



# **SOLUTIONS Training Kit**

## **Cluster 1: Public Transport**

[www.urban-mobility-solutions.eu](http://www.urban-mobility-solutions.eu)



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## About SOLUTIONS

SOLUTIONS aims to foster knowledge exchange and boost the uptake of innovative sustainable urban mobility solutions through the further exploitation of existing knowledge.

The main focus of the SOLUTIONS project is on the exchange between cities from Europe, Latin America and the Mediterranean.

The project looks at the following thematic areas:

- public transport
- transport infrastructure
- city logistics
- integrated planning / sustainable urban mobility plans
- network and mobility management
- clean vehicles



## Introduction to Cluster 1: Public Transport

**Public Transport:** A crucial factor for achieving healthy and liveable cities and metropolitan areas

**Issues:** traffic congestion, traffic pollution, carbon emissions and energy consumption

**Main focus:** learn how to improve the public transport capacity and efficiency in an environment friendly pattern through policy making, technical improvement, integrated planning, etc.

-> Requires detailed discussion about ITS, BRT, subsidies, funding, pricing mechanisms, corresponding infrastructures & energy policy

<b>SOLUTIONS for</b>	<b>Type of impact</b>
<b>BRT system construction and operating with high level service</b>	<b>Improve (Shift)</b>
<b>Trolley bus systems</b>	<b>Shift (Improve)</b>
<b>Metro systems</b>	<b>Shift (Improve)</b>
<b>Use and operate clean vehicles such as CNG, LPG, LNG in public transport system</b>	<b>Improve</b>
<b>Use new technology vehicles such as electric and Hybrid vehicles in public transport system</b>	<b>Shift (Improve)</b>
<b>ITS for public transport</b>	<b>Improve</b>
<b>Integrated planning of public transport network</b>	<b>Improve</b>
<b>Financing public transport</b>	<b>Improve</b>
<b>Integrated fare system</b>	<b>Improve</b>
<b>Eco-driving for professional drivers</b>	<b>Improve</b>
<b>Bus priority</b>	<b>Improve</b>
<b>Bike sharing and public bicycles</b>	<b>Shift (avoid)</b>

## Solution 1.1: BRT system construction and operation with high level service



Dedicated bus lane



## **Solution 1.1: BRT system construction and operation with high level service**

### **Objectives and implementation**

- Provide high level public transport service
- Increase public safety enhance logistics function
- Supported through dispatching information systems
- Best implemented along main roads of cities and metropolises
- Will reduce congestion, increase passenger volume and reduce public transport carbon emissions.



## **Solution 1.1: BRT system construction and operation with high level service**

### **Drivers**

- Increased carrying capacity compared to conventional public transport,
- Environmental appeal of the system
- Independence from terrain limitation
- cost effectiveness

### **Barriers**

- Funding and investment for BRT
- Limited road space
- Public opposition against reducing road space in favour of public transport



## **Solution 1.1: BRT system construction and operation with high level service**

### **Examples**

- BRT system in Curitiba, Brazil
- TransMilenio BRT system in Bogota, Colombia
- Hubei–Yichang Sustainable Urban Transport Project, China;
- Guangzhou BRT



## Solution 1.2: Trolley bus systems



Trolley bus in Gdynia, Poland



## **Solution 1.2: Trolley bus systems**

### **Objectives and implementation**

- Public transport mode using electric propulsion
- Can be operated with renewable energy
- Reduces fossil energy use by maintaining (or even increasing) carrying capacity
- Support cities in achieving their climate goals
- Best implemented in the built up area of a city



## **Solution 1.2: Trolley bus systems**

### **Drivers**

- No local air pollution and less noise emissions
- Positive impact on local emissions
- Effective means to implement electromobility in cities

### **Obstacles**

- Construction and maintenance of the power grid
- In many countries, trolley busses are perceived as old-fashioned
- Many projects, such as the TROLLEY project have demonstrated that such barriers can be successfully overcome



## Solution 1.2: Trolley bus systems

### Examples

- Zurich, Switzerland
- Beijing, China
- Taiyuan Trolleybus project in China
- Hybrid trolley buses (several kilometres autonomy without wires) in Gdynia, Poland



## **Solution 1.3: Metro systems**



## Solution 1.3: Metro systems

### Objectives and implementation

- Rapid public transport mode on rails without the need to change the structure of road networks and built up areas
- Almost independent from the topography of cities
- Best implemented in areas with the need of mass capacity in PT
- Metro systems attract passengers from other transport modes (private cars)



## Solution 1.3: Metro systems

### Drivers

- Potential for mass passenger capacity
- Perceived as fast and reliable
- Electric propulsion decreases local emissions
- Shift of passengers from private cars reduces congestions and emissions from cars

### Obstacles

- Huge investment
- High cost for maintenance and operation decreases the acceptance of metro construction by the public



## Solution 1.3: Metro systems

### Examples

Examples are manifold. Major systems are...

