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# Strategic Research Agenda

for urban, suburban and regional public transport  
and urban mobility in the European Union

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## Europe 2020: a vision for urban mobility

Efficient urban<sup>1</sup> transport systems are critical elements of the sustainable development of urban areas, where some 80% of Europe's citizens already live. They ensure that:

- people have access to employment, education and recreation facilities, goods and services
- the risk of social exclusion is minimised (people without a car, young, elderly, unemployed and mobility impaired people)
- the distribution of goods is properly achieved.

Against a backdrop of scarce public financial resources for public transport and increasing concern for better quality of life, giving priority to public transport and other environmental friendly modes (walking, cycling) is essential for three main reasons:

- low space consumption for mobility, unlike space consumption by private car transport (parking and traffic)
- high dependence on public transport, as even in highly industrialised countries a large percentage of the population has no access to a private car, at least at certain times of the day, even if the household owns a car
- important role of social cohesion played by PT<sup>2</sup>, whereas the private car tends to isolate individuals from each other.

Urban public transport has many assets that can never be shared by private car transport. At the same time, the attractiveness of car ownership and use is increasing every day due on the one hand to intensive car oriented research efforts that are creating a great variety of technical improvements and also the low political priority given to public transport by public authorities.

Public transport will not be able to compete without major improvement in public transport efficiency.

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<sup>1</sup> 'Urban transport' generally includes all transports services at local level: urban, suburban and regional, including the rural areas of the urban hinterland

<sup>2</sup> PT: any shared urban, suburban and regional transport mode available to the public

<sup>3</sup> The European Rail Research Advisory Council

<sup>4</sup> This applies to all local level transport services: urban, suburban and regional, including the low density rural areas of the urban hinterland

This involves substantial investment in research and strong support from public authorities (traffic management and other regulations, funding etc.)

**For operators, appropriate research should aim to:**

- **improve the cost effectiveness of PT system investment and operation,**
- **increase the attractiveness of PT systems for existing passengers and potential new customers.**

As the representative of urban, suburban and regional passenger public transport in Europe, UITP is particularly concerned by the growing gap in research efforts between the private car industry and public transport modes. Acknowledging the efforts deployed through ERRAC for the rail sector only, UITP is convinced that a **multimodal integrated public transport approach is necessary to develop sustainable urban transport systems**<sup>4</sup>.

Given the highly fragmented nature of the urban public transport sector in Europe, UITP is committed to mobilising and bringing together all the stakeholders in order to accelerate progress and optimise the efficient use of resources. This will enable the needs of the public transport sector to be articulated, and provide the bodies financing or performing research with a clear view of the public transport sector's needs and potential.

## Major economic, technological and societal challenges affecting urban transport and the pivotal role it plays

### Economic growth

Continued economic growth is forecast for European Union countries, fuelling further growth in car ownership. The private car is set to continue for some time yet to be perceived as an expression of individuality allowing a level of freedom that public transport cannot provide.

However, most urban areas are affected by increasing traffic congestion, a considerable number of accidents, and high levels of air pollution. The rise in car ownership, combined with the growing separation in traditional cities between employment, shopping, leisure facilities and living areas is increasing the number and length of trips. This in turn intensifies transport problems, thus hampering mobility with increasing costs for the economy.

As a consequence, urban sprawl is also set to continue. While car availability is a trigger for unchecked sprawl, it serves to strengthen car dependency, as long as innovative public transport services cannot be made available and affordable in dispersed suburban structures. The UITP Millennium Cities Database demonstrates that when density is divided by three<sup>(5)</sup>:

- the proportion of journeys on foot, by bicycle and by public transport is divided by three or four
- the cost to the community of trips increases by over 50%
- energy consumption and greenhouse gas emissions rise three-fold
- deaths caused by accidents increase by 50%.

A modal shift towards private car use is currently being experienced in most European cities especially in new Member States. This trend generates external costs for the community:

- in terms of space consumption, the most demanding mode of transport is the private car, especially for parking space requirements. Urban public transport, depending upon the mode - rail or bus - consumes between 20 and 90 times<sup>6</sup> less urban space than private car use
- statistics show that serious injuries or fatalities for public transport are between 10 to 20 times lower<sup>7</sup> per passenger x kilometre than for cars
- public transport is three to five times more energy efficient per passenger carried than the private car

<sup>5</sup> 20 inhabitants/ha instead of 60

<sup>6</sup> Liveable Cities, UITP 1996

<sup>7</sup> Better Mobility in Urban Areas, UITP 2001

<sup>8</sup> European Commission communication on the thematic strategy for the urban environment (COM(2004)60final)

- urban traffic accounts for 40% of transport related CO<sub>2</sub> emissions. Traffic related air pollution is estimated to cost 1.7% of GDP<sup>8</sup>. In contrast, pollution from public transport is marginal, especially for low emission buses (clean diesel or alternative fuels) and even negligible for electrical powered modes.

