transit industry
	NTCIP	US transport management systems
	Inform Norden	Scandinavian forum to exchange ideas and standardisation activities with IT and public transport

Table 2-2: Applicability of standards in the Transport Management area		
Application area	**Standards**	**Nature of Applicability**
Transport Information Database systems	Transmodel	Addresses data dictionary and conceptual models for integrated information systems
	KAREN	An EU framework for ITS solutions
	UTMC	A set of standards for the urban transport environment
	NTCIP	US transport management systems

	Core Technology	General standards for database design and
	Standards	modelling
	ISO/CEN	International standardisation bodies
Transport Data Exchange systems	DATEX	A data exchange standard
	Transmodel	European project that addresses data dictionary and conceptual models for integrated information systems
	TRIDENT	European project to extend DATEX, including internet technologies
	ISO/CEN	International standardisation bodies that include the transport and travel sectors
	JourneyWeb	Data exchange protocol for heterogeneous journey planning systems
	Data Integration	Standards for data integration such as XML, XSL etc
	Interconnectivity and Interfaces	General IT data exchange standards such as FTP, HTTP and CORBA
	Internet Security	Internet security standards such as IP-SEC, ESP etc
Real Time Travel Information Systems	GATS	Automotive telematics standards
	Digital Broadcasting Standards	Standards for DAB and DVB
	TCC	Coordinates travel information relating to English trunk roads
	RTIG	Facilitates the use of Real Time Information in road public transport
	TIH	Provides communications system for the dissemination of TTI
	Interconnectivity and Interfaces	General IT data exchange standards such as FTP, HTTP and CORBA
Journey Planner Systems	ATCO-CIF	General purpose bus time table data exchange standard

	TransXchange	Standard to facilitate interchange of electronic bus timetable and registration information
	RSP	A body to improve retail and ticketing within the rail industry
	RJIS-CIF	National rail information system for timetable, fare and reservation data
	JourneyWeb	Data exchange protocol for heterogeneous journey planning systems
	INFOPOLIS 1 and 2	Guidelines for the presentation of travel information
	Journey Solutions	Cooperation between bus and train operations to support improved multi-modal travelling
Application area	Standards	Nature of Applicability
	TIH	Provides communications system for the dissemination of TTI
	eGIF	Technical standards and policies for the government e-strategy
	Internet Security	Internet security standards such as IP-SEC, ESP etc
	GDS	Provide mainly travel agents for hotel and car-rental booking information
	Interconnectivity and Interfaces	General IT data exchange standards such as FTP, HTTP and CORBA
Ticket booking/reservation/issuing systems	EU-SPIRIT	Project developing passenger services including intermodal reservation and ticketing
	EuroSPIN	Development of a seamless passenger information service
	GDS	Networks for providing hotel and car-rental booking information
	ECBS	Banking standards for payment including cards
	eGIF	Technical standards and policies for the government e-strategy
	Internet Security	Internet security standards such as IP-SEC, ESP etc

	Journey Solutions	Forum for integration of bus and train services
Smartcard systems	ITSO	UK body to develop open standards for Smartcards for local transport
	ADEPT II	Deployment of Smartcards and other ITS technologies
	ECBS	Banking standards for payment including cards

Table 2-3: Applicability of standards in the Travel Information Dissemination area

Application area	Standards	Nature of Applicability
Travel Website Design	Best Practice Guide-Public Transport information Websites	Guidelines encompassing all aspects of PTI
	JourneyWeb	Data exchange protocol for heterogeneous journey planning systems
	INFOPOLIS 1 and 2	Guidelines for the presentation of travel information
	eGIF	Technical standards and policies for the government e-strategy
	Browsers and Viewers	Common standards for IT systems such as HTML, PDF etc
	Data Integration	Standards for data integration such as XML, XSL etc
	GDS	Networks for providing hotel and car-rental booking information
In-Vehicle TTI System Design	GATS	Automotive telematics standards
	MOST Cooperation	Developing multimedia technology for the car
	RTIG	Facilitates the use of Real Time Information in road public transport
	ITSWAP	Project to test the delivery of ITS over WAP
	WAP standards	Common standards for WAP

	TPEG	Developing standardisation for the digital broadcasting of TTI for systems such as DAB and DVB
	Safety Standards for In-vehicle Information Systems	Document details standardisation and safety principles for In-vehicle Information Systems
	RDS-TMC	Standard for the dissemination of TTI to road users through RDS
	Browsers and Viewers	Common standards for IT systems such as HTML, PDF etc
	Data Integration	Standards for data integration such as XML, XSL etc
	Digital Broadcasting Standards	Standards for DAB and DVB
	TCC	Coordinates travel information relating to English trunk roads
	TIH	Provides communications system for the dissemination of TTI
Digital Broadcasting and Dissemination of Travel Information	TPEG	Developing standardisation for the digital broadcasting of TTI for systems such as DAB and DVB
	GATS	Automotive telematics standards
	RDS-TMC	Dissemination of TTI to road users through RDS
	ECORTIS	Project to promote the implementation of RDS-TMC TTI
	ITSWAP	Project to test the delivery of ITS over WAP
Application area	Standards	Nature of Applicability
	WAP standards	Common standards for WAP
	Digital Broadcasting Standards	Standards for DAB and DVB

2.4 Take-up of Transport Direct standards

2.4.1 The Catalogue Standards differ greatly in the take-up that they enjoy, or (if they are not yet taken up in the market place) by the degree of influence that they might be expected to have. Broadly, 'projects' may offer only a relatively limited influence over where the market will move, and therefore the extent to which new users should investigate them, while established de facto standards offer a much stronger guide. However, a well-funded and well-respected project or

programme may have a disproportionate influence on developments, while a poorly-supported or obsolescent standard may no longer be worth following.

2.4.2 Figures 2-2 to 2-4 provide an indication of the 'significance' for each standard/initiative, respectively for the Asset Management, Transport Management and Travel Information Dissemination areas. More specific statements on take-up and 'significance' are included in the Catalogue entries in Annexes A-C.

2.4.3 'Significance' has been assessed by considering, in general terms, the extent to which a stakeholder considering a new policy or system might look to follow each initiative. This is composed of a number of aspects:

- current take-up and availability of compliant systems;

- planned take-up by stakeholders (users or developers) not currently working within the standard;

- the strength of agreement within the stakeholder community, ie evidence of collective de facto support for the standard;

- the value of early projects as 'showcase' demonstrations, ie the extent to which early adopters are likely to be copied by those coming afterwards;

- the importance of 'compliance' in the context of the individual standard (eg for general guidelines 'compliance' may be much less concrete and definite than for technical specifications).

2.4.4 Inevitably any such assessment of 'significance' can only be a very incomplete representation:

- the position of individual standards will evolve over time - for instance, if the outputs of a project are submitted to and taken up by a formal standards body;

- there may be special good reasons for adopting a standard in a particular circumstance, even if it is in other respects less influential;

- stakeholders, including those developing each particular standard, will have different views of the importance and influence of their standard.

2.4.5 These figures and statements should therefore be used carefully.

Figure 2-2: 'Significance' of standards in the Asset Management area
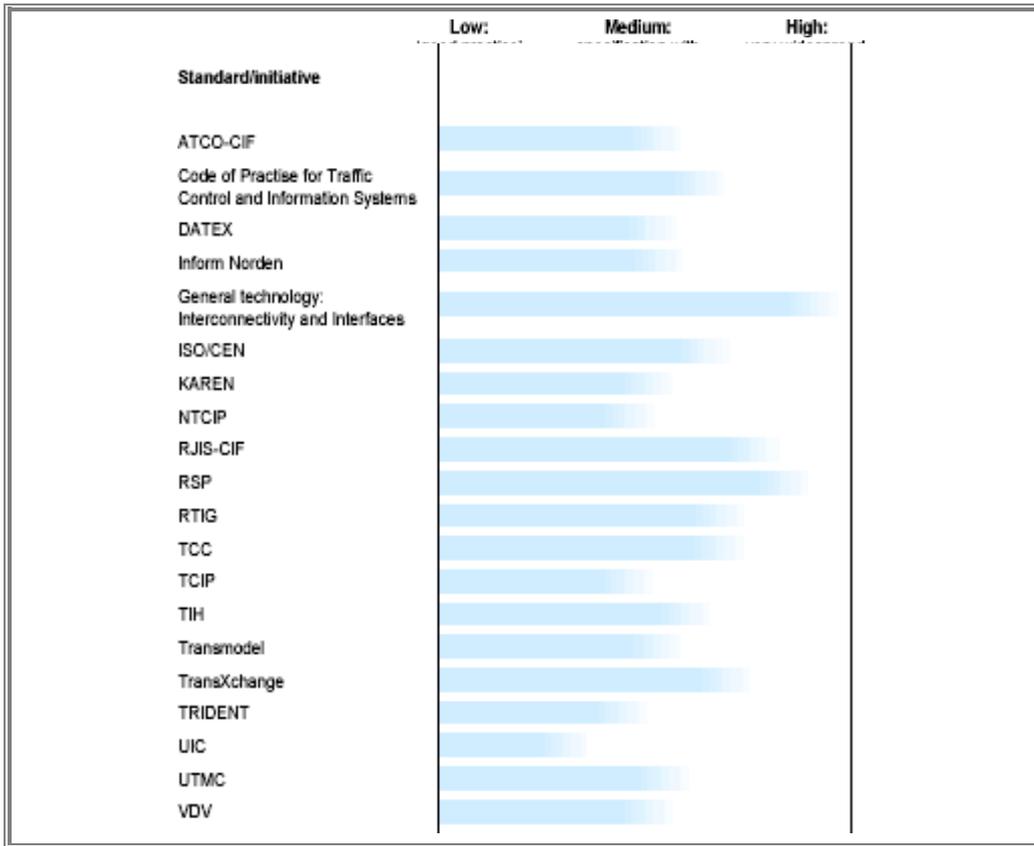
Figure 2-3: 'Significance' of standards in the Transport Management area
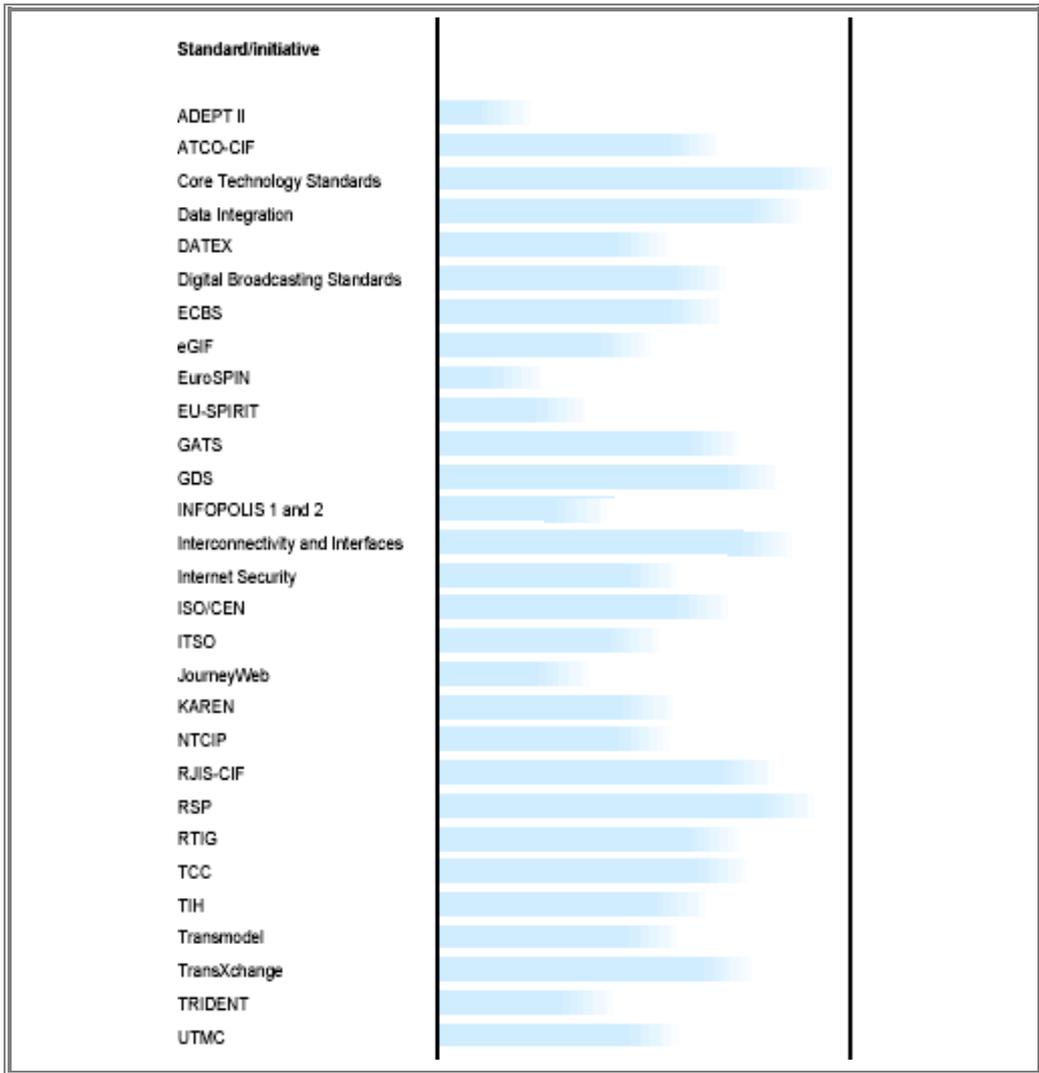
Figure 2-4: 'Significance' of standards in the Travel Information Dissemination area

Standard/initiative	Low: 'good practice'	Medium: specification with	High: very widespread
Best Practice Guide - Public Transport Information Websites			
Browsers and Viewers			
Data Integration			
Digital Broadcasting Standards			
ECORTIS			
eGIF			
GATS			
GDS			
INFOPOLIS 1 and 2			
ITSWAP			
JourneyWeb			
RDS-TMC			
RTIG			
Safety Standards for In-vehicle Information Systems			
TCC			
TIH			
TPEG			
WAP standards			
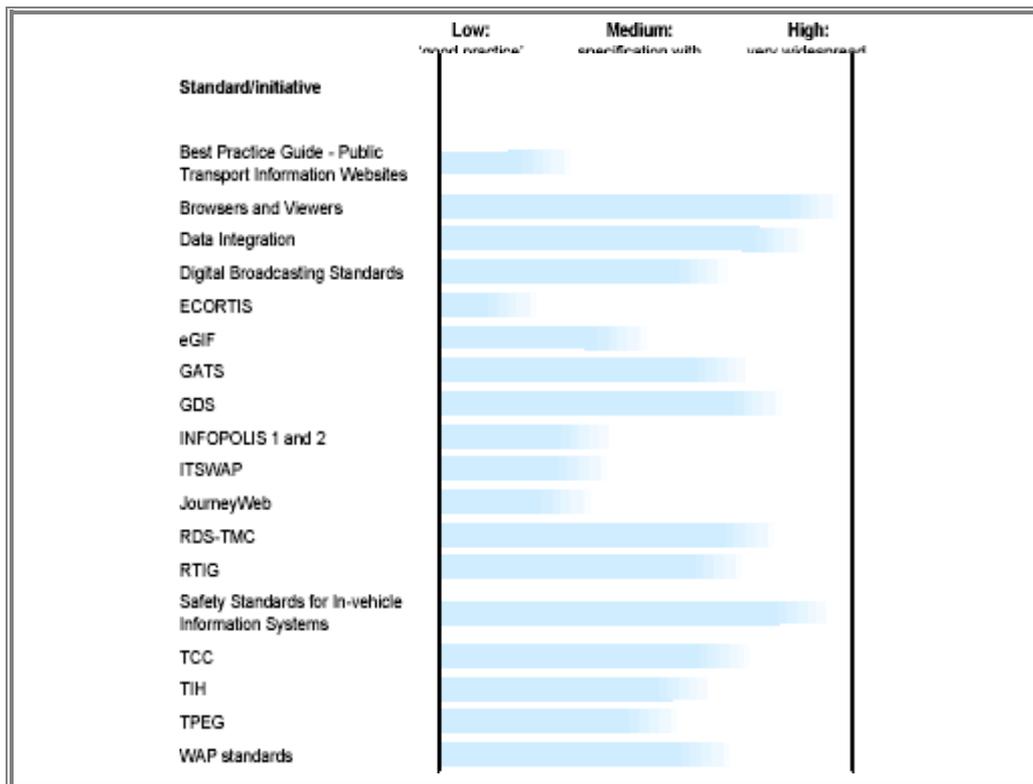
2.5 Future development of standards

2.5.1 In the medium to long-term, extension of existing standards will continue to meet evolving user needs and ensure interoperability with new applications/general technology standards. Such an extension of standards will aid Policymakers, Suppliers and Service Providers in better meeting their policy and business objectives.

2.5.2 The process of extending transport specific standards already taking place. For example:

- ATCO-CIF is being superseded by TransXChange which incorporates XML-based schemata of the kind also used in TRIDENT, JourneyWeb and a number of commercial offerings;

- Transmodel has been developed over 10 years through four European projects each increasing the scope of the standard, and further extensions are currently underway;

- TransXchange in turn may be developed to include details such as personnel disposition, automatic vehicle monitoring and management information and multi-modality;

- JourneyWeb will be enhanced to incorporate a national public transport gazetteer and to enhance protocol performance.

3 Perspectives on the Standards Catalogue

3.1 Different types of standards

3.1.1 Section 2 gave an indication of how individual standards relate to the key Transport Direct applications areas. This section provides a number of different, high-level, graphical 'views' on how the various standards compare and contrast for different purposes. Specifically:

- Section 3.2 compares and contrasts standards on the basis of scope covered and level of detail;

- Section 3.3 addresses the policymaker's perspective, assessing the maturity and take-up of the catalogue standards and the way they fit together to enable systems to work together;

- Section 3.4 addresses the implementer's perspective, assessing the applicability of the catalogue standards to different roles in the delivery of Transport Direct.

3.2 Overview comparison: scope and detail of standards

3.2.1 Figure 3-1 compares, in diagrammatic form, a range of standards in the catalogue with respect to the two parameters:

- **Scope of standard**. Some standards are highly focussed, and address closely the requirements of a specific area; an example is ATCO-CIF, which defines a range of specific messages to exchange data concerning bus timetable information. Other standards affect a much wider set of contexts, either by covering more areas (cf the frameworks of UTMC or the eGIF) or by relating to more pervasive systems (eg IP, which provides the founding technology for the Internet).

- **Level of detail**. Some standards are very closely defined, to the point where they can be used or almost used to support system coding. (In the extreme case, de facto standards may be based on actual products.) Other standards are very abstract and high-level - these may more typically be termed 'architectures', 'frameworks' or 'best practice guides'.

3.2.2 Note that in this diagram, and other diagrams in the sections below:

- regions have been colour coded, primarily to provide contrast and ease reading the diagram, but partly also to indicate other useful information - in this case, where the standards originate or apply;

- the precise placement or size of the region representing a standard is a matter of judgement, and in some cases standards have been shifted slightly to allow all areas to be displayed clearly.

3.2.3 Clearly, not all relevant differences between standards can be highlighted in a single diagram.

Figure 3-1: Standards presented by generality of application vs level of detail
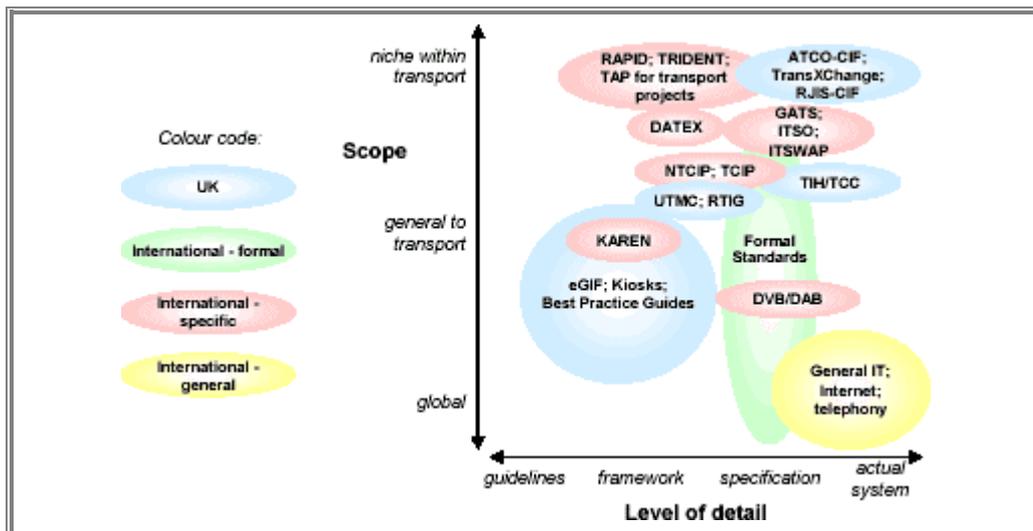
3.2.4 Each standard has its own position in this diagram, but they fall broadly into the following groups:

- ***Facilitating infrastructure standards***: Global 'standards' for IT, internet and telephony include core IT standards (eg IP v4) and technology standards (for browsers & viewers, data integration, interconnectivity & interfaces, security, and WAP standards). They also include some of the broader formal standards (including broadcasting standards such as DVB/DAB), and some of the broader best-practice guides (such as the e-Government Information Framework, e-GIF). This category of standards reflects a background of systems, services and guidelines used widely by non-transport sectors, and constitutes an opportunity for Transport Direct services to exploit mainstream technologies and facilities.