- London underground
- Berlin underground
- MRT in Singapore
- Beijing underground
- Dalian metro system, etc.



## Solution 1.4: Use and operate clean vehicles such as CNG, LPG, LNG in public transport systems



CNG bus, Delhi, India (Markus Spring)



## **Solution 1.4: Use and operate clean vehicles such as CNG, LPG, LNG in public transport systems**

### **Objectives and implementation**

- Reduces air pollution and carbon emissions from public transport
- Compressed natural gas (CNG), liquefied natural gas (LNG) together with liquefied petroleum gas (LPG) have higher fuel efficiency and much lower emission of pollutants than diesel
- CNG, LPG and LNG vehicles can be operated in cities of all sizes
- Potential for considerable impact on air quality
- Reduces heavy reliance on traditional fossil fuels



## **Solution 1.4: Use and operate clean vehicles such as CNG, LPG, LNG in public transport systems**

### **Drivers**

- Cities can achieve climate protection objectives faster
- Reduction of operating costs

### **Obstacles**

- Gas is still a fossil fuel with CO<sub>2</sub> emissions
- Limited range of gas propelled vehicles (Broader use of LNG could resolve this)
- Although there are sufficient experiences in CNG and LPG, global exchange on the use of LNG in public transport is needed



## **Solution 1.4: Use and operate clean vehicles such as CNG, LPG, LNG in public transport systems**

### **Examples**

- CNG buses in Delhi (India), Berlin (Germany), Lille (France), Hongkong (PRC)
- LNG public buses in Guiyang (PRC)
- Xian public buses (PRC)

## Solution 1.5: Electric and hybrid vehicles in public transport systems



Figure 3: Hybrid bus, Germany



## **Solution 1.5: Electric and hybrid vehicles in public transport systems**

### **Objectives and implementation**

- A good opportunity to test and implement electromobility
- Electric vehicles help to reduce local air pollution and noise
- Hybrid vehicles have greater flexibility due to the extended range offered by a conventional aggregate
- Aims at attracting more passengers to clean public transport
- Scope: city and metropolitan wide
- Works best along dedicated corridors



## **Solution 1.5: Electric and hybrid vehicles in public transport systems**

### **Drivers**

- Decrease the reliance on the fossil fuel
- Use of local energy sources

### **Obstacles**

- Considerably higher cost (batteries)
- Limited range of the vehicles
- Climate conditions affect the reliability of the technology (e.g. reduced range in low temperatures)
- Higher operating costs, hence higher ticket prices?



## **Solution 1.5: Electric and hybrid vehicles in public transport systems**

### **Examples**

- China: Shenzhen electric buses, Beijing electric buses; Hybrid(gas) buses in Guiyang
- Europe: Aachen, Bremen





## **Solution 1.6: ITS for public transport**



## **Solution 1.6: ITS for public transport**

### **Objectives and implementation**

- Helps passengers to receive real-time information on arrival and departure times of vehicles
- Provides further information services to travellers
- Allows for monitoring of vehicles and traffic situations to respond to disruptive situations
- Can be applied at subway and bus stations
- Can be applied on board of vehicles using GPS and GPRS



## **Solution 1.6: ITS for public transport**

### **Drivers**

- Raises the attractiveness of public transport: shift from other transport modes
- Ensures the safety of public transport operation
- Makes management effective and convenient

### **Obstacles**

- Initial high investment
- Data acquisition and integration
- Maintenance and operation of technical equipment



## **Solution 1.6: ITS for public transport**

### **Examples**

- Most major cities in Europe and other developed countries
- Some cities of emerging economies are building the intelligent dispatch systems for public transport, but no good examples exist in China



