

# **MAIN**

## **Model Application of Intelligent Public Transport Systems and Sustainable Mobility Policies in Ningbo**

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# Table of Contents

<b>0 ABBREVIATIONS</b> .....	<b>5</b>
0.1 ABBREVIATIONS .....	5
<b>1 INTRODUCTION</b> .....	<b>6</b>
<b>2 REVIEW OF INTELLIGENT PUBLIC TRANSPORT SYSTEMS (IPTS)</b> .....	<b>7</b>
2.1 OVERVIEW .....	7
2.1.1 Traveller Information .....	7
2.1.2 Electronic Ticketing .....	9
2.1.3 Operational Management.....	10
2.1.4 Safety & Security .....	10
2.2 APPROACH TO IPTS IN MAIN .....	11
2.3 ANALYSIS OF INFORMATION COLLECTED .....	11
2.4 CONCLUSIONS .....	12
<b>3 SUSTAINABLE MOBILITY REVIEW</b> .....	<b>13</b>
3.1 THE EUROPEAN PERSPECTIVE.....	13
3.2 CURRENT EU TRANSPORT TRENDS .....	14
3.3 AIR QUALITY.....	16
3.4 CLIMATE CHANGE.....	17
3.5 THE URBAN DIMENSION.....	18
3.6 HEALTH19	
3.7 EC PROGRAMMES AND PROJECTS .....	19
3.8 REALISATION OF MAJOR PROBLEM .....	20
3.9 MOBILITY SOLUTIONS .....	21
3.10 TRAVEL PLANS.....	22
3.11 HOME ZONES .....	23
3.12 ROAD PRICING .....	23
<b>4 EUROPEAN SUSTAINABLE MOBILITY CASE STUDIES</b> .....	<b>24</b>
4.1 SUSTAINABLE MOBILITY IN MERSEYSIDE .....	24
4.1.1 Policies .....	24
4.1.2 Merseytravel in Europe .....	25
4.1.3 Infrastructure projects in Merseyside .....	27
4.2 SUSTAINABLE MOBILITY ISSUES IN AALBORG.....	30
4.2.1 Policies .....	30
4.2.2 Aalborg in Europe .....	32
4.2.3 Infrastructure projects in Aalborg .....	33
4.3 SUSTAINABLE MOBILITY ISSUES IN NAPLES .....	34
4.3.1 CTP Policies .....	34
4.3.2 CTP in Europe .....	37

<b>5 SEMINAR REPORT.....</b>	<b>40</b>
5.1 SEMINAR REPORT.....	40
REPORT ON THE QUESTION AND ANSWER SESSION.....	41
<b>6 TRANSFER OF EXPERIENCE AND KNOW HOW.....</b>	<b>43</b>
6.1 MAIN PROMOTION.....	43
6.1.1 Main Website.....	43
6.1.2 MAIN Leaflet.....	43
6.1.3 MAIN in the wider media in China.....	44
6.1.4 MAIN in the wider media in Europe and the Rest of the World.....	45
6.2 MAIN SEMINAR.....	46
6.3 MAIN CONFERENCE.....	47
6.4 CHINESE DELEGATION VISITS TO EUROPE.....	47
6.4.1 Visit to Aachen & Bonn, Germany.....	47
6.4.2 Visit to Aachen, Germany and Gorizia, Italy.....	47
6.4.3 Visit to Aalborg, Denmark.....	48
6.4.4 Visit to Copenhagen, Denmark.....	49
6.4.5 Visit to Liverpool, United Kingdom.....	50
6.4.6 Visit to Naples, Italy.....	51
<b>7 ADAPTATION OF EUROPEAN IPTS TECHNOLOGIES FOR APPLICATIONS IN CHINA.....</b>	<b>52</b>
7.1 IDENTIFICATION OF THE REQUIREMENTS OF THE CHINESE MARKET.....	52
7.1.1 Key Findings of survey of Public Transport Users.....	52
7.1.2 Key Findings of survey of Operators.....	53
7.1.3 Key Requirements of the Chinese Operators.....	53
7.2 BACKGROUND OF THE ADAPTATION PROCESS.....	54
7.3 TECHNOLOGICAL FEATURES OF THE EXBUS SYSTEM.....	55
7.4 DESCRIPTION OF THE MAIN DEMONSTRATION.....	56
<b>8 CONCLUSIONS.....</b>	<b>57</b>

## 0 Abbreviations

### 0.1 Abbreviations

<b>AVL</b>	Automatic Vehicle Location
<b>AVM</b>	Automatic Vehicle Monitoring
<b>CIVITAS</b>	City–VITAlity–Sustainability
<b>CCTV</b>	Closed Circuit Television
	Compagnia Trasporti Pubblici Spa (Public Transport Company, Naples)
<b>CTP</b>	
<b>ECCP</b>	European Climate Change Programme
<b>EC</b>	European Commission
<b>EU</b>	European Union
<b>GPRS</b>	General Packet Radio Service
<b>GIT</b>	Global 1st Technologies
<b>GPS</b>	Global Positioning Systems
<b>GSM</b>	Global System for Mobile Communication.
<b>GDP</b>	Gross Domestic Product
<b>ICT</b>	information and communication technologies
<b>IPT.S</b>	intelligent public transport services
<b>ITS</b>	Intelligent Transport Systems
<b>LED</b>	light-emitting diode
<b>LCD</b>	Liquid Crystal Display
<b>MT</b>	Merseytravel (Merseyside Passenger Transport Executive)
	Model Application of Intelligent Public Transport Systems and Sustainable Mobility Policies in Ningbo
<b>MAIN</b>	
<b>NBJG</b>	Ningbo Public Transport Company
<b>NBST</b>	Ningbo Science and Technology Bureau
<b>PIT</b>	Public Interactive Terminals
<b>TFT</b>	Thin Film Transistor
<b>TTR</b>	Transport & Travel Research Limited
<b>WLAN</b>	Wireless Local Area Network
<b>WHO</b>	World Health Organisation

# 1 Introduction

This deliverable presents the results of Activity 3 of the MAIN Project. The MAIN project uses the experience of a group of European local authorities, transport companies and experts to assist the Chinese metropolis Ningbo to develop and validate a model implementation of sustainable mobility policies and intelligent public transport services (IPTS) and to disseminate this good practice to a great number of Chinese cities.

The overall objectives of the MAIN Project are to:

- ? stimulate enhancement of the urban social infrastructure in China with specific reference to transport systems and services
- ? develop and validate a model implementation of sustainable mobility policies and IPTS technologies that are based on European experience but suitable for widespread application in China
- ? foster the introduction of sustainable mobility policies and services in Chinese cities that will strengthen economic development in the cities without some of the adverse consequences that Western Europe has experienced.

Activity 3 (Capacity Building) of the project aims to adapt European experience with the development and implementation of sustainable mobility policies and IPTS technologies to the Chinese context. This has been achieved by a series of tasks:

1. An analysis of European IPTS technologies relevant to Chinese user requirements (as identified in Deliverable D2 “User Needs and Requirements Analysis Report”).
2. An analysis of sustainable mobility policies in Europe with specific reference to the 3 MAIN partner cities Merseyside (UK), Aalborg (Denmark) and Naples (Italy).
3. Transfer of experience and know-how by means of a series of educational visits in the European Partner Cities, attended by delegates from Ningbo City Government. These visits have allowed the delegates to get a real idea of the problems facing European Cities dealing with sustainable mobility issues, and how they tackle them. The MAIN Consortium has also already organised a seminar in Ningbo to reach a wider audience in the city and beyond (attended by representatives from the national ministry of transport), explaining the principles of sustainable mobility.
4. Adaptation of EU experience and specification of a demonstration IPTS system.

The results of the user needs analysis in Ningbo (D2) and the survey of good practice in Europe (D3) will be to develop a vision for sustainable mobility policies and transport systems in Ningbo and elsewhere in China. This vision was outlined in Deliverable 2 and will be elaborated during the remainder of the project.

The remainder of this report is structured as follows. Sections 2 and 3 provide a general review of Intelligent Public Transport Systems and Sustainable Mobility issues respectively. Section 4 describes local approaches to sustainable mobility in Merseyside, Aalborg and Naples. A report on the MAIN Seminar held in Ningbo in July 2004 is given in Section 5, while Section 6 describes how the transfer of experience and know-how has been organised. Section 7 examines how European IPTS technologies can be adapted for the Chinese market, and briefly describes the demonstration system to be installed in Ningbo. Some conclusions are drawn in Section 8.

## 2 Review of Intelligent Public Transport Systems (IPTS)

### 2.1 Overview

A comprehensive overview of the state of the art in the development and implementation of Intelligent Public Transport Systems in Europe has been prepared by the tr@nsITS project<sup>1</sup>. The review covers a number of ITS domains and is summarised below.

#### 2.1.1 Traveller Information

##### *Pre-trip - interactive individual media*

Such an application is generally based on Web services. It is provided to the end user either through his or her own home (or office) computer or through dedicated public terminals installed in relevant locations.

This kind of service normally allows travellers to decide:

- Whether they will travel or not;
- At what time (day – hour) they will travel;
- Which mode (or mode sequence) they will use;
- What budget they will need.

It will also provide them with operational data such as:

- Location of the trip starting point (in the public transport);
- Cost of the journey and of its components;
- Duration of the journey;
- Comfort and safety level;
- Joint or added services.

Pre-trip information should be multimodal, allowing the provision of information relative to any kind of mode and allowing a fair comparison between use of car and public transport. It should ideally become intermodal, providing information allowing door-to-door trips by a combination of modes. As a “Virtual Travel Agency”, it may also provide other useful information about accommodation, weather, exchange rates etc.

##### *Pre-trip – proactive collective media*

In this case, the public service operators or dedicated information service providers provide information to the potential passenger without him having to make any specific request. The media used can be either Radio, TV, dedicated public transport schedule screen (home/office terminal), or in the case of park and ride information: in-car terminal or Variable Message Signs.

The information provided is usually limited to bus/train/tram due times, or disruptions to the schedule.

### *On-trip – proactive collective media*

Two types of applications are available according to location:

#### *At stop (or in station) proactive collective media.*

The information provided here is mainly the waiting time before the departure of the expected bus, tram or train and is provided by an operator. In station such a system can also indicate the place where the bus tram or train will be found. It is provided by any operator and may be merged in a collective system. This information is distributed through collective displays or speaker terminals

#### *On board proactive collective media*

In this case the main information provided is the name of the next station and when necessary, safety or service linked information. The medium can be either on board display terminals or on board audio speaker terminals

### *On-trip - interactive individual media*

Two kinds of applications can be identified in this field:

#### *Publicly accessible systems such as Public Interactive Terminals (PIT)*

This kind of application is provided by transport operators, and will have two aims:  
Re-assuring of the traveller of his current location (Tracking)  
Providing ad-hoc local information about the remainder of the journey

Once the user has informed the system of his intended journey, the service operator server is then able to provide up to date information to the user on the remainder of his trip and especially what he has to do very precisely at the end of his current trip, or at the place where the device is located (PIT).

This kind of service needs tiling: provision of information about a mode, aboard or in the context of another mode, which implies a co-operation between operators.

#### *Privately owned systems: hand held terminals*

This kind of application aims to provide traveler information to travelers at any time, anywhere. "The information is always in the pocket". It uses interactive portable terminals such as pagers, GSM or Internet based GSM terminals. Pagers provide local specific information such as waiting times for a bus at a bus station, or level of traffic on a particular road. GSM provides customised intermodal information through short messages. Specific portable terminals provide customised intermodal information using a graphic interface.

Once the user has informed the system of his position and intended journey, the service operator server is then able to provide up to date information to the user on the remainder of his trip.

## 2.1.2 Electronic Ticketing

Electronic Ticketing and Electronic Fare Management have been attracting the attention of public transport users, operators and authorities for some years. While the first term is historically applied when a paper ticket is just being replaced by an electronic media storing the same data, the latter indicates a more comprehensive view. This, for example, could include automatic passenger registration without any user interaction, completely new fare systems or the integration of interservice, each of which may somehow integrate with conventional tickets as commonly known but are not necessarily restricted to them.

Looked at from the transport operator's point of view, three basic strategies can be identified as the main driving forces towards electronic fare management:

1. A first one says that many public transport operators try to attract new customers who currently do not use public transport. Although this has a positive economic impact on the operators in terms of revenue, market share etc., it is also in line with improving the modal split in cities and urban areas and with social, environmental and further aims of the public. The required knowledge and the necessity of purchasing a ticket prior to a journey may however discourage occasional users or those who are not familiar with local specifics from using public transport.

It is argued that electronic fare management can provide appropriate solutions to this problem by reducing access barriers concerning things such as

- a-priori knowledge of fares (Which ticket? Which tariff zone? Price information etc)
  - a-priori knowledge of how and where to buy a ticket (Where is a ticket vending machine? How to use it? Does it accept bank notes or credit cards?)
  - more user-convenient ways of ticket distribution (at any time, at any place, e.g. mobile phones)
2. A second strategy seeks to improve the intensity of using public transport. This relates to the fact that in many cases transport capacity which is available could be used by more passengers at no or little extra cost for the operator, thus improving its overall economic situation. Here the assumption is that occasional and frequent customers may use public transport more often if there would be:
    - reduced or no user-required actions through automatic passenger registration without the need to buy tickets
    - attractive and more customer-oriented fare systems
    - individual customer loyalty or bonus programmes
    - interservices, such as park & ride or access to leisure activities

Electronic fare management can reduce the restrictions on fare policies that are caused by the limitations of using conventional vending machines (e.g. only few buttons for ease of use). New fare systems can also be designed to satisfy the demands of different user groups or to take individual travel behaviour into account.

3. A third strategy tries to improve the operator's economic situation at constant demand. This can be achieved either by improving the overall efficiency or by increasing fare revenues; specifically by -
  - reduced usage and maintenance of vending machines and other distribution devices if replaced by automatic passenger registration
  - flexible, short-time and cost-efficient electronic adjustment of fares
  - replacement of cash money by electronic ways of payment

- reduced fare evasion and ticket forgery
- comprehensive and cost-efficient collection of statistical data
- revenue sharing between operators based on exact data

Also for this strategy electronic fare management can provide the appropriate solutions.