- ***Integration standards***: A number of the broader transport-related standards provide guidelines and frameworks that help Transport Direct services, and associated services (information providers, dissemination mechanisms etc), to integrate effectively with each other. These include framework specifications such as UTMC/RTIG, some of the more specific 'best practice' guides (such as the HA's Code of Practice for Traffic Control and Information Systems, MCH1869), international initiatives such as KAREN and NTCIP/TCIP; arguably TIH/TCC activities as a 'focus' for integration too.

- ***Device or interface standards***: There are a number of standards which apply to a particular type of system, device or interface within Transport Direct. Some of these are projects, frameworks etc (with RAPID, TRIDENT, and other European projects being typical examples here). Others operate more explicitly as standards (for instance ATCO-CIF, TransXchange, RJIS-CIF, GATS, or ITSWAP). This type of standard is likely to be of particular interest to those looking at developing or acquiring a specific type of standard.

3.3 The policymaker's perspective: maturity and openness

3.3.1 Policymakers are concerned to ensure that an appropriate degree of consensus is reached to achieve benefits, such as rapidity and ease of implementation, without stifling innovation. Typical they will be concerned with the following aspects of standards:

- **Maturity**. Standards typically begin with a project to consider a particular systems issue, then proceed through degrees of consultation and ratification. As time passes, they may be updated but all standards will eventually become obsolescent.

- **Openness**. Formal standards are openly published. De facto standards may not be, or may be so only to a limited extent (cf the Windows^{TM} suite of operating systems for PCs).

3.3.2 Figure 3-2 compares, in diagrammatic form, the standards in the catalogue with respect to these two axes. This view highlights which standards are likely to be most applicable for policymakers to adopt as a matter of policy:

- where policy governs external connection or applies to many different organisations (as with public policy, for instance), open standards which are mature or approach mature will naturally be preferred;

- where policy is internal to a company for the purpose of connecting together its own systems, openness becomes less important and innovative standards are more likely to be acceptable.

Figure 3-2: Standards presented by maturity and openness
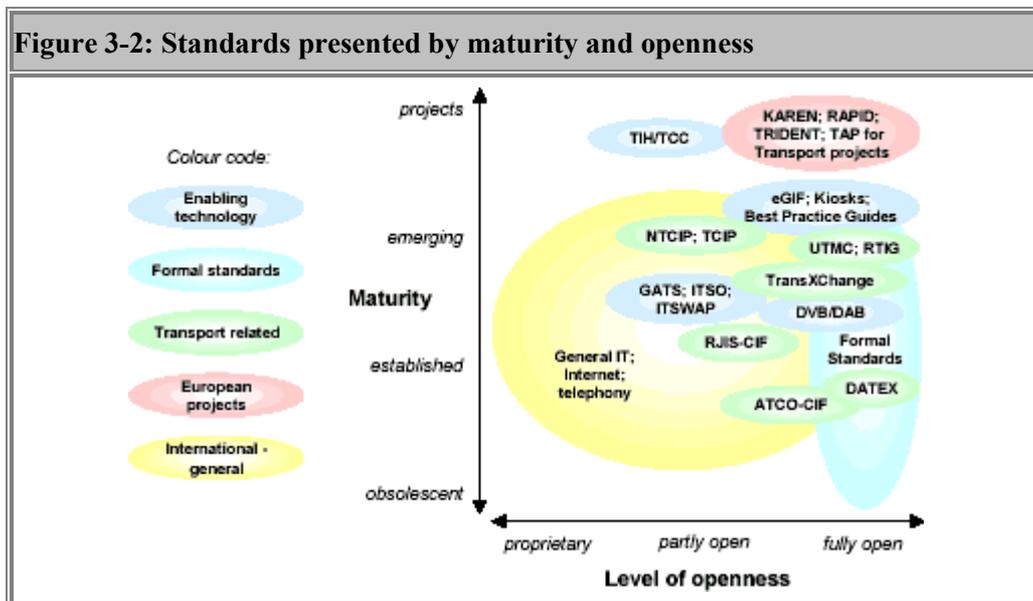
3.3.3 Some, but not necessarily all, of the projects at the top of the diagram may migrate towards the bottom as they develop towards established standards.

3.3.4 Policymakers will generally focus on open standards, as described. However, this may not always provide the best solution for a specific problem. Some standards will not be fully open (for example NTCIP in openly specified but the IPR is retained by the publisher). Similarly, for 'standards' arising from actual core systems such as TIH/TCC or RJIS-CIF, the 'standard' is defined by and under the control over the core system owner.

3.3.5 From the policymaker's perspective, the standards on this diagram fall approximately into the following groups [1]:

- *Global context standards*: Global 'standards' for IT, internet and telephony form a diverse category of emerging and established standards, ranging from formal standards adopted by standards organisations to proprietary or partly-open standards. These are areas where a policymaker may have little practical choice in adoption of

a standard, being driven by market forces and the availability of suitable 'commodity' equipment, services and skills.

- *Accepted local standards*. Standards which may be indicated for adoption by policymakers include both formal open standards (DVB/DAB, DATEX, etc), standards which have been agreed on a local basis (eg ATCO-CIF or TransXchange), and open frameworks (eGIF, UTMC etc). Any individual policymaker will have a greater or lesser ability to influence the evolution of these, although to an extent these are already 'in the market' and therefore major change may be difficult.

- *Potential or emerging standards*: At an earlier stage (i) projects (KAREN, RAPID, TRIDENT and TAP for Transport projects); (ii) emerging standards (eGIF, Kiosks and Best Practice Guidelines, UTMC, RTIG, TransXchange and some formal standards); and (iii) established standards.

3.4 The implementer's perspective: value of standards to Transport Direct roles

3.4.1 Many different types of organisation will be involved in the delivery of Transport Direct, as described in Section 2.2 and Figure 2-1. Different stakeholders will have a need for, or an interest in, different sets of standards.

3.4.2 Figure 3-3 outlines the applicability of the standards in the Catalogue by:

- **Nature of activity**, concentrating on some of the core Transport Direct activities - from the underlying management of networks and fleets to traveller enquiry;

- **Layer of applicability**. Standards may focus on the 'low level' technicalities of hardware and communications, or on 'high level' aspects of functional specification, or somewhere between (eg data exchange or data presentation).

Figure 3-3: Standards presented by activity and layer
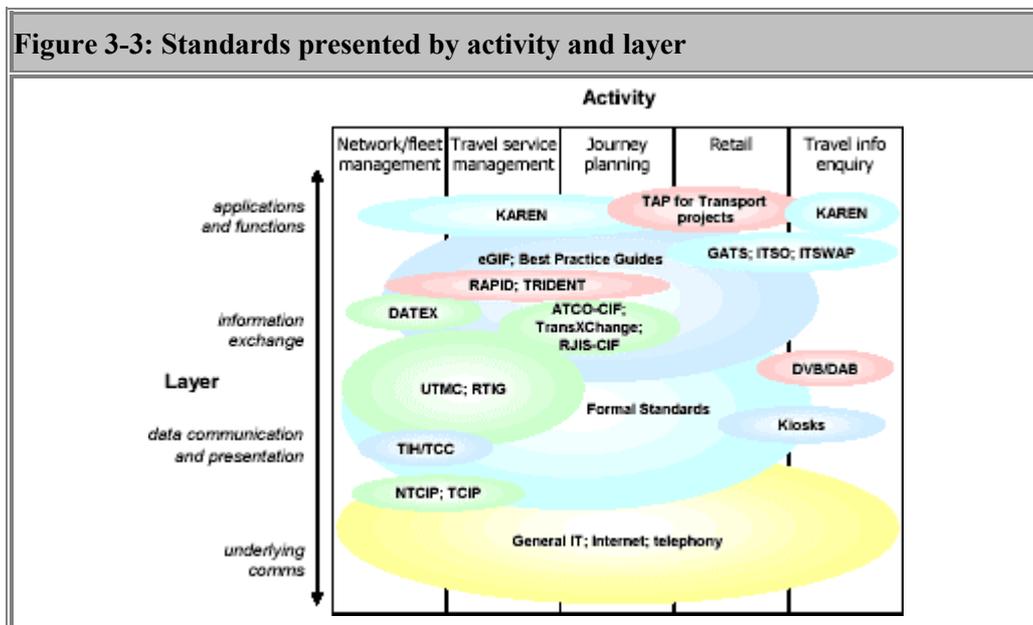
3.4.3 From the implementer's perspective, the standards on this diagram fall approximately into the following groups:

- *Generally applicable standards*: Global 'standards' for IT, internet and telephony are applicable to the majority of Transport Direct activities. At a higher level, the wide range of formal standards and best practice guides are typically generic to systems and apply across Transport Direct. For standards in these areas, however, there will still be significant choices to be made - for instance, the telecommunications or database standards suitable for a fleet manager may be very different from those suitable for an internet travel retailer.

- *Transport operations standards*: A number of standards cluster towards the left of the diagram. These are standards that support the exchange of information primarily for operational management purposes - DATEX, UTMC, TIH etc.

- *Traveller service standards*: A further set of standards cluster towards the right of the diagram; these are standards that support the exchange of information between travellers and other stakeholders. Most relate to devices (DVB, kiosk standards, ITSO, etc) or information presentation (eg RDS-TMC, TPEG and the Best Practice Guide for transport-related websites). The journey planning elements of RAPID and other projects have a 'traveller-facing' aspect too.

3.4.4 A somewhat different approach is taken in Figure 3-4. This diagram shows how the Catalogue of Standards affects different travel modes: walk/cycle, car, bus/coach, rail and air/sea.

Figure 3-4: Transport mode vs maturity
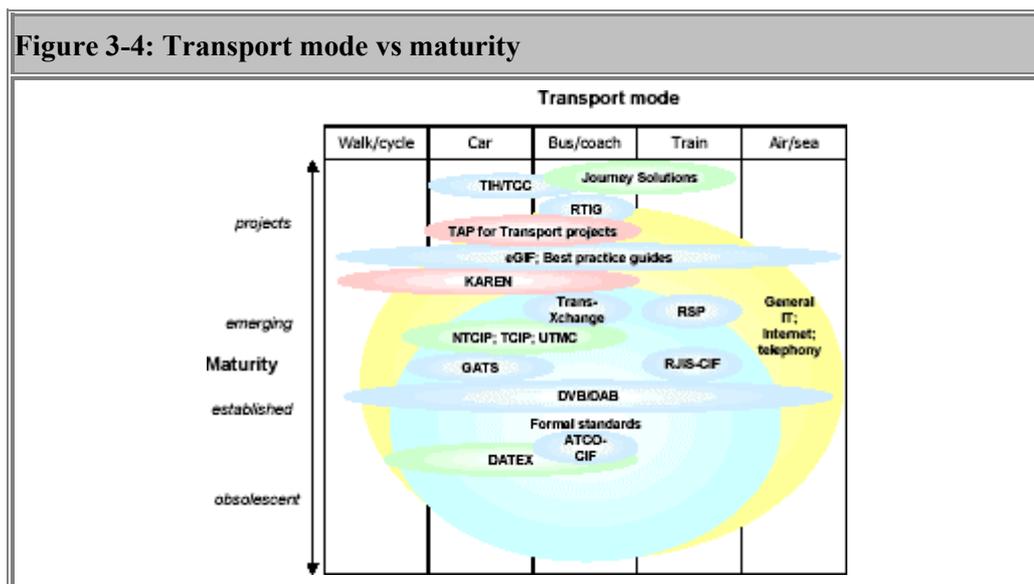
3.4.5 Again, a number of standards groups are applicable across all aspects - general IT, internet and telephony, DVB/DAB, eGIF, best practice guides etc.

3.4.6 However the great majority of specifically transport-related standards are limited to one or two modes; and of these, car and bus/coach are the modes that have the largest number of applicable Transport Direct Standards. This is not surprising, since these modes involve the largest number of interworking organisations.

3.4.7 There are some transport standards which are applicable across several modes, in principle if not in practice. However even the more general standards and projects have been developed in a specific modal context, and therefore have not been designed for or tested against the requirements of other standards. There is still a degree of inertia or resistance in taking, for instance, TIH into the rail domain, or UTMC or DATEX into public transport.

[1] The dearth of obsolescent and proprietary standards in this view is likely to be an artefact: proprietary and obsolete standards have not, in general, been included in the catalogue.

4 Gaps in standards provision

4.1 This section

4.1.1 A key question for Transport Direct, and the UK at large, is where the absence of standards may cause difficulties for the implementation of Transport Direct. This section presents the main gaps in standards provision, as determined from the Catalogue in consultation with stakeholders.

4.1.2 For a more detailed explanation of the rationale, approach and findings of the gap analysis please refer to Annex E.

4.2 Typology of gaps

4.2.1 Gaps can be categorised by the level, or levels, at which standards are believed to be absent and by the key drivers that led to a perceived gap in standards provision. Gaps may occur at the following levels:

- application area gaps: ie gaps in the provision of applications that require the interoperation of many standards;

- coverage gaps: ie gaps in the coverage of standards frameworks associated with preexisting applications.

- standards gaps: ie gaps in the provision of individual standards within pre-existing applications.

4.2.2 For both application level and standards level gaps, perceived absence or inadequacies in the provision of standards may occur because of:

- implementation gaps: poor or patchy take-up of existing standards within a segment, or across many segments, of the transport community (take-up dependent gaps); or

- integration gaps: the incompatibility of closely related applications or standards that prevents full interoperability (neighbouring incompatibility).

4.2.3 However, the absence of a standard relevant to a particular area may not be an indication of a 'gap' worth filling. There is therefore a key distinction to be drawn between:

- 'apparent gaps' (in which no standard exists because one is not needed);

- 'real gaps' (in which no standard exists although having one would be of positive benefit).

4.3 Current gaps in Transport Direct standards

Application, coverage and standards level gaps

4.3.1 On the basis of the analysis undertaken, no application level gaps and only a small number of coverage and standards level gaps have been identified.

4.3.2 The following coverage gaps have been identified:

- Transmodel 5.0, while extensive and thorough, omits a number of travel-related components and may prove difficult to implement in UK (this has been commented on in a separate report to DTLR);

- TransXchange is currently used primarily for timetabling but could be extended to address personnel disposition, automatic vehicle monitoring and management information and multi-modality (as is already planned);

- UTMC does not cover key areas such as road user charging and has relatively poor extension into public transport management systems (though the ongoing working links with RTIG should assist in strengthening this);

- Journey Solutions is still at the concept stage so its scope and coverage are not well-defined yet.

4.3.3 The following standards gaps have been identified:

- linkages between car park management and other applications (Medium priority)
- linkages between bus systems and other applications (Medium priority)
- consistent signing at bus stops (Low priority)
- standard process for updating bus timetable databases (Low priority)
- standards for naming and location, eg of bus stops (Medium priority) - standards for communications to and from public transport vehicles (Low priority)
- 'type approval' for information service equipment such as kiosks and signage (Low priority)

4.3.4 It is noted that some of these may emerge from current initiatives, notably car park management from UTMC, timetable databases through TransXchange, and PT vehicle communications from RTIG.

Implementation gaps

4.3.5 It is considered to be most unlikely that take-up of existing standards is leading to major gaps in standards provision. However minor (real) gaps in take-up exist for WAP standards for the dissemination of static and real-time information and those standards which are categorised as either "growing within UK" or "low within UK" (for further information please refer to Table E-4 in Annex E), namely:

- Best practice guides for PTI websites;
- Journey Solutions;
- Kiosk accessibility;
- ITSO;
- RAPID;
- TCC;
- TIH;
- TransXchange;
- UTMC.

Integration gaps

4.3.6 Overall the majority of applications are adequately integrated and have limited scope for further development of standards areas. Levels of interoperability between applications vary,

however current levels of interoperability are fit for purpose. For example rail management and in vehicle-TTI systems design applications would not be expected to be closely integrated.

4.3.7 The major areas of integration gaps are in:

- the link between travel service, travel information and other retailers and connected parties (network and fleet operators, operators of user presentation devices).

- the link between network operator systems (eg UTMC) and service provider systems (car park management, bus and rail management). It is likely that this will prove to be take-up dependant gap and it can be expected that this gap should be ameliorated with the continuing development of the relevant programmes.

4.4 How DTLR might help fill standards gaps

4.4.1 In general, the provision of standards is adequate and there are no potentially show-stopping gaps in the current provision of application areas and standards that could seriously impact on the success of Transport Direct. Nevertheless some minor gaps in standards provision do exist.

4.4.2 A summary of possible DTLR action, over and above existing activities, is presented in each area in Table 4-2. Note that 'priority' here refers not to the importance of the action, or even the importance of the DTLR's involvement, but to the priority that DTLR should place on beginning new action to assist in a particular area.

Table 4-2: Summary of gap analysis			
Description of "gap"	**Type of gap**	**Priority**	**Action for DTLR**
Coverage of Transmodel	Coverage; Integration	Medium	Support relevant international standards development activity to fill in gaps
Coverage of TransXchange	Coverage; Implementation	Medium	Support relevant national standards development activity to fill in gaps
Coverage of Journey Solutions	Coverage	Low	Continue to support the emergence of Journey Solutions as an umbrella framework
Coverage of UTMC; linkages between bus management and other applications	Coverage; Standards level; Implementation; Integration	High	Continue to encourage cooperation between UTMC and public transport sector including through RTIG
Linkages between car park management and other applications	Standards level; Implementation;	Medium	Encourage take-up of UTMC compliant car park management systems as part of UTMC

	Integration		initiative
Standard process for updating bus timetable databases	Standards level	Medium	Facilitate industry-led standardisation efforts, encourage TransXchange
Standards for naming and location, eg of bus stops	Standards level	High	Facilitate industry-led standardisation efforts
Standards for communications to and from public transport vehicles	Standards level; Implementation	Low	Encourage development and take-up of RTIG standards
Type approval for information service equipment eg unsupervised outdoor displays or kiosks	Standards level	Low	Facilitate industry-led standardisation efforts it is unlikely that official type approval is necessary
Framework for retail of travel related services	Implementation; Integration	High	Continue to promote ITSO for smartcard retail; facilitate coordination among travel retailers to develop good practice (along the lines of RTIG)
XML standards for web and WAP distribution of static and real-time data	Implementation	Low	Facilitate industry-led standardisation efforts eg ITSWAP
Bus and rail publicity displayed at stops, stations and terminals	Standards level	Low	Facilitate development and subsequent take-up of industry-led standardisation efforts eg ATCOs Provision of Information guidelines for bus services
Low/growing take-up of standards (Best practice guides for PTI websites; Journey Solutions; Kiosk accessibility; RAPID; TCC; TIH; TransXchange; UTMC)	Implementation	Medium	Encourage take-up of standards by exerting influence with key stakeholders
Security framework	Integration	Medium	Encourage the spread of good integrated-systems security practice among existing standards/frameworks (eg TransXchange, RTIG)

4.4.3 Of the gaps identified in Table 4-2, high priority gaps which should be addressed in the short-term in order for the full potential of Transport Direct to be realised are:

     - linkages between public transport management and network applications;
     - standards for naming and location, eg of bus stops.

4.4.4 Although not itself a gap in standards provision, stakeholders consultation highlighted that DTLR might have a role to play in developing and clarifying a suitable architecture by which different standards fit together. This might be achieved through:

     - development of the proposed National Framework;
     - a White Paper on technology elements and basic end-to-end architectures.

4.4.5 These would naturally follow on from the current Data Management Framework Scoping Study.

5 Summary and conclusions

5.1 The Standards Catalogue

5.1.1 This document has provided a comprehensive catalogue of UK, European and International standards initiatives within the traveller information and retail area which are of relevance to the development of the Transport Direct Initiative. The standards presented vary in terms of:

- their scope;
- their level of detail;
- their maturity;
- their openness;
- the layer upon which they act;
- the mode(s) to which they apply; and
- the activities in the Transport Direct operations model to which they apply.