## Challenges:

### Improving PT attractiveness

Existing urban public transport systems must improve their travel speed, reliability and quality. New organisations and wider application of new PT systems based on existing new technologies with lower cost must be investigated.

The design and application of new innovative public transport services should be developed in areas with low population density and in periods of low demand.

## Financial resources

Public funds available in Europe are limited and strongly disputed. The shortage of public funds forces better accountability of public expenditure for public transport and alternative financial resources to be sought, notably through new forms of contribution by the indirect beneficiaries of PT.

## Challenges:

### Innovative funding and financing

New sources of innovative funding need to be identified and legally facilitated to provide additional financing streams for public transport infrastructure and services. The potential of public private partnerships should be examined in more detail.

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## Demographic developments and social aspects

The demographic developments considered as having the highest impact on public transport are the continuous *decline in birth rate* and the *growing life expectancy* of the European population. Both trends signal a significant shift in the age structure towards higher ages. Yet, the elderly are expected to be more active in future and new mobility needs, but ageing will generate new transport requirements<sup>9</sup>.

All European countries have been seeing a considerable drop in the average household size, which is set to further increase the car ownership.

Major lifestyle changes will continue in the future with a rise in new forms of work, different consumer behaviour and diversified leisure activities. The majority of customers will also expect individualised products and services. Public schedules will become less important. Travel patterns will become more individual and complex over distance and time. Traditional public transport services will have to be adapted accordingly.

On the other hand, it has to be taken into account that a growing part of the society might not be able to adapt to the new information and communication technologies in PT. Many users are wary of using high-tech devices (eg. ticket machines or fully automatic transport systems). Car industry experience should be used as a reference in this area. Specific approaches have to be developed.

### Challenges:

#### More customer-oriented services

**In order to deliver more tailor-made yet efficient public transport services, travel patterns need to be analysed in as much detail as possible. Public transport providers must respond to the varying mobility needs of the different customer groups across distance and time (including at night).**

### Ensuring easy access to PT use

**In increasingly complex travel services and devices require public transport systems to be easy to understand before and during use, and to reduce inhibition thresholds. Ticketing and information systems will need to respond to the door-to-door service approach that users want and be as simple as possible. A higher level of accessibility for public transport infrastructure and rolling stock is needed to meet all travellers' demands.**

## Technological opportunities

### Intelligent transport, information and communication technologies (ICT & ITS)

Public transport is a dynamic sector that has always been very open to new technologies. Innovations in vehicle technology, fuels or telematics have often been tested and used first in the PT sector. In most cases new technologies were introduced to best effect when they were adapted to existing good solutions.

Innovative technologies will also help to make travelling easier. Interoperable electronic fare systems could reduce access barriers to intermodal systems and even to other non-transport services ('passport to the city'). However, it should be noted that some devices (eg. Internet, wireless devices) will only be used by certain segments of the population.

Information and communication technologies will also have a growing impact on people's private lives. Although the trend towards e-commerce and tele-working is evident, its impact on daily life and travel behaviour is strongly disputed. Anticipated lifestyle changes are however sure to raise customers' expectations in terms of public transport flexibility and availability.

<sup>9</sup> Many young people are more and more reluctant to walk to bus stops and metro stations

### **Challenges:**

#### **Integration of new technologies into existing PT environment**

ICT and ITS innovations will contribute to improving public transport system management and operation. New technologies will enhance system efficiency and safety. A milestone in Europe will be the implementation of the GALILEO system.

#### **Development of a mobility approach**

As well as wanting to reach their destination as quickly as possible, customers are mainly interested in a high quality door-to-door mobility service; they do not mind who provides it. Public transport operators have to become integrated mobility providers, offering a wide range of services going beyond the integration of different public transport modes.

#### **Providing user-friendly information services**

Providing citizens with the right information is the first step. New operational marketing techniques, mobility management and new information technologies offer a big chance for public transport.