### **2.1.3 Operational Management**

This theme covers the ITS systems that support the daily real-time management of public transport fleet operations. Systems for railways or underground are not the main focus since these systems have their own specific requirements. Nevertheless, interconnections with these systems are taken into account and, if relevant, also experiences in their field can contribute to the development of better performing and more reliable systems for the control of fleet operations in a street environment.

Such systems are based on information and communication technologies (ICT) which allow voice communication and data transmission between the control room and the company vehicles on the network (buses, trams, trolleys, etc.), in order to perform fleet monitoring and generate related control actions, thus optimizing the company's operations (by means of increasing the commercial speed, the regularity, etc.) and guaranteeing a more efficient transport service to citizens. These systems are often referred to as "Automatic Vehicle Location Systems" (AVL Systems) or "Automatic Vehicle Monitoring Systems" (AVM Systems) since they provide Public Transport Companies with a set of relevant operational data on the fleet network service situation (bus position on the network, actual travel time/speed, amount of transported passengers, line regularity, lost trips, etc.) which is the basic information for the production process and verification of the planned public transport service. In literature and in southern European countries - mainly in France, Spain and Italy - these systems are also referred to as "SAE" or "SAEI" (Systèmes d'aide à l'exploitation et à l'information).

AVM systems have a strong relation to real-time passenger information systems. In many AVM systems, real-time information to the passenger is considered as an integral part of the AVM system.

### **2.1.4 Safety & Security**

There are three broad location categories for safety and security systems, each with two subdivisions:

- In-vehicle, with clear distinction between applications on rail-based modes (Commuter Rail and Metro) and street-based modes (Bus and Tram)
- At public transport facilities, with a clear distinction between Boarding Areas (platforms, bus/tram stopping places, termini) and Public Areas (Circulation Areas, concourses, stairs and passages)
- Control and supervisory points, with a clear distinction between Control Centres and Mobile or distributed personnel/workstations

Applications are drawn from a very broad range of possible ITS. Six categories can be identified, each with a range of associated potential applications:

- Image Gathering and Processing

- Alarm and Communications for Personnel and Passengers
- Simulators and Training
- Emergency Plan Management
- Vehicle Detection and Collision Avoidance
- Diagnostics

## **2.2 Approach to IPTS in MAIN**

In order to introduce the most appropriate European IPTS technologies to China within the MAIN framework, dedicated survey and analysis activities to identify good European practice in applying IPTS technologies have been carried out by the MAIN partners. The technical approaches for collecting relevant information and data include the following:

- Questionnaire survey for the MAIN partners
- Interviews with other relevant players in supplying and applying IPTS technologies.

All the MAIN European partner cities; Liverpool, Aalborg and Naples have completed questionnaires. This has provided information on establishing and operating IPTS services in the respective partner cities.

In addition, interviews have been carried out with key European IPTS suppliers, including telematica e trasporti (t&t), Gorizia, Italy and GMV, Valladolid, Spain to gain the first hand information from suppliers on the IPTS applications outside of the MAIN partner cities.

The information has been analysed with the Chinese specific conditions and requirements identified by 'Activity 2: Analysis of User Needs' in mind. These results are summarised in Section 2.3.

## **2.3 Analysis of Information Collected**

According to the information collected the IPTS applications which have been implemented in Europe have three integrated common parts. These three integrated common parts are the following:

- Central system installed at the control centre and including the central software system, number of servers and working stations;
- On-board computer and the related on-board devices, e.g. driver terminal, mobile communication device, GPS, visual display, voice information facility, etc;
- Intelligent Bus Stops (e.g. visual display, mobile communication device, etc).

**To give more specific information on these three parts:**

### **Control Centre**

- Real-time monitoring, including in most cases vehicle position and alarm; in some cases also fee collection, vehicle status, etc (e.g. the IPTS services in Rome supplied and installed by t&t);
- GPRS is commonly used for mobile communication; and in other cases also private radio communication and WLAN are used;
- Fleet management: vehicle dispatching support and fleet operation statistics(Aalborg);
- Passenger information service via internet(Naples).

### **On-Board Devices**

- GPS – which normally has positioning accuracy: 3-20 m;
- GPRS and WLAN are generally used for mobile communication;
- On-Board information supply by LED, TFT, which typically would provide information to passengers indicating next stop;
- In some cases voice announcement of next stop also provided;

- Ticket validator integrated with the on-board computer used in Naples, Rome, Valladolid;
- On-Board CCTV monitoring used in Naples;
- On-Board database is available.

### **Intelligent Bus Stop**

- GPRS is mostly used for mobile communication;
- Passenger information supply by LED or LCD, mostly indicating arriving time and route number, in some cases also bus location or destination;
- Multi-line display (mostly 3 lines, in Naples 8 lines);
- In most cases, automatic failure check and remote information input available.

## **2.4 Conclusions**

The practices employed in Europe for the setting up and running of IPTS were analysed against the needs and requirements of the Chinese Operators as defined by 'Activity 2: Analysis of User Needs'.

Based on this analysis, the following conclusions can be drawn:

- The European IPTS technology is in general quite in line with the Chinese requirements;
- Real-time monitoring of 'vehicle position' and 'vehicle operating status' is an important requirement within the operation of the IPTS control centre in China;
- GPRS and WLAN are more suitable mobile communication networks for application in China in comparison to private radio network due to the considerable investment necessary for this solution;
- On-Board information supply via on LED or TFT display and voice announcement are necessary parts of passenger information provided on-board, providing information on the next stop;
- Although it is not achievable to integrate the on-board computer with the ticket validator within the framework of the MAIN Project due to the current lack of the standardisation of systems. However the experience gained Naples, Rome and Valladolid could be very important for the Chinese public transport operators.

## 3 Sustainable Mobility Review

### 3.1 The European Perspective

Energy and transport are two key elements of the “Lisbon Strategy” agreed by the European Council in March 2000. The goals include the implementation of policies favourable to sustainable development in the energy and transport sectors. Current activity is based on two major Commission documents: the Green Paper “Towards a European strategy for the security of energy supply”, published in November 2000, and the White Paper “European transport policy for 2010: time to decide”, published in September 2001.

The analysis presented in the Green Paper leads to three observations:

- The European Union is increasingly dependent on external energy sources;
- It has very little room to manoeuvre in terms of the conditions of energy supply ;
- Unless the EU takes a proactive approach, it will not be able to meet the challenge of climate change, and in particular the commitments made in Kyoto.

The Green Paper proposes a clear strategy, based on controlling energy demand, with the transport sector being identified as one of two priority areas.

The Transport White Paper acknowledges that the European transport system still faces 3 major difficulties:

- imbalance in the development of different modes
- congestion on the main overland routes and in cities
- the major impact transport continues to have on the environment and on citizens' health.

The White Paper proposed four main priorities:

- Adjusting the balance between the different modes of transport
- Implementing the trans-European transport network
- Placing the user at the heart of transport policy
- Managing the effects of transport globalisation

To supplement its legislative actions, the Commission has supported research and technological development by allocating a substantial part of the budget for the Sixth Framework Programme of Research and Technological Development (FP6) to innovation in the field of renewable energy sources, energy efficiency and clean transport. Research has concentrated on 3 areas: reinventing urban mobility (the CIVITAS initiative), investing in hydrogen (CUTE) and other related activities. The Commission has also established a number of support programmes to FP6, including the new "Intelligent Energy – Europe" (EIE) programme, which addresses non-technological barriers to energy efficiency and the increased use of renewable energy sources.

Transport also figures prominently in the EU's Sixth Environment Action Programme (6EAP) and Sustainable Development Strategy. At its June 2001 summit in Gothenburg, the European Council singled out the transport sector as one of the four priority areas where sustainability policy development has to be put on a faster track. Achieving progress requires better integration of environmental considerations into all areas of transport policy-making.

### 3.2 Current EU Transport Trends

The second report from the EU's transport and environment reporting mechanism<sup>2</sup> shows that transport in the EU is becoming less and not more environmentally sustainable. Transport contributes to damage to the environment and human health by emitting significant levels of toxic pollutants and "greenhouse" gases, generating wastes and noise and fragmenting the countryside.

The report warns that current trends point away from achieving the EU's recently-announced objectives of breaking the link between economic growth and growth in transport. As a shift towards greater use of cars and planes continues, passenger and freight transport is growing at a faster rate than the economy as a whole, bringing increasing threats to the environment and human health. Furthermore, growth in energy use and greenhouse gas emissions from transport is jeopardising the EU's ability to meet its targets under the Kyoto Protocol on combating climate change.

There are some positive trends, mainly due to advances in technology and fuels that have made new road vehicles less polluting. A significant improvement in urban air quality has resulted, although in many cities air quality still poses health risks and further improvement is needed. The energy efficiency of car transport has improved slightly over the past two decades, although low occupancy rates and the use of heavier and more powerful vehicles have partly offset fuel efficiency gains in new cars.

The report argues that better integration of environmental considerations into all areas of transport policy-making is required to achieve progress towards a more environmentally sustainable transport system.

#### TERM 2001 - main findings and projections

- Between 1990 and 1998, transport sector emissions of acidifying gases fell by 20% and emissions of the pollutants that cause ground-level ozone "smog" – oxides of nitrogen (NOx) and volatile organic compounds (VOCs) – by 25%. However, extra efforts are needed - also in other sectors - to reach EU targets for reducing emissions of these substances.
- Energy consumption by the transport sector has increased by 47% since 1985, compared with 4.2% for the other economic sectors.
- Transport is responsible for 24% of the EU's total man-made emissions of carbon dioxide (CO<sub>2</sub>), the main greenhouse gas, with transport by road alone accounting for an 84% share of this. CO<sub>2</sub> emissions from transport increased by 15% between 1990 and 1998.
- The number of cars scrapped each year in the EU's 15 current Member States is expected to grow from 11.3 million in 1995 to 17 million in 2015.
- Transport infrastructure is increasingly fragmenting the EU countryside. The length of the motorway network has increased by more than 70% since 1980, while that of conventional railway lines and inland waterways has fallen by about 9%.
- The EU car fleet grew by 64% between 1980 and 1998 to 451 cars per 1,000 inhabitants.
- Trucking now accounts for 43% of freight transport in terms of tonnage carried and distance travelled (total tonne-kilometres), against 33% in 1980. Short sea shipping has become quite successful for longer distances, accounting for 42% of total tonne-km.
- "External" costs of transport – covering environmental damage, accidents and congestion – are estimated at 8% of gross domestic product (GDP). Cars, trucks and planes have the highest external costs per unit transported. Several countries are establishing tax or charge systems to include these costs in transport prices.
- Transport fatality rates are falling, but road accidents still claim 41,000 lives a year. The number of people injured is about 40 times the level of fatalities and is falling more slowly than the fatalities total.

<sup>2</sup> TERM 2001: Indicators tracking transport and environment integration in the European Union

- It is estimated that more than 30% of the population is exposed to traffic noise levels that can be annoying or harmful to health.

### 3.3 Air Quality

Air pollution has been one of Europe's main political concerns since the late 1970s. European Union policy on air quality aims to develop and implement appropriate instruments to improve air quality. The control of emissions from mobile sources, improving fuel quality and promoting and integrating environmental protection requirements into the transport and energy sector are part of these aims.

Motor vehicle emissions are regulated by Directive 70/220/EEC (light vehicles) and 88/77/EC (heavy vehicles) and amendments to those directives. A whole series of amendments have been issued to gradually tighten the limit values. Other relevant legislation includes Directive 96/62/EC, which defines the policy framework within which limit values for twelve air pollutants will be set, and Directive 99/30/EC, which sets limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air.

Road transport is a major source of most of the local air pollutants covered by the EU Directives. Pollutants from road transport are particularly important in busy, urban areas where meeting the Strategy's objectives is likely to prove most challenging. Road transport is responsible for a significant proportion of nitrogen dioxide and particles (PM<sub>10</sub>) – the pollutants for which the Strategy's objectives will be hardest to meet. Cutting road transport emissions is therefore a key part of local air quality management.

Emissions are measurably falling because of these measures, even though traffic volumes continue to rise. The implementation of the Auto-Oil Programme will result in further improvements in urban air quality. Stricter limit values on the emissions of carbon monoxide (CO), Volatile Organic Compounds (VOC), nitrogen oxides (NO<sub>x</sub>) and particles will be implemented for light vehicles in 2005 (Directive 98/69/EC) and for heavy duty vehicles in 2005 and 2008 (Directive 1999/96/EC).