5.1.2 The contents of individual entries in the Standards Catalogue have been verified with the standards owners and its completeness established through consultation with key stakeholders.

5.2 Further work

5.2.1 DTLR has acknowledged its role in ensuring the availability of a suitable framework of standards for Transport Direct through relevant means, which may include:

- sponsoring, where justified, the development or extension of (UK or international) standards;
- developing and clarifying a suitable architecture by which different standards fit together;
- facilitating the exchange of good practice in standards usage among stakeholders;
- continued development and promulgation of this Catalogue to interested parties.

5.2.2 By these means, DTLR will seek to ensure that the Transport Direct standards framework remains open and can move alongside other national initiatives such as TIH and UTMC.

5.2.3 At present, there are no show-stopping gaps that could seriously impact on the success of the Transport Direct initiative. Of the minor gaps that have been identified, the priorities should be to encourage:

- the take up of UTMC, especially compliant car park management systems;
- the evolution and implementation of systems and standards through RTIG;
- the take up of (full) TransXchange as an information exchange 'backbone' for public transport, alongside TIH;
- the consolidation of a framework for retail and payments, based on ITSO but working alongside DIRECTS;
- the agreement of standards for the naming and location of bus stops;
- the adoption of good practice guidelines for websites, kiosks etc.

5.2.4 The extension of existing standards will also be required to meet evolving user needs and ensure interoperability with new applications/general technology standards. Such an extension of standards would aid Policymakers, Suppliers and Service Providers in better meeting their policy and business objectives.

5.3 Action plan for DTLR

5.3.1 Based on the high-priority conclusions in Section 4 and in Section 5 above, Table 5-1 proposes a suggested action plan for DTLR. Some of these actions reach wider than the standards management remit for Transport Direct, but will have a significant impact on TD.

Table 5-1: Suggested action plan for DTLR		
Action	**Timing**	**Objective**
Establish Departmental position		
Workshop with key stakeholders within DTLR, and the Highways Agency, to brief the output of this standards stock-take and agree a way ahead	February 2002	ensure that the Transport Direct standards framework remains open and can move alongside other national initiatives such as TIH and UTMC
Establish organisational and operational mechanisms within DTLR to coordinate ITS standards, act as a central ITS standards library, consolidate UK input into international bodies etc	by June 2002	provide a Departmental focus and leadership to coordinate the standards work of programmes
NB this should be wider than Transport Direct, and should cover UTMC, DIRECTS, existing HA standards and standards emerging from supplier groups		
Work with RTIG and UTMC programme to assist the extension/establishment of their standards frameworks with a clean join	2002-2003	facilitate joined-up standards and operational practice across the roads authority/transport operator interface
Support their development and demonstration through trial sites		
Promote the Transport Direct standards framework in a European context and conduct European outreach, working with Euro-regional projects as appropriate	during 2002	raise the awareness of Transport Direct and the Transport Direct standards approach in a European setting
Support standards uptake/development		
Disseminate standards information to key stakeholders, eg local authorities, public transport operators, policymakers via appropriate means (Inform Group, ITS UK, RTIG, ITS Assist, etc)	ongoing	raise the awareness of standards relevant to Transport Direct encourage the uptake of standards relevant to Transport Direct
Develop and promulgate good practice guidelines and case studies via appropriate means (as previous)	ongoing	raise the awareness of standards relevant to Transport Direct encourage the uptake of standards relevant to Transport Direct

Workshop to address framework for location referencing	April 2002	provide leadership and consolidate industry practice in an important emerging aspect of Transport Direct
Possibly leading to study on location referencing framework (unless already available through data management framework study)		
Facilitate the establishment of an industry working group to address the issue of standards in transport retail and payment services (along the lines of RTIG)	first half of 2002	provide leadership and consolidate industry practice in an important emerging aspect of Transport Direct
Update Standards Catalogue and reissue as necessary (eg to capture changes in standards maturity/uptake and major new developments)	at least annually	provide up to date information to stakeholders to support the awareness/uptake objectives above
Full scale review of standards provision relevant to Transport Direct	2004/5	re-assess the adequacy of standards provision to support the Transport Direct initiative and in particular whether the extension of standards envisaged in this document meet user needs

A Formal standards initiatives

A.1 About formal standards

A.1.1 Some standards have a formal position in law. This annex provides an overview of these as they apply to Transport Direct:

- Section A.2 outlines the main bodies involved in the development of standards relevant to Transport Direct;

- Section A.3 outlines the process by which standards are developed and their force in law;

- Section A.4 outlines the key working groups of formal standards bodies and their remit;

- Sections A.5-A.7 list individual standards, either published or in development, of these key working groups.

A.2 Formal standards bodies

A.2.1 Standards bodies exist at international (global), European and national level. Names and contacts for a number of key standards bodies are provided in Table A-1.

Table A-1: Summary of formal standards bodies		
Standards body	**Scope**	**URL**
International Organization for Standardisation (ISO)	International	http://www.iso.ch/
International Electrotechnical Commission (IEC)	International (Electrical)	http://www.iec.ch/
International Telecommunications Union (ITU)	International (Telecoms)	http://www.itu.org
Internet Engineering Task Force (IETF)	International (Internet)	http://www.ietf.org
Object Management Group (OMG)	International (Data objects)	http://www.omg.org
Committee European de Normalisation (CEN)	European	http://www.cenorm.be/
European Committee for Electrochemical Standardisation (CENELEC)	European (Electrical)	http://www.cenelec.org/
European Telecommunication Standards Institute (ETSI)	European (Telecoms)	http://www.etsi.org/
British Standards Institution (BSI)	National (British)	http://www.bsi-

		global.com/

International standards

A.2.2 International standardisation is conducted under the auspices of the International Standardisation Organisation (ISO), a body established with the backing of the United Nations. ISO operates through a number of Technical Committees (TCs) which focus on particular standards areas. ISO standards have the prefix ISO.

A.2.3 Other affiliated bodies develop standards in particular areas, of which the most relevant is the International Telecommunications Union (ITU) for telecommunications (formed by a merger of the previous bodies CCITT and CCIR). ITU standards are named with a letter-dot-number format, such as I.320 (for ISDN telecomms) or V.90 (for modems) or X.400 (for messaging).

A.2.4 There are a number of industry-sponsored bodies which have a strong position in the sponsorship of *de facto* standards, notably:

> - the Internet Engineering Task Force (IETF) for internet standards;

> - the Object Management Group (OMG) for CORBA and associated object-oriented computing technologies.

A.2.5 IETF standards are, for historical reasons, termed "Requests for Comment" or RFCs.

A.2.6 ITS standardisation activity at an international level is conducted by working group TC204 of ISO.

European standards

A.2.7 The primary body responsible for formal standardisation in Europe is the Comité Européenne de Normalisation (CEN). Separate bodies have been created for the standardisation of:

> - electric systems (European Committee for Electrochemical Standardisation, CENELEC);

> - telecommunications systems (the European Telecommunications Standards Institution, ETSI).

A.2.8 CEN/CENELEC standards are prefixed EN. ("Voluntary" CEN standards have the prefix ENV, though in practice there is little distinction between ENs and ENVs.) Drafts are prefixed prEN. ETSI standards are prefixed ETS, and in draft prETS.

A.2.9 CEN, CENELEC and ETSI are the bodies to which the European Union turns institutionally for the development of technical specifications necessary for the implementation of European Union Directives.

A.2.10 ITS standardisation activity at a European level is conducted by working group TC278 of CEN. There is a formal working relationship between ISO TC204 and CEN TC278 by which the leadership of the various work items has been divided between them in order to avoid duplication of effort as far as possible. The IEC is involved in standardisation of generic telecommunications standards within the scope of Transport Direct.

A.2.11 Following the "new approach" to standardisation in the European market, legislative harmonisation (Article 100a of the Treaty of Rome) is limited to essential requirements. The

majority of standards are therefore not mandatory, in the sense of being required under European law. Most mandatory standards are related to safety (eg "Explosives for civil uses", "Personal protective equipment", "Construction products" etc). Mandatory standards of indirect relevance to Transport Direct are raised under Directives 89/336/EEC (Electromagnetic Compatibility) and 99/5/EC (Radio and Telecommunications Terminal Equipment).

National standards

A.2.12 Individual states have their own national standards bodies; in the UK this is the British Standards Institute (BSI). National standards bodies have a coordinating role in the development and approval of European and international standards, and also act as 'attestation' bodies for assessing whether a particular product achieves compliance with European Directives.

A.2.13 British Standards are prefixed BS.

A.2.14 National standards bodies play a very limited role in the development of ITS standards. Some, but not all, national standards bodies have transport working groups; the UK has one (coordinated by Terry Sullivan, HA).

A.3 Development and force of standards

A.3.1 Standards, whether technical specifications or best practice guidelines and whether formal or industry standards, have a lifecycle creation, development, acceptance and obsolescence. Figure A-1 shows the main elements of this lifecycle.

A.3.2 The concept for a standard may arise either from a standards body determining a need, or from the sponsorship of a suitable (usually public sector) agency. This is developed into an idea either formally (ie through the established standards body route) of informally (through industry development). Certain agencies have a direct operational link with associated standards bodies - notably the tasking arrangements between the European Commission and CEN/CENELEC/ETSI.

A.3.3 Specifications may also be proposed by private sector developers to industry groupings as a de facto' standard (common examples include the computer system interfaces designed by Microsoft^{TM}), and these may in turn be proposed to (or be picked up by) established standards bodies for adoption as formal standards.

A.3.4 Formal standards are not necessarily legally binding and, as such, compliance with them is voluntary. Compliance with formal standards may be legally mandated (for instance on the grounds of safety or security) by the European Commission/National Governments, or specified in a contract between two parties.

Figure A-1: Standards evolution model

Public sector (UK Govt, European Commission etc)

tasking

sponsorship

Standards body action plan

novel

development/ consultation/ approval

submission to standards body

adoption/ evolution

Private sector

mainstream

legal adoption

Legally mandated standards

proposal to industry body

obsolescent

Formal standards   **De facto standards**
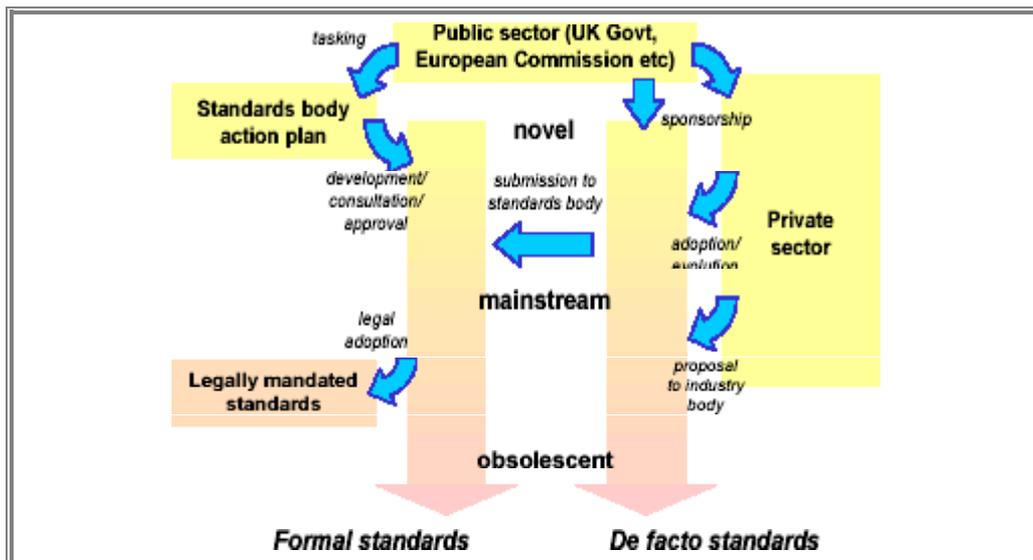
A.3.5 The force of a formal standard may therefore arise in two distinct ways.

- A formal standard may be mandated by a public body seeking to buy a system. (Mandating any other technical aspects of a system might be considered anticompetitive and therefore unlawful.) To be able to supply this market, a supplier must therefore comply with the standard - though of course it is a business decision as to whether customers are likely to demand compliance, and private sector buyers are not constrained in this way.

- Exceptionally, compliance with a formal standard might be mandated under law. In this case, any system deployed must meet the required standard, whether private or public and whether explicitly specified or not. A legal mandate for compliance with a standard will necessarily be for reasons that override competition or freedom concerns; the main reason is health and safety, although there are others (eg mandated standards on electromagnetic compatibility).

A.3.6 There is a hierarchy of priority, established in European law, which UK users wishing to mandate a standard must follow:

- If there is a European standard, this must be used.

- If there is no European standard but there is an international standard, the international standard must be used.

- If there is no European or international standard but there is a British Standard, the BS must be used.

- In the absence of the above, a Departmental or other local standard may be used.

A.3.7 Note that unless compliance is a legal requirement, there is nothing to prevent a body from not specifying a standard at all, and accepting a submission which complies with an 'inferior' standard but fails to comply with a 'superior' standard.

A.4 Key working groups of formal standards bodies

A.4.1 ISO TC204 working groups are:

- WG 1: System Architecture
- WG 2: Quality and Reliability Requirements
- WG 3: Referencing and Updating Procedure
- WG 4: Automatic Vehicle and Equipment Identification
- WG 5: Fee & Toll Collection/Management and Access Control
- WG 6: General Fleet Management
- WG 7: Commercial/Freight Management
- WG 8: Public Transport/Emergency
- WG 9: Integrated Transport Information, Management and Control
- WG 10: Traveler Information Systems
- WG 11: Route Guidance and Navigation Systems
- WG 14: Vehicle/Road Warning and Control Systems
- WG 15: Dedicated Short-Range Communications for TICS Applications
- WG 16: Wide Area Communications/Protocol and Interfaces

A.4.2 CEN TC278 working groups:

- WG 1: Automatic fee collection and access control
- WG 2: Freight and Fleet management systems
- WG 3: Public transport
- WG 4: Traffic and traveller information
- WG 5: Traffic control
- WG 6: Parking management
- WG 7: Geographic databases
- WG 8: Road data traffic/Elaboration, storage and distribution
- WG 9: Dedicated short-range communication
- WG 10: Man-machine interface
- WG 11: Subsystem and intersystem interfaces
- WG 12: Automatic vehicle and equipment identification
- WG 13: Architecture and terminology
- WG 14: After theft systems for the recovery of stolen vehicles

A.4.3 Aside from transport standards the activities of the following technical committees of ISO, related to disabled persons, are relevant to Transport Direct:

- TC 145 Graphical symbols and pictograms/ SC1 Public Information Symbols (pictograms)

    - WG 3 Graphical symbols covering the need for information by disabled

- TC 173 Assistance and technical aids for disabled:

    - WG 1: Walking aids
    - WG 2: Braille-Tactile reading and writing
    - WG 6: Tactile and acoustic signals that indicate the position of traffic lights
    - WG 7: Provision and means for orientation of visually impaired people in pedestrian areas

A.4.4 Aside from transport standards the activities of technical committees of ISO related to disabled persons are relevant to Transport Direct:

- CEN/TC224: Machine Readable Cards, Related Device Interfaces and Operations

- WG 6: Identification Card Systems - Man-Machine Interface

A.4.5 User Interface Design Standards include:

- ISO 9241: Ergonomic Requirements for Office Work with Visual Displays Units.

- Usability, Evaluation, and Measurement Standards:

- ISO (1992): Guidance on Usability Specification and Measures.
ISO, CD 9241-11

- Pictograms Design Standards:

- ISO/CD 9186: Procedure for the Development and Testing of
Public Information Symbols
- ISO 3461: Graphic Symbols to be used on Equipment
- ISO 7001: Public Information Symbols (1990)

- Technical committee/subcommittee: TC 145/SC 1.
Descriptors

A.5 Published ISO/TC204 Standards

Road Transport and Traffic Telematics (RTTT) - Electronic Fee Collection

Table A-3: List of published ISO/TC204 standards (as of September 2001)	
Document	Title
ISO/TR 14813-1:1999	Transport information and control systems - Reference model architecture(s) for the TICS sector - Part 1: TICS fundamental services
ISO/TR 14813-2:2000	Transport information and control systems - Reference model architecture(s) for the TICS sector - Part 2: Core TICS reference architecture
ISO/TR 14813-3:2000	Transport information and control systems - Reference model architecture(s) for the TICS sector - Part 3: Example elaboration
ISO/TR 14813-4:2000	Transport information and control systems - Reference model architecture(s) for the TICS sector - Part 4: Reference model tutorial
ISO/TR 14813-5:1999	Transport information and control systems - Reference model architecture(s) for the TICS sector - Part 5: Requirements for architecture description in TICS standards
ISO/TR 14813-6:2000	Transport information and control systems - Reference model architecture(s) for the TICS sector - Part 6: Data presentation in ASN.1
ISO/TS 14815:2000	Road transport and traffic telematics - Automatic vehicle and equipment identification - System specifications

ISO/TS 14816:2000	Road transport and traffic telematics - Automatic vehicle and equipment identification - Numbering and data structure
ISO/TS 14819-3:2000	Traffic and Traveller Information (TTI) - TTI messages via traffic message coding - Part 3: Location referencing for ALERT-C
ISO/TR 14825:1996	Geographic Data Files (GDF)
ISO/TR 14904:1997	Road transport and traffic telematics - Automatic fee collection (AFC) - Interface specification for clearing between operators
ISO/TR 14906:1998	(EFC) - Application interface definition for dedicated short range communications
ISO/TS 15624:2001	Transport information and control systems - Traffic Impediment Warning Systems (TIWS) - System requirements

A.6 Published CEN/TC278 standards

Table A-4: List of published CEN/TC278 standards (as of September 2001)	
Document	**Title**
ENV 12253:1997	Dedicated Short-Range Communication - Physical layer using microwave at 5.8 GHz
ENV 12313-1:1998	Traffic and Travel Information (TTI) - TTI Messages via traffic message coding - Part 1: Coding protocol for Radio Data System - Traffic Message Channel (RDS-TMC) using ALERT- C
ENV 12313-2:1997	Traffic and Travel Information (TTI) - TTI Messages via traffic message coding - Part 2: Event and information codes for Traffic Message Channel (RDS-TMC)
ENV 12313-4:1999	Traffic and Travel Information (TTI) - TTI Messages via traffic message coding - Part 4: Coding protocol for Radio Data System - Traffic Message Channel (RDS- TMC) - RDS-TMC using ALERT-Plus with ALERT-C
ENV 12314-1:1996	Automatic vehicle and equipment identification - Part 1: Reference architectures and terminology
ENV 12315-1:1996	Traffic and Travel Information (TTI) - TTI Messages via Dedicated Short-Range Communication - Part 1: Data specification - Downlink (roadside to vehicle)
ENV 12315-2:1996	Traffic and Travel Information (TTI) - TTI Messages via Dedicated Short-Range Communication - Part 2: Data specification - Uplink (vehicle to roadside)
ENV 12694:1997	Public transport - Road vehicles - Dimensional requirements for variable electronic external signs
ENV	Public transport - Reference data model

12896:1997	
ENV 13093:1998	Public transport - Road vehicles - Driver's console mechanical interface requirements - Minimum display and keypad parameters
ENV 13106:2000	DATEX traffic and travel data dictionary (version 3.1.a)
ENV 13149-1:1999	Public transport - Road vehicle scheduling and control systems - Part 1: WORLDFIP definition and application rules for onboard data transmission
ENV 13149-2:2000	Public transport - Road vehicle scheduling and control systems - Part 2: WORLDFIP cabling specifications
ENV 13372:1999	Dedicated Short-Range Communication (DSRC) - DSRC profiles for RTTT applications
ENV 13777:2000	DATEX specifications for data exchange between traffic and travel information centres (version 1.2.a)
ENV 13998:2001	Public transport - Non interactive dynamic passenger information on ground
ENV 14815:1999	Automatic vehicle and equipment identification - System specification
ENV ISO 14812:1999	Glossary of Standard Terminologies for the Transport Information and Control Sector
ENV ISO 14816:1999	Automatic vehicle and equipment identification - Numbering and data structures
ENV ISO 14819-3:2000	Traffic and Travel Information (TTI) - TTI Messages via traffic message coding - Part 3: Location referencing for ALERT- C
ENV ISO 14821-1	Traffic and Travel Information (TTI) - TTI messages via cellular networks - Part 1: General specifications
ENV ISO 14821-2	Traffic and Travel Information (TTI) - TTI messages via cellular networks - Part 2: Numbering and ADP message header
ENV ISO 14821-3	Traffic and Travel Information (TTI) - TTI messages via cellular networks - Part 3: Basic information elements
ENV ISO 14821-4	Traffic and Travel Information (TTI) - TTI messages via cellular networks - Part 4: Service-independent protocols
ENV ISO 14821-5	Traffic and Travel Information (TTI) - TTI messages via cellular networks - Part 5: Internal services
ENV ISO 14821-6	Traffic and Travel Information (TTI) - TTI messages via cellular networks - Part 6: External services
ENV ISO 14821-7	Traffic and Travel Information (TTI) - TTI messages via cellular networks - Part 7: Performance requirements for onboard positioning

