Development and deployment of Intelligent Transport Systems (ITS) have increased greatly over the past decade. This has been supported by widespread availability of mobile technology with GPS and high speed internet connections. Travellers are now able to access real-time information about transport anywhere and at any time. Planning trips – regardless of the mode – has never been so easy. Service providers and operators are able to better serve their customers.
What is real-time information for public transport about?

Due to recent technological advances, a growing number of commuters now have access to real-time travel and traffic information. The market penetration of smartphones with a mobile internet connection has grown drastically. At the same time, public transport vehicles are now commonly equipped with GPS and mobile internet. This has enabled public transport operators to track the progress of vehicles in real time and makes it possible to retrieve information of vehicles such as their location and speed immediately. All elements in the chain, from the vehicle to operation centre to the traveller, have become connected. Through intelligent processing and development of user-friendly services it is now possible to directly inform travellers about the current status of services, incidents and delays.

Transport systems, including public transport systems, are subject to disturbances caused by technology, human error, and external factors. By informing users and passengers in real time, it is possible to improve level of service quality, making public transport more efficient and more passenger-friendly.

The main element in real-time information for public transport is the use of interconnected systems to deliver personalised information and advice about public transport. Real-time information offers better choices between different alternatives and reduces uncertainty for travellers, such as in the case of delays or accidents, new or infrequent public transport passengers, and people with reduced mobility. Real-time information could serve multiple purposes:

- **Planning:** how to get from A to B at a certain time, time of arrival and departure, general information about fares and services
- **Travelling:** monitoring the time taken to travel, changing modes or services easily
- **Re-scheduling:** providing information about delays and possible alternatives

As well as information about public transport services, systems using real-time information can also provide data about the weather, and commercial advertising. This could be key to financing the implementation and operation of such systems. Common channels to provide real-time information are dynamic panels at public transport stops and vehicles, on websites, mobile applications, and updates via Bluetooth or SMS messaging.

Providing updated information is becoming a more important part of public transport services overall. Certain channels (mobile applications, websites, Twitter, telephone) offer the possibility to directly communicate with individual customers. Providing accurate and timely information is closely related to traveller satisfaction.
CIVITAS helps to make passenger transport more reliable and more efficient

Innovative transport telematics systems for traffic management and traveller support can make urban passenger transport faster, more reliable, more efficient, and more passenger-friendly. CIVITAS cities have worked on real-time road-user information using transport telematics. The CIVITAS Initiative’s Thematic Group on Transport Telematics¹ provides a number of resources, such as training manuals, guidance material, policy recommendations, and also learning opportunities such as trainings, study tours or workshops. The group allows members to get in contact with city officials and experts involved in examples of best practice.

Since the start of the CIVITAS Initiative in 2002, cities have been experimenting with real-time information systems for public transport. The City of Winchester (United Kingdom) was involved in the CIVITAS MIRACLES project (CIVITAS I 2002-2006) and installed variable message signs and an automatic number plate recognition system on strategic routes to show air quality and travel information, including the availability of parking spaces. Real-time information was also made available at key locations to public transport passengers². The City of Rotterdam (The Netherlands) developed a new website to provide passengers with intermodal information on a regional scale in a user-friendly format (CIVITAS TELLUS, CIVITAS I 2002-2006)³. As part of CIVITAS SUCCESS (CIVITAS II, 2005-2009) La Rochelle (France) developed a system to provide real-time information using SMS and electronic information panels⁴. Suceava (Romania) implemented electronic displays providing real-time transport information as part of the SMILE project (CIVITAS II, 2005-2009)⁵.

Similar measures have been implemented more recently, as three examples from CIVITAS PLUS (2008-2012) illustrate.

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Ljubljana (Slovenia): Real-time public transport information

Ljubljana considers providing real-time information service as a solution to help make the bus network more passenger-oriented and increase its image as a reliable transport option.

The main objectives of this measure were to:

- Provide staff and passengers with real-time information about public transport services at different locations on the CIVITAS ELAN corridor;
- Increase passenger satisfaction, retention and accessibility of public transport;
- Increase the number of public transport passengers.

As part of the measure 54 bus stops were equipped with remotely-managed LED information displays. The displays show the estimated arrival time of the next buses and other messages related to public transport. They are integrated with the existing management system of the public transport operator.

The aim was to ensure accurate information that passengers can rely on. The displays are very popular and well-accepted by residents, and the City of Ljubljana has...
Aalborg's aim is to make its bus service more attractive to users by reducing barriers to public transport and improving service quality. One of the city's measures is to display travel information in buses with the aim of increasing user satisfaction. Local public transport authority Nordjylland Trafikselskab equipped 50 buses operating in the CIVITAS ARCHIMEDES corridor with flat screen monitors, giving the passengers real-time information regarding the destination, upcoming stops, and transfer possibilities. The service also displays the weather forecast, news and advertisements.

User surveys showed that almost all passengers considered the screens and information as a service improvement and were satisfied with the way the information was presented. Almost two thirds of the passengers found it acceptable that advertisements were shown in between travel information. For the advertising agency, the exposure generated by advertising was positive, but economically the screens did not have the expected impact immediately after implementation.