#### 4.5(2)

##### Emission Standards for Road Vehicles

Passenger Cars (1)					
grams/km					
Petrol	as from (2)	CO	HC	NO <sub>x</sub>	
EURO I*	1.7.1992	4.05	0.66	0.49	
EURO II*	1.1.1996	3.28	0.34	0.25	
EURO III	1.1.2000	2.30	0.20	0.15	
EURO IV	1.1.2005	1.00	0.10	0.08	
Diesel	as from (2)	CO	HC	NO <sub>x</sub>	PM
EURO I*	1.7.1992	2.88	0.20	0.78	0.14
EURO II*	1.1.1996	1.06	0.19	0.73	0.10
EURO III	1.1.2000	0.64	0.06	0.50	0.05
EURO IV	1.1.2005	0.50	0.05	0.25	0.025

Notes : \* : as measured on new test cycle for application in year 2000  
 (1) "Euro III and IV" (Directive 98/69/EC) : standards also apply to light commercial vehicles (<1305 kg)  
 (2) the above dates refer to new vehicle types; dates for new vehicles are 1 year later

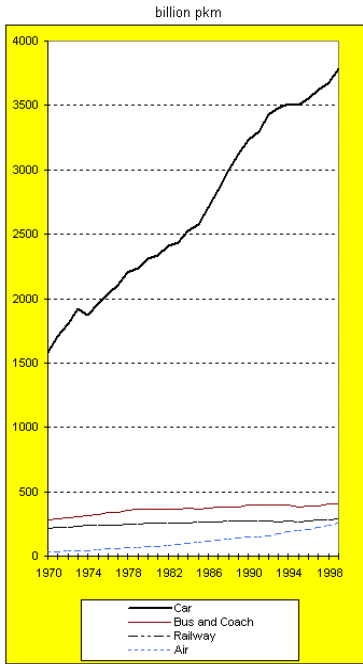
#### 4.5(1)

##### Emission Standards for Road Vehicles

Heavy Duty Vehicles (lorries)							
grams per kWh							
	as from :	test cycle	CO	THC	NMHC	NO <sub>x</sub>	Particulate matter (PM)
EURO I	1.10.1993	13-mode	4.5	1.10	-	8	0.612 <85 kW 0.36 >85 kW
EURO II	1.10.1996	13-mode	4.0	1.10	-	7	0.15(a)
EURO III	1.1.2000	ESC(c)	2.1	0.66	-	5	0.10 0.13(b)
		ETC(d)	5.5	0.78	1.6	5	0.16 0.21(b)
EURO IV	1.10.2005	ESC(c)	1.5	0.46	-	3.5	0.02
		ETC(d)	4.0	0.55	1.1	3.5	0.03
EURO V	1.10.2008	ESC(c)	1.5	0.46	-	2	0.02
		ETC(d)	4.0	0.55	1.1	2	0.03

Notes : (a) : until 30/11/1998 the particulate limit for engines <700 cc per cylinder and with a rated power speed of more than 3000 rpm was 0.25 g/kWh  
 (b) : for engines <750 cc per cylinder and with a rated power speed greater than 3000 rpm  
 (c) : measured on the European Steady Cycle (ESC)  
 (d) : measured on the European Transient Cycle (ETC)  
 "Euro I and II" : Directive 91/542/EEC; "Euro III, IV and V" : Council position December 1998 and agreed with the European Parliament  
 THC : total hydrocarbons  
 NMHC : non-methane hydrocarbons

**Performance by Transport Mode**  
EU15 : 1970 - 1999



**Emissions by Type of Pollutant**

Pollutant		Total emissions EU 15	of which :		of which :	
		1000 tonnes	1000 tonnes	transport	1000 tonnes	road transport
NO <sub>x</sub> Nitrogen oxyde	1990	13 257	7 080	53%	5 549	42%
	1996	11 932	6 255	52%	4 791	40%
	Evolution 1990-96	-10%	-12%		-14%	
CO Carbon monoxyde	1990	51 218	33 265	65%	31 394	61%
	1996	40 964	25 449	62%	23 124	56%
	Evolution 1990-96	-20%	-23%		-26%	
VOC Volatile organic compounds	1990	15 950	6 287	39%	5 726	36%
	1996	13 807	4 785	35%	4 267	31%
	Evolution 1990-96	-13%	-24%		-25%	
SO <sub>2</sub> Sulphur dioxide	1990	16 459	693	4%	467	3%
	1996	9 386	557	6%	371	4%
	Evolution 1990-96	-43%	-20%		-21%	

Source : Eurostat; "EEA Data Service, compiled by ETC/AE, October 1999"

In addition to advancements in the environmental performance characteristics of vehicles, a number of experiments and demonstration projects have been undertaken with alternative fuels such as Liquid Petroleum Gas, Compressed Natural Gas, biodiesel, methanol/ethanol, as well as battery-electric, hybrid and fuel cell drive trains. The operational performance of alternative fuel vehicles has, however, been mixed and their market penetration continues to be poor. Further demonstration projects are required to give operators confidence in the technologies, and manufacturers a platform on which to build the market. The EC has supported, and continues to support, both research and demonstration in this field.

**3.4 Climate Change**

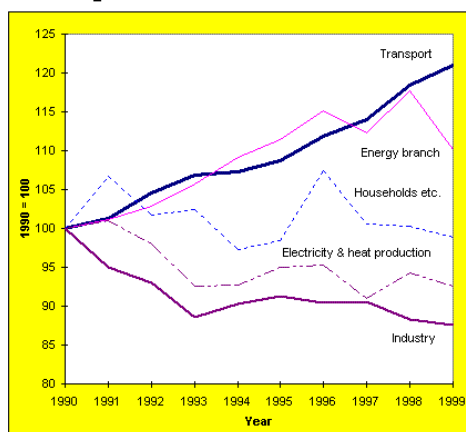
The European Union is at the forefront of international efforts to combat climate change, one of the greatest environmental and economic threats facing the planet and a top policy priority for the EC's Environment Commissioner. The Earth's average surface temperature rose by around 0.6°C during the 20th century and evidence is getting stronger that most of the global warming over the last 50 years is attributable to human activities, such as burning fossil fuels and deforestation, which cause emissions of carbon dioxide (CO<sub>2</sub>) and other 'greenhouse' gases.

The EU wants all industrialised countries to take urgent action to reduce or limit their future greenhouse gas emissions in view of the consensus projection by the Intergovernmental Panel on Climate Change that global average surface temperatures will rise by 1.4-5.8°C by the end of this century if 'business as usual' continues. This temperature increase could trigger serious consequences for humanity and other life forms alike, including a rise in sea levels of an estimated 9-88 cm over the period that could flood coastal areas and small islands, and greater frequency and severity of extreme weather events.

The latest monitoring data indicate that the European Union has delivered on its long-standing commitment to stabilise emissions of carbon dioxide (CO<sub>2</sub>) - the main greenhouse gas responsible for man-made global climate change - at their 1990 level by 2000. In March 2000 the Commission launched the European Climate Change Programme (ECCP) to prepare additional policies and measures, as well as an emissions trading scheme, to ensure that the EU achieves the 8% cut in emissions by 2008-2012 to which it is committed under the Kyoto Protocol.

4.2(1)

**CO<sub>2</sub> Emissions (EU 15)**  
**CO<sub>2</sub> Emissions from Fossil Fuels**



Regarding CO<sub>2</sub> emissions from passenger cars, the EU's aim is to reach - by 2010 at the latest - an average CO<sub>2</sub> emission figure of 120 g/km for all new passenger cars marketed in the Union. However, TERM 2001 warns that the trend of continuing growth in car use remains a problem if the Kyoto targets are to be met.

### 3.5 The Urban Dimension

Around 80% of the European Union's population lives in cities and towns. Urban areas are therefore the places where environmental problems most affect the quality of life of Europe's citizens. Urban areas also create environmental problems in their own right due to the high density of activities that take place there.

This high level of urbanisation within Europe means that there is a strong urban dimension to many of the Community's environmental policies. In addition, the urban environment is increasingly discussed as a subject in its own right as reflected in the requirement in the 6<sup>th</sup> Environmental Action Programme to prepare a [Thematic Strategy on the Urban Environment](#).

For urban local authorities, the [Sustainable Cities and Towns Campaign](#) brings together a series of 10 networks of cities involved in different aspects of sustainable urban development. The objective is to encourage and support local authorities working towards sustainability at the local level through initiatives such as Local Agenda 21 and the Aalborg Charter. The Campaign is the principal source of information for information on sustainable

urban development issues for urban authorities. Any local authority (including city, town or network of local authorities from any part of Europe) may join the Campaign.

### **3.6 Health**

Although much progress has been made in improving the quality of air, water and soil, the situation remains far from satisfactory. Today, there is evidence that factors such as particulate matter in the air, noise and ground-level ozone damage the health of thousands of people every year. Thousands of man-made chemicals, including pesticides, persist in the environment, accumulating over time and we do not know enough about their long-term effect on our health. Although a range of specific policy actions are being taken to address those problems, by themselves they are not sufficient to deal with the complex, cumulative interaction between our environment and our health.

Many acute environment and health related problems have been solved, but much remains to be done, in particular with respect to the health implication of chronic exposures, as reported by organisations such as the European Environmental Agency, WHO and a number of national organisations. They indicate that the interaction between environment and health is far more complex than is commonly understood. In particular, little attention has been paid to the interaction of different pollutants in the human body as well as in the environment. Even low level exposure over a period of time to a complex cocktail of pollutants in air, water, food, consumer products and buildings is likely to contribute significantly to the health status of European citizens.

It is estimated that around 20% of the burden of disease in industrialised countries can be attributed to environmental factors, with the bulk of this affecting children and vulnerable groups. The magnitude of the problem is also perceived by the majority of Europeans: in a recent survey, some 89% are worried about the potential impact of the environment on their health. Furthermore, new technologies, changing lifestyles, work and life patterns, present new and sometimes unexpected impacts on the environment and its influence on health.

The Community Action Programme on public health (2003-2008) takes the environment as a major health determinant, while the EU Research Framework Programmes have included specific actions on this issue. The overall objective of the strategy is to reduce the disease burden caused by environmental factors in the EU, to provide a healthy environment and to prevent new environmental health threats. This will require an integrated approach at European level ensuring the integration of environment and health concerns into other policy areas.

### **3.7 EC Programmes and Projects**

The Targeted Transport Projects, carried out in 70 cities under the European Commission's THERMIE energy saving programme<sup>3</sup>, represent the previous state of the art in terms of demonstrating the impact on air quality of advanced vehicle and fuel technologies integrated with transport management and land-use measures. The final report concluded that complex

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<sup>3</sup> [www.thermie-transport.org](http://www.thermie-transport.org)

demonstration projects in real world applications can be managed successfully, and they provide significant social and environmental benefits as well as pump-priming for the commercial exploitation of new technologies. The report also concluded, however, that much work remains to be done to gain public and political acceptance of the fundamental changes required to achieve sustainable mobility and to develop markets for energy efficient technologies in the transport sector.

A new Commission initiative was launched by in 2000. CIVITAS<sup>4</sup> - cleaner and better transport in cities - stands for City–VITALity–Sustainability. With the CIVITAS Initiative, the EC aims to generate a decisive breakthrough by supporting and evaluating the implementation of ambitious integrated sustainable urban transport strategies that should make a real difference for the welfare of the European citizen. CIVITAS I started in early 2002 with 19 cities clustered in 4 demonstration projects; CIVITAS II started in early 2005. with a further 17 cities in 4 demonstration

The objectives of the CIVITAS Initiative are to promote and implement sustainable, clean and (energy) efficient urban transport measures, to implement integrated packages of technology and policy measures in the field of energy and transport in 8 categories of measures, and to build up critical mass and markets for innovation.

Other significant EC Programmes and projects include the CATCH project in the LIFE-Environment Programme, and the LUTR Cluster. CATCH addresses similar issues to the CIVITAS projects. It is different in its emphasis, however, with its specific focus on the integration of environmental considerations into urban development and transport planning processes, in support of the 6EAP. The LUTR Cluster<sup>5</sup> in the City of Tomorrow Key Action (FP5) has synthesised best practice in urban land use and mobility planning.

**Finally**, results from a whole range of European projects connected to sustainable mobility can be found on the ELTIS website

### **3.8 Realisation of major problem**

Throughout Europe it has become increasingly apparent that mobility requirements cannot be met by continually expanding and extending transport provision, especially where this is based upon attempting to cater for unrestrained use of private cars.

This has taken a period of many years as the steady rise in traffic volumes, caused by growing car ownership and use, have occurred in line with high levels of affluence.

Future provision not only needs to offer the same level of mobility, but also needs to do this more efficiently and more equitably whilst being more environmentally friendly in the long-term.

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<sup>4</sup> [www.civitas-initiative.org/main.phtml?lan=en](http://www.civitas-initiative.org/main.phtml?lan=en)

<sup>5</sup> [www.lutr.net/](http://www.lutr.net/)

### 3.9 Mobility Solutions

Transport, health and the environment are intrinsically linked, and any means to address the negative impacts of transport need to recognise this fact. European policies on transport now recognise that energy use and therefore greater fuel efficiency can go some way to reduce resource use and pollution generated. However this cannot be done in isolation of supporting the use of more sustainable forms of transport and discouraging unnecessary car trips, particularly as car use and ownership are rapidly increasing.

Sustainable mobility can be achieved through a mixture of hard and soft factors, policies and fiscal measures, discouraging single occupancy or unnecessary journeys and encouraging and promoting more environmentally friendly and healthier forms of transport. In particular this means attractive, affordable, high quality integrated and efficient public transport systems, walking and cycling facilities, linked to appropriate land-use planning and decision-making.

In a society with high car ownership, alternative forms of transport have to be made more appealing to the individual who has a choice of transport.

Different approaches have been employed to do this by selling the health benefits of walking and cycling and promoting cost savings of car sharing.

In addition the use of technology not only to reduce emissions of vehicles but also to make best use of existing road space and to inform public transport users with the information they require (i.e. when a bus is due, if it's on time and where to catch it) have been used.

However underpinning all these issues there needs to be a well designed, efficiently operated and attractive system of sustainable public transport services from bus, rail, tram or ferry. This requires attention to be paid to all section of the public transport journey as set out below in 5 stages:

Enquiry - information is vital to allow the user to know when the bus or train is due:

Walk – to the stop or station needs to be accessible and safe and as short as possible

Wait – at the stop needs to be in a well designed environment where people feel safe and comfortable and are informed of when their bus or train is due

Ride – the ride on the bus or train must be accessible to all and be high quality service with efficient friendly staff giving a comfortable and enjoyable experience to the user

Walk – the final stage is the walk to the destination and this again must be short and especially in a city area, provide shorter link than from the car park

Any of these stages can be a deterrent to the user so all must be addressed effectively. High quality trains and buses are of no use if the user is concerned about the walk to the station or does not have accurate information about when the service is due to leave. For this reason information systems are especially important in attracting car users to public transport.

Real time information is employed across the European cities and regions e.g. Naples (Italy), Aalborg (Denmark) and Merseyside (UK) involved in the MAIN project.

There are also on line journey planners for planning journeys by public transport in Europe, one such example is available on Merseytravel's website [www.merseytravel.gov.uk](http://www.merseytravel.gov.uk). Journey Planners are designed to improve access to public transport to allow users to accurately plan their journey. Maps are available to identify where to get on and where to get off public transport.

Key innovations in Europe in the last decade have been in Travel Plans, Home Zones and Road Pricing.

### **3.10 Travel Plans**

Many European countries are looking to travel plans or mobility plans using soft factors to promote the use of walking, cycling, public transport and car sharing as a means to improve accessibility and equity in transport and also improve air quality and health. In the UK Travel Plans are mainly applied to business although residential developments are also targeted.

#### Transport and land use planning

Land is a finite resource; historically land has been swallowed up for transport and developments such as out of town shopping centres. These were designed to be fully accessible by fast road links and ultimately to those with private transport. Accessibility by more sustainable forms of transport had not been considered at the planning stages.