ENV ISO 14821-8	Traffic and Travel Information (TTI) - TTI messages via cellular networks - Part 8: GSM-specific parameters
ENV ISO 14825:1996	Geographic Data Files
ENV ISO 14904:1997	Electronic Fee Collection (EFC) - Interface specification for clearing between operators
ENV ISO 14906:1998	Electronic Fee Collection - Application interface definition for Dedicated Short - Range Communication
ENV ISO 14907-1:1999	Electronic Fee Collection - Test procedures for user and fixed equipment - Part 1: Description of test procedures

A.7 Future CEN standardisation activities

Table A-5: Future CEN standardisation activities (as of September 2001)			
Work Item	**Title**	**Present Status**	**Document**
00278002	Transport Information and Control Systems - Reference Model Architecture(s) for the TICS Sector - Part 1: TICS Fundamental Services	Ready for Formal Vote	prENV ISO 14813-1
00278027	Traffic and Travel Information - Medium-range pre- information	Under development	
00278041	Geographic road data - Location catalogues	Starting up	
00278044	Geographic road data - Maintenance rules	Starting up	
00278065	Road vehicles -Transport information and control systems - Man-machine interface - Auditory information presentation	Parallel Enquiry completed	prEN ISO 15006
00278070	Road vehicles - Man Machine Interfaces - Visual demand measurement method - Part 1: Requirements	Parallel Enquiry completed	prEN ISO 15007-1
00278073	Road traffic data - Elaboration, storage, distribution - Exchange procedures (low level)	Dormant	
00278074	Road traffic data - Elaboration, storage, distribution - Exchange formats (low level)	Under development	
00278075	Road traffic data - Elaboration, storage, distribution - Physical interfaces	Under development	
00278080	Public Transport - Road vehicles - AVMS on board equipment - Environmental and electrical conditions and limits	On hold	

0027808 1	Public transport - Road vehicles - Visible variable passenger information devices inside the vehicle	Under development	
0027808 4	Traffic and Travel Information - Messages via media- independent stationary dissemination systems - Graphic data dictionary for pre-trip and in-trip information dissemination system	TC comments received	N1116
0027808 8	Automatic vehicle and equipment identification - Intermodal goods transport - Numbering and data structures	Ready for Parallel Formal Vote	N980
0027808 9	Automatic vehicle and equipment identification - Intermodal goods transport - System parameters	Ready for Parallel Formal Vote	N981
0027809 0	Automatic vehicle and equipment identification - Intermodal goods transport - Architecture and terminology	TC comments received	prENV ISO 17261
0027809 4	Freight and Fleet Management Systems - Reference architecture and terminology - Part 1: high level architecture and terms	TC comments received	N739
0027809 5	After-theft systems for the recovery of stolen vehicles - Common status message set	Under development	
0027809 6	After-theft systems for the recovery of stolen vehicles - Interface and system requirements in terms of short range communication system	Under development	
0027809 7	After-theft systems for the recovery of stolen vehicles - Interface and system requirements in terms of communication system	Under development long range	
0027809 9	Road vehicles - Ergonomic aspects of transport information and control systems - Specifications and compliance procedures for in-vehicle visual presentation (ISO/DIS 15008:2001)	Under Parallel Enquiry	prEN ISO 15008
0027810 1	Road vehicles - Ergonomic aspects of in-vehicle presentation of traffic information and control systems - Dialogue management principles and compliance procedures	Parallel Enquiry completed	prEN ISO 15005
0027810 2	Road vehicles - Man Machine Interfaces - Visual demand measurement method - Part 2	Under development	
0027810 3	Electronic Fee Collection (EFC) - Test procedures for user and fixed equipment - Part 2: EFC application interface conformance tests specification	Under development	

0027810 4	Electronic Fee Collection (EFC) - Application interface definition for CN/GNSS based EFC	Under development	
0027810 5	Electronic Fee Collection - Security framework	Out for TC comments	prENV ISO 17574
0027810 7	Transport Information and Control Systems - Reference Model Architecture(s) for the TICS Sector - Part 2: Core TICS reference architecture	Ready for Formal Vote	prENV ISO 14813-2
0027810 8	Transport Information and Control Systems - Reference Model Architecture(s) for the TICS Sector - Part 3: Example Elaboration	Ready for Formal Vote	prENV ISO 14813-3
0027810 9	Transport Information and Control Systems - Reference Model Architecture(s) for the TICS Sector - Part 4: Reference model tutorial	Ready for Formal Vote	prENV ISO 14813-4
0027811 0	Transport Information and Control Systems - Reference Model Architecture(s) for the TICS Sector - Part 5: Requirements for Architecture Description in TICS standards	Ready for Formal Vote	prENV ISO 14813-5
0027811 1	Transport Information and Control Systems - Reference Model Architecture(s) for the TICS Sector - Part 6: Data presentation in ASN.1	Ready for Formal Vote	prENV ISO 14813-6
0027811 2	Traffic and Travel Information (TTI) - TTI Messages via traffic message coding - Part 1: Coding protocol for Radio Data System - Traffic Message Channel (RDS- TMC) using ALERT-C	Ready for Parallel Formal Vote	prEN ISO 14819-1
0027811 3	Traffic and Traveller Information (TTI) - TTI Messages via traffic message coding - Part 2: Event and information codes for Radio Data System - Traffic Message Channel (RDS- TMC)	Parallel Enquiry completed	prEN ISO 14819-2
0027811 4	Electronic Fee Collection - System architecture for vehicle related transport services	Ready for parallel Formal Vote	prENV ISO 17573
0027811 7	Traffic and Travel Information (TTI) - TTI Messages via traffic message coding - Part 5: Location referencing for ALERT-Plus	Under preparation	
0027811 9	Dedicated Short Range Communication - Physical integration with the vehicle of On Board Units (OBU) for Electronic Fee Collection (EFC)	Under development	
0027812 2	Public transport - Road vehicle scheduling and control systems - Part 3: WORLDFIP message	Under development	

	content		
0027812 3	Public transport - Road vehicle scheduling and control systems - Part 4: General application rules for CANopen transmission busses	Ready for Formal Vote	N1097
0027812 4	Public transport - Road vehicle scheduling and control systems - Part 5: CANopen cabling specifications	Ready for Formal Vote	N1098
0027812 5	Public transport - Road vehicle scheduling and control systems - Part 6: CAN message content	Under development	
0027812 6	Automatic Vehicle and Equipment Identification (AVI/AEI) - AVI/AEI Interfaces	Under development	
0027812 7	Road vehicles - Ergonomic aspects of transport information and control systems - Procedure for determining priority of on board messages presented to drivers	TC comments received	prEN ISO 16951
0027812 8	Road vehicles - Ergonomic aspects of transport information and control systems - Procedure for assessing suitability for use when driving	Parallel Enquiry finalised	prEN ISO 17287
0027813 7	Geographic Data Files - Version 4.0	TC comments received	prENV ISO 14825
0027813 8	Public transport - Interoperable fare management systems architecture	Under preparation	
0027813 9	Electronic Fee Collection (EFC) - Interface specification for clearing between operators (review)	Ready for Parallel Vote	
0027814 0	Public transport - Reference data model (review)	Under development	
0027814 1	Dedicated Short-Range Communication - Physical layer using microwave at 5.8 GHz (review)	Out for TC commenting	prEN 12253
0027814 2	Dedicated Short-Range Communication (DSRC) -DSRC Data link layer: Medium Access and Logical Link Control (review)	Enquiry completed, comments	prEN 12795 rev
0027814 3	Dedicated Short-Range Communication - Application layer (review)	Enquiry completed, comments	prEN 12834 rev
0027814 4	Dedicated Short-Range Communication (DSRC) -DSRC profiles for RTTT applications (review)	Out for TC commenting	prEN 13372
0027814 5	Traffic and Travel Information (TTI) - TTI Messages via traffic message coding - Part 4:	Under development	

	Coding protocol for Radio Data System - Traffic Message Channel (RDS- TMC) - RDS-TMC using ALERT-Plus with ALERT-C (review)		
00278146	After-theft systems for the recovery of stolen vehicles - Messaging interface	Under development	
00278147	Traffic and Travel Information (TTI) TTI via Transport Protocol Expert Group (TPEG) data-streams Part 1: Introduction, Numbering and Versions	TC comments received	N1082
00278148	Traffic and Travel Information (TTI) TTI via Transport Protocol Expert Group (TPEG) data-streams Part 2: Syntax, Semantics and Framing Structure (SSF)	No TC comments received	N1083
00278149	Traffic and Travel Information (TTI) TTI via Transport Protocol Expert Group (TPEG) data-streams Part 3: Service and Network Information (SNI) Application	TC comments received	N1084
00278150	Traffic and Travel Information (TTI) - TTI via Transport Protocol Expert Group (TPEG) data-streams Part 4: Road Traffic Message (RTM) Application	TC comments received	N1085
00278151	Traffic and Travel Information (TTI) - TTI Messages via traffic message coding - Part 3: Location referencing for ALERT- C (review)	Ready for Parallel Enquiry	prEN ISO
00278152	Electronic Fee Collection - Application interface definition for Dedicated Short-Range Communication (review)	Under development	
00278153	Public transport - Automatic ticket vending machines - Traveller interface	Under development	
00278154	Public transport - Public interactive information terminals - Traveller interface	Under development	
00278155	Public transport - Road vehicles - Validators (review)	Starting up	
00278156	Public transport - Road vehicles - Driver's console mechanical interface requirements - Minimum display and keypad parameters (review)	Starting up	
00278157	Automatic vehicle and equipment identification - Part 1: Reference architectures and terminology (review)	Starting up	

A.8 Future ISO standardisation activities

Table A-6: Future ISO standardisation activities	
Document	**Title**
TR ISO 14812	Glossary of standard terminologies for the transport information and control sector
TR2 ISO 14813-1	Reference model architecture for the TICS sector - TICS fundamental services
TR2 ISO 14813-2	Reference model architecture for the TICS sector - Core reference model
TR2 ISO 14813-3	Reference model architecture for the TICS sector - Example elaboration
TR2 ISO 14813-4	Reference model architecture for the TICS sector - Reference model tutorial
TR2 ISO 14813-5	Reference model architecture for the TICS sector - Description of architecture in TICS standards
TR2 ISO 14813-6	Reference model architecture for the TICS sector - Data presentation in ASN.1
TR2 ISO 14813-7	Reference model architecture for the TICS sector - TICS Data Profiles
ENV ISO 14814	Reference model architecture for generic AVI/AEI
TR ISO 14815	Standard AVI/AEI generic system specifications
TR 14816	Numbering schemes for generic AVI/AEI
ENV 14817	Rules for populating Data Dictionaries (was 17383-1)
TR2 ISO 14817-1	Data modelling for transport information - Data Registry(ASN.1)
14817-2	Data modelling for transport information - Data Dictionary Documentation(ASN.1)
14817-3	Data modelling for transport information - Data Message requirements(ASN.1)
14818	TTI conceptual model architecture and terminology
ENV ISO 14819-1	TTI messages via traffic message channel, coding protocol for radio data system RDS-TMC
ENV ISO 14819-2	TTI messages via traffic message channel, event & information codes for radio data system TMC
ENV ISO 14819-3	TTI messages via TMC Coding part 3 location referencing for Alert-C

ENV ISO 14819-4	TTI messages via TMC Coding part 4 protocol for Alert +
ENV ISO 14819-5	TTI messages via TMC Coding part 5 Location coding for Alert +
14820-1	TTI messages via dedicated short range communication, data specification downlink
14820-2	TTI messages via dedicated short range communication, data specification uplink
TR ISO 14821	TTI messages via cellular networks (now in 8 parts - see below)
TR ISO 14821-1	TTI messages via cellular networks Part 1 General Specifications
TR ISO 14821-2	TTI messages via cellular networks Part 2 Numbering and ADP Message header
TR ISO 14821-3	TTI messages via cellular networks Part 3 Basic Information Elements
TR ISO 14821-4	TTI messages via cellular networks Part 4 Service-independent protocols
TR ISO 14821-5	TTI messages via cellular networks Part 5 Internal services
TR ISO 14821-6	TTI messages via cellular networks Part 6 External services
TR ISO 14821-7	TTI messages via cellular networks Part 7 Performance requirements for onboard positioning
TR ISO 14821-8	TTI messages via cellular networks Part 8 GSM-specific parameters
14822	Medium range pre-information
TS ISO 14823	Stationary dissemination systems for traffic and traveller information
ISO TR 14825	Geographic Data File
14826	Physical storage for TICS database technology (revised
ENV ISO 14827-1	Data interfaces between centres for transport and information control systems (TICS) part 1 Message definition requirements
ENV ISO 14827-2	Data interfaces between centres for transport and information control systems(TICS) - Part 2 DATEX-ASN
14904	EFC Interface specification for clearance between operators(review)
14906	Electronic fee collection application interface definition for dedicated short range vehicle-beacon communication
ENV ISO 14907-	Test procedures for electronic fee collection user equipment and

1	electronic fee collection fixed equipment part1, description of test procedures
14907-2	Test procedures for electronic fee collection user equipment and electronic fee collection fixed equipment part2, Application interface conformance tests specification
TR ISO 15074	User services integration for traffic and traveller message lists
ENV ISO 15075	In-Vehicle Navigation Systems - Communications message set requirements
ENV ISO 15622	Adaptive cruise control
ENV ISO 15623	Forward vehicle collision warning system
15624	Roadside traffic impediment warning systems
ENV ISO 15625	DSRC Profiles for RTTT applications
ENV ISO 15626	DSRC physical layer 1 (microwave) 5.8Ghz
ENV ISO 15627	Data link layer for dedicated short range communication - DSRC layer 2
ENV ISO 15628	Application layer for dedicated short range communication - DSRC layer 7
15662	TICS wide area communication message protocol structure(Revised)
ENV ISO 15784-1	Data exchange involving roadside modules in Transport Information & Control Systems - Overview
ENV ISO 15784-2	Data exchange involving roadside modules in Transport Information & Control Systems - Profiles
ENV ISO 15784-3	Data exchange involving roadside modules in Transport Information & Control Systems - Management Standards
ENV ISO 16263	Privacy principles for TICS
ENV ISO 16272	Exploration of Map database Quality Requirements for adv Driver Systems
ENV ISO 16275	Exploration of survivability Requirements for emergency Notification Systems
16914	On Board navigation System Architecture - A Reference Model
ENV ISO 17261	AVI/AEI Intermodal Goods Transport - Architecture and Terminology
ENV ISO 17262	AVI/AEI Intermodal Goods Transport - Numbering and Data Structures
ENV ISO 17263	AVI/AEI Intermodal Goods Transport - System Parameters

EN ISO 17264	AVI/AEI Intermodal Goods Transport - Interfaces
17265	Transit Vehicle Local Area Network
17267	Navigation system application program interface
17361	Lane Departure Warning Systems
17362	Navigation system application program interface(API)
17382	Transit communication Protocol
TR ISO 17383	Transport Information and Control Systems - Integrated Transport Information, management and Control - Data Dictionary
17384	Requirements for Interactive Centrally Determined Route Guidance
17386	Manoeuvring Aid for Low Speed Operation
17387	Side Obstacle Warning Systems
17388	Theft prevention for parking access
17389	Sequential video for red light violations
17390	OCR type approval procedures
17391	Support for storing and retrieving video images
17392	Crypto signature to be embedded in video images
17393	OCR contained in video images
17394	Crypto transmission of compressed images point to point via different media
17395	Capturing and handling of video images
17571	Publishing update for geographic databases(Revised)
17572	Location referencing(revised)
ENV ISO 17573	Electronic Fee Collection Reference Architecture
ENV ISO 17574	Security Services Framework for EFC
ENV ISO 17575	EFC Applications Interface Definition for CN/GNSS based EFC
17684	TICS message set description language
PAS ISO 17684	Message set description language(was 17385)
17685	Standard Numbering for Public Transport Stops
17686	Transit communication Protocol

17686	Public Transport Communications Interface Profile (TCIP)
17687	Data Dictionary and Message Sets for Electronic identification and monitoring of Hazardous Materials/Dangerous Goods Transportation
17688	Transport Area Cabling
ENV ISO 18234-1	TTI messages over high data broadcast digital bearers(TPEG) Part1
ENV ISO 18234-2	TTI messages over high data broadcast digital bearers(TPEG)Part 2 SSF
ENV ISO 18234-3	TTI messages over high data broadcast digital bearers(TPEG)Part 3 SNI
ENV ISO 18234-4	TTI messages over high data broadcast digital bearers(TPEG)Part 4 RTM
18253	DSRC Resource Manager
ENV ISO 20561	TICS Reference Architecture Representations and Mappings
ITR ISO 21210	CALM - Network Protocols
21211	CALM - 1GC
21212	CALM - 2GC
ITR ISO 21213	CALM - 3GC
ITR ISO 21214	CALM - IR
ITR ISO 21215	CALM - Microwave Communications
TR ISO 21707	Quality of input data for ITS systems
21708	Message header and Control for Wide Area Communications
22951	Data Dictionary and Message Sets for Pre-emption and Prioritisation Signal System for Emergency and public transport (PRESTO)
22952	Medium and Long range (wireless) Communications Requirement (Investigate)
TR ISO 22953	Extended Geographic Data File XGDF
N102	Taxonomy of Driver-vehicle transactions with advanced navigation & route guidance
N103	Op standards for Driver-vehicle control & warning systems
N104	Framework for integration of Driver Information and Control Systems

pwi	XML description of navigation message set
pwi	Windshield mounting of DSRC equipment
pwi	Vehicle probe data for Wide Area communications
pwi	Physical integration of DSRC Equipment in Vehicles
pwi	Forward vehicle collision avoidance system
pwi	Extended Reversing and Backing Aid
pwi	Enhanced ACC
pwi	ASN.1 message set translator

B Catalogue of Generic Standards

B.1 List of standards

B.1.1 Annex A presented formal standardisation initiatives. The areas covered in this annex include primarily systems and communications technologies which have a wide uptake outside the transport sector, but which also offer useful facilities to transport.