## **Solution 1.7: Integrated planning of a public transport network**

## **Solution 1.7: Integrated planning of a public transport network**

### **Objectives and implementation**

- Align the public transport network and operation with the overall urban planning layout
- Often a subset of sustainable urban mobility planning
- Keep travel distances between urban functions short, efficient and manageable by walking, cycling and public transport
- Cross-sector cooperation inside the administration is important
- Best applied in cities (or areas of cities) with insufficient public transport capacities



## **Solution 1.7: Integrated planning of a public transport network**

### **Drivers**

- Demand for public transport, sustainable urban development and development within limited space

### **Obstacles**

- Fragmented competences,
- Differing interest of land use
- Resistance from society/inhabitants



## **Solution 1.7: Integrated planning of a public transport network**

### **Examples**

- Stockholm, Sweden
- Curitiba, Brazil
- Hefei BRT project
- Yinchuan BRT project





## **Solution 1.8: Financing public transport**



## **Solution 1.8: Financing public transport**

### **Objectives and implementation**

- Make sure that public transport has sufficient investment capital to keep high quality service and to keep up with increasing demand
- Balance between high quality service and affordable pricing



## **Solution 1.8: Financing public transport**

### **Drivers**

- Participatory decision making
- Good transport planning practices

### **Obstacles**

- Insufficient capital source (or willingness of decision makers to assign sufficient budget)
- unnecessary subsidies for public transport companies (and hence lack of competition)



## **Solution 1.8: Financing public transport**

### **Examples**

- Transport Tax, Paris, France
- Ticket system for PT in German cities and Japanese cities
- Beijing, China
- Ticket system PT in Dalian city, China



## **Solution 1.9: Integrated fare system**



## **Solution 1.9: Integrated fare system**

### **Objectives and implementation**

- One of the basic conditions to provide convenient access to a public transport system in a city
- Allows transfers within or between different transport modes with a single ticket that is valid for the complete journey
- Public bicycles or carsharing could be included



## **Solution 1.9: Integrated fare system**

### **Drivers**

- Encourage people to use public transport by simplifying switching between transport modes and by increasing the efficiency of the services

### **Obstacles**

- Need for cooperation of different authorities and operators
- Investments for corresponding equipment are needed



## **Solution 1.9: Integrated fare system**

### **Examples**

- London (Oystercard)
- Beijing, China
- Smart card for Japanese cities
- Bremen, Germany





## **Solution 1.10: Eco-driving for professional drivers**



## **Solution 1.10: Eco-driving for professional drivers**

### **Objectives and implementation**

- Eco-driving has the potential of saving up to 20% of fuel
- Improve eco-driving skills of bus drivers to improve energy use efficiency and reduce emissions
- Applied to professional drivers of buses, subways and light rail systems



## **Solution 1.10: Eco-driving for professional drivers**

### **Drivers**

- Reduction of fuel cost
- Reduced wear and tear of the vehicles

### **Obstacles**

- Continuous training efforts of drivers to maintain the level of eco-driving within public transport fleets



## **Solution 1.10: Eco-driving for professional drivers**

### **Examples**

- Demonstrated in various European transport projects, such as ACTUATE and BENEFIT
- Some companies in some cities in China have applied eco-driving of professional drivers.

## Solution 1.11: Bike sharing and public bicycles



Foshan, China



## **Solution 1.11: Bike sharing and public bicycles**

### **Objectives and implementation**

- Fixed rental bicycle systems will solve the 'last mile' problem in urban transport systems
- Provide truly door-to-door travel connections
- Provides means of transport for population in high-dense residential areas
- Best combined with public transport hubs



## **Solution 1.11: Bike sharing and public bicycles**

### **Drivers**

- Safe cycling infrastructure
- Good access to installations

### **Obstacles**

- Potential vandalism
- Obstruction of the operation
- Maintenance of the corresponding equipment



## **Solution 1.11: Bike sharing and public bicycles**

### **Examples**

- Amsterdam, The Netherlands
- Paris, France
- Berlin, Germany
- Hangzhou bike-sharing system, Changzhou bike-sharing system, China



# Thank you!

## Contact us:

[info@urban-mobility-solutions.eu](mailto:info@urban-mobility-solutions.eu)

[www.urban-mobility-solutions.eu](http://www.urban-mobility-solutions.eu)



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