

3.1 Publishable summary

The 3iBS project (Innovative, Intelligent and Integrated Bus System) is founded on the consideration that buses still remain the most universal solution for a balanced and sustainable urban development effectively taking into account the economic, environmental and social perspectives. Urban sprawl, new mobility habits and the resulting chronic congestion call for the need of satisfying a rising demand for accessibility within a context of growing sustainability concerns. Following the outcomes resulting from previous researches on Bus Systems, in particular the European Bus System of the Future project (EBSF), 3iBS is committed to strengthen the competitiveness of the bus in the urban environment by capitalising on the development of existing effective solutions. Under the coordination of UITP, 9 partners together with about 30 associated members have decided to continue striving for **increased performance, accessibility and efficiency of bus systems**.

Looking at the bus system as a whole including vehicle, infrastructure and operations, 3iBS identified 7 key innovation areas with high potential in generally perfecting bus infrastructures and operations, namely:

- **Accessibility and Safety**
- **Bus service operations during special events**
- **Intermodality with private and public transport modes**
- **Level of service**
- **Internal and external modularity**
- **Energy sustainability**
- **IT Standardisation for PT.**

For each of these research areas, the main objective is to stimulate the integration of key solutions in bus networks by promoting exchanges of knowledge on a global scale. All in all, the exploitation of results and further development of the innovation areas will help to make bus systems more attractive for passengers, more efficient and economic to operate and more environmentally friendly, reinforcing at the same time the position of the European bus industry.

The overall methodological approach developed to achieve the project objectives is based on 4 core activities described below together with the main results achieved since the beginning of the project.

1. Validate innovative solutions through the analysis of Study Cases

Aiming at creating a link between the concepts defined and tested in previous research projects and their actual implementation in PT networks, the analysis of Study Cases was based on a set of good practices selected thanks to the experience of PT operators. More than 30 operational or infrastructural solutions tested in France, Germany, Italy, the Netherlands, Spain, United Kingdom, Turkey and South Africa have been analysed and guidelines for the implementation of such good practices across European cities have been produced to support other PT stakeholders interested in items to realize within their network. Moreover priority actions for further research and standardisation have been identified.

Since the 7 key research areas deal with very different aspects of bus systems, specific methodologies have been developed for the analysis of the relative study cases.

The study cases on **accessibility and safety** (Rome and Nantes) have been assessed in terms of how well they could fulfil travellers' needs and requirements with a focus on the elderly population and travellers with special needs. They have also been analysed in terms of their impact on passenger safety, i.e. reducing accidents and incidents (e.g. falling accidents) as well as travellers' perception of safety when travelling by public transport. Conflicts between different categories of travellers have been identified. A complementary inventory was made of EU-projects to provide additional inputs for the settlement of the main requirements for accessible and safe bus stops/stations, vehicles, ticketing systems and information systems. The ambition was to present unique examples to propose and evaluated solutions which do not overlap one another.

The analysis showed the importance of a changed mindset from individual solutions to a "design for all thinking" since such an approach is considered to have a substantial effect on the solutions developed.

Cities are the theatre of a growing number of **special events**: sport competitions, concerts, cultural festivals and religious pilgrimages, to name just a few. Experience shows that special events critically rely on the ability of the public transport system of the host city to get large amounts of extra travellers to the right places, as it is the only way to avoid inextricable traffic jams. The analysed study cases cover three different types of special events (planned, unforeseen and periodic) and provide a comprehensive overview of existing procedures and actions undertaken by European and Worldwide transport operator and municipalities for the management and provision of bus services during special events.

Based on the methodology developed in the NODES project (New Tools for Design and Operation of Urban Transport Interchanges) and the classification of "points of connection" produced in the EBSF project (i.e. long distance interchanges, metropolitan interchanges, intermodal areas and connecting points), selected good practices implemented in Umbria Region (Italy), Istanbul (Turkey), Osnabrück (Germany) and Madrid (Spain) have been analysed. The main requirements for **intermodality**, as the needs of bus services when combining with other public modes and complementary modes (walking, bike, car pooling and car sharing, etc.), have been identified. To enable a wider approach towards intermodality, the analysis focused not only on interchange infrastructure but also on intermodal systems (e.g. integrated ticketing systems).

The study case analysis showed that continued development of physical infrastructures, improvement of advanced information systems and further efforts in terms of policy and legal frameworks to facilitate intermodal cooperation are the key areas of enhancement to overcome barriers to passenger intermodality in urban and suburban contexts.

Bus system solutions in operation in Barcelona (Spain), Cagliari (Italy), London (United Kingdom), Paris and Nantes (France) have been analysed according to their **level of service** taking into account environmental, economical and comfort aspects. To do so, a first differentiation between Level of Service (LoS) and Quality of Service (QoS) has been made, followed by an assessment of the performance and efficiency of the different solutions through a set of indicators which includes the vehicle, the infrastructure and operational concepts.

All the study cases show good performance in terms of LoS, mostly in terms of age of the fleet, Intermodal Transport Control System, priority and commercial speed. Regarding QoS, it is also noticeable the good performance of indicators as info to passengers, level of safety and ride quality. Only quality of docking, image and ticketing scored very low. Criticalities

appear to be mostly the availability of dedicated lanes on the bus networks and the passenger load factor.