B.1.2 This covers an immense range and, rather than identify specific standards or initiatives, this annex presents information on a range of functional 'areas' of generic standards. The standards areas considered in this annex are as follows (in alphabetical order):

- Data exchange services
- Data modelling, access and exchange
- Digital broadcasting standards - eGovernment Information Framework
- European Committee for Banking Standards
- Networking standards
- Screens, browsers and viewers
- Security
- WAP standards

B.2 Presentation

B.2.1 A datasheet is presented for each area of generic standards. The datasheets provide basic information about each area, indicating how additional information might be obtained, in the following form:

Standard	Name
Contact	Name Address Phone Fax E-mail
URL	Website address
Scope	What field is covered by the standard
Description	Overview of the standards group, and list of relevant specific standards
Current Status	The current position of the standard including ongoing status
Future Development	Future initiatives/project end dates etc
Region	Geographical area of use
Take-up	Degree of take-up, or likely future influence on the marketplace
Applicability	Applicable to stakeholder groups eg rail/bus operators, VASPs (Value-

	added service providers), travellers, and network managers

B.3 Data exchange services

Standard	Internet protocol suite: data exchange services
Contact	not applicable
URL	http://www.ietf.org/rfc.html
Scope	Group of standards common to IT interconnectivity and interfaces
Description	
Web page exchange	HTTP v1.1 (Hyper Text Transfer Protocol) (RFC 2616)
E-mail	SMTP/MIME (Simple Message Transfer Protocol) (this includes RFC 821; RFC 822; RFC 2045; RFC 2046; RFC 2047; RFC 2048; RFC 2049)
File transfer protocols	FTP (File Transfer Protocol) (RFC 959) and HTTP (RFC 2616)
Current status	Continuously evolving internet standards set
Future development	Likely to evolve following advances in the IT industry
Region	Global
Take-up	Extremely widespread; as for browsers, these are now pre-installed in most new PCs
Applicability	Any remote exchange of information, especially over the internet (eg by Travellers) but also for intranet usage (eg for Transport Managers)

B.4 Data structures and access

Standard	Data structures and access
Contact name	not applicable
URL	http://www.w3.org/TR (for XML,RDF) http://www.omg.org/technology/documents/formal/omg_modeling_specifications_avai http://www.opengis.org/techno.specs.htm (for GML)

Scope	Group of standards common to data integration in IT systems
Description	
Metadata/meta language	XML (Extensible Markup Language)
Metadata definition	XML-Schema
Data transformation	XSL (Extensible Stylesheet Language)
Minimum operable	Transformation Format 8 bit UTF-8
character set	
Geospatial data	GML (Geospatial Markup Language)
Data modelling and	UML (Unified Modelling Language) RDF (Resource Description
description language	Framework)
Database access	SQL
Data object exchange	CORBA (Common Object Request Broker Architecture)
Current status	Continuously evolving internet standards set
Future	Likely to evolve following advances in the IT industry
Region	Global
Take-up	XML is fast becoming the de facto internet standard for complex data exchange; GML is much less widespread. SQL is almost universal for database access and query. CORBA and UML are gaining strong popularity and look set to have a very widespread influence
Applicability	Complex data exchange over IP networks

B.5 Digital broadcasting standards

Standard	Digital Audio Broadcasting (DAB)/Digital Video Broadcasting (DVB)
Contact	Julie Ackerman

	DAB Project Manager Phone: +44 20 7288 4642 E-mail: ackerman@worlddab.org DVB Project Office 17a Ancienne Route CH-1218 Grand Saconnex Geneva Switzerland Phone: + 41 22 717 27 19 Fax: + 41 22 717 27 27 E-mail: anthony.smith@dvb.org
URL	http://www.worlddab.org/ and http://www.dvb.org/
Scope	To develop standards for the broadcast of digital content (ie audio, data, text, pictures, and videos)
Description	Sets of standards for digital broadcasting; including audio, conditional access, interactivity, interfacing, measurement, MHP, multiplexing, sub-itling and transmission are being developed. Some standards have ISO/CEN force, for example; (i) MPEG-2 audio is specified in ISO/IEC 13818-3, TR 101 154 specifies the minimum requirements for the interoperability of baseline receivers; (ii) Dolby AC-3 audio for surround sound described in TR 101 154, TR 101 211, EN 300 468.
Current Status	Continuously evolving industry standards
Future Development	Likely to evolve following advances in the consumer electronic industry
Region	Global but strongly European
Take-up	In Europe, the definitive set of core standards for digital broadcasting
Applicability	Transport authorities, VASPs

B.6 eGovernment Information Framework

Standard	eGIF (eGovernment Information Framework)
Contact	Office of the e-Envoy Stockley House 130 Wilton Road London SW1V 1LQ E-mail: ukgovtalk.gov.uk@e-envoy.gsi.gov.uk
URL	http://www.govtalk.gov.uk/egif/home.html
Scope	To transform government and the services it provides to the public by improving information services
Description	The eGIF framework documents the technical standards and policies that will act as the foundation for the e-government strategy
Current Status	Evolving sections currently undergoing public review

Future Development	Version 3 to be published in the Autumn 2001.
Region	UK (government)
Take-up	Likely to become widespread throughout UK government, as a result of Cabinet Office standardisation initiatives
Applicability	UK Transport Authorities, Travellers

B.7 European Committee for Banking Standards

Standard	European Committee for Banking Standards (ECBS)
Contact	European Committee for Banking Standards (ECBS) 12 Avenue de Tervuren B-1040 Brussels Belgium Phone: +32 2 733 3533 Fax: +32 2 736 4988 E-mail: ecbs@ecbs.org
URL	http://www.ecbs.org/
Scope	To promote European trade and standards by co-ordinating demands for technical standards in banking across the EU and EFTA-countries
Description	The ECBS facilitates the development of a technical framework to facilitate cross-border trade of goods and services for the benefits of European citizens and companies. Technical Committees have been established on Plastic Cards & Related Devices, Automated Cross Border Payments, Security and Electronic Services. The ECBS has official liaisons with CEN/TC 278.
Current Status	Emerging standards set
Future Development	Ongoing development of standards
Region	Europe
Take-up	Widespread
Applicability	VASPs, Travellers, Retailers

B.8 Location Referencing Standards

Standard	Location Referencing Standards
Contact	Not applicable
URL	Not applicable
Scope	Standards for location of objects such as vehicles,

	bus/train stops etc.
Description	
ALERT-C and ALERT-PLUS	Used in DATEX and RDS-TMC and outlined in various ISO and CEN standards.
ATCO-CIF	Contains location Referencing for bus information
ILOC	European location referencing system for ITS developed through projects such as EVIDENCE
Ordinance Survey	The British national mapping agency who have developed OSCAR that covers the British road network
UIC	UIC have developed a set of location codes for international railways
Current status	Continuously evolving industry standards
Future development	Likely to evolve following advances in the transport industry
Region	Global
Take-up	Widespread
Applicability	Many applications

B.9 Networking standards

Standard	Internet protocol suite: networking standards
Contact	Not applicable
URL	http://www.ietf.org/rfc.html
Scope	To provide standards for various core IT functions: data modelling/description, database access, directory services, domain name services, e-mail, LAN/WAN interworking, transport
Description	
Directory services	X.500 (defined in GNC Technical Notice 1/2001), LDAP
Domain name services	DNS (Directory Network Service) (RFC 1035)
E-mail	SMTP/MIME (Simple Message Transfer Protocol) (this includes RFC 821; RFC 822; RFC 2045; RFC 2046; RFC 2047; RFC 2048; RFC 2049)
LAN/WAN	IPv4 (Internet Protocol) (RFC 791)

interworking	
Transport	TCP (RFC 793)/UDP(RFC 768)
Current status	Continuously evolving industry standards
Future development	Likely to evolve following advances in the IT industry
Region	Global
Take-up	Variable but generally very widespread. Some are pervasive (eg IPv4 is the network standard at the heart of the internet), others more localised but still almost universal within their area (eg the DNS for networking or SQL for database access)
Applicability	Many applications

B.10 Screens, browsers and viewers

Standard	Presentation, browsers & viewers
Contact	Not applicable
URL	http://www.ietf.org/rfc.html
Scope	Group of standards common to browsers and viewers in IT systems
Description	
Hypertext interchange formats	HTML (Hyper Text Markup Language) and XHTML (Extensible Hypertext Markup Language)
Document file types	Adobe Acrobat (.pdf) Rich text format (.rtf) Plain/formatted text (.txt)
Spreadsheet file types	Comma separated variable (.csv)
Proprietary viewer file types	Hypertext interchange format (.htm)
Extended document types	Lotus Notes Web Access (.nsf) Microsoft Word Viewer (.doc)
Character sets and alphabets	UNICODE (ISO/IEC 10646-1:2000)
Graphical/still image	Joint Photographic Experts Group/ISO 10918 (.jpg)
interchange formats	Graphical Interchange Format (.gif) Portable Network Graphics (.png)

		Tag Image File Format (.tif)
Moving Image and audio/visual information		Moving Image Experts Group (.mpg) MPEG-1/ISO 11172
Audio/video streaming		Real Audio, Real Video, Shockwave, Marcomedia Flash (.swf), Dynamic
data and animation		html (.dhtml)
Scripting		ECMA 262 Script Java virtual machine
Retrieval of information held on local servers		CGI scripts
Current status		Continuously evolving industry standards set
Future development		Likely to evolve following advances in the IT industry
Region		Global
Take-up		Extremely widespread. Most new PCs are pre-installed with many of these standards
Applicability		Any PC-based application

B.11 Security

Standard	Internet protocol suite: security
Contact	Not applicable
URL	http://www.ietf.org/rfc.html
Scope	Group of standards common to IT security
Description	
IP security	IP-SEC (RFC 2402/2404)
IP encapsulation security	ESP (RFC2406)
E-mail security	S/MIME V3 (this includes RFC 2630; RFC 2631; RFC 2632; RFC 2633)
Transport security	SSL v3/TLS (Secure Socket Layer) (RFC 2246)
Current status	Continuously evolving internet standards set

Future development	Likely to evolve following advances in the IT industry
Region	Global
Take-up	Widespread; SSL in particular is almost universal in e-commerce sites
Applicability	Any user requiring security notably retail processes

B.12 WAP standards

Standard	WAP 2.0 conformance release
Named contact	Not applicable
URL	http://www.wapforum.org/what/technical.htm
Scope	Group of standards common to WAP (Wireless Application Protocol)
Description	WAP is used as a delivery mechanism for information over mobile phones
Current status	Evolving parts undergoing public review
Future development	Likely to evolve following advances in the IT/mobile telephony industry
Region	Worldwide
Take-up	Growing
Applicability	Any user wishing to deliver or receive information over WAP

C Initiatives on Specific Evolving Standards

C.1 List of standards

C.1.1 This annex presents the catalogue of 'standards' relevant to Transport Direct, covering specific transport-related areas. It incorporates relevant frameworks and best-practice guides as well as formal standards and specifications.

C.1.2 The standards considered in this issue are as follows (in alphabetical order)[2]:

- ATCO-CIF*
- Best Practice Guides - Public Transport Information Web Sites
- Code of Practice for Traffic Control and Information Systems - MCH1869
- DATEX*
- European Fifth Framework projects
- European TAP for Transport projects
- European TEN-T projects
- GATS
- GDS
- INFORM*
- Inform Norden*
- ITS (UK)*
- ITSO
- ITSWAP
- Journey Solutions*
- JourneyWeb*
- KAREN*
- Kiosk accessibility*
- MOST Cooperation*
- NTCIP*
- RDS-TMC*
- RJIS*
- RSP*
- RTIG*
- Safety Standards for In-Vehicle Information Systems*
- TCC*
- TCIP*
- TIH*
- TPEG*
- Transmodel*
- TransXchange
- TRIDENT*
- UIC
- UTMC*
- VDV*

C.1.3 The above list may be incomplete, and information concerning other standards or initiatives of material relevance to Transport Direct would be welcomed. This might include reports that have been produced by trade associations to provide guidelines for their members, where the report can reasonably be claimed to have the force of a *de facto* standard.

C.2 Presentation

C.2.1 This catalogue cannot provide definitive information about the wide range of standards addressed. Rather, the datasheets provide basic information about each standard, following a common format, and indicating how additional information might be obtained.

C.2.2 As with Annex B, the datasheets have the following form:

Standard	Name
Contact	Name
	Address
	Phone
	Fax
	E-mail
URL	Website address
Scope	What field is covered by the standard
Description	Short description of how the standard operates
Related Standards	Standards from this list that are from relevant fields
Current Status	The current position of the standard including ongoing status
Future Development	Future initiatives/project end dates etc
Region	Geographical area of use
Take-up	Degree of take-up, or likely future influence on the marketplace
Applicability	Applicable to stakeholder groups eg rail/bus operators, VASPs (Value-added service providers, travellers, and network managers

C.3 UK Standards and Guidelines Initiatives: Organisations and Fora

INFORM

Standard	INFORM
Contact	INFORM Coordinator Transport and Travel Research Ltd 36 Regent Street Nottingham NG1 5BT Phone: 0115 941 1141 Fax: 0115 941 1331 E-mail: ttr_nottingham@compuserve.com
URL	http://www.ttr_ltd.com/inform

Scope	To facilitate the exchange of ideas within the transport and telematics industry
Description	The INFORM Public Transport Informatics Group was formed in 1995 to enable users, operators of public transport and more recently suppliers of telematics systems to exchange ideas and experiences and to act as a focus for exploring and monitoring future developments in the field.
Related Standards	ITS (UK)
Current Status	Growing organisation
Future Development	Has recently begun working with government and universities with the aim of advancing the debate about research funding
Region	UK
Take-up	Reasonably widespread within the UK
Applicability	Transport Operators, Transport Authorities, Network Managers, Suppliers

ITS (UK)

Standard	ITS (UK) (Intelligent Transport Systems United Kingdom)
Contact	David Clowes General Secretary Suite 412 Channelsea House Canning Road London E15 3ND Phone: 020 8519 1222 Fax: 020 8519 1717 E-mail: mailbox@its-focus.org.uk
URL	http://www.its-focus.org.uk
Scope	Aims to ensure that ITS become widely accepted and used
Description	ITS (UK) acts as a forum for the organisations involved in ITS. It encourages discussion on issues such as public/private cooperation, legislation, information provision, new technology and standards through conferences, seminars, workshops, newsletters and publications.
Related Standards	RTIG, ITSO, TCC
Current Status	Current membership is approximately 100 organisations
Future Development	Continually seeking new members
Region	UK with related forums through out the world
Take-up	Reasonably widespread within the UK ITS market
Applicability	ITS market Transport Operators, Transport Authorities, Network Managers,

	Suppliers, Academia

ITSO

Standard	Integrated Transport Smartcard Organisation (ITSO)
Contact	Alan Leibert ITSO General Manager Centro House 16 Summer Lane Birmingham England B19 3SD Phone: 0121 214 7216 E-mail: alan.leibert@itso.org.uk
URL	http://www.itso.org.uk/index.asp
Scope	Development of a Smartcard standard for local transport
Description	ITSO manages the implementation and development of an open national standard for Smartcards used for transport ticketing and payment. ITSO is currently capturing the commercial and operational requirements for data exchange protocols and the technical specifications of the card and reader, as well as security and confidentiality issues. ITSO standards will be compatible with other potential applications of Smartcards, for example congestion charging schemes and car parking in transport; also retail purchases, loyalty schemes and social uses.
Related Standards	RSP, ECBS, ADEPT II
Current Status	Produced the initial specification in 2000
Future Development	Ongoing work to develop smartcards
Region	UK
Take-up	Supported widely though not universally eg London Transport use a legacy system which was specified before the ITSO standard came into use
Applicability	Transport Operators, Travel Authorities, Travellers, Suppliers

Journey Solutions

Standard	Journey Solutions
Contact	Claire Haigh PO Box 30781 London WC2B 6AP Phone: 020 7240 1819 Fax: 020 7240 6565 E-mail: clairehaigh@journeysolutions.com
URL	http://www.journeysolutions.com
Scope	Cooperation between bus and train operations to support improved multi-modal travelling
Description	Journey Solutions is an initiative of the UK transport industry aimed at promoting and improving integration between transport modes. It is supported by the UK Government, and by its independent transport advisory body, the Commission for Integrated Transport. It is established as an independent entity funded by rail and bus operators, through their representative associations ATOC and CPT.
Related Standards	JourneyWeb
Current Status	Early stage of work there is a steering group in place and a standardisation framework is being considered
Future Development	Journey Solutions is expected to develop ideas over the coming few years
Region	UK
Take-up	Widely supported by both bus and train industry stakeholders, though current take-up is very limited
Applicability	Transport Operators, VASPs, Travel Authorities, Travellers

RSP

Standard	Rail Settlement Plan Ltd (RSP)
Contact	John Verity Phone: 0207 904 3048 E-mail: john.verity.atoc@ems.rail.co.uk
URL	http://www.atoc.org/rsp/fs_rsp.htm
Scope	To improve retail and ticketing within the rail industry.
Description	RSP is an industry body responsible for ticketing and settlement systems. They have compiled a TIS Approval Information pack. that outlines the minimum requirements of any Ticket Issuing System (TIS) and Ticket Issuing Process (TIP). The pack covers: RSP's TIS Approval Standards

	RSPs TIP Standards SDCI Related documents RJIS Related Documents.
Related Standards	UIC, RJIS-CIF
Current Status	Final stages of deployment
Future Development	Will continue to evolve to practical needs
Region	UK
Take-up	Core rail industry activity sponsored by the Association of Train Operating Companies (ATOC)
Applicability	Rail Operators, VASPs, Rail Users

RTIG

Standard	Real Time Information Group (RTIG)
Contact	Real Time Information Group Secretariat c/o ITS United Kingdom Suite 412, Channelsea House Canning Road E15 3ND Phone: 020 8519 1222 Fax: 020 8519 1717 E-mail: realtime@its-focus.org.uk
URL	none at present
Scope	To assist UK local authorities, PTEs, and public transport operators implement real time technology to deliver better public transport services and travel information
Description	RTIG brings together the requirements of local authorities and bus/light rail operators across the UK. Through various studies standards for the operation of real time equipment including data presentation will be developed. RITG is working at operational, functional, data exchange and communications layers, and working alongside other UK initiatives such as UTMC. Communications are expected to utilise IP protocol in a bearer independent manner. RTIG is about to sponsor a communications study, co-funded by a number of authorities, to review appropriate radiocommunications technologies.
Related Standards	ATCO-CIF, JourneyWeb, TransXchange, UTMC, TCC, TIH, TRIDENT
Current Status	Has an agreed Strategy and outline Functional Specification

Future Development	Further work is underway to develop a common approach to radio communications, data exchange standards etc
Region	UK
Take-up	Strongly supported by local authorities and public transport operators, although there is not yet any commitment to implement
Applicability	Transport Operators, Transport Authorities, VASPs, Travellers

TCC

Standard	**Traffic Control Centre (TCC)**[3]
Contact	The TCC Contract Manager Highways Agency, Broadway, Birmingham B15 1BL E-mail: tcc@highways.gsi.gov.uk
URL	http://www.highways.gov.uk/info/tcc/tccp/
Scope	The TCC aims to improve traffic management, operation and monitoring of the English national strategic road network and increasing the availability of information to travellers.
Description	A public/private partnership that will perform up-to-the-minute traffic monitoring, data co-ordination and information dissemination service, providing the opportunity to minimise the effects of traffic incidents and other events, on travel times. Information will be made available to the traveller through the media, web VMS and telephone. The TIH is seen as the primary method for the TCC to communicate with other network operators and VASPs. Standards are envisaged to evolve over the course of the project
Related Standards	TIH, UTMC
Current Status	Contractor in place. The Highways Agency aims to start delivering TCC services in 2003
Future Development	
Region	England.
Take-up	As the core of the traffic information service for England TCC's influence is likely to be felt strongly throughout England and elsewhere in UK
Applicability	Road Users, Police, Media, Transport Authorities, VASPs, HA

C.4 UK Standards and Guidelines Initiatives: Standards or Specifications

ATCO-CIF

Standard	**Association of Transport Coordinating Officers-Common Interface File (ATCO-CIF)**
Contact	Mike Ness W S Atkins Ltd

	Woodcote Grove Ashley Road Epsom Surrey KT18 5BW Phone : 01372 726140 E-mail : Mike.ness@wsatkins.com
URL	http://www.atco.org.uk/
Scope	A data exchange standard for bus timetable information operating in the information level.
Description	ATCO-CIF is a general-purpose interchange format for common elements of bus timetable information e.g. stop locations etc. ATCO-CIF operates at the information level and is a simple, clearly understandable and well-documented standard that has been widely taken up by the UK public road transport community. ATCO-CIF will, in time, be superseded by TransXchange. To ensure back compatibility with ATCO-CIF is maintained, ATCO-CIF will continue to provide a necessary sub-set for the TransXchange Logical Reference Model. In addition, TransXchange will be capable of generating ATCO-CIF records from TransXchange records.
Related Standards	TransXchange, RJIS-CIF
Current Status	Beginning to age
Future Development	Being replaced by TransXchange
Region	UK
Take-up	Widely adopted in the road public transport and related local authority sectors
Applicability	Transport Operators, Transport Authorities, Network managers

Code of practice for traffic control and information systems MCH1869

Standard	Code of practice for traffic control and information systems MCH1869
Contact	Highways Agency Room 705 Tollgate House Houston Street Bristol BS2 9DJ
URL	http://www.highways.gov.uk/
Scope	Code of practice that applies to roadside systems that convey instructions or information to road users by signal control, variable signs/symbols
Description	Code of practice covering: (i) manufacture and supply; (ii) installation, testing and commissioning; and (iii) operation and maintenance of traffic control and information systems. Includes procedures for statutory type approval and safety review.