However, recognition of the increase in car journeys generated and the exclusion of non-car owners has reversed this trend. There is now more use of 'brownfield sites' to reduce the land taken up by transport and there is more integration between land use planning and transport. The recognition that we cannot build our way out of congestion has also rationalised the road building policies in Europe.

Planning Policy Guidance Note 13 in the UK addresses land use planning and sets maximum parking standards for developments to discourage use of cars for short journeys. It also gives planning authorities the powers to request travel plans with measurable targets for use of sustainable modes at new developments.

Public transport must be designed into new developments from the earliest planning stages so that access to bus or rail services can be made easy and efficient, and also bus routes are direct to avoid costly circuitous diversions. Stops, which are at natural focal points of the footpath network, and linked to other facilities such as shops and community services, can ensure that waiting can be secure and give the opportunity even to do some shopping before the bus or train arrives. Attractors should be grouped around stops and stations to maximise the catchment for any access point onto the transport network.

Improved signage and pathways for pedestrians and cyclists have made journeys more attainable by these modes but there are still safety issues associated. The increased dependency on cars has led to a decline in the use of these modes. School children previously cycling are now being driven to and from school due to perceived increased safety. There is a definite decline in cycle training for school children in the UK, with some

local authorities being more proactive than others; this downward trend has not been replicated in other countries such as Denmark and the Netherlands where effective land use policies have been employed along with pro cycling measures.

### **3.11 Home Zones**

The principles of Sustainable Mobility have also been applied to residential developments. The Home zone concept has been employed across Western Europe since its inception in the Netherlands in the 1970's. They aim to promote a more balanced use of street space for all users and to remove the predominance of the car. Streets are designed to ensure cars drive more safely and more slowly and allow pedestrians and cyclists to move freely.

Often these developments have an affiliated car club, which enables residents to enjoy the door-to-door flexibility of a car without the expense of owning one. When required, cars can be booked and used on a pay as you go basis. Developments also have improved cycle storage and can include preferential tickets for public transport to reduce car dependency.

### **3.12 Road Pricing**

Congestion is occurring on a daily basis in many European towns and cities. Action is being taken by national, regional and local authorities to improve public transport services or to charge road users for access to congested areas, as is now the case for drivers entering the central districts of cities like London and Genoa.

Road pricing charges drivers for the road space they use and is an important way to discourage unnecessary trips and congestion and to encourage use of more sustainable forms of transport including alternatively fuelled vehicles. Road pricing is also an important way to ensure drivers pay for the external costs generated.

Drivers in London spend 50% of their time in queues. A £5 (approx €7.5) congestion charge was introduced on 17<sup>th</sup> February 2003 to help to reduce congestion and unnecessary trips taken in the city centre. Since its introduction, the average reduction in congestion has been around 30% (TFL, April 2004). In addition, there have been increases in average bus speed and levels of patronage of public transport. A proportion of the revenue from the congestion charge is reinvested into public transport improvements in London.

Road pricing is becoming the most favourable and fair option to charge road users for the congestion and the negative effects they create whilst driving.

## 4 European Sustainable Mobility CASE STUDIES

### 4.1 Sustainable Mobility in Merseyside

#### 4.1.1 Policies

The Merseyside Local Transport Plan (LTP) has the following four key aims:

- To ensure that transport supports sustainable economic development and regeneration
- To moderate the upward trend in car use and secure a shift to more sustainable forms of transport such as walking, cycling and public transport
- To secure the most efficient and effective use of the existing transport network
- To enhance the quality of life of those who live work in and visit Merseyside

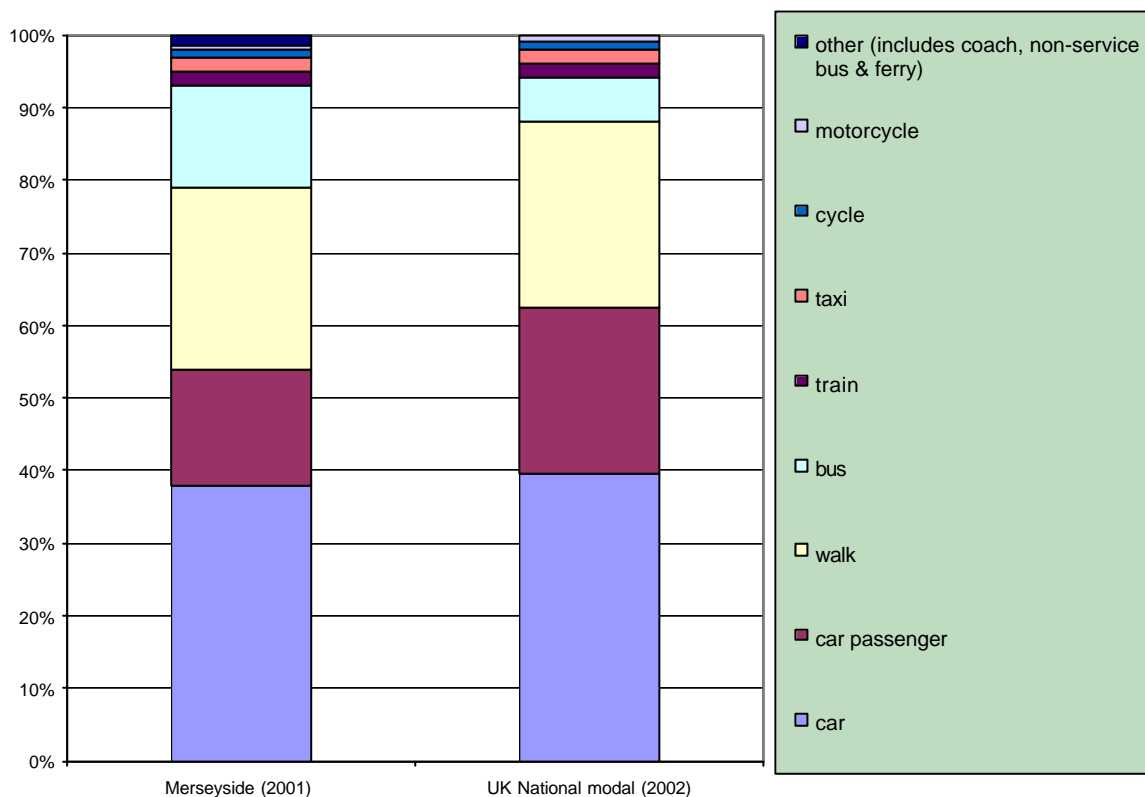


Fig. 4-1 Comparison between Merseyside and UK Modal Splits

It can be seen that Merseyside has a lower figure for car use, walking and cycling than the National figure but higher bus and taxi use.

Merseytravel, comprising the Merseyside Passenger Transport Authority and Executive, is committed to the implementation of a single integrated sustainable transport network for the region, which is accessible to everyone.

In order to ensure maximum accessibility for all the community, Merseytravel has a policy that Merseyside residents should not be more than 800 metres (m) from steel wheels (train or tram) or 400m from a bus stop.

The organisation issued an Environmental Strategy in 2001 that set out the policies to be adopted by all its business areas in support of this commitment and the organisation has also been accredited for its ISO 14001 Environmental Management System. Merseytravel promotes integrated transport in a number of ways; allowing bicycles on trains at no charge and during the peak hours and improving signing at rail stations to assist interchange with buses.

The deregulation of the UK bus industry in 1985 has meant that Merseytravel do not operate any commercial services. This has created a series of challenges in order to ensure stability of services, quality of vehicles and integration of ticketing and information systems.

Merseytravel does however procure socially necessary services. These services account for around 20% of the network and provide valuable links particularly in areas of high unemployment and social exclusion. The contracts for running these services are also designed to improve access and equity. Buses on subsidised services must have low floor accessibility for ease of use by passengers with mobility impairment, wheelchairs or push chairs.

In line with the Environmental Strategy, subsidised services are subject to:-

- all operators are in compliance with current statutory environmental legislation with regard to noise and exhaust emissions, and use best environmental practice
- all new buses must adhere to the latest Euro standard.

Merseytravel actively supports the introduction of buses using proven alternative technologies and continues to encourage operators to invest in pollution abatement equipment via the tendering process and financial incentives.

Merseytravel is committed to increasing environmental standards to improve urban air quality and believes influencing the environmental performance standards of the supported bus sector will affect the standards throughout the fleet.

#### **4.1.2 Merseytravel in Europe**

Merseytravel have taken leading roles in many European projects on sustainable mobility and have an extensive programme of promotion through the TravelWise campaign, green transport festival, Don't choke Britain and also plays an active role with Merseyside partners during International Car Free Day.

Actions by Merseytravel largely take the form of infrastructure improvements, projects and promotion. Merseytravel also works within the planning process to improve public transport routes and infrastructure at new developments.

Joblink

A new public transport service developed by Merseytravel. It is designed to provide improved public transport for people wishing to take up new employment, training or work-based learning. The service now consists of over 20 dedicated low floor buses consisting of fixed routes connecting areas of high unemployment with key employment sites and a demand responsive door-to-door service for clients referred by employment and training

agencies in Merseyside. Joblink is funded by an Urban Bus Challenge grant from the UK government, ERDF Objective One funding from the European Union, Single Regeneration Budget and Wirral Action Team for Jobs. Joblink is widely regarded as an innovative way to reduce social exclusion in Merseyside.

#### The Jupiter 2 project 1997

Its aim was to use a package of innovative vehicle technologies together with integrated traffic management and support measures to reduce the level of energy use and the pollutant emissions due to personal transportation. It included:

- Innovative vehicle technology combined with integrated traffic management
- Improved transport management and introduction of local electric buses
- Upgrade of park and ride service run on Compressed Natural Gas (CNG)
- Upgrade of bus services to run on clean diesel fuel with particulate traps on exhausts

Other features include improved bus shelter quality, with lighting and CCTV. Services are frequent and allow for interchange with other bus and train routes. All buses are fully accessible with real time information at bus stops and in some cases on board the bus.

#### ALTEReco

A demonstration of transport alternatives to protect the ecology of Europe running between 2000 and 2003. The project brought together partners from Italy, Denmark, Romania and the UK and was supported financially by the European Commission DG REGIO through the Ecos-Ouverture Programme.

In the UK, the Merseyside town of St. Helens devised a traffic management plan to reduce private traffic in the town centre- this was complemented by the introduction of new shuttle bus services using innovative battery-electric buses. The project was designed to be convenient and fully accessible. It also aimed to reduce journeys by private vehicles (cars) by serving the places that residents, students and visitors want to go to on a 15-minute frequency. The key aim was to enhance quality of life and environment for residents. The electricity supply for the buses was from renewable sources. High quality bus stops have timetable and real time information, information, dropped kerbs, tactile paving and lighting.

#### CATCH

Clean Accessible Transport for Community Health (CATCH) is a demonstration project in the European Commission's Life-Environment Programme and supports the Sixth Environmental Action framework by promoting sustainable mobility in order to improve air quality. Three European cities are taking part Liverpool (UK), Suceava (Romania) and Potenza (Italy). The beneficiary is Merseytravel, the Partners are: Liverpool City Council, Arriva North West and Wales Ltd, CTP Napoli (Italy), Suceava Municipality (Romania), TTR. The main finances come from the EC Life-Environment Programme (€1.48m) and the project is co-financed by the UK Government's Energy Saving Trust.

CATCH objectives are to:

- Promote sustainable mobility
- Develop an innovative, partnership-based approach to transport-related environment policy in Liverpool

- Improve urban air quality
- Contribute to the EC's Kyoto commitments
- Disseminate results and promote best practice
- Transfer knowledge and experience to other EU member states and Candidate Countries

So far, eighty-nine existing vehicles in the Arriva fleet operating in Liverpool City centre have had particulate traps fitted to reduce particulate emissions. There will also be 6 new hybrid vehicles running between the city centre and major education and employment sites. These actions are an integral part of Liverpool's Air Quality Management plan. CATCH also involves pollution monitoring in the city centre and has encouraged city centre residents to use sustainable transport; offering free public transport tickets, calorie maps for city centre walks and discounts at cycle shops together with cycle maps.

ECOtravel is the one-stop information bureau for both business and the public which aims to raise awareness of sustainable travel, alternative fuels and the environment on Merseyside. The bureau is part of the European Commissions (EC) funded CATCH project.

#### **4.1.3 Infrastructure projects in Merseyside**

Merseytravel's infrastructure projects are also designed to be fully sustainable and integrated. Two of the current major developments in Merseyside are the Merseytram and Liverpool South Parkway.

##### **Merseytram**

Will provide low emission transport and be fully accessible, connecting the city centre with areas of low car ownership, hospitals, investment areas and Liverpool John Lennon Airport. Merseytram is integral in realising Merseytravel's policy of every resident in Merseyside being within 800 metres of "Steel wheels" (train or tram).

##### **Liverpool South Parkway**

A major project to merge and redevelop two rail stations in South Liverpool (Allerton and Garston) into a public transport interchange. It will provide an important link in providing an efficient, fully accessible integrated public transport network. It will include secure cycle facilities, park and ride facilities serving Liverpool and the wider region, dedicated high frequency shuttle buses to Liverpool John Lennon Airport, new bus, rail and tram interchange facilities serving local, regional and national markets and improved bus/rail connections between Liverpool and Manchester airports. It is predicted that Liverpool South Parkway will reduce social exclusion in one of the most deprived wards in the Country.

##### **Other Rail infrastructure improvement schemes**

A variety of improvement schemes have been or are in the process of being implemented within Merseyside, from park and ride at stations, to completely rebuilding stations so that they are fully accessible to the mobility impaired. New stations have been built in development areas to help regeneration of the areas and improve access to employment, whilst new ones are planned.

Liverpool City Centre is at the heart of the region and the local rail network offers a frequent and reliable service along key travel corridors. The City Centre stations are Gateways for visitors and workers alike. A major improvement scheme is currently being developed for Lime Street Station with particular emphasis being made on improving existing interchange between rail and bus passengers and allowing for the introduction of Merseytram which will have a stop conveniently located outside the station. With major retail development taking place in the City, it is recognised that this will place further pressure on Liverpool Central Station, the busiest station on the Merseytravel Network. A study has shown that the station falls well below the standards that would be expected at such a busy station. There are proposals to upgrade passenger facilities and provide additional lifts so as to bring it up to the current disability and access standards.