Modularly designed bus concepts are a relatively new strategy to save operational costs while keeping the same capacity or provide additional services for passengers without increasing the operators' cost. Seven study cases from six European cities (Rome, Taranto, Padua, Vicenza, Paris, Chambéry) have been analysed considering internal modularity (adaptation of capacity by using foldable seats) as well as external modularity (bus-trailer-combinations and coupleable buses) solutions. The main achievement of this task is to provide a clear and facts-based list of the cost advantages due to the introduction of bus-trailer-combinations and coupleable buses by replacing conventional buses on selected lines. Furthermore, operational implementation plans have been developed to help transport operators with the identification of suitable bus lines and the setting-up of specific implementation plans.

Solutions to improve **energy sustainability** of bus systems have been addressed in the study cases analysis in terms of:

- potentialities in reducing energy consumption and emissions of eco-driving systems and advanced gearbox
- comparison of different propulsion technologies available on the market (i.e. hybrid buses versus Diesel and CNG) based on real-world fuel consumption data provided by PT operators partners of the project.

Finally the results of the application of hybrid buses running on a re-design bus network have been assessed based on the Barcelona study cases to show a characterization of consumption and emissions on a real bus network.

Building an **IT platform** that enables communications between different Public Transport applications, and that enhances communications between on-board units and back-office systems through a unique IP gateway was the achievement of the EBSF IT platform. Based on such specifications, the 3iBS IT focus group has developed guidelines to assist PT operator, PT authorities and bus manufacturer to set up a standard IT architecture and to help them to define and answer to tenders referring to these standards.

The guidelines include onboard systems, vehicle installation requirements and backoffice interoperability and are based on “compliance levels” according to a modular approach: from minimum requirements to prepare the introduction of the standard IT architecture to high level needs for a complete implementation of PT systems and applications via basic needs as intermediate level to ensure basic compliance including relevant support functions with standard IT architecture.

2. Define a work-plan to move from research to innovation

With the aim of reinforcing the position of EU bus industries, the 3iBS Exploitation Platform deals with the exchange of experiences between innovative urban bus systems already existing or under development worldwide and with the exploitation of such research results into business.

A PT stakeholders' consultation was launched to identify the actual implementation status of bus system strategies in European cities. The questionnaire addressed to PT operators, PT authorities and municipalities collected up-to-date quantitative information on both the state of the art of the bus fleet in operation in Europe and future tendencies by focusing on 4 main areas of interest: fleet composition, propulsion system, energy and future strategies impacting

bus systems. The analysis of the responses, totalling a fleet of around 70.000 buses and trolley buses serving a population of over 100 million inhabitants in 24 countries, provides a significant snapshot of the bus fleet in operation in Europe and highlights the relevance of bus systems in local mobility policies.

3. Develop a Roadmap for European Advanced Bus Systems

One of the main goals of the project is to develop a **Roadmap for European Advanced Bus Systems** research that will support National and European institutions in identifying the main priorities for research on bus systems. The first issue of the Roadmap has been delivered in 2011 as part of the EBSF project in the frame of ERTRAC (European Road Transport research Advisory Council) and has been supported by more than 100 key bus stakeholders. On those bases, the Roadmap for advanced Bus Systems is going to be updated through the review of results of closed and on-going projects and thanks to the outcomes of the analyses of the 3iBS key topics.

As a first step, the funding instruments available at European and National Level to support and finance bus or PT research in different member states have been identified. Such screening has been carried out to provide a clear understanding of the financing opportunities to be put in relation with the roadmap for its implementation and to influence the content of the future funding instruments promoting the adoption of the research priorities highlighted in the roadmap.

In 3iBS, the rule is to go beyond purely dissemination activities to enlarge the awareness of the 3iBS project to the largest public possible. The aim is also to share a message with the audience to put forward the value of an EU-scale collaboration to show citizens and public transport stakeholders that a project like 3iBS can benefit them in their daily lives. By diversifying as much as possible the communication and dissemination actions, the goal is to share the idea that the urban bus is an efficient mode of public transport in the frontline to answer the new challenges of urban mobility and to keep the interest towards the project's activities at a high level.

3iBS is present through a wide scale of communication channels: events (local, national, European, international), working groups (3iBS Stakeholders Expert Group, UITP Commissions and Committees), media (newspapers, magazines, website, social media...) The communication tools (publications, presentations, reports, trainings, roundtables...) address the experts of the sector but also the general public. In terms of leadership, UITP is supervising the biggest part of these activities but the 3iBS partners are very involved through their contributions (in writing articles for example) and their participations to events and working group meetings. UITP gives a constant creative impulse in 3iBS together with the key participation and opinion of the 3iBS partners.

The expected final results of 3iBS can be summed up in three core goals:

- **Stimulate PT stakeholders** to integrate innovations in their bus systems and spread the acceptance of effective solutions and technologies tested in previous and on-going research projects (e.g. EBSF) by setting the frame for their harmonization and standardisation. As a result, improved attractiveness and a more user-friendly image of the vehicle and its service will contribute to generally increase the market share of buses in urban and suburban areas.
- **Support bus industry** (manufacturers and suppliers), **bus operators and authorities** in achieving objectives such as: reduction of the production costs,

better effectiveness of investments and operation costs, environmental performances and smart use of energy alternatives, accessibility for all typologies of passengers with their specific needs.

- **Strengthen the competitiveness of EU bus industries** also outside Europe. Today Europe is world-leader for most of the technologies linked to the bus services but, with the incoming of new actors on the market, it is becoming more important to keep and strength their competitiveness in such more complex scenario. Within 3iBS the main European bus stakeholders are closely cooperating with PT Operators and authorities to promote common strategies for innovation on the basis of the EBSF good results.