Related Standards	None
Current Status	Published code of practice
Future Development	None planned
Region	UK
Take-up	Widespread
Applicability	Transport Operators, Transport Authorities

JourneyWeb

Standard	JourneyWeb	
Contact	Roger Slevin Phone: 020 7944 2668 E-mail: roger.slevin@dft.gsi.gov.uk	Dr A. C. Lock University of Southampton Highfield, Southampton, SO17 1BJ Phone: 02380 592188 E-mail: a.c.lock@soton.ac.uk
URL	http://www.journeyweb.org/	
Scope	JourneyWeb is an extensible protocol for dynamic data exchange over the internet between multimodal public transport journey planners	
Description	JourneyWeb is an open XML-schema designed for use over the internet to link multi-modal journey planning systems. The protocol enables any one journey planner to send questions to another, and to receive answers back, so that journeys can be planned beyond the boundary of the first journey planning system. The protocol can be used with journey planners used in telephone call centres, on the internet or at kiosks.	
Related Standards	EuroSPIN, EU-Spirit, Intercept	
Current Status	Development completed and implementation now under way	
Future Development	Complementary research, to develop a national public transport gazetteer and to enhance protocol performance, has continued under the follow-up project RAPID	
Region	UK	
Take-up	PTI2000 requires JourneyWeb to be implemented, at least passively, in all traveline regions. Currently most regional traveline services and national operators (i.e. National Express, and National Rail) are developing their implementation.	
Applicability	Travellers, VASPs, Transport Authorities, Transport Agencies	

RJIS

Standard	Rail Journey Information System
Contact	John Verity Phone: 0207 904 3048 E-mail: john.verity.atoc@ems.rail.co.uk
URL	http://www.atoc.org/rsp/sa/di19.htm is a diagram for RJIS. This has hyperlinks to all the interface documents. http://www.atoc.org/rsp/sa/fs_sa.htm is the root URL the service architecture and provides access to the full architecture
Scope	To improve the coordination of rail information systems on a nation scale
Description	RJIS is the national rail journey information system for distributing data about timetables, fares, reservations etc. RJIS comprises three parts, the Data Factory (for acquiring, checking and storing data), the Integration Layer (a facility for computer systems to enquire about journeys, which uses the data factory and links to the reservations service) and the Presentation.
Related Standards	RSP, XML
Current Status	Release 1 in operation. Release 2 expected March 2002
Future Development	Currently there are no plans to integrate with other systems or to change the adopted standards
Region	UK
Take-up	Will be the rail industry standard
Applicability	Rail Operators, VASPs, Rail Users

Safety Standards for In-Vehicle Information Systems

Standard	Safety Standards for In-Vehicle Information Systems
Contact	Alan Stevens Transport Research Laboratory Old Wokingham Road Crowthorne Berkshire RG45 6AU Phone: 01344 770945 Fax: 01344 770643 E-mail: AStevens@trl.co.uk
URL	http://www.nrd.nhtsa.dot.gov/departments/nrd-13/driver-distraction/PDF/30.PDF
Scope	To minimise driver distraction whilst using In-Vehicle Information Systems
Description	The publication, Development of Safety Principles for In-vehicle Information and Communications Systems, provides a detailed account of UK and European

	standardisation within this area. In particular it highlights relevant BSI and EC standards documentation.
Related Standards	ITSWAP, TPEG, RDS-TMC
Current Status	An area where little progress has been made due to the difficulties of performing research but is recognised to have increasing importance
Future Development	EC is currently sponsoring further research under the fifth framework programme
Region	UK/Europe
Take-up	Individual standards are strongly supported and enforced because of the safety implications
Applicability	Transport Industry, VASPs

TIH

Standard	Travel Information Highway (TIH)
Contact	http://www.tih.org.uk, http://www.qmiss.org.uk, http://www.trafficmap.org.uk The Highways Agency Information Line Room 13/16, St. Christopher House, Southwark Street, London SE1 0TE Phone: 08457 50 40 30 E-mail: ivan.wells@highways.gsi.gov.uk, tel. 0117 372 6163 (general) or alan.raines@highways.gsi.gov.uk (standards)
URL	http://www.tih.org.uk/
Scope	The TIH aims to provide real time travel information
Description	The Highways Agency developed the TIH to provide a backbone communications service for TCC using CORBA. TIH is available openly to all UK stakeholders who have a requirement for the interchange of TTI. This will enable the dissemination and exchange real-time information on travel information through third party information service providers (VASPs) who in turn provide this information to travellers. VASPs are also able to provide processed travel information back onto the TIH thereby creating a network of interdependent value added services. The pilot QMISS Database stores Dynamic and Static Traffic Data prior to TCC. Data is also available from the MDIS, MATTISSE, TfL and the Welsh Road Network Master Database (though the COURIER project). All these sources are independent of QMISS and each other but are all made available to VASPs
Related Standards	CORBA, UML, DATEX (DATEX-Net [ENV 13777 Vers 1.2a] and DATEX Data Dictionary [ENV 13106 Vers 3.1a]), XML, UTMC, RTIG
Current Status	Limited to a single database interacting with a variety of clients (TfL, Mattisse, RNMD, QMISS etc are separate databases - to date, only a few systems have been linked to the TIH and all are demonstrators, QMISS is a pilot for TCC, the others are operational although only MATTISSE is fully operational. A service currently under development will allow the DATEX-based exchange of traffic information between the UK and

	France, French data subsequently being published via the TIH. COURIER is also developing a DATEX-based service which will allow the delivery of English and Welsh traffic information via the TIH.
Future Development	Will be developed by TCC (qv) on a commercial basis, though HA will retain some role in service development
Region	England and Wales (Scotland, NI and Eire to join as part of Streetwise, France as part of Centrico)
Take-up	A small number of trial connections exist and others are planned. The vision is to allow transport network operators and authorities across the UK and Europe to connect directly to the TIH to provide comprehensive, European data sources and value-added services.

TransXchange

Standard	TransXchange
Contact	Email: transxchange@tan.gov.uk
URL	http://www.transxchange.dtlr.gov.uk/
Scope	To facilitate interchange of electronic bus time table and registration information
Description	TransXchange is a national XML based data standard for the interchange of bus information between Bus Operators, the Traffic Area Network, Local Authorities and Public Transport Executives, and the National Passenger Transport Information System. Its purpose clearly overlaps with that of ATCO-CIF and it is envisaged that over time TransXchange will replace ATCO-CIF. TransXchange is also being developed to be compliant with Transmodel and JourneyWeb.
Related Standards	ATCO-CIF, RJIS-CIF, Transmodel, JourneyWeb
Current Status	Under development
Future Development	Possibly to include details such as personnel disposition, automatic vehicle monitoring and management information
Region	UK
Take-up	Likely to be broad across the UK bus sector
Applicability	Bus Operators, Bus Users, Transport Authorities

UTMC

Standard	Urban Transport Management and Control (UTMC)
Contact	The UTMC Programme Office Mouchel Consulting Ltd St John's House Queens Street MANCHESTER M2 5JB Email: utmc@mouchel.com

URL	http://www.utmc.dtlr.gov.uk
Scope	To develop modular and open traffic management systems for the transport market
Description	A £6m DTLR research programme seeking to meet local authorities' growing needs for cost-effective traffic management tools which support a wider range of policies than are served by existing Urban Traffic Control (UTC) systems. The initiative involves the development and commercial realisation of modular systems using open standard communications protocols, interfaces and databases. UTMC has developed a set of standards for the definition and transfer of data including a data dictionary. The open standards route should benefit both users and suppliers by encouraging competition, innovation and growth in the international intelligent transport systems marketplace. The research phase is now complete, and the programme has, since January 2001, embarked on its demonstration phase with four large-scale demonstrator projects in Preston, Reading, Stratford and York. These are currently underway.
Related Standards	CORBA, NTCIP, SNMP, TIH, Internet standards
Current Status	Currently implementing four field trials
Future Development	Programme currently planned to finish in December 2002
Region	UK
Take-up	Beyond current demonstrators, a number of UK cities are planning new initiatives using (parts of) the UTMC framework
Applicability	Transport Authorities, Travellers, Equipment Suppliers, Public Transport Operators

C.5 UK Standards and Guidelines Initiatives: Best Practice Guidelines

Best Practice Guides - Public Transport Information Web Sites

Standard	Best Practice Guide Public Transport Information Web Sites
Contact	The Institute of Logistics and Transport Logistics and Transport Centre Earlstrees Court Earlstrees Road PO Box 5787 Corby, Northants NN17 4XQ Phone: 01536 740100 Fax: 01536 740101 E-mail: enquiry@iolt.org.uk
URL	http://www.iolt.org.uk/
Scope	To improve the design of PTI websites
Description	Best practices guidelines for websites encompassing all aspects of PTI; eg user requirements, interface design and journey planning

Related Standards	European TAP for Transport projects
Current Status	Published best practice guide
Future Development	None planned
Region	UK
Take-up	Too recently release to determine take-up
Applicability	VASPs, Travellers, Transport Operators, Transport Authorities

Kiosk accessibility

Standard	Kiosk accessibility
Contact	Guy Wolfenden Cityspace Limited Astley House 33 Notting Hill Gate London W11 3JQ Phone: 0207 313 8400 Fax: 0207 313 8401 E-mail: guy.wolfenden@cityspace.com
URL	http://www.cityspace.com
Scope	Assist in information and interface design of travel information services delivered through out-of-home self service channels (kiosks and information screens)
Description	Cityspace have a proprietary methodology for assessing ergonomic and other human factors for information services, which seeks to optimise the balance between different types of traveller able-bodied versus disabled in particular. There is a proposal to DTLR that this could be adapted to a national accessibility standard
Related Standards	Browsers and viewers
Current Status	Proposed for sponsorship by UK Government
Future Development	Not yet determined
Region	UK
Take-up	Proposed development based on a proprietary design methodology
Applicability	VASPs, Designers and Operators of kiosks and information screens

C.6 European and International Standards and Guidelines Initiatives: Organisations and Forums

Inform Norden

Standard	Inform Norden
Contact	Inform Norden Secretariat Mr Anders Kåbjörn Gotic Research Trafikkontoret Slussplatsen 1 S-411 06 Göteborg Sweden Phone: +46 31 61 36 70 Fax : +46 31 15 50 79 E-mail: anders.kabjorn@trafikkontoret.goteborg.se
URL	http://www.informnorden.org/
Scope	Joint project by the traffic authorities of Stockholm, Copenhagen, Helsinki and Oslo to facilitate the exchange of ideas regarding the use of IT in public transport
Description	Forum for exchange of ideas and standardisation activities on the areas of passenger information, electronic ticketing, wireless passenger services, geographical information systems and databases & communications systems
Related Standards	Journey Solutions, NTCIP, European Fifth Framework projects, European TAP for Transport projects, European TEN-T projects
Current Status	Successful mediating body
Future Development	Ongoing growth
Region	Nordic countries
Take-up	Likely to be supported in Scandinavian Countries, though direct 'standards' impact may be limited owing to the nature of the initiative
Applicability	Transport Operators, VASPs

MOST Cooperation

Standard	MOST Cooperation
Contact	MOST Cooperation Bannwaldallee 48 D-76185 Karlsruhe Germany Phone: +0049 721 966 50 00 Fax: +0049 721 966 50 01 contact@mostcooperation.com
URL	http://www.mostcooperation.com

Scope	To "establish and refine a common standard for today and tomorrow's needs of automotive multimedia networking."
Description	The MOST Cooperation is based on a partnership of Car Makers, Set Makers, System Architects and Key Component Suppliers to define and develop a common multimedia network protocol and object model. The MOST technology is specified to be an industry de facto standard for low cost, high bandwidth data communications in consumer, telecommunications and computing applications based on plastic fibre optics as a transportation layer.
Related Standards	GATS
Current Status	Global partnership of more than 60 companies
Future Development	Ongoing and continuously growing due to its openness to any company. The Cooperation invites and welcomes other companies to contribute to the development and enhancement of the MOST Technology
Region	International
Take-up	Likely to be widespread within the Automotive industry
Applicability	Transport Agencies, Car users, Car Manufactures

UIC

Standard	Union Internationale des Chemins de fer (UIC)
Contact	UIC 6, rue Jean Rey 75015 Paris France Phone: + 0033 1 44 49 20 20 Fax: + 0033 1 44 49 20 29 E-mail: info@uic.asso.fr
URL	http://www.uic.asso.fr/uk/
Scope	To promote global cooperation between railway enterprises and to carry out activities to develop international transport by rail
Description	UIC prepares standards, regulations and recommendations to facilitate international rail traffic. It co-ordinates numerous projects, particularly in the field of international passenger and freight transport, infrastructure management and research and promoting the exchange of information and experience and international training.
Related Standards	RJIS-CIF
Current Status	Industry body
Future Development	Ongoing development, as described in the recently updated, "the UIC Rail Plan", which acts as the reference framework for all planned projects to be carried out within the UIC

Region	International but strongly European
Take-up	Has sponsored a number of rail standards initiatives for instance the rail variant of GSM, 'GSM-R', which is currently being implemented across Europe under the EIRENE programme
Applicability	Rail Operators, Rail Network Managers

VDV

Standard	**Verband Deutscher Verkehrsunternehmen (VDV)**
Contact	VDV Verband Deutscher Verkehrsunternehmen Kamekestrasse 37-39, D - 50672 Köln Phone: +0049 221 57979-0 Fax: +0049 221 514272 E-mail: info@vdv.de
URL	http://www.vdv.de/
Scope	Aims to improve public transport and freight operations in Germany
Description	VDV provides a platform for the development and exchange of information and best practices recommendations. It publishes reports and recommendations that cover a broad variety of transport issues. Reports are based on specialised subjects whereas recommendations are more substantial and generalised. The areas addressed by each recommendation group are: General/Planning of Transport Facilities, Vehicles, Information Technology/Information Process, Electrical Power Installations, Rail Construction, Operation, Depots and Workshops, Economy and Law.
Related Standards	UIC
Current Status	A large transport organisation within Germany; further members from abroad
Future Development	Ongoing progress
Region	Germany
Take-up	Strong within the German transport industry, European impact
Applicability	Transport Operators, Transport Authorities and their suppliers

C.7 European and International Standards and Guidelines Initiatives: Standards or Specifications

DATEX

Standard	**DATEX (inc DATEX-NET and DATEX-ASN)**

Contact	Michel Liger (Chairman of the DATEX Technical Committee) CETE Méditerranée PO Box 37000 Avenue Albert Einstein, Pôle d'activités des Milles Aix-en-Provence FR-13791 CEDEX 3 France Phone: +33 4 42 24 77 04 Fax: +33 4 42 24 71 41 E-mail: michel.liger@equipement.gouv.fr
URL	http://www.datex.org/
Scope	A standard for data exchange, primarily for information relating to trunk road networks
Description	Long standing (over ten years) data exchange standard that has gone through several developmental stages (ie DATEX, DATEX-Net). DATEX- Net was developed as a data exchange protocol, implemented using the International Standards Organization (ISO) EDIFACT Standard. Deployment of DATEX across Europe is primarily limited to centre-to-centre communications; however this is not the functional limit of the standard. DATEX is an experimental European standard (ENV) under CEN TC 278 WG8 Related development in the USA have led to ASN.1 based version (DATEX-ASN.1) which is under development. DATEX-ASN.1 is undergoing standardisation under ISO TC 204 WG 9.
Related Standards	TRANSMODEL, TRIDENT, RDS-TMC, ISO/CEN, DATEX-ASN.1, TPEG
Current Status	Wide scale European deployment; Undergoing development as part of TRIDENT project
Future Development	TRIDENT aims to develop an object orientated approach within DATEX
Region	European/International
Take-up	Fairly widespread in Europe, particularly for international co-operation but also sometimes used within a state (eg France, Italy, Sweden). No implementation yet in the UK
Applicability	Transport Operators, Network managers

GATS

Standard	**Global Automotive Telematics Standard (GATS)**
Contact	Telematics Forum ERTICO 326, Avenue Louise B-1050 Brussels Phone: 0032 2 400 07 00 Fax : 0032 2 400 07 01 E-mail: telematicsforum@mail.ertico.com

URL	http://www.telematicsforum.com
Scope	Set of standards related to the Automotive Transport and Telecommunications industry
Description	GATS aim to provide common standards for technical, administration, marketing and communication within the automotive, wireless internet, and communications sectors. Current initiatives involve the migration of Telematics applications to utilise generic wireless platforms, with WAP chosen as the first such platform
Related Standards	ISO/CEN, ITSWAP, TPEG, RDS-TMC, WAP
Current Status	Ongoing widely recognised forum for the Automotive/Telematics industries. GATS2 standards are currently being standardised in CENTC278 WG4
Future Development	Ongoing
Region	Global but strongly European
Take-up	Fairly widespread, especially among 'high-end' carmakers
Applicability	VASPs, Car users, Transport Agencies

GDS

Standard	Global Distribution System (GDS)
Contact	Not applicable
URL	The URLs of the four largest GDS are: http://www.amadeus.com/ http://www.galileo.com/ http://www.sabre.com/ http://www.worldspan.com/
Scope	Provides availability and booking information for hotels and car rental companies
Description	Four main GDS networks (Amadeus, Galileo, Sabre and Worldspan) provide travel agents with availability and booking information for hotels and car rental companies. These networks, developed originally by the airlines to provide information to travel agents, have spawned countless Internet Booking Websites in recent years.
Related Standards	Internet standards; data exchange standards
Current Status	Relatively mature concept
Future Development	Ongoing development of internet based standards
Region	International

Take-up	Widespread globally throughout the travel retail industry
Applicability	Travel Agencies, VASPs

NTCIP

Standard	**National Transportation Communications for ITS Protocol (NTCIP)**
Contact	NTCIP Coordinator National Electrical Manufacturers Association 1300 N.17th Street, Suite 1847 Rosslyn Virginia 22209-3801 USA Fax: 001 703 841-3331 E-mail: ntcip@nema.org
URL	http://www.ntcip.org (related sites: http://www.aashto.org and http://www.ite.org)
Scope	To define methods of communication throughout the US transport management systems
Description	The NTCIP is the key US traffic management communications standardisation initiative. It has developed a non-proprietary protocol suite to meet "existing and future traffic control requirements, supports transportation management communications, and accommodates future development in information technology and communications". The NTCIP Joint Standards Committee oversees development activities, and ensures that these standards are recognised internationally by promoting NTCIP to the International Standards Organisation (ISO). NTCIP information standards are still under development and appear at present to be US oriented although some have proved applicable to the UK and are incorporated in the UTMC Technical Specification. NEMA, AASHTO and ITE have all been involved in developing NTCIP standards.
Related Standards	UTMC, TCIP, ISO/CEN, Internet standards
Current Status	Major US transport control standards body
Future Development	NTCIP is open to extension and is actively looking at other protocols such as XML
Region	USA
Take-up	Widely supported throughout USA; used as part of US National ITS Architecture. Some overseas support/trials, eg Australia
Applicability	Transport Agencies, Network Managers

RDS-TMC

Standard	**Radio Data System-Traffic Message Channel (RDS-TMC)**
Contact	Paul Kompfner TMC Forum Coordinator ERTICO - ITS Europe 326, Avenue Louise B-1050 Brussels

	Phone: +32 2 400 07 32 Fax : +32 2 400 07 01 tmcforum@mail.ertico.com
URL	TMC Forum: http://www.tmcforum.com/ RDS Forum: http://www.rds.org.uk/
Scope	To provide a system for the collection and broadcasting of TTI according to a global standard.
Description	TMC aims to enable road users to listen to or view TTI in their own language. This information is delivered over the RDS, available within radio FM channels. The EC funded and EBU led EPISODE (1996-1998) project examined the issues surrounding the integration of RDS-TMC into live broadcasts and contributed to the up grading of the UECP protocol, the European de facto standard for RDS. The ISO standardised protocols to deliver RDS-TMC are ALERT-C (event-based, currently available) and ALERT-Plus (status-based, under development). They were developed concurrently with DATEX and therefore have a degree of compatibility to enable TMC information to be distributed using DATEX.
Related Standards	TPEG, DATEX, ISO/CEN
Current Status	TMC standards are stable, many products are in the market-place, and the number of both public and private broadcast services is increasing. The TMC Forum looks after the maintenance and development of the standards, as well as promotion of TMC generally.
Future Development	Future developments will seek to extend the functionality, e.g. towards travel time information. For high bandwidth services (e.g. DAB) TPEG is likely to include TMC features, and specifications are being designed to facilitate migration from RDS-TMC to TPEG
Region	Europe
Take-up	Deployment is growing rapidly around Europe
Applicability	Travellers, Telecommunications Industry, Vehicle manufacturers, Receiver manufacturers, Traffic information service providers

TCIP

Standard	Transit Communications Interface Profiles (TCIP)
Contact	Isaac K. Takyi, Ph.D. Technical Working Group Chair MTA New York City Transit USA Phone: +1 718-694-3652 Fax: +1 718-694-3012 E-mail: itakyi@nyct.com

URL	http://www.tcip.org/
Scope	To facilitate data exchange in the US transit industry
Description	TCIP is a suite of data interface standards for the US transit industry. Phase 1 was completed in 1999, and established a transit ITS data interface "Framework" and eight "Business Area Object Standards." Phase 2, Part 1 which developed dialogs user requirements was completed on June 30, 2001. Phase 2, Part 2 which is yet to be contracted is built on the work of Phase 1 by developing the transaction sets, application profiles and guidebooks required to test and implement TCIP.
Related Standards	NTCIP
Current Status	Phase 2 Part 1 has been completed
Future Development	Subsequent parts of Phase 2 will involve the development of implementation specifications, testing and deployment
Region	USA
Take-up	Used as part of the US National ITS Architecture. Take-up rates are not yet clear
Applicability	Network Operators