During the project the measure was scaled up from the 50 buses operating in the CIVITAS corridor to the 100 buses from Nordjylland Trafikselskab. Nordjylland Trafikselskab continued to promote the solution to the rest of the region after the end of project.

Among the lessons learned from Aalborg include the need for a clear division of responsibilities between contractors, news providers, and public transport operators, to get the cooperation to work. Secondly, bus drivers have an essential role in giving passengers the best possible experience. An optimal solution requires that the bus driver detects errors with the displays in their vehicle and reports it. Thirdly, an important prerequisite for a successful project is valid data. It is important to have a clear strategy for this work and with more and more systems that are interdependent, it is important that data is collected and maintained in one place.

The decrease of acceptance of the LED display could be attributed to the fact that people expected the system to work with 100 percent accuracy immediately. The expectations regarding the acceptance were probably too high; in general, the public like the displays, but they expected a higher level of accuracy. In this regard, the system should be tested thoroughly before it is put in operation on a large scale. The public should be informed about test periods and that total accuracy should not be expected during this period. The public should be asked to adjust their expectations while the system is being calibrated.

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Donostia-San Sebastián has implemented high-quality public transport corridors in which provision of reliable real-time travel information is a deciding factor in increasing passenger numbers.

The main objectives of the measure under CIVITAS ARCHIMEDES were to:

- Increase the reliability and availability of travel information.
- Make this information accessible to the visually-impaired.
- Increase the number of public transport passengers.

Real-time information was provided in buses, at bus stops through electronic boards, via SMS messages and online. A new website containing public transport information was developed, using accessibility technology so that the information can be understood by the visually-impaired. This measure was closely linked to the introduction of a new bus management system, within which important new data sources were implemented, such as a new passenger counting system and the use of WIFI technology for determining the location of vehicles.

The traveller information system was very successful, with more than 3,500 daily requests for real-time information via SMS or the website during the project lifetime. The information provided was highly reliable, with 98.1 percent of all the information requests assessed by the users as correctly answered. In addition, 60,000 users had access to real-time information at the bus stops through electronic boards.

Surveys revealed that information issues were perceived as very important by the users, with an average score of 8.47 out of 10. User demand for quality information services was therefore very high. Complementing this figure, a user satisfaction survey revealed a very high acceptance level (average of 7.41 out of 10) regarding the information provision. This figure was almost identical to the one achieved in the reference year (2006). The fact that high satisfaction levels were maintained is a very remarkable result, bearing in mind that users’ expectations were also very high, as revealed in the public perception survey.

Current developments

The most important recent technological development is the transition away from providing information via screens and displays to personal devices, such as mobile phones. At the same time journey planners have become more advanced, covering wider areas and more transport modes. This makes it possible to plan routes for door-to-door journeys using multiple modes, and even crossing national borders. Increased computing power has reduced the time needed to deliver information and increased the choices and alternatives available to customers.

Though multiple useful services have been developed, the drawback is that travellers are confronted with different systems and services that might not work well together. In order to provide users with seamless transitions between services, operators, and countries, the European Commission is developing and implementing policies to guide real-time information developments in such way that the end users are offered the most user-friendly services possible.

The remainder of this section will highlight relevant developments in the CIVITAS Initiative and in policy.
6

Data fusion and mobility 2.0

In the CIVITAS PLUS II phase of the CIVITAS Initiative lasted from 2012-2016, with eight cities were involved in two CIVITAS demonstration projects. Two measures with regard to real-time information for public transport are being implemented.

Tel Aviv-Yafo (Israel) is implementing transportation information systems based on ICT and ITS. The measure is based on incorporating data regarding events that may affect mobility to create a unified view from several sources and provide a decision support system for both the individual traveller and the traffic operator. This will lead to a reduction in the travel times of road users as a result of the greater availability of traffic information.

Palma de Mallorca (Spain) is implementing a so-called ‘mobility 2.0’ service. The aim of the measure is to increase the attractiveness of sustainable mobility through an integrated web-based platform and a smartphone app. The platform will offer multiple GIS-based interfaces for users to access and provide real-time information. The creation of social network groups for at least 500 public transport customers and the introduction of mobile phone payment for on-street parking will improve service quality.

Multimodal journey planners

Most public transport operators now offer real-time information and scheduling possibilities via websites and dedicated smartphone applications. Some of them operate across national borders:

- WISETRIP aims to improve the possibilities for planning, booking and making multimodal journeys for individuals. The system is designed to take into consideration user needs, as well as environmental impact and personal preferences.
- Rome2rio aims to organise transport information globally. The service offers a multimodal, door-to-door travel search engine that displays itineraries for road, rail, air- and waterborne transport to and from any location.
- 9292 in the Netherlands is a daily source of travel information for public transport for all kinds of passengers. 9292 brings all information from all transport companies together in a user-friendly way.
- Google Maps Transit. Google invites operators that provide a transportation service that is open to the public, and operates with fixed schedules and routes to participate in Google Maps Transit.

