EBSF: designing the future of the bus

Press Kit

The European Bus System of the Future is an initiative of the EU Commission under the Seventh Framework Programme for Research and Technological Development. Starting in September 2008, it was a four-year project with an overall budget of €26 million (€16 million co-funded) and coordinated by UITP, the International Association of Public Transport.
EBSF: designing the future of the bus

The European Bus System of the Future (EBSF) project was a major opportunity for local authorities, bus manufacturers and operators to transform the image of bus travel, and thus, passengers’ perception of it. With the support of the European Commission, European partners worked together to increase the quality of bus services in Europe. EBSF acted as a trend driver to speed up the pace of change in urban mobility behaviour, an important priority for the new generation of people and cities.

To respond to the challenge of increasing and changing mobility needs, EBSF based itself on the provision of high quality services. The bus service must be reliable and efficient, accessible, easy to understand and user-friendly.

Life on board: developing the bus in line with evolving lifestyles

The mobility needs of travellers were an integral part of the EBSF project. The way in which different categories of users, including youth, use the bus was simulated and contributed to the optimal design of bus interiors according to their preferred door, place inside and on-board behaviour. Such interiors were then implemented in the EBSF bus demonstrators from MAN (in Budapest) and VOLVO (in Gothenburg – above left).

On the EVOBUS bus demonstrator (in Bremerhaven) electrical sockets, GPS amplifiers and WiFi were installed to improve the social connectedness of the vehicle: it is becoming increasingly clear that one of the advantages of public transport with respect to cars is the possibility to stay connected throughout the trip, via social networks. The possibility to display non-transport on-board information (such as for concerts, exhibitions etc.) and the possibility to have ‘personalised’ and ‘funky’ colours in the interior lighting contribute to making the bus more attractive to young passengers as well.

Based on the Mercedes-Benz Citaro G City Bus, the EBSF Evobus demonstrator in Bremerhaven featured technology that when the bus nears the stop, for example, special lighting elements show passengers where best to get on so that congestion is avoided at the doors. Appropriate ceiling lights inside show passengers where vacant seats can be found. This reduces the time spent looking for a seat and the distance needed to walk through the bus. WLAN, GPS, and 230 volt sockets enable passengers to operate laptops and similar devices in the bus, making the bus a more appealing and accessible mobility choice in a fast-changing urban social scenario.

Bus operators and authorities acknowledge that this is the right time for citizens to adopt positive mobility habits and to postpone the purchase of a first car or even to learn to live without one. A new urban lifestyle less based on car mobility is becoming more common and the bus is playing its role in building an integrated system as it is friendly with other ‘soft’ modes. Promoting public transport is not only about vehicles but also and more importantly about generating a concept of better mobility. This approach goes hand in
hand with UITP’s framework strategy of doubling the market share of public transport worldwide by 2025.

The EBSF Bus Station demonstrator installed in Paris changed the concept of the bus stop from a waiting area to an urban living space. The 85m² station showcases groundbreaking new design features and convenient services. One of the main characteristics of the station is its double-front welcoming both passengers and pedestrians. The “bus side” offers interactive information touch screen, sound and light ambiance for a relaxing and pleasant waiting atmosphere, heated glass for a mild sensation of warmth in winter, library services “leave a book, pick up another” and defibrillator for emergencies. The “city side” is composed of a retail area where coffee, juice or flower shops alternate depending on the time of the day, electrical bikes with charging points and interactive web terminal to view information about neighbouring services.

The performance of all the system accessibility aspects, both relative to the vehicle and stop have been then evaluated, taking into account the interaction between passengers, buses and bus stations. The analysis of the relations (limits, constraints, influences, benefits) between design and passenger inclusion requirements for buses and bus stops human interfaces (seats, doors, door mechanisms, aisle, wheel wells bottleneck, driver cabin, waiting areas, turnstiles, etc.) has allowed the development of a complete concept for integrating the bus system into the city image.

EBSF also developed an open IT architecture which links up data sources from all onboard applications: with the harmonisation of such information systems via open technology, the creation of services is infinite and real-time multimodal passenger information is now possible on a European scale. An open common IT architecture has the potential to give passengers access to intermodal information for their journey across one or several geographical areas, involving all modes of transportation available to them to ensure a smooth journey. End-to-end solutions of this kind, particularly in demand by tech-savvy young people, will reduce car dependency in large cities. The EBSF IT architecture also enabled more cost-efficient remote maintenance which has a great potential for cutting operating costs.