TPEG

Standard	Transport Protocol Experts Group (TPEG)
Contact	European Broadcasting Union The TPEG Project Office Ancienne Route 17A CH 1218 Grand-Saconnex (GE) Switzerland Phone: +41 22 717 2723 Fax: +41 22 747 4723 E-mail: kopitz@ebu.ch
URL	http://www.tpeg.org/
Scope	To improve TTI dissemination over digital broadcast systems; develop bearer independent TTI protocol
Description	TPEG was initiated in 1997 to develop a new ISO/CEN standard for the transmission of transport and travel information within digital broadcast systems such as DAB, DVB and the Internet using XML. The TPEG system is bearer independent and builds on experience gained with the development of RDS-TMC for FM broadcasting, however without the limitations of that system and specifically without the need to use location code numbers within the road network. Test and validation areas include the UK (through the BBC) and a large number of Europe- wide initiatives TPEG is currently being standardised under CEN TC 278 WG4 and ISO TC 204 WG 10 (joint CEN/ISO working group)

Related Standards	RMS-TMC, ISO/CEN, DVB/DAB, DATEX
Current Status	Under development
Future Development	TPEG currently makes use of the Internet and DAB (Digital Radio)
Region	Europe
Take-up	Strongly supported by broadcasters in particular. Likely to begin to take the place of RDS-TMC gradually over the next decade
Applicability	Road Users, Network Operators, Transport Operators, Broadcasters, Telecommunications Industry

Transmodel

Standard	TRANSMODEL
Contact	Kasia Bourée TRUST E.E.I.G.(Transmodel Users' Support Team) 91, rue Escudier 92100 Boulogne France phone/fax: 33 1 41 31 12 21 E-mail: kbouree@pacwan.fr
URL	http://www.transmodel.org
Scope	Transmodel addresses the requirements of public transport companies as regards data structures for constructing integrated information systems. It describes the data structures as a conceptual data model accompanied by a data dictionary. It refers to the domains: Scheduling/Rostering, Passenger Information, Fare Collection, Personnel Disposition, Management Information/Statistics, Operations Monitoring and Control.
Description	Transmodel is an open architectural framework that can be used in information system design to define data exchanged between different application programmes. As a conceptual data model, it describes elementary data structures dedicated primarily for data base design (the different applications have then a common data pool). It has been developed independently from any project linked to the definition of messages (e.g. DATEX), but the Transmodel objects contain information to be used when defining messages linked to public transport applications. Transmodel has been developed through several EC research and development programmes. In particular, Cassiope (1989-1991), EuroBus (1992-1994), Harpist and Cartridge (1994-1995) and TITAN (1996-1998). Version 4 was voted pre-standard in September 1997 by the CEN
Related Standards	GDF Norm
Current Status	Covers modes such as buses, trams, trolleybus, lightrail and metro systems in urban areas. Transmodel v4.1 voted in '97 as ENV 12896 has been extended to become Transmodel v5 (additions: real-time control domain, multi-modality, multiple operators environment,

	extended versions management, generic network modelling) presented to CEN as the revised proposal for European standard.
Future Development	Extensions in France to cover specific needs in the domain Fare Collection and User Information and inter-urban transport.
Region	Europe
Take-up	Widespread throughout the transport development sector. Applied in Lyon (France), Hanover (Germany), Salzburg (Austria)
Applicability	Transport Operators, Transport Agencies

C.8 European and International Standards and Guidelines Initiatives: Projects

European projects: Fifth Framework

Standard	European projects: Fifth Framework
Contact	The Cordis website (URL below) includes links and contacts for each of the Fifth Framework projects
URL	http://www.cordis.lu/fp5/
Scope	To improve Europe
Description	Group of projects which aim to test innovative policies, systems and technologies at the local level. Projects relevant to Transport Direct include the following:
CATCH-2004	Multilingual, conversational system for dissemination of travel and city information
CENTURI 21	Project investigating many aspects of the delivery of essential services via the internet and associated technologies
INVETE	Intelligent in-vehicle termination for multimodal transport services
SMITH/TITOS	Application of the latest European and global standards for public transport and road traffic information using Turin city as a testbed
TAPESTRY	Research and demonstration project aiming to assess the effectiveness of travel awareness related initiatives and provide best practice recommendations for multi-modal travel awareness programmes
TELEPAY	Developing a telepayment system for multimodal transport service using mobile phones
TRANS-3	Intends to create and trial multimodal pre-trip information for the tri-national agglomeration of Basel extending over France, Germany and Switzerland
TRAVEL-GUIDE	Aims to develop guidelines for information provision by systems that are

	related to traffic information and traffic management, to assess the information needs of the end-user with respect to content & presentation, availability & reliability and timing & priority and finally, to develop and test new methods of information provision
VOYAGER	Aim to establish a comprehensive vision of the public transport systems required in the future and further develop ELTIS (European Local Transport Information Service) on-line database of case studies
Related Standards	JourneyWeb, DATEX, TRIDENT, European TAP for Transport projects, European TEN-T projects
Current Status	Some projects have been started while others are still in development
Future Development	Six Framework projects are likely to occur
Region	Europe
Take-up	Most projects include trial or demonstrator deployment at several cities in Europe
Applicability	Transport Authorities, Transport Operators, Travellers

European projects: TAP for Transport

Standard	European projects: TAP for Transport
Contact	The Cordis website (URL below) includes links and contacts for each of the projects
URL	http://www.cordis.lu/telematics/tap-transport/research/11c.html
Scope	To encourage the Transport sector to use Telematics Applications Programme (TAP) (funded by the European Commission through Fourth Framework of DG XIII)
Description	Group of projects which aim to develop and validate telematics applications to provide enhanced services to transport users through improved efficiency, safety and environmental quality. From the 113 projects the most relevant to Transport Direct include:
ADEPT II (TR 1002)	Addressed issues surrounding the deployment of smartcards and other ITS technologies in the field of payment, IS and demand management
CAPE	Outreach project to increase awareness and knowledge of telematics based solutions for transport and environmental problems
CARISMA-Telematic	Project to investigate the issues arising for the experience of cities and regions using intelligent transport systems
CODE	Programme for the Europe-wide dissemination of knowledge regarding the achievements of transport telematics
CONCERT	A demonstration of transport telematics applications in 7 EU countries
CONVERGE	Promotion of Transport Sector Projects by supporting developing systems

	architectures, and approaches to validation and standardisation
CROMATICA	Improvement of security in public transport focusing on underground subway systems
EU-SPIRIT	Development of a European system for passenger services including Intermodal Reservation, Information and Ticketing
EuroSPIN	Development of a seamless European passenger Information Network
EVIDENCE	Test and validation of location referencing Intersection LOCation (ILOC) method
INFOPOLIS 1	Presentation of advanced passenger information to the traveller
INFOPOLIS 2	Electronic presentation of advanced passenger information to the traveller
INTERCEPT	Encourage the implementation of intermodal door-to-door transport solutions within European cities
PROMISE	Trials to provide mobile travel and traffic information to traveller
SIAMS	Provision of on-line information to the traveller during journeys by sea, and for facilitating the management of maritime transport operations, using Web-based technological infrastructure
TABASCO	Trials of telematics applications (in Bavaria, Scotland and elsewhere)
Related Standards	JourneyWeb, DATEX, TRIDENT, European TEN-T projects, European fifth framework projects
Current Status	Projects are at various stages of completion
Future Development	More transport related Fifth Framework projects are currently underway
Region	Europe
Take-up	Most projects include trial or demonstrator deployment at several cities in Europe
Applicability	Transport Authorities, Transport Operators, Travellers

European projects: TEN-T

Standard	European projects: TEN-T
Contact	The Europa website (URL below) includes links and contacts for each of the projects
URL	http://www.europa.eu.int/comm/transport/themes/network/english/its/tent-projects.htm
Scope	Group of projects in the Transport sector of the Telematics Applications Programme (TAP) (funded by the European Commission through Fourth Framework of DG XIII)
Description	Group of projects which aim to develop and validate telematics applications to provide enhanced services to transport users through improved efficiency, safety and environmental quality. Projects the most relevant to Transport Direct include:
ARTS, CENTRICO,	Euro-regional projects involved in implementation of traffic management and information services including RDS-TMC and pre-trip information services

CORVETTE, SERTI and VIKING	
ECORTIS	Project to promote the implementation of RDS-TMC traffic information broadcasts on specific routes
EDEN	Project dealing with the technical solutions, organisational aspects and operating procedures for networking Traffic Information Centres to facilitate cross-border exchange of traffic and travel information
ITS City Pioneers	Project to help promote the use of ITS in urban and peripheral areas
MARTA	Project to co-ordinate and harmonise systems providing Traffic and Travel information services using short range (5.8 GHz) communications
Other national / regional projects	Miscellaneous projects involved in implementation of traffic management and information services
Related Standards	JourneyWeb, DATEX, TRIDENT, European TAP for Transport projects, European 5th framework projects.
Current Status	Ongoing
Future Development	Projects are currently underway; development beyond end of project is not currently a consideration
Region	Europe
Take-up	Most projects include trial or demonstrator deployment at several cities in Europe
Applicability	Transport Authorities, Transport Operators, Travellers

ITSWAP

Standard	ITSWAP
Contact	Mr. Chris White ERTICO - ITS Europe 326, Avenue Louise B-1050 Brussels Phone: +32 2 400 07 38 E-mail: c.white@mail.ertico.com
URL	http://www.ertico.com/links/itswacon.htm
Scope	Access and facilitate the delivery of ITS over WAP medium
Description	A 2 year project to define and test the WAP delivery mechanisms for a number of ITS applications in four trial sites across Europe and will promote the adoption of WAP as a platform to deliver ITS. It will also identify elements necessary to allow the convergence of WAP with other services such as GATS and TPEG services. The project aims to involve several different partners to join forces for delivering services. These include content and service providers, telecom operators and terminal and car manufacturers.

Related Standards	TPEG, GATS, WAP
Current Status	Ongoing Project
Future Development	Aims to deliver key recommendations by 12/01, unclear after that.
Region	European
Take-up	Currently focussing on demonstrator trial service
Applicability	Car Users, Car Manufactures, VASPs, Travel Authorities, Telecommunications Industry

KAREN

Standard	Keystone Architecture Required for European Networks (KAREN)
Contact	Jan Willem Tierolf Rijkwaterstaat AVV Phone: +31 10 2825879 Fax: +31 10 2825842 E-mail: j.w.tierolf@avv.rws.minvenw.nl Helpdesk & Info: info@frame-online.net
URL	http://www.frame-online.net
Scope	KAREN has developed a framework for the deployment of working and workable ITS solutions within the European Union.
Description	KAREN is the European ITS Framework Architecture for all aspects and modalities of road traffic and transport. It was developed as part of the Fourth Framework Programme, funded by DGXIII. The intention is that its structures and recommendations should be developed into national architectures by Member States (and/or other more detailed frameworks in other contexts). Recommendations for standardisation have been forwarded to CEN. It is explicitly being used in France, Italy, the Netherlands and Scandinavia. It has also been cross-compared against a number of current initiatives in UK and overseas, including the DTLR's Road user Charging and UTMC initiatives. COMETA was a European project working closely with KAREN outputs. It developed a systems architecture for on board systems in commercial vehicles, covering functions such as fault management; mobile EDI; electronic tachograph; driver assistance; and road pricing.
Related Standards	UTMC
Current Status	Currently explicitly deployed in several European countries under guidance of the FRAME-NET forum for users and the FRAME projects for training, user support, maintenance and evolution.
Future Development	Permanent Consultative Group did ensure that the results were endorsed by stakeholders. National and other developments and deployments now will be "co-ordinated" by the member states and other stakeholders in FRAME-NET, a Thematic Network of the EC, under the 5th Framework Programme funded by DG INFSO. (Same contact details as KAREN)

Region	Europe
Take-up	Widespread throughout the European national transport authorities and the transport development industry
Applicability	Transport Authorities, Network Managers

TRIDENT

Standard	**TRansport Intermodality Data sharing and Exchange NeTwork (TRIDENT)**
Contact	Paul Kompfner ERTICO - ITS Europe 326, Avenue Louise B-1050 Brussels Phone: +32 2 400 07 32 Fax : +32 2 400 07 01 E-mail : tridentertico@mail.ertico.com
URL	http://www.ertico.com/links/5thfp/trident/homecon.htm
Scope	To extend DATEX to enhance the exchange of public transport, road traffic and multimodal information; trial object oriented approaches and technologies
Description	TRIDENT will address the extension of DATEX to enhance the exchange of public transport, road traffic and multimodal information within Europe. It aims to achieve this by establishing a common approach to the sharing of all types of travel information between transport operators of different modes and information service providers. It will also investigate the use of new Internet technologies, such as XML and Java and object orientated database technologies, such as CORBA. This will lead to proposals for new standards through CEN, as well as recommendations supporting the implementation of systems based on the project's results. Field trials at test sites in Flanders, Paris, Rome, West Yorkshire and Strathclyde have been included to examine common specifications, prototype development and run implementation and validation activities.
Related Standards	DATEX, SMITH/TITOS, CORBA, TRANSMODEL, TRANSXCHANGE, ISO/CEN
Current Status	In development
Future Development	Project scheduled to end in July 2002, its future unclear after that
Region	Europe
Take-up	The project will involve trial sites. Relationship with both formal standards bodies (CEN/ISO) and other frameworks (DATEX, UTMC) indicates potential for substantial future use of TRIDENT specifications
Applicability	Transport Operators, Network managers

[2] Standards marked with an asterisk have been verified for accuracy and completeness with the named contact given. The authors acknowledge the co-operation assistance of these contacts in this task.

[3] Traffic Control Centres already exist in Scotland (NADICS) and Wales. TCC is considered here as a standard as it will require standardised interfaces in order to interoperate with other initiatives and stakeholders eg TIH, Police Control Rooms, Local Authority Control Rooms.

D Acknowledgements

D.1 Introduction

D.1.1 During the validation exercise stakeholders were approached to determine their willingness to participate. Electronic copies of the Standards Catalogue, Deliverable 1, were circulated to interested stakeholders and their comments invited upon the completeness of the catalogue and the areas, if any, that they felt there was a dearth of standards provision.

D.1.2 Stakeholders were specifically asked to respond to the following questions:

- If you were given the resources to create a new standard what would it be and why?

- If you were given the resources to facilitate the uptake of current standards which groups of standards would you target and why?

- What should DTLR be doing to facilitate the provision of standards relevant to Transport Direct?

D.1.3 This annex contains:

- a list of stakeholders who were contacted as part of the validation exercise grouped by industry category;

- comments made by stakeholders contacted as part of the consultation process regarding perceived gaps in standards provision and implied actions for DTLR. These comments are presented as a vox pop with potential gaps being fed into the gap analysis.

D.1.4 The authors wish to acknowledge the valuable contribution of those stakeholders who took part in the consultation exercise.

D.2 Stakeholders contacted

Table D-1: List of stakeholders who were contacted as part of the validation exercise	
Name	**Organisation**
Consultants & Industry Groups	
John Mason	Anite
John Austin	Austin Analytics
Kieran Holmes	CGEY
Jim Dixon	Independent Consultant
Members of Inform	Inform
Members of ITS (UK)	ITS (UK)

Paul Burton	Oscar Faber
Richard Bossom	Siemens Traffic Control Limited
John Walker	Thales Translink
Phil Hunt	TRL
Name	**Organisation**
Laurie Pickup	TTR
Glenn Lyons	University of Southampton
Peter White	University of Westminster
Mike Ness	WS Atkins
Policymakers	
John Verity	ATOC
Roger Slevin	DTLR
Alan Hobbs & Ivan Wells	Highways Agency
Leighton James	National Assembly for Wales
Peter Stoner	Northumberland County Council
Jonathan Young	Scottish Executive
Mark Smith	Strategic Rail Authority
Suppliers & Service Providers	
Mark Saunders	AA
Dan Wright	BBC Travel News
Derrick Bilsby	Connex Rail
Nick Knowles	KIZOOM
Dave Mastin	London Buses
Paul Williams	National Express Group
Mark Percival	NCP
Malcolm Phillips	RAC Trafficmaster
Jeremy Acklam	Virgin Trains

D.3 Standards gaps identified

D.3.1 "Most location referencing systems attempt to give a precise spatial location to an object. In many instances travel involves enquiries to imprecise locations which are not well handled by existing standards. I believe there is scope for developing standards. I believe there is scope for developing standards for fuzzy location referencing to aid the interchange of travel information between different systems."

Stakeholder from Consultant & Industry Group

D.3.2 "As far as Public Transport is concerned, the most important aspect at present is the need within the UK for a standardised communication processes to and from the bus (or other fleet vehicle). The lack of this standard is inhibiting development of real time applications as operators are faced with a number of incompatible systems. Clearly they do not wish to put in a vehicle location and passenger information in one city to find that buses so equipped need a different on-board system in another city."

Stakeholder from Consultant & Industry Group

D.3.3 "In the infrastructure area the real need now is for a firm interface at the communications interface for traffic signals and signs. The interfaces were initially designed in the 1960s and NTCIP is not proving to be satisfactory for the low data levels needed. No really satisfactory systems are emerging although the UTMC project is working in the area."

Stakeholder from Consultant & Industry Group

D.3.4 "I would use the resource to kill off all existing and competing standards in all areas. The main ill of standardisation is that the consensus building process rather than the technical stuff is what hinders the process. The Holy Grail for me is truly open systems that are Bearer Independent - of course this is not possible as many "Bearer Independent" solutions are wasteful of bandwidth and so are not implementable on any practical economic on any practical bearer to the user!"

Stakeholder from Consultant & Industry Group

D.3.5 New standards required relating to processes:

"Standards of precision for data lying "behind" bus timetables eg

    - minimum acceptable degree of precision of OS coding of bus stops

    - agree standard for whether bus stops should be identified each side of the road or not, and, if the standard is that this can vary, then a standard for the criteria determining how this should vary...

Standard procedures for naming bus stops (ie agreement that one and only one organisation is ultimately responsible for naming a bus stop, and that this name should be used by all publishers/users of bus stop data).

This leads on to standard naming principles for naming bus stops (relating to eg order of words and concepts within the bus stop name: many bus stops will have aliases and it will not be possible to decide unique names for these stops, but the naming principles should be standard and used by each alias.

Standard processes for updating bus timetable databases particularly relating to origin of data,. This "best practice" is intended to avoid incorrect or incompatible/inconsistent data being entered in to the database by ensuring that only the most accurate source is used. Care would need to be taken in devising best practice procedures because of the range of different administrative arrangement used in different traveline regions."

Stakeholder from Consultant & Industry Group

"The first job would be to identify the interfaces for which new standards are needed. This could be done through the creation of the part of the proposed National Framework that covers the services that are to be provided by Transport Direct. This would then enable the actual functional building blocks to be defined, which in turn would lead to the definition of the interfaces between them. To produce these definitions, it would first be necessary to see what standard(s) are already available. If there are no suitable standards then a new standard (or standards) could be created. However, anything new should if possible be based on what already exists, thus hopefully simplifying the process. What would have to be avoided is getting involved in the CEN/ISO standard creation process, as this takes far too long."

Stakeholder from Consultant & Industry Group

D.3.6 "Real time incidents so as to enable capture and exchange and distribution of incident information.

Bus stop departure XML standard to enable web and WAP distribution of stop data. This would help local councils specifying requirements for new CIS systems

Train movement XML standard to enable web and WAP distribution of real time data

POI standard to facilitate distributed development of journey planning"

Stakeholder from Suppliers & Service Providers Group

D.4 Gaps in uptake identified

D.4.1 "Further resources are needed to improve the uptake of best practice of PTI website design. However, the means to do this is not entirely clear: it principally involves getting the commitment of the major transport groups and of key local authorities to these design principles... The web is crucial to Transport Direct. In my view, it is currently a resource that is underused by the transport industry to present its services: good design can lead to high-profile successes, which can encourage the industry to invest wisely in this new medium."

Stakeholder from Consultant & Industry Group

D.4.2 "If I were to target a particular set of standards for adoption thin I would be looking at the database type ones that would allow intermodality to take place."

Stakeholder from Consultant & Industry Group

D.4.3 "The honest answer is that there is no immediately obvious candidate. There are many standards already in existence and many suppliers offering products and services in the areas covered by Transport Direct. A way forward is again to create the part of the proposed National Framework covering the services to be provided by Transport Direct. Instead of identifying new standards, the results would be used to identify where existing standards could be used. These would be the standards whose uptake should be facilitated."

D.4.4 "...Exchange and distribution of incident information - Because it has the greatest potential for making public travel more useable in the short term. It also has potential to improve public safety (eg rapid response to bio-terrorism).

Bus stop departure XML standard - Mobile distribution of real time information is [an] important tool for modal shift: need to facilitate its rapid uptake."