### **Environmental technologies**

Public transport could essentially contribute to decreasing overall greenhouse gas emissions by shifting mobility from private car use towards more energy efficient travel modes. Driven by increasing public awareness and technological innovations in the automobile industry, major efforts have been put into developing cleaner power systems for public transport vehicles. Comparative environmental friendliness - public transport's big selling point in the past - is narrowing. This trend will continue when the latest technologies, such as fuel cell cars, enter the market. However braking energy regeneration systems and lightweight materials could allow for significant savings in PT operations.

### **Challenges:**

#### **Better environmental performance**

Bus engines running on alternative fuels need to be developed and optimised.

Noise reduction and vibration levels need to be addressed in public transport systems.

New preferably recyclable materials have to be developed and used for manufacturing vehicle bodies and interior compartment components.

### **Security concerns**

There is a growing security concern regarding the use of public transport. Greater automation and lower staff presence are likely to heighten feelings of insecurity. Recent incidents such as September 11 have drawn attention to the vulnerability of public spaces. The metro attacks in Tokyo or South Korea and the suburban rail attack in Madrid on March 11 have shown that public transport systems, with their high concentration of people, are also exposed.

### **Challenges:**

#### **Improving security**

Security concerns call for concerted action, not only to continuously improve rail and road security but also to respond to vandalism and to major problems (including terrorist attacks).

## Research recommendations

### Improving the cost effectiveness of urban transport system investment and operation

#### Urban transport planning and policy aspects. Economic and transportation research

- Developing more comprehensive urban land use and transportation planning studies and their implementation in all European regions/cities: enhancing Sustainable Urban Mobility Plans in coordination with Environment Management Plans as approaches and instruments for sustainable urban development of European cities
- Building a European vision for sustainable urban transport: highlight the transport challenges urban agglomerations are facing, provide reference to pertinent regulation and practice in some Member States, analyse the specific situation in the New Member States, build on the framework policy approach of the European Commission, train the various stakeholders
- Developing comprehensive economic studies on externalities of urban transport projects
- Investigating the impact on the general traffic, citizens' behaviour and public transport of a variety of measures, including
  - pricing and other car (and parking) restriction measures applying to car (and parking) design, (ownership) and use
  - PT improvement measures
- Defining of common criteria for European level impact assessment studies for new systems
- Exploring innovative solutions (dedicated taxation of indirect beneficiaries, tax reduction, tax-free PT vouchers as alternative to company car...) for
  - sustainable funding of investment in new PT systems or new PT services and in upgrade of existing PT systems,
  - sustainable financing of operation and maintenance of PT networks
- Exploring potential for public-private partnership in the provision of PT related services

- Exploring potential for new services combining PT activities with activities from other sectors (freight transport and distribution, telecommunications, banks, shopping...) and integration of such concerns in PT installations design and in PT services design at the local level

#### PT system design (see also p 8)

##### *Research on harmonisation of PT constituents, sub-systems and interfaces*

- European harmonisation and standardisation of certification procedures and tender specifications on the basis of new research findings
- European harmonisation of some fundamental (functional and technical) characteristics of new PT systems, subsystems and constituents and of their interfaces (rail and bus)(common prescriptions, new standards for new systems, improved standardisation available system modules)
- Development of 'modular' and 'interchangeable' constituents or sub-systems for both new and existing PT installations (design on the basis of 'plug and play' concept for constituents and sub-systems) (rail and bus)
- Technology migration paths, implementation strategies and conformity testing

##### *Innovative design of systems and constituents (see also p 8)*

- Research into automation of existing rail systems and development of innovative operating systems and strategies (unmanned driverless metro or light rail)
- Development of high-performance urban rail infrastructure
- Development of dedicated road infrastructure for bus (bus rapid transit), including international comparisons and further development of harmonised assessment methods
- New control-command and signalling concepts for rail systems in order to increase their capacity and availability over time (including night services)
- Research into innovative constituents to increase Reliability, Availability, Maintainability and Safety (RAMS) whilst decreasing life cycle cost (LCC) of PT systems (rail and bus)



- Research into the specific issue of tram-train (especially in the case of cross-border services)
- Research into new customer friendly design of vehicles and installations (rail and bus)
- Research into the specific issue of waterborne public transport
- Innovative small PT vehicles and new ways to use them (from shared taxis to shared cars and even car-sharing) especially at off-peak periods or in low density (and rural) areas
- Innovative guided PT systems operated on their own on street right-of-way
- Innovative high capacity PT rail vehicles
- Innovative devices for improving passenger comfort<sup>10</sup> (air conditioning, ITS connection points in vehicles and stations, accelerated walkways...)