Aware and concerned about the environment, young people favour the bus mode - despite its relatively poor image - largely because it is a practical and cheap solution to their mobility needs. Indeed, their attitude also demonstrates an anxiety about their economic situation: when investing in a car appears impossible or too burdensome, using public transport becomes the obvious solution. Looking beyond current circumstances, young people are ready to teach the next generations how to make it through life without a car and they are already taking steps to help seniors catch up with these new mobility trends.

**Use case: Madrid, Spain**

Multimodal, real time information was provided to users in an innovative pilot between Madrid and Majadahonda via web, SMS, displays and Bluetooth. Once passengers know the real waiting time, they can decide whether to change mode or to use the waiting time for other activities. For example: a passenger riding a bus approaching a railway station can choose either to get off and take the train – if there is a problem in the high occupancy vehicle (HOV) lane, such as an accident or congestion – or to stay on the bus. A passenger on the train is informed of a breakdown on the track and can decide whether to switch to the bus.

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Capacity: finding the right balance to offer the right mobility solutions

To respond to the mobility trends of today, public transport has to offer intelligent solutions that are economical, environmentally-friendly, attractive, and flexible. Public demand is extremely variable, both during the day and during the year, depending for example on early morning and late evening commuter bus flows and on tourist affluence. This enables the system to be more effective.

This is particularly the case in Rome where EBSF tried to adapt the internal layout to the real volume of passengers. Innovative solutions to improve the internal vehicle capacity and thus to offer more comfort to passengers and to improve the operation costs are was tested and evaluated by ATAC on a bus demonstrator Irisbus Iveco (Hynovis concept bus) pictured below:

![Bus Demonstrator](image)

Internal modularity of the bus

Irisbus designed and produced an innovative and aesthetically appealing bus that is able to adjust its capacity by modifying the amount of seats. This sliding seat technology provides an additional 24% (21+5) available seats.

The EBSF bus demonstrator was based on the Hynovis concept bus developed by Irisbus Iveco. This bus offers a very innovative passenger compartment providing comfort and well being to passengers:

- easy access to the seats: no steps in the first 10 metres of the bus (out of 12);
- a central aisle increased to 1.2 m (instead of 0.9 m) to ease passenger movement;
- a glazed surfaced increased by 20%, to reflect the vehicle on the city and to bring in light

A new modular layout of seats has been developed by the EBSF project to enable adjustments of capacity in order to meet passenger needs and to optimize space and comfort.

Modularity can increase the attractiveness of the bus system, through the optimization of capacity, consumption (and emissions) and frequency at different times according to the demand. It also provides benefits to operators’ efficiency thanks to the increase in capacity and the reduction of driving costs during peak hours.

Use case: Gothenburg, Sweden

By relocating the front axle further forward, Volvo was able to provide more seats in the front section of the bus. Total capacity of seated and standing passengers, increased by 25% from 116 on a standard articulated bus to 147 on the prototype without any increase in the overall length. One novel feature is the use of tip-up seats in the front area that can lock into the closed position at peak periods to create more standing capacity.

Next steps: The end goal is dedicated regulations allowing modularity and an optimal - and cost effective - deployment plan for operators.

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Accessibility for all passengers

**Use case: Rouen, France**

Buses have made most people’s lives easier. Unfortunately, a small percentage of the population is not fully catered for. **Mobility-challenged people** still see buses as an obstacle to urban travel.

Although the TEOR system in Rouen offered significant improvements in terms of accessibility thanks to the optical guidance system making it easier to align the bus at the station, a few more centimetres are still needed to fill the gap completely, particularly for the vertical gap.

**The EBSF innovations in Rouen** were a further step forward to granting easy access to all, including those with special needs. Accessibility is improved thanks to two innovative solutions completing the current optical guidance system and removing all gaps between vehicle and dock of station: a **height regulation** and a miniflap called ‘**gap filler**’.

Two Irisbus Iveco Buses: one articulated Citelis and one articulated Agora, both with optical guidance system. In the framework of the EBSF these vehicles are equipped by two enhanced systems:
- a suspension electronic control for **vertical gap filling**
- a gap filler installation for **horizontal gap filling**

The new system enables to simultaneously bridge over the lateral and the vertical gaps between the bus and the dock, offering optimised accessibility for all types of passenger. In this way, this enhanced solution reduces completely the step due to residual vertical gap and fills in fully the horizontal gap.

More generally the entrance and the flow of passengers is considerably improved, improving the accessibility of the bus and shortening the time at stops to offer a more **comfortable** and efficient bus system.