### Quality Bus Corridors

Better, more accessible bus services are essential to Merseytravel's goals of improving accessibility for all in the community and assisting with regeneration. Quality bus corridors involve partnerships between bus operators, Merseytravel, local authorities and the local police. Specific routes along the corridors have high quality passenger infrastructure which is well maintained, includes comprehensive, up to date passenger information, fully accessible low floor buses, improved pedestrian access to the bus stops, bus priority measures and improved interchange facilities (where appropriate). All aspects are designed to make public transport more accessible and appealing. The corridors are modelled on the SMART bus services introduced in the mid 1990's and have been extended to include several major corridors across Merseyside. Fifteen new corridors were proposed in the 2001/2-2005/6 LTP.

### Sustainable Transport Promotion

A full range of examples of sustainable projects developed by Merseytravel and partners is in LTP Annual Progress Report. A number of more innovative schemes promotions are discussed below.

#### TravelWise

Merseytravel together with the 5 local authorities of Merseyside funds 7 people to form The TravelWise team which supports schools and businesses to develop Travel Plans across Merseyside.

The team also raise awareness and promote healthier, more sustainable forms of transport-including a series of bike rides that start and finish at Merseyrail train stations, bike week, Walk to school week and International Car Free Day. TravelWise have been integral in developing Merseytravel's own Travel Plan.

TravelWise have also launched an online car-share database for Merseyside, accessible from [www.gotravelwise.com](http://www.gotravelwise.com)

## TravelSafe

The joint initiative which includes Merseytravel, police and local authorities has the aim "to work as partners to create a public transport system that offers the opportunity for all members of the community to travel safely and without fear".

This is inherently linked to the overall Local Transport Plan aim of increasing use of public transport, as concern for personal security is a factor preventing access to and thus preventing usage of public transport. Similarly, staff providing this service deserve to be able to work without fears for their security, and this in turn will impact upon the security of passengers.

### Online Journey Planner

Merseyside Journey planner is accessible from the Merseytravel website. It plans journeys for an individual from start to finish and gives details of what is the best mode of travel, where to get on and where to get off. The journey planner also links with neighbouring counties of Greater Manchester and Lancashire and is regularly updated.

### Ongoing Issues

Although this report has outlined progress being made it must be stated that there remain challenges ahead ranging from full integration of land use and planning to the need to be able to effectively integrate bus networks with other modes when much is in the control of commercial operators. It is still a challenge to attract people to sustainable transport in the face of strong lobby and marketing promotion by car manufacturers

However, Merseytravel, through its firm sustainable policies and approach of consulting with community, developing solutions appropriate to local needs and implementing these using the best available technologies, design standards and people, are committed to transport solutions which will be sustainable on the long term for the benefit of future communities as well the present.

Further information can be found at:

[www.merseytravel.gov.uk](http://www.merseytravel.gov.uk)

[www.transportplan.merseyside.org](http://www.transportplan.merseyside.org)

[www.gotravelwise.com](http://www.gotravelwise.com)

[www.ecotravel.org.uk](http://www.ecotravel.org.uk)

[www.merseyrail.org](http://www.merseyrail.org)

[www.cleanaccessibletransport.com](http://www.cleanaccessibletransport.com)

## **4.2 Sustainable Mobility Issues in Aalborg**

With a population of 162,000 inhabitants, Aalborg is the fourth largest city in Denmark and the economic, cultural and educational centre of North Denmark. Being the centre of the county, a further 65,000 people in neighbouring areas form part of the daily activities in Aalborg – working, shopping, visiting public service facilities or making use of the recreational attractions in the city.

Aalborg can be characterised as two semi-circular urban areas reaching north and south of the Limfjord.

The city is geographically located where the distance over the Limfjord is shortest, and as a result the infrastructure for crossing the Limfjord has been placed here. Therefore the city has always been the connection to the northern part of Jutland and the transit route to/from western Norway and western Sweden.

The continuous growth in regional and interregional relations therefore has an immediate impact on Aalborg, and it faces the risk of becoming a future bottleneck, with adverse effects on the opportunities of economic development in the region and negative environmental impacts as likely consequences.

The annual growth in regional car traffic currently is around 3%.

### **4.2.1 Policies**

The transport policy in Aalborg is based on the principles of sustainability. Targets for reductions of the impacts of increased traffic - accidents, visual intrusion, noise nuisance, emissions of pollutants, energy consumption, etc. - were laid down in the 1994 Action Plan for Traffic and Environment. This plan adapted the national targets and specified local actions that would help meet these targets.

The Action Plan for Traffic and Environment was revised in 1998-99, reiterating Aalborg's commitment to solving the environmental problems caused by traffic. The targets of the 1999 plan that are still valid are:

- To achieve a sustainable development by balancing the need for mobility against the desire to minimise the environmental impact of traffic
- To reduce energy consumption and emissions in accordance with national targets
- To reduce the number of dwellings affected by traffic noise levels exceeding 65 dB(A) by 1,000 before 2010
- To reduce the number of fatalities and severe traffic injuries by 40% in 2007 compared to 1987

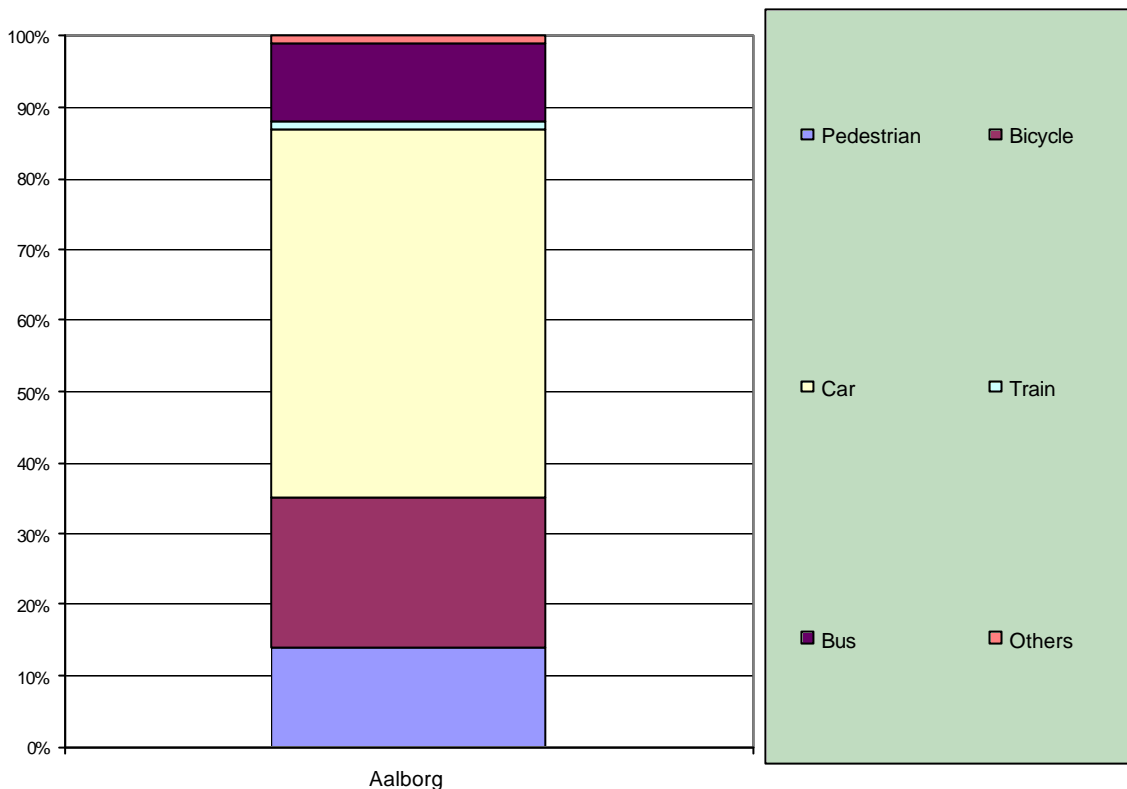


Fig. 4-2 Aalborg Modal Splits

The public transport plan was revised in 2004. One of the targets of the plan is to promote public transport where it is environmentally and economically sensible. This means that there is high frequency bus lines where the demand is high e.g. in the city centre and only few buses where the demand is low.

### The Aalborg Commitments

In 1994 the Aalborg Charter was adopted. Since then the Charter has been signed by more than 2000 European cities and towns working towards sustainability. Now ten years later, we are moving on from 'Charter to Commitments'.

Like many municipalities throughout Europe, Aalborg is ambitious to maintain and actively pursue positive development towards sustainability, thus enhancing the quality of life and the environment. In the coming decade, all our efforts for sustainable urban development will be underpinned by the Aalborg Commitments.

In order to carry out our responsibilities to the Aalborg Commitments we strive to develop better mobility with a reduction in traffic. We will therefore strive to:

1. reduce the necessity for private motorised transport.
2. increase the share of journeys made by public transport, on foot and by bicycle.
3. promote attractive alternatives to the use of private motor vehicles.
4. develop an integrated and sustainable urban mobility plan.
5. reduce the impact of transport on the environment and public health.

### **4.2.2 Aalborg in Europe**

The City of Aalborg has participated in several European projects during the last 10 years to become a more sustainable city.

#### **Jupiter**

In the period from 1993 to 1997 the City of Aalborg participated in the JUPITER project supported by the JOULE-THERMIE programme.

The overall aim of the JUPITER project was to promote the concept of the energy efficient city from the perspective of the transport sector.

#### **Quo Vadis**

In the period 1994-1996 the City of Aalborg participated in the Quo Vadis project partially funded by the EU programme DRIVE. The overall purpose of the QUO VADIS project was to investigate how best to use variable message signs to improve the traffic flow on a road network.

#### **Jupiter 2**

The JUPITER project was followed by a JUPITER-2 project which began in 1996 and was completed at the end of 1999. The project was especially founded on efficient public transport and bicycling.

#### **ALTEReco**

The ALTEReco project in Aalborg aimed to sustain the growth of the central business area by establishing an environmentally-friendly city centre and thereby attracting citizens.

The innovative and sustainable actions of the ALTEReco project in Aalborg have helped to fulfil the aims of the Aalborg Charter. Aalborg is investing in natural capital by increasing environmentally friendly urban transport.

#### **Viking**

Aalborg participates in the VIKING project together with cities in Finland, Sweden and the northern part of Germany. The project is supported by the EU, and it consists of five sub-projects.

Under the heading Information Networks, Aalborg is participating in the development of a National Traffic Information scheme for further integration into a common Euro-regional Action Plan for the mid-term perspective.

#### **Vivaldi**

VIVALDI is one of the projects within the EU-funded programme CIVITAS. It is a demonstration project aimed at reducing traffic and supporting sustainable transport in urban areas. The project started in February 2002 and ends in December 2005.

### **4.2.3 Infrastructure projects in Aalborg**

Two of the future major developments in Aalborg are a third link of the Limfjord and development of the harbour area near the city centre. The two projects are going to change the infrastructure dramatically in the whole area.

Today there are only two roads across the Limfjord in the Aalborg area. This means that all north-south going traffic has to cross at these two points and it faces the risk of becoming a future bottleneck. There is also a political wish to develop the city centre towards a more sustainable city. Therefore it is also necessary to have another link directing the traffic around the build up area. Construction of a third crossing will also include building of infrastructure around the new crossing.

The development of the harbour areas near the city centre will include the new House of Music and other recreational facilities. The new harbour areas will give a lot of different possibilities because it will form a large recreational area very close to the centre.

### 4.3 Sustainable Mobility Issues in Naples

#### 4.3.1 CTP Policies

In the last years CTP has pursued Sustainable Mobility policies according to the guidelines recommended by the Italian Ministry of Environment and ASSTRA, the National association grouping all Italian public transport operators.

Italian cities congestion point and environmental issues in general, are becoming more and more critical. In fact, as you this figure shows, the number of movements per year has increased in the last 40 years from 2.500 to 15.000, whilst at the same time, transport demand satisfied by local PT has decreased from 50.13 % (1960) to the 16.68 % (2000)

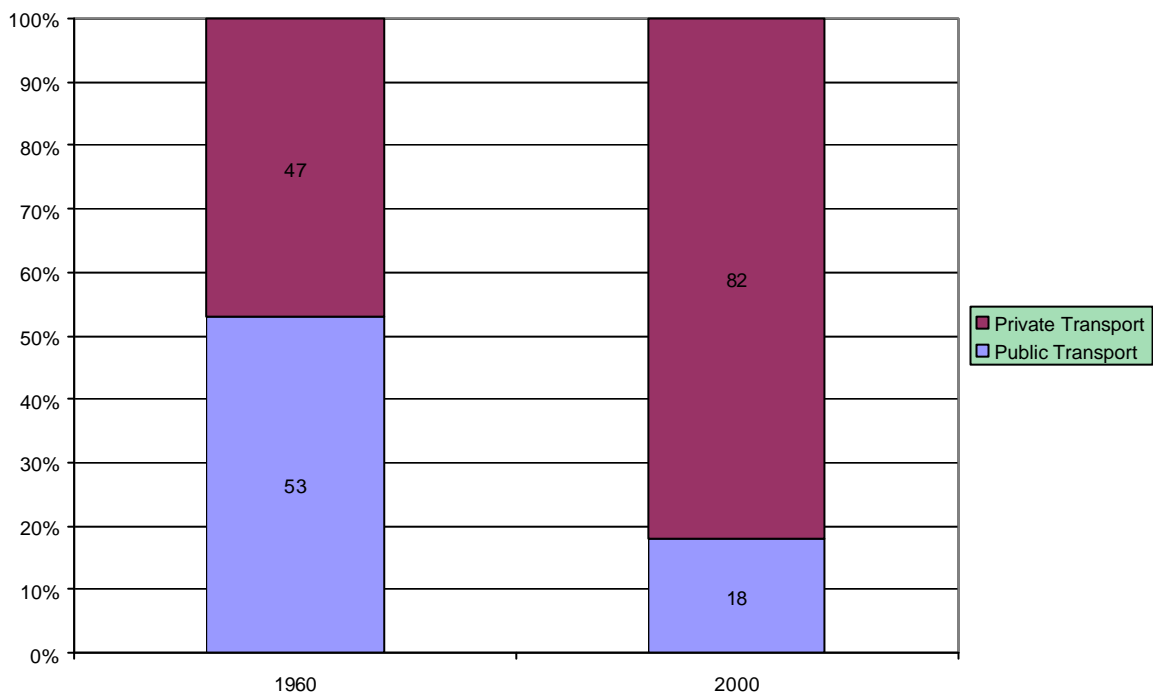


Fig. 4-3 Changes in Modal Split between 1960 and 2000 in Naples

Moreover, the modal split figure at a national level shows that the use of private car journeys account for 80% the movements.