D.5 What should DTLR being doing?

D.5.1 "The data lying behind Transport Direct is absolutely vital to Transport Direct's success, without high data quality Transport Direct will fail. DTLR should play a larger role than it appears to be doing to help achieve high data quality. It can do this by first providing the incentives to the industry to get the data right (through financial regimes and/or legislation regarding the traveline service) and then providing the means to do this (by encouraging or leading the development of standards for procedures and processes."

D.5.2 "An area where DTLR involvement could help in data quality would be through DTLR imposing a requirement on all operators to register bus services electronically through TransXchange... Clearly many small operators would not have the resources to register services electronically, so alongside this there must be mechanisms for agencies to register services electronically on small operators' behalf. These agencies could be overseen by local authorities but this does not imply that local authorities should necessarily act as agents themselves."

D.5.3 "I think to start forcing the adoption of common data structures to allow modal choice and the combination of modes to achieve a journey. This could be done through LTPs and subsidies for operators."

D.5.4 "The DTLR should probably be dividing the standards relevant to Transport Direct into two types - communications and human interfaces. For the first type, Transport Direct should concentrate on making the best use of what standards are currently available. In doing this, it should aim at the standards that are the most popular (ie have the most supplier/product support), the most recent, not likely to be replaced, and do not have "de facto" equivalents. If some of these are not standards in the strictest sense ie have not been through the CEN/ISO standards making process then they should still be used. Transport Direct could initiate the CEN/ISO standards creation process, but it should not wait for this to happen as it takes far too long.

The human interface standards should cover the way in which information is presented to Travellers. These standards do not have to be very detailed and could be codes of practice. For example, they could define the way in which the steps to purchase a ticket are described on the front of ticket machines in car parks. Similar, but perhaps different standards could be provided for Public Transport ticket machines. The standards could also specify that for the Internet, pages in other languages (French, German to name but two) must be available. A "standard" layout for Public Transport timetables would also be very good, although probably difficult to achieve."

D.5.5 "Finance the development of specific *XML mini standards* for exchanging data for concrete well defined areas... Could be accompanied by reference implementations that both providers and consumers of data could test against.

I keep encountering massive confusion as [to the] role of different technology elements for building travel information systems, arising partly form a total vagueness about the overall architectures needed to fit everything together. (I'm not talking about technical detail here, just high-level stuff about flows, what resides where - scaleable. This is exacerbated by a failure to distinguish between abstract and concrete references (eg XML/DATEX/Corba as platforms/protocols versus specific concrete schemas/implementations for a specific application domain) and a complete lack of realistic context and specific examples. Without this kind of big picture it is very difficult for people to understand what standards are required - and just a importantly, what does not require standardisation. I would recommend that the DTLR commission a white paper on technology elements and basic end-to-end architectures that would help clear the confusion... Such a paper should take some specific, concrete examples end-to-end and just discuss at a high level the components and interfaces needed to build them so that different providers can work together (none of this is rocket science). Would base this round different specific use cases eg Journey Planning, Incidents, Real Time Data, Other Reference/Facility Data."

Stakeholder from Suppliers & Service Providers Group

E Gap analysis - methodology and findings

E.1 This annex

E.1.1 This annex provides a more detailed overview of the gap analysis performed in Deliverable 2. The findings of the gap analysis are summarised in Section 5 of the main text.

E.2 Approach

E.2.1 The gap analysis used the applications and standards identified in the catalogue of standards published in Annexes B and C. This implicitly assumed that the standards catalogue within was complete; that is, gaps identified in this document may arise simply because we have not found the relevant standard yet.

E.2.2 Table E-1 summarises the types of gap and different approaches to determine the existence of each type of gap.

Table E-1:		
Type of 'gap'	**Description**	**Technique used**
Application, coverage and standards level gaps	Areas in which standards have not been developed, but where the development of standards would be useful - a distinction is made between application level gaps (requiring the interoperation of many standards), coverage gaps (where a standards framework might not cover a sufficient area) and individual standards	**Expert judgement** and **consultation** with key stakeholders **Cost-benefit analysis** used to determine apparent gaps
Implementation gaps	An area in which standards have not been fully-taken-up by the stakeholder community	Analysis of take-up using **levels of take-up** previously stated in Deliverable 1
Integration gaps	An area in which the incompatibility of closely related applications or standards prevents full interoperability	**Coherence analysis** of the current standards provision at applications and standards level

E.2.3 In this table:

- 'Expert judgment' refers to the assessment of the project team, based on experience.

- 'Consultation' with key stakeholders sought to provide input from a variety of perspectives, ensuring that our own assessment of 'gaps' is bolstered by the views of policymakers, operators and implementers in a range of areas relevant to Transport

Direct. Specific and general comments were trapped and compared against own expert judgment.

- 'Cost-benefit analysis' has been conducted by the project team, informally (ie without quantitative modelling). It addresses issues such as the number of beneficiaries of a standard, the effort taken to produce and maintain it, the time it would take to gain agreement and the consequences of constraining many parties to adopting the same system (financial and operational).

- 'Level of take up' is based on the information presented in Annexes B and C, as validated/corrected by stakeholders.

- 'Coherence analysis' has again been conducted by the team. It addresses issues ranging from the extent to which standards make different of incompatible assumptions about the transport environment, to fundamentally different approaches at a 'hard' technical level.

E.3 Analysis of benefits and costs

E.3.1 The benefits and costs of developing further applications or standards are largely generic and can be attributed to four main areas. There are also overarching political implications (see Table E-2).

Table E-2: Identification of areas of costs and benefits		
Area	Benefits/costs	Description
technical	benefits	facilitates enhanced interoperability of applications without recourse to work-arounds or resulting lock-in to supplier offerings
	costs	requirement for increased R+D spend to develop compliant applications
service	benefits	increase quality of service to the public
	costs	could stifle innovative practices and reduce quality of public service
financial	benefits	facilitate wider market (pan-European) for applications
	costs	requirement for increased R+D spend to develop compliant applications
time to market	benefits	decreases time to market due to the adoption of generic well-tested technologies
	costs	increased time to market due to the development of new standards.

E.3.2 Cost benefit analysis was performed to determine whether the gaps were true gaps or vacant gaps. Costs and Benefits were annotated with an assessment of the form (B, C) where B is the

probability of benefits arising and C is the likely cost entailed. Costs and benefits were rated as High, Medium and Low. The categorisation used is set out in Table E-3.

Table E-3: Categorisation of the benefits and costs of standards provision			
Categorisation		**Benefits**	**Costs**
H	High probability	Likely to lead to substantial benefits	More likely to entail substantial increases in costs
M	Medium probability	Fairly likely to lead to benefits	Fairly likely to entail increases in costs
L	Low probability	Low likelihood of benefits arising	Low likelihood of increases in costs

E.4 Potential application level gaps

E.4.1 An **application level gap** is a gap in the provision of applications that require the interoperation of many standards, ie a broad area of cooperative working that lacks a framework to ensure operational commonality.

E.4.2 To identify these we refer to Figure 2-1, which shows some of the key Transport Direct roles. An application level gap would appear somewhere within one of the three 'layers' of the Transport Direct Operations model, or relating to the interaction between adjacent layers, namely:

- Vehicles and networks and data collector layer (shaded green);

- Travel service operator, travel service manager and information service provider layer (shaded yellow);

- Traveller and traveller system layer (shaded orange).

Vehicles and networks/data collector

E.4.3 Applications for the local management of vehicles and networks are comparatively well developed and include:

- Car park management

- Bus management

- Rail management

- Transport management systems (local/national)

- Transport management systems (international)

E.4.4 Historically there is a strong incentive for public transport operators and network operations to monitor key parameters, so as to enable the more effective management of assets. Legacy interfaces with other applications, and especially information service providers, are currently not well developed.

E.4.5 A major challenge will be to develop the interfaces between the vehicles and networks and data collector layer and the travel service operator, travel service manager and information service

provider layers. The use of transport information database and transport data exchange applications will ensure this occur. No application level gaps are apparent within this layer.

Travel service operator, travel service manager and information service provider

E.4.6 Applications for transport management represent a growing sector within transport. Applications within the travel service operator, travel service manager and information service provider layer are diverse and facilitate the core activities of the Transport Direct initiative; namely:

> - the provision of information prior to, during, and after travel (including aspects such as journey planning, real-time information on available travel modes, lost property, complaints etc);

> - the selection, reservation, booking and issue of tickets (or other travel permits), covering all aspects of a journey (including aspects such as multimodal journeys, seat/slot reservation and car parking).

E.4.7 Applications in this layer include:

> - Transport Information Database systems

> - Transport Data Exchange systems

> - Real Time Travel Information Systems

> - Journey Planner Systems

> - Ticket booking/reservation/issuing systems

> - Smartcard systems

E.4.8 Interfaces need to be consolidated with the data collection layer. As has previously been mentioned, the use of transport information database and transport data exchange applications will ensure that this occurs. Legacy interfaces with other applications, and especially information service providers are less well developed. Nonetheless, no application level gaps are apparent within this layer.

Traveller and traveller system

E.4.9 Applications within the traveller and traveller system layer are typically rapidly evolving in response to technological advances. Applications for travel information dissemination area include:

> - Travel Website Design

> - In-Vehicle TTI System Design

> - Digital Broadcasting and Dissemination of Travel Information

E.4.10 There is a strong commercial incentive for Value Added Service Providers (VASPs) and public transport operators to fill any potential gaps in applications if it is commercially viable to do so. Although applications in this layer are less mature than the previous two layers, no application level gaps are apparent within this layer.

E.5 Potential coverage and standards level gaps

E.5.1 A **standards level gap** is a missing individual standard within an application. A **coverage gap** is a shortfall in the coverage of a standards framework within an application. These were identified by considering each of the applications in turn and assessing the comprehensiveness of available standards provision, as depicted in the standards catalogue. The list developed by the team was extended based on the feedback from stakeholders consulted.

E.5.2 The following *prima facie* standards level gaps were identified:

- No standards currently exist for the format and content of publicity information at bus stops, and bus/rail stations;

- There is no standard process for updating bus timetable databases so as to ensure accuracy of timetable data;

- No standards exist for the naming and location of bus stops;

- No universal standard exists for communications to and from public transport vehicles;

- No satisfactory communication interface for traffic signals and signs;

- No specific standards exist to facilitate the exchange of information on timetables, real-time information and fares between transportation modes;

- No interchange standards, equivalent to ATCO-CIF/RJIS-CIF, exist for Air, Sea, Walk and Cycle modes;

- No linkages exist between car park management and other applications;

- There are no formal standards for the approval/accreditation of the implementation and acceptance testing of systems eg unsupervised outdoor displays or kiosks;

- No documented best practices exist for the approval/accreditation of the robustness of field equipment.

E.5.3 Of these, some would not be worth developing for the benefit delivered, and so are 'apparent gaps' only. Of the others, ie those that would yield positive benefit for the effort involved, the following priority for development/sponsorship is assessed:

- linkages between car park management and other applications (Medium priority)

- linkages between bus systems and other applications (Medium priority)

- consistent signing at bus stops (Low priority)

- standard process for updating bus timetable databases (Low priority)

- standards for naming and location, eg of bus stops (Medium priority)

- standards for communications to and from public transport vehicles (Low priority)

- 'type approval' for information service equipment such as kiosks and signage (Low priority)

E.5.4 Coverage gaps primarily relate to extended frameworks of standards within a particular applications area (or across applications areas). The following coverage gaps were identified:

- Transmodel 5.0, while extensive and thorough, omits a number of travel-related components and may prove difficult to implement in UK (this has been commented on in a separate report to DTLR);

- TransXchange is currently used primarily for timetabling but could be extended to address personnel disposition, automatic vehicle monitoring and management information and multi-modality (as is already planned);

- UTMC does not cover key areas such as road user charging and has relatively poor extension into public transport management systems (though the ongoing working links with RTIG should assist in strengthening this);

- Journey Solutions is still at the concept stage so its scope and coverage are not well-defined yet.

E.6 Potential implementation gaps

E.6.1 Some potential gaps may be apparent as the result of the inadequate or patchy take-up of existing standards and not necessarily the result of a dearth of standards. Such **implementation gaps** are often transient, disappearing once the standard(s) in question become more mature and take-up increases.

E.6.2 Analysis of implementation gaps was performed using the levels of take-up stated in Annexes B and C. To aid comprehensibility, standards were split into generic technology standards and transport specific standards.

E.6.3 The reported level of take-up for a selection of generic technology standards and transport specific 'standards' (ie formal standards and initiatives on specific evolving standards) is presented in Table E-4 below.

Table E-4: Summary of take-up of generic and transport specific standards		
Level of take-up	Generic technology standards	Transport specific 'standards'
Extremely widespread/widespread/Global	Data exchange services; Networking standards; Screens, Browsers and viewers; Security; GDS; Data structures and access; Location Referencing Standards	MOST Cooperation
Europe-wide	Digital Broadcasting standards; ECBS	DATEX; GATS
Widespread within Europe		UIC; RDS-TMC; Transmodel
Growing within Europe	WAP standards	Inform Norden; TPEG; European Fifth Framework

		Projects; TAP for Transport Projects; European Ten-T projects; ITSWAP
Widespread nationally		VDV; NTCIP
Level of take-up	Generic technology standards	Transport specific 'standards'
UK-wide		eGIF; ATCO-CIF; RJIS-CIF
Widespread within UK		JourneyWeb; INFORM; ITS UK; ITSO; RSP; RTIG; Code of Practice for Traffic Control and Information Systems; Standards for in-vehicle Information Systems
Growing within UK		TCC; TIH; TransXchange; UTMC; Kiosk accessibility; Journey Solutions
Low within UK		RAPID; Best Practice Guides for Public Transport Information Web Sites
Unknown		TCIP

E.6.4 Most generic technology standards, with the exception of WAP standards (which are growing within Europe), have an international take-up. In contrast transport specific standards have varying levels of take-up with the UK, Nationally, within Europe and worldwide. Only a small number of transport standards have low or unknown levels of take-up (NB this is often because they are too new for take-up to be adjudged).

E.7 Integration gaps - applications level

E.7.1 There is a requirement for high-level interoperability both between applications and within applications relevant to Transport Direct. Interoperability of applications is aided by:

- the use of generic technology standards/open transport specific standards; and

- the usage of common standards within neighbouring applications.

Car park management

E.7.2 Car park systems are traditionally run as isolated systems and so coherence with external systems is limited. At present the use of proprietary standards and the absence of suitable interfaces makes it difficult to exchange car park management information with other applications, and in particular:

- local transport management systems;

- transport information systems;

- broadcasting and dissemination of travel information.

E.7.3 The uptake of UTMC compliant car park management systems should aid integration with various applications that use open generic systems for underlying communications and data exchange.

Bus and rail management

E.7.4 Bus management and rail management application are historically well integrated as they use closely related derivatives of a common interface file format to aid data exchange ie ATCO-CIF and RJIS-CIF. The use of common interfaces will permit the interoperation of bus and rail management applications with other applications, for example:

- transport information systems;

- real time travel information systems.

E.7.5 As with car park management, there is an outstanding issue concerning the linkage between public transport management systems (including real time systems) and UTMC systems. However the relevant programmes are working in close cooperation and there is no real evidence of long-term incompatibility.

Transport management systems (local/national and international)

E.7.6 Transport management systems at local and national level use transport specific standards (Transmodel, Karen, UTMC, TCC, TIH, ISO/CEN) and generic technology standards for interconnectivity and interfaces. This ensures high levels of coherence with other applications that use the same standards. Links are especially strong with:

- transport information systems;

- transport data exchange systems.

E.7.7 Coherence may potentially be reduced if the different national implementations of international standards occur.

Transport information systems

E.7.8 Transport information systems use transport specific standards (Transmodel, Karen, UTMC, TCC, TIH, ISO/CEN) and generic technology standards for interconnectivity and interfaces. This ensures a high level of coherence with other applications that use the same standards. Links are especially strong with:

- transport management systems;

- transport data exchange systems.

Transport Data Exchange systems

E.7.9 Transport data exchange systems at local and national level use transport specific open standards (DATEX, Transmodel, Karen, UTMC, TCC, TIH, ISO/CEN) and use generic technology standards for interconnectivity and interfaces. This ensures high levels of coherence with other applications that use the same standards. Links are especially strong with:

- transport management systems;

- transport information systems.

E.7.10 Coherence may potentially be reduced if the different national implementations of international standards occur. However there are frameworks to address this, and the Highways Agency has for example successfully configured a DATEX-TIH link without difficulty.

Real Time Travel Information Systems

E.7.11 The provision of real time travel information systems is an emerging application area. Several initiatives ensure strong linkages between the real time travel information systems application and other applications. For example:

- RTIG will ensure interoperation with sources of real-time data such as bus management and rail management applications

- The Travel Information Highway will facilitate interoperability with transport information systems and journey planner solutions.

- GATS will ensure interoperation with digital broadcasting/dissemination of travel information and in-vehicle TTI systems.

E.7.12 These all make use of mainstream technologies and there is no evident incompatibility issue at present.

Journey Planner Solutions, Ticket booking/reservation/issuing systems and smartcard systems

E.7.13 The widespread global uptake of the GDSs has ensured interoperability of journey planning and ticketing across many transport modes. The development of journey planner solutions and ticket booking/reservation/issuing systems applications has been the focus of several EC-funded projects eg Trans-3; Transmodel, EUSpirit and EuroSPIN. These differ in approach but there is no evident incompatibility issue.

E.7.14 Interoperation of Journey Planner Solutions, Ticket booking/reservation/issuing systems with Smartcard systems and kiosks is still under development but should improve once Smartcards and kiosks become more mature technologies (as promoted under ITSO).

Travel Website Design

E.7.15 The guidelines for PTI website design are sufficiently general to facilitate the spread of best-practice to any Transport Direct application that uses a website for the exchange of information with the traveller or other applications eg through the Travel Information Highway. No limitations on interoperability are expected.

In-Vehicle TTI Systems Design and Digital Broadcasting/Dissemination of Travel Information

E.7.16 In-vehicle systems and digital broadcasting and the dissemination of travel information use many common transport specific standards (GATS, TPEG, RDS-TMC, WAP standards and Digital Broadcasting standards). The use of such standards ensures interoperation with other applications such as real time travel information.

E.8 Integration gaps - standards level

E.8.1 Incompatibility between standards could hamper successful implementations and might make some information flows impossible or more costly to achieve.

E.8.2 By definition generic technology standards are cross-cutting and are present in the majority of applications. In contrast the transport specific standards occur in relatively few, often closely related applications and are often common to more than one application thus aiding interoperability.

E.8.3 The work of the formal standards bodies CEN/ISO and EU Commission funded projects has ensured reasonable coherence of standards provision and interoperability between applications and standards. The only exception is of car park management where there is currently a dearth of standards and scant support for interoperability.

E.8.4 The level of coherence between current standards within an application depends on the application in question. For example, standards in the bus management area are coherent at least partly because the specification for TransXchange stated that ATCO-CIF and TransXchange should be fully interoperable. Rail management is less coherent as standardisation has been hampered by fragmentation of the industry. This disparity should however be expected to improve as time progresses.

E.8.5 A graphical analysis of communality in transport specific standards between Transport Direct applications is presented in Table E-5.

Table E-5: Assessment of standards level comparability between applications

Standards \ Application area	Car park management	Bus management	Rail management	Transport management systems (local/national)	Transport management systems (international)	Transport information systems	Transport Data Exchange systems	Real Time Travel Information Systems	Journey Planner Solutions	Ticket booking/reservation/issuing systems	Smartcard systems	Travel Website Design	In-Vehicle TTI Systems Design	Digital Broadcasting and Dissemination of Travel Information
ATCO-CIF		●							●					
Best practice guides PTI websites												●		
MCH1869				●										
DATEX						●		●						
EU Fifth Framework Projects									●	●		●	●	●
EU TAP for Transport Projects									●	●		●	●	
EU TEN-T Projects														

GATS							●				●	●
GDS								●	●	●		
INFORM				●								
Inform Norden					●							
ITS UK				●								
ITSO										●		
ITSWAP											●	●
Journey Solutions								●				
JourneyWeb						●		●		●		
KAREN			●	●	●							
Kiosk accessibility						●	●	●	●			
MOST Cooperation											●	
NTCIP				●	●							
RAPID						●		●				
RDS-TMC											●	●
RJIS-CIF		●						●				
RSP		●						●				
RTIG	●						●				●	
Safety standards for in-vehicle information systems											●	
TCC			●				●				●	
TCIP				●								
TIH			●				●				●	
TPEG												●
Transmodel			●	●	●	●						
TransXchange	●							●				

TRIDENT					●		●							
UIC			●											
UTMC	●			●		●								
VDV			●											