**Adjustable electric system**

For height regulation and vertical gap filling (Agora and Citelis): the height regulation system detects the height of the dock thanks to electronic infrared cells placed on the side of the vehicle. The system regulates automatically the vehicle’s height with an automatic suspension system and so places the bus at the same level than the dock.

This operation is undertaken automatically when the vehicle is approaching a bus station equipped with dedicated transponders based on RFID technology (Radio Frequency Identification). Moreover, the movements due to suspensions are similar to those produced by a conventional electronic suspension system.
Passenger flow: better accommodating high passenger volumes

Use case: Budapest, Hungary

In Budapest, urban buses are the daily choice of two million users amongst all modes provided by the public transport network (bus, tram, metro, suburban railway and trolleybus).

Increasing the flow of bus passengers, while improving comfort, space and security, was one of the challenges faced in the EBSF use case.

Five doors shorten the time spent at stops and offer more comfort and accessibility to passengers. The EBSF bus (MAN Lion City GL) was fitted with a new generation of doors for test purposes, equipped with an optimised, electrical drive mounted on the top of the rotating column. This saves space and does not need a complex mechanism, saving weight and reducing maintenance.

The passenger compartment has been designed to allow the best possible passenger flow, flexibility and comfort. The design was based on scientific studies in the form of simulations carried out for this project.

- To provide extra seats, the driver is able to release seven electrically folding seats in the forebody. The driver can block or release these seats at the touch of a button on the dashboard. This enables a generous amount of standing room to be made available for the efficient boarding and alighting of passengers.
- An optical signal on the seat shows the passenger whether it is free or occupied.
- A sophisticated 3D counting system at the doors registers the passenger flow. This system is capable of distinguishing between children and adults.

Test results:

Budapest - 20% increase in capacity
Gothenburg:
- Dwell time 5.75 min (-25%)
- Average speed 25 km/h. (+4%)
- Capacity 139 passengers (+20%)
- Required buses 12.1 (-18%)

The passenger perspective:
Testing the specially modified MAN Lion’s City GL on Budapest’s 11-kilometre inner-city route 86, a line with high-passenger volumes, was an ideal opportunity to test pioneering concepts in practice and to compare the results with the existing infrastructure. 400 route 86 passengers were questioned before the testing period and after the beginning of the operational test. On the basis of the received responses during the EBSF project, the service quality and the reliability of the bus improved; the passengers outlined the cleanliness of the vehicle, the comfort and the adequate number of the seats but also found inner temperature and sound level better. On the new bus, 88% of the passengers rated the quality of the applied developments good or very good.
Safety and comfort: the new driver workplace

Improving the working conditions for drivers was a key issue for EBSF: a common driver workplace was built in Dresden and tested by drivers from Gothenburg, Dresden and Rome. The objective being to offer the highest level of security, safety and comfort; the new EBSF driver workplace thus improves service performance.

The improvement of work conditions for driver is a key human element in ensuring better service, performance and industrial relations between employer and employee. The cabin is where the driver spends six to eight hours every day, thus it needs to be comfortable, ergonomic, safe and should assure the best microclimatic conditions. The cabin guide is highly unhomogenous in Europe at the moment, due to the lack of official EU standards and the extremely variable typology of buses.

Based on the deep analysis of drivers during real operations, and the application of sound ergonomic principles, the new EBSF driver workplace demonstrates improved comfort and safety and led to a simpler and more intuitive driving style. The ergonomics of the work space, usability and friendliness were all improved, in accordance with the requirements from the major stakeholders (eg. operators, manufacturers, authorities).

A static mock-up of a future European driver’s workplace was specially designed for tests in the driving simulator at the IVI-Fraunhofer Gesellschaft in Dresden, Germany. The ergonomic quality of the mock-up in the driving simulator (reproducing two bus lines in Rome and Dresden) was tested by drivers from different European cities (Dresden, Gothenburg and Rome). The results established the following:

1. **Driver comfort**
   - New ergonomics to reduce fatigue and facilitate access to controls
   - Seat design adapted to varying drivers’ morphologies
   - Seat highly protected against vibrations
   - High acoustic and microclimatic comfort conditions

2. **Driver safety**
   - Wide open view of the surroundings thanks to the new design of the cabin
   - Comfortable and ergonomic cabin access with modular upgrade (cabin door with safety window or closed cabin) which enables a high driver security

3. **Better service performance**
   - Driver’s console informs about the state of the bus and any malfunction. Cabin design enables drivers to give information to passengers, welcome them aboard and easily sell them tickets.