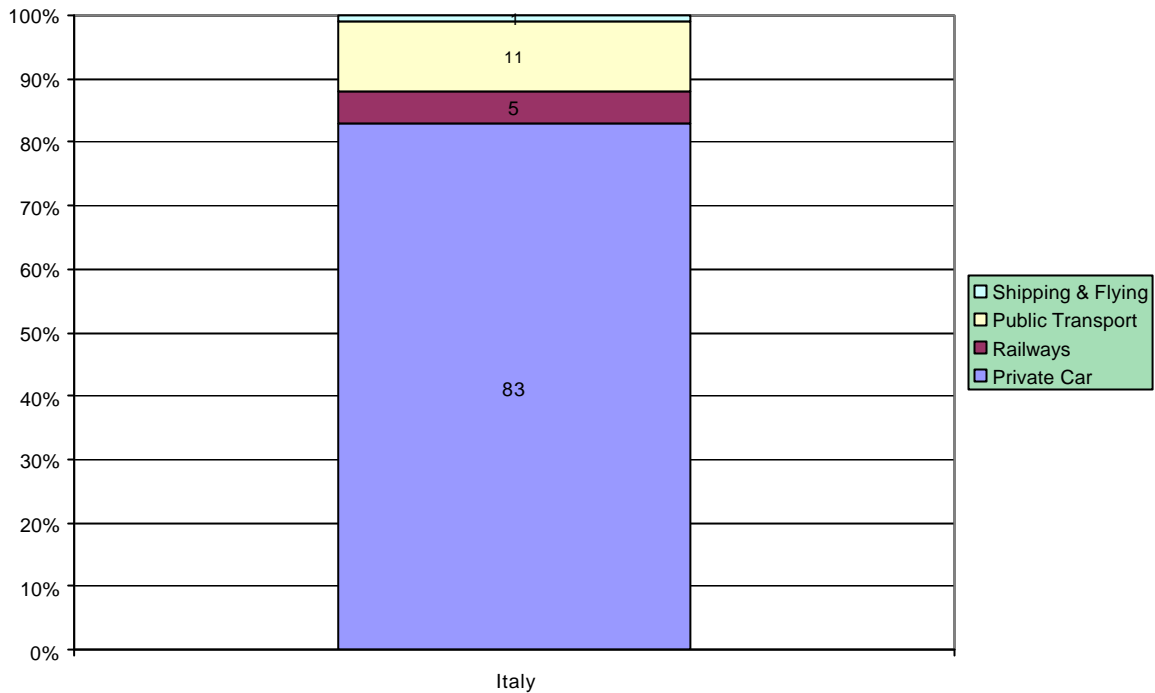


Figure 4.4 Modal Split at National Level in 2000 (?)

The key aims of these guidelines are to:

- Increase the standards of quality of local public transport to make it more attractive;
- Progressively equip and improve vehicle fleets resulting in a lower environmental impact;
- Promote the introduction of alternative fuels;
- Promote intermodality;
- Promote cultural change in mobility behaviour
- Implement flexible transport systems
- Introduce free or low emission zones inside urban areas
- Monitor the air quality in city centres
- Introduce a mobility demand management systems

CTP has developed activities at local level in order to achieve:

- Social sustainability
- Environmental sustainability
- Economic sustainability

Charter on sustainable development – in May 2003 CTP signed a charter on sustainable development during the UITP World Congress held at Madrid where the challenges to face and the ways to reach a sustained mobility in the future were specified. With this signature, the associates engaged themselves to carry out proper actions, contributing in short and long periods to sustainable development.

Moreover, CTP obtained the quality certification, in compliance with the UNI EN ISO 9001:2000, which places at the centre of the companies strategies implicit and explicit client needs and the elimination and/or reduction of those services non-conform. In 2004, CTP also

acquired the SA8000 certification demonstrating this way its engagement towards a social responsibility.

CTP has also increased the local public transport standards in terms of environmental impact and comfort, by renewing more than 60% of its fleet with new Euro III engines buses. As well as purchasing 6 diesel-electric, and 4 new euro 5 hybrids (natural gas- electric). All new buses are equipped with air conditioning, kneeling system and platforms for disabled people to increase customer comfort.

During 2003, CTP built a natural gas refuelling station and purchased 50 compressed natural gas buses.



Fig. 4-5 One of the fleet of Compressed Gas Buses in Naples

In order to improve air quality, CTP has extended its trolley network, resulting in the second longest in Italy and has purchased 10 new bi-fuel trolleybuses.



Fig. 4-6 A Trolley Bus in Naples

In relation to the introduction of alternative fuels, CTP has carried out a test campaign on the use of water-diesel emulsion. As there have been positive results, in terms of decreasing the

opacity of exhaust gases, by 2005, their buses will function with this kind of fuel for a total coverage of 300.000 km; this will be funded grants coming from the Municipality of Naples.

Besides the intervention on the buses, CTP have made modifications to its plants to decrease their environmental impact. Examples of this include the construction of Photovoltaic plants and solar thermal plants. In particular, CTP has already installed a 87 kWpeak photovoltaic power plant that will feed a recharge station for the new hybrid (natural gas- electric) buses, whilst other two 20 kWpeak plants are being constructed. All the photovoltaic plants will avoid, during their lifecycle estimated 30 years, the production of 3.620 tons of CO<sub>2</sub> due to the production of ca. 5.300.000 “green kWh”.

The solar thermal plant supplies hot water for 3 depots, thus limiting the emission of CO<sub>2</sub>.

CTP is also involved in the **Comfort Project**; this project is run under the guidance of the University of Naples / “Federico II” and with participation of ANEA, ANM and the Municipality of Naples. Through the Comfort Project CTP has analysed their employee from home to work modality choices by distributing questionnaires to their dependants. This provided information on the home to work movement modality making possible an offer for alternative and adequate transport solutions. This study will allow to the realistic evaluation of the use of private cars used for car pooling/sharing with other colleagues.

#### **4.3.2 CTP in Europe**

CTP has taken part in many European Projects which have covered a several areas relating to sustainable mobility these include; the promotion of cultural change in mobility behaviour, the implementation of flexible transport systems, the Introduction of free or low emission zones within urban areas, the monitoring of air quality in city centres and the Introduction of a mobility demand management system.

##### **ALTERECO**

The project, developed in the ECOSOVERTURE programme, regarding the urban sustainability studies. The following has achieved: the draw-up of a feasibility study for the introduction of a ZTL in the historical centre of Pozzuoli with a demonstrative phase (application and installation of variable message panels, technological bus shelter) has been carried out.

##### **LEONARDO**

Formation-planning and experimentation of Information Learning Centre relating to sustainable mobility.

##### **MEROPE**

This project, financed by the INTERREG III B - Medocc Area Program- has been developed in the Comune of Pozzuoli. The aims of the project were to study parking and mobility in the historical and urban centre in order to avoid congestion at embarking / disembarking points for the islands. As a result of this project, new regulation for parking and mobility has applied and new equipments installed.

## BESTRANS

This project is a thematic network on the methodology of analysis for energy and gas emission regarding urban transport. The participation allows for an exchange and comparison of data between the participating companies and assistance on the part of the union consortium association in the data elaboration.

*Ongoing projects*

## CATCH

This project foresees a study and introduction of a ZTL in the historical centre of Potenza. The purchase of hybrid buses and eventual other functional devices for ZTL and for the reduction / monitoring of the air quality levels

## PLUME

This is a thematic network in the area of the key action “City of Tomorrow and Cultural Heritage” of the 5th Framework Programme. In the field of an integrated use of land use and transportation planning, the aim of this project is to facilitate the transfer of the community research innovations to city experts across Europe with the aim of improving the quality of life in the urban areas.

## CTUE

The project aims to promote investments in human resources as a company strategy to develop the capacity to adapt to technological and organizational modifications.

## AGATA

The local project foresees a feasibility study for a DRTS flexible transport service in the rural areas of the Potenza Municipality. The strategic aims to obtain will be:

Make collective transport more efficient with integration between conventional and flexible services;

Increase the accessibility to collective transport for both vulnerable customers (disabled, old people, etc.) and for the marginal and rural areas;

- Create and sustain social connection between rural and urban areas;
- Reduce private vehicle movements and the accident rate.

## SMILE

The project foresees a creation of a Mobility Centre in the area of the Potenza Municipality for a realisation of Home-to-Work Mobility Plans, the experimentation of a DRTS - Demand Responsive Transport System, and the purchase of clean vehicles.

Within the SMILE proposal, the Potenza demonstration can be considered as a completion of the work already undertaken in Catch, and is aimed at stimulating a sustainable mobility environment in an urban context. In particular, the local project will develop the following main actions:

Realisation of Mobility Management policies;  
Implementation of clean vehicles within the local bus fleet.

Mobility Management policies will include:

The creation of the Potenza Mobility Centre, whose main function will consist in informing about local mobility and proposing, organising and managing sustainable mobility related activities;

- The creation of a Mobility Office within the principal traffic generators of the town. Their main task will be to promote and to manage the site mobility plan;
- The implementation of a web site concerning Potenza mobility system and distribution of informative leaflets;
- The introduction of two new transport services, "car pool" (crew definition based upon a single database) and "DRTS - Demand Responsive Transport System" service for people going to the centre from the suburban zones;
- The organisation of conferences and seminars regarding sustainable mobility in schools and work sites;
- The organisation of events "in centro senza auto" (in the centre without a car) where Potenza's town centre becomes a large pedestrian area;
- Organisation of training courses for personnel involved in Mobility Management activities;
- A before-after analysis in order to assess project effectiveness.

Finally, CTP developed other actions for social sustainability, among which the most important are:

- On-board CCTV and mobile telephones
- AVM - Automatic Vehicle Monitoring - system
- Engine fire control systems
- Smart cards
- On-board bus display
- International committee participation for security
- Contact Project for cultural mediation towards extra-European people

## 5 SEMINAR REPORT

### 5.1 Seminar Report

The MAIN Consortium ran a Seminar in Ningbo 1-2 July 2004 with the aim of sharing knowledge, know-how and experience in the areas of Intelligent Public Transport Systems (IPTS) and sustainable mobility. It was primarily intended for local stakeholders in Ningbo, but invitations were extended to the National Government in Beijing. The Seminar was well attended, with about 35 delegates from across the spectrum of Ningbo Local Government Organisations and Agencies, as well as delegates from National Ministry of Construction and from private companies.



Fig. 5-1 European and Chinese Delegates at the MAIN Seminar

This was the first opportunity for the European partners in MAIN to share with their Ningbo counterparts, their experiences with the use of Intelligent Public Transport Systems (IPTS) and real time information systems.

The session began with introductions presented by the partner city representatives introducing their cities with emphases on the public transport systems and initiatives. There were presentations on Ningbo, Merseyside, Aalborg and Naples. This gave a chance for all the delegates to understand the situation in the European partner cities and the efforts that have been made to maximise the advantages given by Intelligent Public Transport Systems (IPTS). This included technical information on the Systems itself as well as descriptions of the softer measures such as sustainable mobility policies that each city has in place.

There were also introductions to Intelligent Public Transport Systems (IPTS) in China and Europe given by the associate partners TTR and BPV. TTR also gave an introduction to Sustainable Mobility policies and concepts.

The Seminar provided a series of workshops to allow greater detail in the technical aspects of Intelligent Public Transport System (IPTS), Sustainable Mobility and also a brief introduction to Transport Policy Evaluation.

Copies of the PowerPoint presentations given are available on the website (www.main-eu.com).

## **Report on the Question and Answer Session.**

### Questions on Intelligent Public Transport System (IPTS) Technology Displays

#### **How are the bus stops powered?**

In Aalborg real-time information-enabled bus stops are located close to traffic lights in order to ensure a constant supply of power. Where this is not possible, a power supply has to be purchased from local suppliers. In Ningbo, it would be possible to share the power which feeds the street lighting during the hours of darkness. Installing batteries in the RTI-enabled bus stops which charge up during the night would be another solution which was expected to be feasible in Ningbo.

#### **How fast are data transfer rates and how much does it cost to operate RTI systems?**

In Ningbo, the data transfer rate is one gigabyte per day per bus stop. Information on data transfer rates was not readily available for EU cities. The cost of operation of RTI systems in Aalborg is sufficiently low that it is not an issue.

### Questions on Intelligent Public Transport System (IPTS) Communication

#### **What sort of on-vehicle equipment is required to operate RTI systems?**

In Aalborg the buses have a fundamentally standard CPU (Central Processing Unit) although it is much more physically robust than a standard CPU, in order to withstand the constant movement of the bus. The result is that the on-board computer costs approximately ten times more than the average computer. It also has a lower operating speed than an average computer in order to reduce heat emissions.

The portal used is standard XP.

### Questions on Sustainable Mobility

#### **Why is sustainable development taking so long to become a reality despite high levels of funding?**

Sustainable development policies and concepts are always fighting against an ever-changing situation. People are buying more and more cars. In general, the policies that European Governments are able to enforce are not tough enough. This is because it is elected officials that must make the really tough decisions to achieve modal shift away from the private car, but these officials are unlikely to be re-elected if the population do not like these decisions. The result tends to be policies of encouragement to try alternatives to the car rather than obvious restrictions to using the car.

#### **Why is the modal split for public transport reducing in Europe?**

In the UK, the population is very attached to their cars, and as a direct result, public transport usage is continuing to decrease. For the last 20 years, transport professionals have been aware of the trend of declining public transport usage, but it is only very recently that the problems caused by decreasing public transport and the corresponding increase in car

usage have become known to the general public. It is frustrating, as if this problem had been tackled earlier, the problem might not have escalated to the scale witnessed today.

### **Which bodies in Italy promote and communicate information about Intelligent Public Transport System (IPTS)?**

In Italy these functions are performed by local and national government.

### **Who manages the Intelligent Public Transport System (IPTS) that are used in Naples?**

Compagnia Trasporti Pubblici in Naples has primary responsibility for the Intelligent Public Transport Systems (IPTS). While a regional agency oversees all the programmes relating to public transport, this means that our company must respect the requirements that have been set up by these authorities.