### ***Innovative design of services***

- Development of 'seamless'<sup>11</sup> mass transit services based on clock-faced<sup>12</sup> and 'rendez-vous'<sup>13</sup> principles harmonised at European level
- Innovative demand responsive services in distance (city, suburbs, region) and time (day peak, day off-peak, night) and new tools for designing, implementing and tailoring service supply to the customer
- Coordination and/or integration of on-demand transport services into regular services

## **Operation management**

### ***Innovative ITS***

- Further development of data transmission techniques for PT needs, which take new research findings of the communications technologies sector into consideration

- Innovative IT tools and traffic management methods to prioritise PT vehicle operation over that of the general road traffic
- Integrated traffic control centres at whole city level
- Fleet management: innovative ITS on board of PT vehicles and innovative strategies
  - for better control and management of PT vehicles in operation (at company or city level), and
  - for advanced and intelligent maintenance of PT vehicles (diagnostic devices...).
- New operation methods for full automation of existing urban rail systems (automatic vehicle operation)<sup>14</sup>

### ***Innovative operation methods and tools***

- Research into innovative organisation and communications structures for PT undertakings
- New operation methods to better meet flexible demand (flexible working time for staff, new skills...)
- Research into optimisation of fleet and operating systems by considering interfaces with other modes/companies as part of an integrated city / hinterland-wide network. Development based on efficient PT supply chain management
- Integrated technical platforms for intermodal communication and real-time 'rendez-vous' between vehicles (different lines, different modes, different operators, different authorities...)
- Development of dynamic methods for adapting to capacities: on-line capacity control
- New operation methods and tools to recover normal operating conditions after an incident
- Innovative tools for managing PT companies; new services and devices for staff

<sup>10</sup> Innovation benefits have to be balanced with a possible increase in costs

<sup>11</sup> 'Seamless' means without a feeling of disruption in the transport chain, even if there is a transfer between successive transport modes between trip origin and destination

<sup>12</sup> Departure at the same time in minutes within every hour of the operating period

<sup>13</sup> Coordination of arrivals and departures between the various transport modes at selected transfer stations

<sup>14</sup> This priority, as well as other rail mode based recommendations, is developed in the context of ERRAC.

- Dynamic business, pricing and bidding models
- Innovative marketing techniques

### Information management

- Common frame for databases on PT supply (timetables, real time adjustment...), traffic, incident management
- Dynamic control of passenger information in PT interchanges and on-board vehicles (including real time information on connecting modes)

### Quality management

- Quality objectives expressed in terms of results for customers and assessment by detailed criteria, eg. timeliness measured by the number of customers affected rather than by the number of trains delayed
- Harmonisation of the methods used to check passenger numbers and deviations from timetables
- Benchmarking studies on PT costs and PT efficiency (priority should be given to investment costs and to comparison with other urban transport modes or other sectors)

- Pay specific attention to the accessibility of PT systems for persons with reduced mobility
- Pay specific attention to the needs of tourists
- Pay specific attention to urban PT services in airports and high speed train stations

## Increasing the attractiveness of PT systems: more customer-oriented services

PT systems can be made more attractive by the provision of more 'seamless' services, a more competitive average travel speed between origin and destination, greater regularity and comfort all along the mobility chain, and the use of technical innovations expected in every constituent and sub-system of PT installations. The key word is 'intermodality', but the concept of a PT system as the gateway to all city services, through effective information and ticketing "multi-service" systems, is also essential (access to education, administrative services, culture, sport...).

In addition, applicable for all of the above:

- Explore the potential of Galileo for developing the communications capability (specific programmes and structural funds at EU level)
- Analyse the more advanced applications of innovation in competing sectors (automotive industry...) and in non-European countries
- Explore the specific requirements for new Member States (especially with regard to rolling stock and infrastructure and PT funding and financing)
- Explore consequences of EU enlargement on PT undertakings of the 'old' Member States
- Develop skills needed for developing and managing innovative and more efficient public transport systems in the future, and properly applying EU directives on staff training: training of students at schools and universities, training of PT providers managers and employees, training of authorities, job certification etc

### PT system design; design of PT services; provision of PT services

#### *Research into the transport market*

- Research into current and expected urban, sub-urban and regional PT markets and about modes competing with PT
- Benchmarking studies on PT use characteristics over Europe
- Development of innovative socio-economic, demographic and urban transport data collection and analysis for improved urban transport system design, eg. innovative methods for short term, medium term and long term traffic forecasts. It includes innovative methods for population and employment census updates; use of GIS; travel surveys; stated preference and revealed preference analysis...
- Creation of mobility observatories in Europe
- Development of sociological studies, statistical and econometric models on transport needs and passenger traffic assessment, and their evolution in Europe (better understanding of why people use PT or not, or may use PT or not in the future)