**Next steps:**
Results are being formed in to a “Recommendation for an ergonomic, European driver’s workplace”, opening the floor for future possible development of European guidelines on the ergonomic design of bus driver workplaces, following the consultation of all stakeholders.
Energy management: towards a green evolution of the whole bus system

An 80% increase\(^1\) in urban mobility network energy efficiency by 2030 requires smart energy use all along the bus system, and better environmental performance.

In EBSF, The Fraunhofer Institute for Transportation and Infrastructure Systems IVI explored the high fuel-saving potential of a strategy to better manage the energy consumption of the auxiliaries (heating, ventilation, air conditioning, IT equipment, and so on). To reduce auxiliary energy consumption a dynamic programming algorithm was used to improve the management of operational levels of the auxiliaries according to the vehicle drive cycles and auxiliary system loads.

Similar analyses have been done also to understand how fuel consumption is affected by the choice of vehicle body components and define the right energy control strategy, in particular in relation to weather operational conditions.

Due to the great importance of the topic, energy aspects have a key place in the EBSF roadmap, defining the areas for further research on bus systems. In particular, future research should focus on:

**Energy efficient system, materials and components**
- Overall energy management solutions for bus systems: vehicle, infrastructure and operating conditions.
- Energy management at bus stations/stops (via photovoltaic decentralised energy supply)
- On-board energy generation, storage and intelligent management, recovering maximum braking energy for hybrid vehicles, new Heating, Ventilation and Air Conditioning, auxiliary components and total energy management for electric buses.
- Alternative fuels and renewable energy focusing on hybrid and electric.
- Standardised On-Road Testing (SORT) evolution and standardisation at European level.
- New light weight materials and concepts for vehicle bodies and interior components.
- Smooth (eco) driving, optimal tyre-asphalt interface.

**Better environmental performance**
Research priorities include:
- Further optimise vehicle traction technology including innovative gear control systems
- Actively reduce noise and vibrations
- Develop EBSF Environmental Management System
- Develop a European tool for the environmental assessment of buses and technologies, (covering complete lifecycle and energy source).

**Electrification of bus system (zero local emissions)**
Bus fleets are ideal for electrification as buses normally operate 10 to 18 h/day and charging infrastructure can be installed cost-efficiently at depots or dedicated stops. Second generation plug-in hybrid buses are a first step in the direction of fully electric buses.
Research priorities:
- Fast energy charging concepts/technologies (“plug-in”/docking systems/inductive power transfer, high performance batteries/batteries swapping, supercapacitors) at stops or termini.
- Full electrification - developing batteries for urban buses and optimising recharging interface.

\(^1\) ERTRAC Strategic Research Agenda

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• Adapting existing **infrastructure** for maintenance, and designing new infrastructure for energy charging at depots/main bus stops/terminals.
• Staff training for fully electric vehicles.
• Common **European platform** (operators and industry) for economies of scale, exchange, feedback and joint studies.
• **Business models** for the electrification of buses and exploring funding and incentive schemes.
• **Trolleybuses**: braking energy recuperation and feedback in the grid or combination with energy storage systems; contactless concepts/technologies for down-town and historical city centre operation.

**Next steps:** Recommendations and guidelines for updating the network and the vehicles (new or retrofit) to be more efficient and sustainable – reducing energy consumption and local and global emissions – under 3iBS (Intelligent, Innovative, Integrated Bus Systems, the successor project to EBSF).
EBSF is an initiative of the European Commission under the Seventh Framework Programme for Research and Technological Development. Starting in September 2008, EBSF is a four-year project with a budget of €26m (€16m co-funded) coordinated by UITP, the International Association of Public Transport.

For the first time EBSF brings together the five leading European bus manufacturers and 42 other partners in 11 EU countries.

European bus manufacturers: Evobus/Mercedes, Iveco Irisbus, MAN, Scania, Volvo

Public authorities: Vasstrafik Gothenburg, Nantes Metropole, Consorcio Regional de Transportes Madrid, BIS Bremerhaven

Public transport operators and national public transport associations: RATP, ATAC Rome, Veolia, TEC, Bremerhaven Bus, ATV Verona, ATM Milan, RATB, BKV, VDV, ASSTRA, UTP

The supply industry: Hübner, Init, Digigroup, Ineo, Pilotfish, Actia, Hogia, Vultron, Tekia

Research/consultancy: D’Appolonia, Berends, CERTU, Chalmers, CEIT, Fraunhofer, Transyt, FIT, Newcastle University, PE International, INRETS, University of Rome 3, University of Rome/DICEA, TIS, CRF

UITP (the International Association of Public Transport) represents 3,400 members from 92 countries.

www.ebsf.eu
UITP ACTS AS...