In Denmark, all decisions at the strategic level are based upon the decisions made at the 'United Nations Conference on Environment and Development' held in Rio de Janeiro in 1992, and Agenda 21. The Aalborg Charter 1994 was based upon and further developed Agenda 21, which has been embraced fully by Local Government and the European Union. The Charter alone, however, is nothing without actions to support it, which is what the citizens require. In Denmark, there have been many actions taken, ranging from the introduction of very high tax on new cars through to many initiatives to encourage bicycle usage.

### **How have these initiatives and programs been financed?**

In Italy most of the projects are funded by regional government although often some of the money (up to 25% of the total) comes from the private sector.

In the UK almost all of the funding for Intelligent Public Transport Systems (IPTS) and Sustainable Mobility Policies comes from national government, via various funding bodies. As most of the public transport companies in the UK have been privatised, there is little funding available from such companies for projects to develop Intelligent Public Transport Systems. Private sector transport companies are interested in systems which will have a direct positive impact on their profits. In the case of Intelligent Public Transport System (IPTS), although transport companies have been convinced of their value in relation to fleet management and similar functions, they have yet to be convinced of the value of passenger information systems.

In Denmark there is a regional authority that has overall responsibility for public transport. Any work to develop IPTS is contracted out to the private sector, with the public sector funding all of the work and retaining complete control.

## 6 Transfer of Experience and Know How

### 6.1 MAIN Promotion

#### 6.1.1 Main Website

TTR has set up a website for the MAIN Project, [www.main-eu.com](http://www.main-eu.com), which provides a major route for dissemination for members of the general public, as it provides an overview of the project in both English and Chinese. There is also a private area for members of the consortium to see presentations that have been given at previous meetings and a discussion forum for matters relating to the MAIN Project.

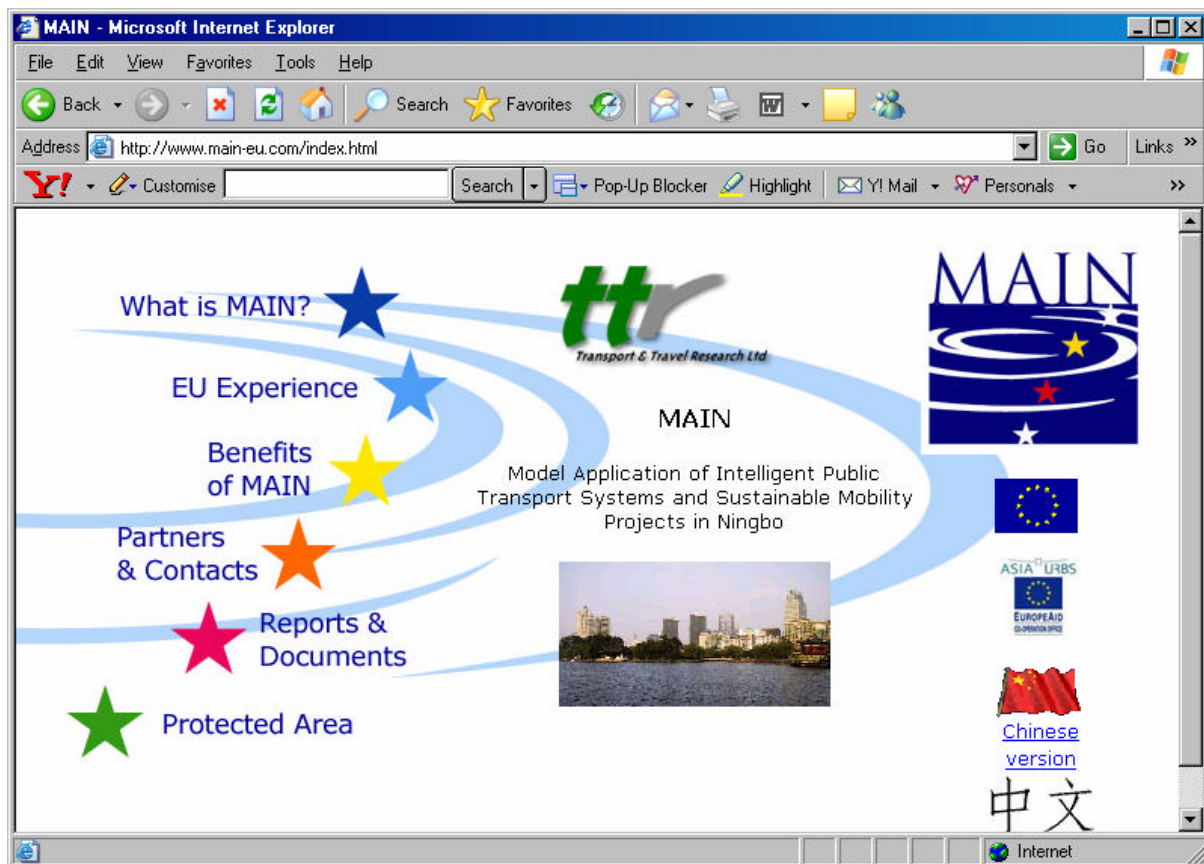


Fig. 6-1 Screen shot of the MAIN Website Front Page

#### 6.1.2 MAIN Leaflet

A Leaflet to publicise the MAIN Project will be produced in 2005, this will be an important marketing tool to attract delegates to the final conference in Ningbo. The leaflet will be bilingual, and will provide background on the project and further information about the conference.

### 6.1.3 MAIN in the wider media in China

The MAIN project has attracted some media attention in Ningbo, just before the seminar on the 29<sup>th</sup> June 2004, an article was published in each of the Ningbo Areas largest circulation newspapers, 'Ningbo Evening News' and 'Ningbo Daily'. The original articles are below, with abstracts of the articles in English.

**Ningbo Evening News Abstract:** 10 Experts from Britain, Denmark, Italy and Germany came to Ningbo to attend symposium on IPTS and sustainable mobility policy to solve traffic congestion problem in Ningbo. The MAIN project which has won financial support from EU; it will use European advanced IPTS to improve the intelligent level of Ningbo traffic and offer decision-making support for Ningbo sustainable mobility policy.

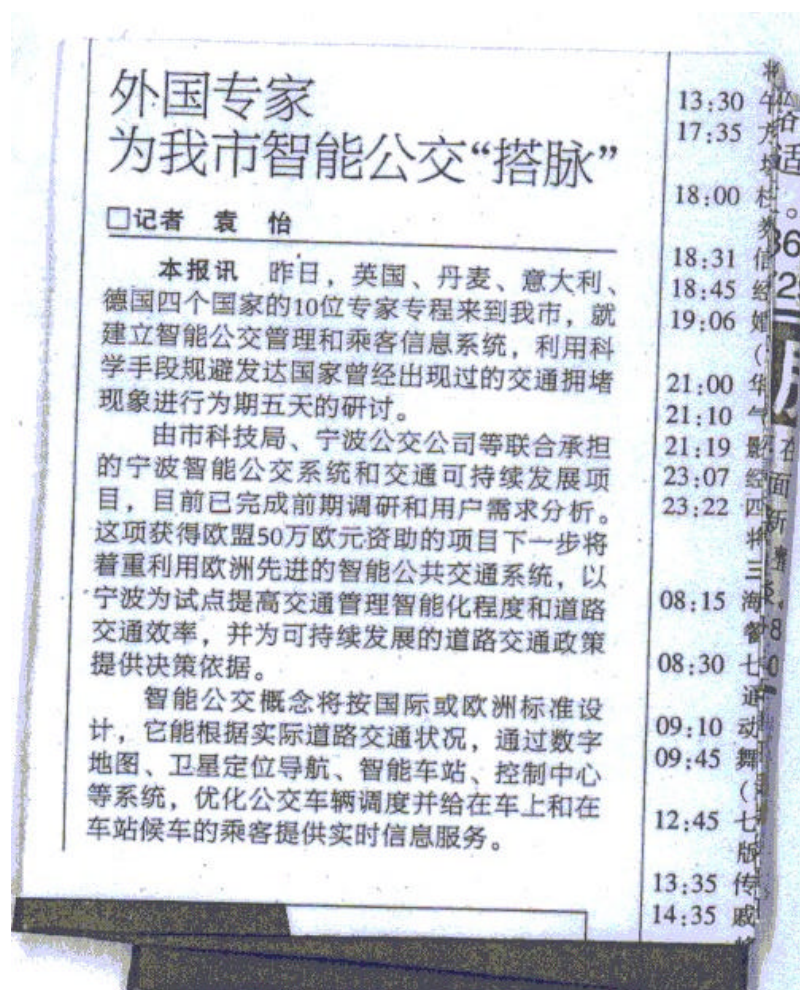


Fig. 6-2 MAIN Article Ningbo in Evening News

**Ningbo Daily Abstract:** MAIN project-Model Application of Intelligent Public Transport Systems and Sustainable Mobility Policies in Ningbo-is the first international science and technology cooperation project which wins support from EU. Yesterday, 10 experts from Britain, Denmark, Italy and Germany came to Ningbo to attend Consortium Meeting and Symposium. MAIN is EU's sole demonstration project in public transport area in China and it will be promoted nationwide after its success. The MAIN project will use European advanced

IPTS to improve the intelligent level of Ningbo traffic and offer support for sustainable mobility policy decision-making. The project is jointly carried out by Merseyside Passenger Transport Executive, City of Aalborg, Compagnia Trasporti Pubblici Spa, Ningbo Science and Technology Bureau, Beratung Und Planung Im Verkehrswesen, Global 1<sup>st</sup> Technology Company Limited, Ningbo Public Transport Company and Transport & Travel Research Limited.



Fig. 6-3 MAIN Article in Ningbo Daily

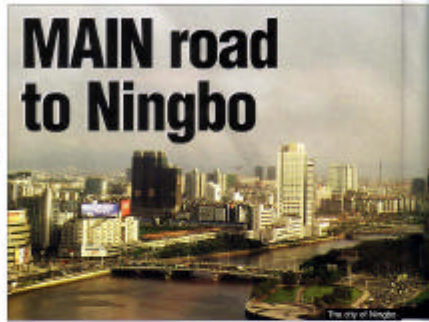
There was also coverage on the Seminar on Ningbo Local Radio on June 29<sup>th</sup> 2004; unfortunately no transcript of the programme is available. It is understood that an article was also published in the 'People's Daily', but the article has not been identified, so we are unable to confirm the existence of the article at this time.

It is hoped that the MAIN project will have at least the same level of coverage for the Final Conference.

#### 6.1.4 MAIN in the wider media in Europe and the Rest of the World

An article on the MAIN project was published in 'ITS International' Magazine (and also on their Website), as part of a 'Focus' on 'ITS in China'. This is particularly satisfying as it a magazine serving the Transport IT Community Directly. The article summarised background information on the project and provided contact information. Figure 6.4 shows the article as published in Volume 10, Issue 6, November/December 2004.

KATHERINE MCWILLIAM  
REPORTS ON A PUBLIC  
TRANSPORT INITIATIVE



**MAIN** (Main Application of intelligent public transport systems and sustainable mobility policies in Ningbo) is an innovative, two-year European Commission (EC) supported project. It aims to take advantage of lessons learnt in Europe over many years of building mobility issues through the deployment of ITS-based intelligent public transport systems (IPTS) and apply the results to China.

Modelled through the EC's Asia Urban Programme, it aims to share expertise in sustainable mobility, at both infrastructural and policy levels. It is meeting this objective by setting up a demonstration, in China, of a modern, intelligent public transport information system.

At the same time, it is establishing a forum for bilateral discussion of sustainable mobility policies. All Asia Urban funded projects are intended to promote an EU-Asian approach to good governance and project implementation, while generally raising Asian awareness of the European Union (EU).

MAIN is the responsibility of a consortium of private and local authority organisations from both Europe and China. All the European public-sector partners have extensive experience in running IPTS and, in particular, real time passenger information (RTPI) systems within their own cities.

The three European public-sector partners are the City of Aalborg Technical Department (Denmark), CTP (Spain) Eshel and Movimiento BNG. They are being supported by two consultants that are involved in providing technical assistance to China: Transport and Travel Research Ltd (TTR), from the UK, which is providing project management, and RPTV, from Germany, which is providing critical and technical design.

The Chinese side has two local governmental organisations: NSMG, the public transport operator of Ningbo, the Chinese demonstration city, and NMGIT, a department of the Ningbo People's Municipal Government (PMG). A joint-venture partner, CIT, provides technical support.

Ningbo lies in the Shaoxing River Delta about four hours' drive south of Shanghai. It has been the site of a major port since the Tang Dynasty, at the seventh century, and remains one of China's most significant maritime coastal cities, currently ranking as the world's 10th largest international port.

The city has a population of 5.9 million, with an average GDP per head of US\$3,400. It continues to experience rapid economic growth, owing, in no small part, to the outward looking policies that its government has adopted to attract manufacturing and investment.

With an increasingly robotised economy, and its progressively more affluent residents, Ningbo's PMG has recognised the importance of making public transport an attractive option for those that have a choice of using cars and other private vehicles. It intends to invest tens of millions of yuan (US\$ 1) per annum over the next decade.

The challenge of mobility is one that is being recognised all over China. The country's National Commission Ministry (NTCM) has stated that "with the number of vehicles in China increasing rapidly, the proportion of relevant accidents in the air is higher - and this is a particular problem in cities. The Chinese way of resolving this is to make a priority of developing urban public transport".



Ningbo already has an extensive public transport network, which enjoys high levels of usage. But the challenge is to maintain it up at current levels as ridership is spreading faster than ever - and, with it, their travel options. Public transport has to continue to be seen as an attractive option, and one way of defusing this is by providing enhanced passenger information services.

A selected demonstration route, which will benefit from the application of the MAIN real time information system, passes through the city's central business district (CBD) and connects its old town with the scenic Miaohe Lake, several hospitals and residential districts, as well as with an industrial zone to the east.

The MAIN Consortium intends to use the project to define a 'roadmap' implementation strategy for installing IPTS systems on

five routes in urban areas throughout Mainland China. It is also introducing a number of key sustainable mobility concepts from Europe.