- Investigation into customer expectations and behaviour (including quality aspects and pricing)

### **Research into customised services**

- Use of ITS to better understand travel patterns / smart cards (short term and medium term PT services adjustment)
- Innovative methods and tools for designing advanced customer oriented demand responsive services

### **Information component**

- Support intermodal traveller information strategies at national and regional level for the development of real time information and personalised information on PT services
- New services and devices for customers to access PT services and to make time spent in public transport more valuable
- Innovative interoperable (throughout Europe) personalised information devices and interoperable real time information content on PT services
- Choice-support and guidance services for customers. Access to human support any time anywhere
- Innovative CRM (Customer Relationship Management) tools and techniques

### **Fare policy and management, ticketing systems**

- Use of innovative concepts in the field of ticket distribution and ticket selling. Personalised and advanced booking, reservation services to the customer (web, mobile phone, voice recognition, person-oriented)
- User-friendly integrated tariffs, fare policy and ticketing systems. Innovative multi-service contactless passes, including “passport for city” facilities. Interoperability between European cities and later at European level (for the ‘European traveller’)
- Automatic fare collection based on innovative fare systems. Dynamic costing and pricing models

## Better environmental performance

- Development of clean vehicles and lower energy consumption :
  - Research on alternative energies (fossil or renewable) and their impact on PT operation
  - Efficient rail traction and energy supply
  - Innovative braking energy regeneration systems (on-board, track side)
  - Innovative light weight materials
- Design of PT installations and especially vehicle constituents using recyclable materials and research on operational effects: consequences for maintenance, new industry company, etc.
- Research on eco-procurements specifications and harmonisation
- Research on noise and vibrations reduction through appropriate design of sub-systems and interfaces (wheel-platform...)
- For all above: research on new funding rules for environmentally-friendly applications

## Better safety and security for all

- Research on tools and methods to improve the collaboration between stakeholders in order to achieve better personal security of PT company staff and PT customers, including tackling vandalism, incivilities, assaults, terrorist attacks
- Research on how to support, prioritise and enable an ad hoc arena to discuss PT security matters at a Schengen scale. European PT security legislation, standardisation and certification Initiatives
- Better integration of safety and security concerns in the design of infrastructures (including stations and surroundings) and rolling stock. New materials (fire safety)
- Safer accessibility measures for persons with reduced mobility

- Emergency management; crisis management
- Research on and dissemination of innovative solutions to prevent and condemn offences and support victims of assaults or attacks

## Conclusion

Up to now, the approach to transport research at the European level has been a modal and global one, for air, rail, road and waterborne transport: the European Commission actively supported the creation of “technology platforms” in charge of defining the strategy for European research in the various transport sectors (ACARE for air, ERRAC for rail, ERTRAC for road, ACMARE for waterborne, ISTAG for Intelligent Technologies).

UITP has been actively participating in ERRAC, and is supporting ERRAC which now better takes into account the specificity of urban rail systems (tramway, light rail, metro, other guided rail transit, and suburban and regional rail...). As regard ERTRAC, the urban road based PT services are not yet a priority concern. ACMARE does not take into account urban waterborne PT services. And ISTAG concentrates on the individual and its private environment (intelligent car, intelligent house, intelligent clothes...). In fact, the current advisory bodies are “modal platforms” which do not address a multi-modal integral approach of metropolitan and regional transport problems. Numerous transport research issues require a co-ordinated or integrated approach, with as major concern a better service to the urban transport customer (or specific categories of customers), whatever the transport chain used (a better “mobility for all”).

It is therefore strongly suggested that, in close coordination with existing platforms, a new advisory body is created with the support of the Commission in partnership with the main stakeholders in this sector (including of course manufacturers). This new body, whatever it is called, would build up a strategy and priorities for “intermodal” research in urban, suburban and regional public transport, as well as for harmonisation of public transport at the European level (in respect of the subsidiary principle). From the industrial point of view, the scope would cover technologies relevant to:

- land use, transport and traffic data collection, analysis, regulation and forecast
- inter-modal interchanges
- “i.transport” focusing on integrated public transport services and information, including multi-service contact-less pass (“passport for the City”), and
- new systems, subsystems, equipment and devices for urban transport not addressed by existing modal platforms.

Setting up this new body would facilitate:

- revealing and catalysing stakeholders’ expectations regarding European research
- coordinating actions by the main actors in the sector, including institutions at regional, national and European level.