The global **network** of all mobility actors

UITP is a global network with **3,400** members from some **92** countries, including public transport authorities and operators, policy decision-makers, scientific institutes and the public transport supply and service industry.

> It is a platform covering **all** modes of public transport where members can connect and share experiences.

> UITP has its headquarters in Brussels and **11** regional and liaison offices around the globe.

> About **30** events every year
UITP ACTS AS...

The catalyst for new **business** opportunities

**UITP is a platform**
where public transport stakeholders can:

> set up business **partnerships** and **joint ventures**
> establish **connections** in a neutral and trusted environment

**UITP holds**

> the **largest** urban and transport exhibition in the world every two years
> several **regional** and **thematic** congresses and showcases

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**10 training programmes**

UITP anticipates needs and comes up with innovative solutions to be prepared for tomorrow through:

> About 10 **training programmes** held by UITP every year
> Some 10 **visionary** and **innovative projects**
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Mobi+ database
32,000 references

PTI magazine 6 times a year in 6 languages

15 new publications every year

UITP is an EXPERT for the entire public transport sector acting as a:

> Point of reference, centre of best practices and benchmarking, and a knowledge hub on past and current developments as well as future trends

> Thanks to the work of the different UITP Commissions and Committees, the Association offers its members various tools:

  - **Mobi+**, electronic library with some 32,000 references
  - **Public Transport International**, published 6 times a year in 6 languages
  - About 15 new publications every year in addition to many reports, surveys, studies and projects

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UITP ACTS AS...

The advocate for public transport and sustainable mobility

UITP is the voice of the entire public transport sector and has a strong political and economic influence when defending the sector’s interests through:

> The **EU-Committee**

> Collaboration with **international bodies** such as the United Nations (UNEP, UNESCO, UN-HABITAT, UNFCCC...) and the World Bank

> **Focus Papers** (official UITP positions)

> The **Charter on Sustainable Development** already signed by more than 150 UITP members

> **Press relations** with both general and trade press

> **Awareness campaigns**

> The **Youth Project**

UITP **Strategy** for the public transport sector: doubling public transport market share worldwide by **2025**. In order to reduce energy consumption caused by transport, public transport is the smart green solution.

Cities and governments have a crucial role to play in order to foster economic development and wealth creation. For urban mobility, this involves prioritizing public transport.

- Public transport empowers the economy
- Public transport helps the planet breathe
- Public transport alleviates congestion
- Public transport brings everyone everywhere

Therefore UITP calls on governments, operators, authorities, investors and the industry to take action and forge a better mobility for our cities.

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Alain Flausch

Secretary General of the International Association of Public Transport (UITP)

Alain Flausch was selected Secretary General of the International Association of Public Transport (UITP) in September 2011 by UITP Executive Board.

This choice acknowledged the long-standing engagement of Mr. Flausch on the international stage.

Chairman of the sub-committee Finance & Commerce of the International Metro Committee (2001-2009), he was also member of the UITP Executive and Policy Boards (2004-2009), Executive member of the International Metro Committee (UITP- 2001/2009), member of the Transport Management Committee (UITP) and Chairman of the Design & Culture Platform.

Mr Flausch was also elected President of UITP during the Association’s 58th World Congress in Vienna in June 2009.

Mr Flausch is also the president of the Belgium Union of Regional Public Transports (UBTCUR) which gathers the three national public transport companies.

From 2000 to 2011, Mr. Flausch led the STIB (Brussels Region public transport operator) through an in-depth cultural change, conducting a complete renewal both of the commercial approach and the corporate management, setting a new company culture where clients are at the very heart of the service provision. Since 1999, STIB ridership has increased by more than 100% and last June STIB received the ‘4-star Recognised for Excellence’ label awarded by the European Foundation for Quality Management (EFQM).

From September 1973 to January 1982 Mr Flausch was an attorney at the cabinet Simont Gutt & Simont in Brussels.

From February 1982 to March 1990 he held the position of Deputy General Manager with the Chemical Belgian Group Prayon-Rupel.

In April, Alain Flausch joined IP Belgium, the first media sales house in Belgium, as Managing Director, where he worked until 1999.

Mr Flausch was born in Brussels in November 1950. He still lives in the Belgian capital. He is a lawyer and holds a Master's degree from the University of Berkeley (California). He is bilingual French-Dutch, speaks fluent English and has a good command of Italian.

Alain Flausch is married and a father of two children. His centres of interest include all different forms of arts and culture as well as political history. Mr Flausch is also engaged in favour of nature preservation.

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