Policy initiatives

Traffic and travel information is seen as a key element of ITS deployment. It can provide the traveller with door-to-door information for well-informed travel decisions before travelling as well as information during the journey. It is vital in achieving ambitions set in the 2011 Transport White Paper with regard to providing seamless connections between different modes of transport.

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10 Mobility 2.0 services, CIVITAS Initiative, accessed April 15, 2016, http://www.civitas-plus.eu/content/mobility-20-services
ITS Directive

The ITS Directive (2010/40/EU) represents a policy and legal framework to accelerate the deployment of innovative transport solutions across Europe to help support the development of a cleaner, safer and more efficient European transport system. The directive focuses on intelligent transport systems for road and its interface with other modes of transport. This Directive is an important instrument for the coordinated implementation of ITS in Europe. It aims to establish interoperable and seamless ITS services while leaving Member States the freedom to decide which systems to invest in and where to deploy.

In accordance with ITS Directive, the European Commission is empowered to adopt so called ‘Delegated Acts’ to define technical, functional and organisational specifications in relation to the six priority actions and an additional number of priority areas. The Directive foresees such specifications to be binding and aims at ensuring the interoperability and continuity of services, where possible based on existing standards and technology, with a set of enabling conditions supporting the growth and operation of services.

The ITS Directive includes two relevant priority actions relevant for real time travel and traffic information:

- Priority action ‘a’ - the provision of ‘EU-wide multimodal travel information services’ (foreseen adoption October-November 2016)
- Priority action ‘b’ – the provision of ‘EU-wide real-time traffic information services’ (adopted 18.12.2014)

Both priority action ‘a’ and ‘b’ are concerned with the enabling conditions to make it easier and more efficient to access and exchange travel and traffic data and services across the EU. The concept of data standardisation for real time information exchange (DATEX II and SIRI) and national access points are important instruments to support this at an EU level.

Data and privacy

The provision of information in the public transport sector has improved significantly over the past decade. Though this development generally contributes to improved customer satisfaction, it is also raising expectations. Customers now demand reliable, instantaneous personal information and attention. This trend can be seen in other domains such as tourism, banking, and telecoms. Across these domains more and more companies use channels such as Twitter or WhatsApp to provide service to customers.

To meet travellers’ demands, service providers have to embrace smart technologies. Open data streams offer opportunities to further enhance and personalise information services. In their publication ‘Big Data and Transport: Understanding and assessing options’ (2015) the OECD highlights the following developments:

- The combination of low-cost and widespread sensing (much of it involving personal mobile devices), reduced costs for data storage and the availability of new data processing algorithms has improved our ability to capture and analyse data in more detail and at higher volumes.
- Locating and tracking individuals with minute precision will likely become standard – at least in urban areas – as location-sensing technologies become omnipresent. The widespread use of smartphone technology in particular

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16 Article 7 of the ITS Directive in accordance with Article 290 of the Treaty on the Functioning of the European Union (TFEU)
18 http://www.datex2.eu/
19 http://user47094.vs.easily.co.uk/siri/
makes this possible in far more ways than in the past. The technologies deployed in today’s mobile phones are increasingly being built into vehicles.

More and more national and local authorities have started initiatives to open up public data. Some examples follow.

- ‘data.gov.uk – opening up government’ (United Kingdom): The British government is releasing public data to help people understand how government works and how policies are made. Some of this data is already available, but data.gov.uk brings it together in one searchable website. Making this data easily available means it will be easier for people to make decisions and suggestions about government policies based on detailed information.

- Transport for London (TFL)21 (United Kingdom): Specific data gathered by TFL is released for developers to use in their own software and services. TFL encourages software developers to use these feeds to present travel information to customers in innovative ways.

- National Data Warehouse for Traffic Information (NDW)22 (The Netherlands). NDW has 19 public authorities working together to collect, store and distribute traffic data. This data is used to provide traffic information, to ensure effective traffic management, and to conduct accurate traffic analyses. The objective of all this is to achieve better accessibility and traffic flows.

- ‘Smart city Wien’ (Austria): The City of Vienna offers a comprehensive, digital information service platform through its internet portal23. It is an innovative gateway to obtain information on events, public housing, environmental data, budget details, and e-governance. An important aspect of this online platform is that it is also available in Bosnian, Croatian, English, Serbian, and Turkish. The wien.at applications are designed to be used on a variety of mobile devices and platforms.

However, there is increasing concern about data security and privacy. Technology is currently advancing faster than rules and legislation on the collection and use of personal data can be made. Data is now collected in ways that were not anticipated by regulations, and authorities have not accounted for the new knowledge that emerges from data fusion (OECD, 201524). In their position paper, Polis25 highlights the balance between legislation for data security and privacy on the one hand, and the opportunities in terms of innovation, economic development and improved sustainable mobility services on the other.

Public transport operators and service providers will have to find a balance between maximising the opportunities that data and technology provides while ensuring the privacy of their customers. Such organisations are tasked with developing services that provide the best offer to their customers, while maintaining the trust of the customer by ensuring that their data is safe.

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23 City of Vienna official website, accessed April 15, 2016, [http://wien.at](http://wien.at)
24 Ibid footnote 17.
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