Many of its European partners feel that, if the current trend continues in China as the country develops, with its high reliance on public transport and bicycles, then the country could experience economic, social and environmental benefits.

MAIN has already served as an effective knowledge learning process. The European delegates were themselves very interested in Ningbo's highly successful smart travel card scheme, which has been attached over a third of a million users.

On 22-23 September 2005 the MAIN partners are organising a conference in Ningbo to share lessons learned from implementing the smart demonstration. Further information is available from: Katherine McWilliam, katherine.mcwilliam@tr-ttd.com

MAIN is a consortium of Transport & Travel Research Ltd  
<http://www.tr-ttd.com>  
<http://www.aalborg.dk>  
<http://www.ctp.es>  
<http://www.rptv.de>  
<http://www.ttr.co.uk>

that are shared from Europe and other non-dependent societies. In other words, China has the opportunity to learn from mistakes that have been made within the Main.

The Consortium held its first seminar in Ningbo in July 2004, to share knowledge, know-how and experience in the areas of IPTS and sustainable mobility. The event drew around 50 delegates from across the spectrum of Ningbo local government organisations and agencies, as well as private sector representatives.

It also introduced delegates to the spirit of information that IPTS can deliver, beyond the obvious examples of 'real time' and 'time of arrival', and examined the technologies that are available to enable the design and dissemination of the information. The European partners explained the decision processes and choices that they take into consideration in deciding on a particular technology choice. The Chinese delegates were also interested in the other benefits that are achievable from an IPTS system, as well as a holistic approach to the use of resources.

November/December 2004

Fig. 6-4 MAIN Article in ITS International

A paper will be presented by David Blackledge TTR, to the 12<sup>th</sup> World ITS Congress in San Francisco in November 2005 focusing on the IPTS parts of the MAIN project. An abstract was also submitted for the European Transport Conference 2005 focusing on the Sustainable Mobility Policy, but this has not been accepted.

**6.2 MAIN Seminar**

The MAIN Seminar took place at the beginning of July 2004 a full report is in Section 5 'Seminar Report'.

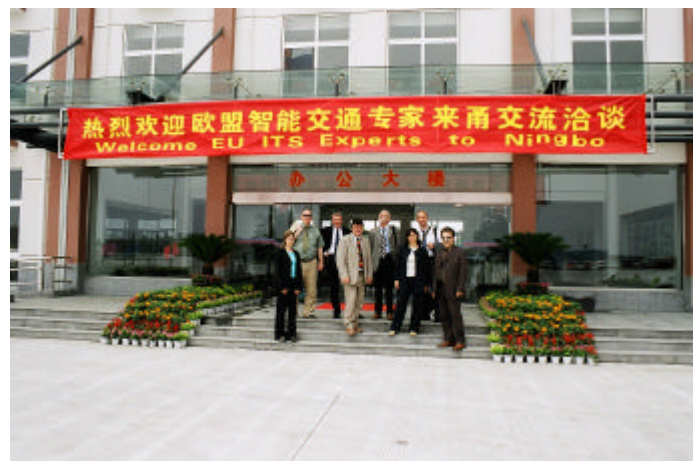


Fig. 6-5 EU ITS Experts are welcomed to Ningbo

The Seminar allowed the European Partners to share the knowledge they have gained through a history of running Intelligent Public Transport Systems (IPTS) and transport mobility policies. The attendees came from a diverse range of National Chinese Government,

Ningbo Local Government (and its agencies) and other private organisations in Ningbo. This totalled just fewer than 50 Delegates in all.

In section 6.1.3 there are some press cuttings that were stimulated in the Chinese Media, by journalists that attended the event. This means that the messages of the MAIN Seminar were spread to beyond those that attended the Seminar.

### **6.3 MAIN Conference**

The MAIN Conference is scheduled to take place in October 2005. It is hoped this will attract a wider audience from across Mainland China and will have twice as many attendees as the Seminar. The Conference will be another opportunity to share the experiences of the European Partners with Chinese Delegates, as well as being a forum for dissemination of information about the MAIN Project Demonstration and its evaluated results.

### **6.4 Chinese Delegation Visits to Europe**

#### **6.4.1 Visit to Aachen & Bonn, Germany**

Mr. Zhang Jianguo and Mr. Ni Fumo of Ningbo Science and Technology Bureau (NBST) paid a technical visit to Aachen and Bonn, Germany between 30<sup>th</sup> April 2004 and 9<sup>th</sup> May 2004. The key purpose of this technical visit is to exchange experience with the MAIN German Partner, Beratung und Planung im Verkehrswesen (BPV) in applying IPTS services and in learning first-hand experience with ITS applications in Germany.

The visit also included the following activities:

Seminar at BPV on Urban Transport Planning and Traffic Management (4 days);  
Visiting Fraunhofer Institut Autonome Intelligente Systeme in Sankt Augustin (1 day);  
Visiting traffic management and information service in Bonn (2 days).

#### **6.4.2 Visit to Aachen, Germany and Gorizia, Italy**

One of the MAIN Chinese partners, Global ITS Technology Co Ltd (GIT) carried out a technical visit to Germany and Italy between 18<sup>th</sup> and 30<sup>th</sup> October 2004. The purpose of this visit was to learn in detail about the EXBUS system from t&t, and to take part in a tripartite exchange of information and experiences with BPV and t&t, in adapting leading edge European IPTS technologies to be suitable for the Chinese users.

The other activities of the visit include the following:

- Technical seminar with BPV and t&t (1 day);
- Analysing the preliminary IPTS technology adaptation results achieved by GIT based on t&t technologies (5 days);
- Technical visit to Rome (1 day);
- Technical visit to Aachen (1 day).

### 6.4.3 Visit to Aalborg, Denmark

Mr Jiang, Mr Sang and Ms Wu from NBST (as well as the European Partners) visited Aalborg on the 22<sup>nd</sup> to 24<sup>th</sup> of November 2004, Aalborg Technical Department set up a interesting series of technical visits and presentations on many aspects of Aalborg's Transport Network and sustainable .

There were visits organised to various interchanges across the city of Aalborg, including a design award winning local Train Station 'Aalborg Vestby' and the new Compact Bus Terminal. This was of great interest to all the partners who wanted to see how this station worked in practice; there was also an interesting presentation by the operator of the bus station, Nordjylland Trafikselskab. This system of a compact bus station requires there to be accurate data. The partners were all impressed by the space saving opportunities that the bus station presents.



Fig. 6-6 Aalborg Compact Bus Station

The group also had presentations on sustainable mobility policy in the city of Aalborg, along with presentation on other aspects of the cities transport network such as the tunnels that run under the Limfjord. The group also went on a tour of new development area that has been planned, in the vicinity of Aalborg University campus, showing how public transport routes and facilities are planned from the early stage.



Fig. 6-7 Consortium Meeting in Aalborg

#### 6.4.4 Visit to Copenhagen, Denmark

Mr Jiang, Mr Sang and Ms Wu from NBST had a day of technical visits to Copenhagen on the 25<sup>th</sup> November 2004. The MAIN partners from Aalborg had arranged a comprehensive programme of technical visits, allowing the Chinese Delegates to experience the wide range of IPTS that are used in the public Transport Systems of Copenhagen.

The Greater Copenhagen Authority (HUR) gave a series of presentations which introduced themselves and their remit which covers aspects of the coordination and planning of public transport. HUR provided the delegates with an extensive explanation of the responsibilities of all those involved in public transport. The various networks of buses that operate in the Copenhagen were also explained. This led to in depth presentation on the 'A-Bus' system, described as a 'metro on the street'. One of the main characteristics of the 'A-Bus' is its simple clear passenger information, which is displayed systematically across the infrastructure and the fleet.

The delegates were also given an introduction to the ITS system that is used on the public transport system, where emphases was given to the cost effectiveness of the use of standard systems. Examples were given including IT on the 'A-Bus', Travel Planning and Use of the Travel Card. HUR explained that it was important to ensure that there was a seamless travel interface across the public transport modes that were available in Copenhagen.

The Delegates then went on at series of technical visits to see various aspects of the public transport in Copenhagen including the 'A-Bus' System and the local train network.

#### 6.4.5 Visit to Liverpool, United Kingdom

Mr Jiang, Mr Sang and Ms Wu from NBST visited Liverpool on the 26<sup>th</sup> November 2004; this allowed them to see a wide variety of Merseytravel operations. They joined up with the Liverpool City Council organised 'Moving on' Conference for a technical visit; this meant that they saw the Mersey Rail Station with focus on the new revenue protection barriers, and the Queens Square Bus Station Operations. They also got the opportunity of meeting with British public transport operators, commissioners and policy makers.



Fig. 6-8 The Chinese Delegates look at a Bus Stop Real Time Information Display in Liverpool

Merseytravel arranged for the supplier of their real time information systems, ACIS, to give a detailed presentation on the Merseytravel system. There was also a demonstration of how the system works en route; this allowed the delegation to see first hand how the signs at bus stops and signs on buses operate. The delegates then enjoyed seeing something of the culture of Liverpool experiencing a trip on the Mersey Ferries, and seeing the sights such as the Three Graces and the Cammel Laird Shipyards.



Fig 6-9 Jim Barclay, Merseytravel, presents Mr Jiang, NBST with a picture of a Mersey Ferry.

#### 6.4.6 Visit to Naples, Italy

On the 13<sup>th</sup> – 15<sup>th</sup> April 2005, the Consortium had a meeting in Naples, Italy. The host CTP arranged a comprehensive programme for the large delegation from NBST and NBJG, led by Dr Liu and Mr Tong respectively. This involved visiting various organisations and sights in Rome and Naples, seeing examples of sustainable mobility whilst seeing various aspects of Italian culture and history. The meeting was schedule to run concurrently with the EnergyMed Exhibition and Conference, which provided a showcase for various types of sustainable technology, from across Italy. The EnergyMed conference also had a series UITP (The International Association of Public Transport) Workshops running of which the delegation were able to take part in one; 'Public Transport responding to the Sustainability Challenge', this was particularly interesting as it gave more case studies from across Europe.

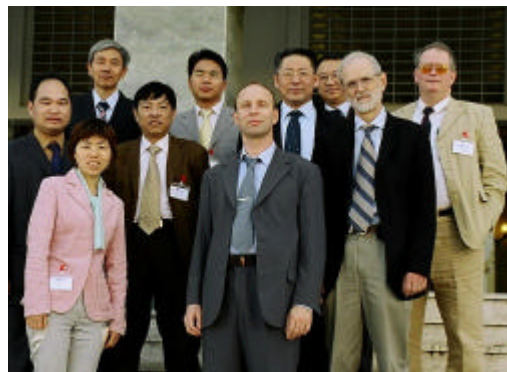


Fig 6-10 Consortium Members outside the meeting room, Mr Tong, NBJG, and Dr Liu, NBST, standing centre of middle row.

As part of the visit the consortium were shown the CTP new electric hybrid buses, where the smoothness of ride was admired by all. There was also an opportunity to visit Instituto Motori of the National Research Council, where electric engines are developed and designed, this gave a chance for the engineers of NBST to talk with engineers at the forefront of engine development in Italy. The Consortium Members were shown much of the city of Naples, where they were shown the historic sites and admired the food and culture of the city. A high point for all concerned was a reception for those at the EnergyMed in an 18<sup>th</sup> Century Palace, allow for further interaction between Chinese Delegates and European Sustainability professionals.



Fig. 6-11 One of the Historical Sites of Naples, The Duomo.

## **7 Adaptation of European IPTS technologies for applications in China**

### **7.1 Identification of the Requirements of the Chinese Market**

To define the system requirements of the Chinese markets, BPV with assistance from TTR and GIT, carried out a series of surveys to gather the opinions of various stakeholders and users. There were three principal methods of consultation undertaken to gauge the requirements. The three surveys undertaken were:

- Structured Questionnaire among politicians and local authorities.
- Questionnaire of public transport users.
- Survey across operators from other cities.

#### **7.1.1 Key Findings of survey of Public Transport Users**

35 public transport users were surveyed to gauge public opinion on public transport in the Ningbo area in general and intelligent public transport system plans in particular.

The key findings when asked about public transport in general were as follows:

- Only 27% of users think that current levels of public transport quality and efficiency are good, whilst 7% say that it is poor and 3% state that they are very poor. The remainder have neutral opinions.
- When asked about the public transport network 53% of respondents thought they were good. 3% thought they were poor with the rest stating they had neutral opinions.
- 70% of users felt that the public transport services met their requirements 'on the whole', 3% felt that they met their requirements completely and the remainder felt that they did not meet their needs.
- 40% of users do not change services the route between home and work, 33% of users change once on this journey, 23% change twice and 3% change more than twice.

When the users were asked about what sort of public transport information they would like, the key findings were:

- Users cited different information as important to them to have before they travelled these were travel cost 38%, best route 35%, sightseeing information 22%, and trip cost 5%.
- When the users were asked what information they would like to have at stops they cited the following; 30% start/end time, line route 26%, 22% vehicle location, 19% arrival time, 2% wanted travel location and 1% advertising.
- When the users were asked what they thought of the quality of bus stop information 57% were neutral, 23% were poor and 20% were good.
- The users were then asked about what information they would like to have on board, 25% stated the route direction, 24% travel time, 24% next stop, 17% weather information, 8% information on route length and 2% wanted information on the price.

### **7.1.2 Key Findings of survey of Operators**

Public Transport Operators were questioned from 26 cities across China, the key findings of this survey include:

- Two thirds of operators felt the service that they provide is of good quality service
- All the operators believe that more and/or better IT could improve their fleet management and vehicle scheduling.
- A large majority (83%) of operators do not have or are not happy with their current public transport management system.
- Half of the operators feel that they have good efficiency and quality, and another 17% felt that they have very good efficiency and quality.
- None of the operators were positive about the level of integrated fleet management and resource sharing, one third felt it was a critical issue and the remainder were neutral.
- All the operators felt that they needed optimisation of vehicle scheduling.
- The operators stated that a variety of information should be available pre-trip for passengers include best route (33%), travel time (27%), sightseeing information (20%), trip cost (13%) and 7% cited other things.
- The operators felt that at the stop it was important to provide the following information at the stop; Start/end time (28%), Service Route (28%), Arrival Time (22%), Vehicle Location (17%) and advertising (6%).
- The operators felt that the most important information to have for customers on the on board displays were the next stop (38%), route direction (38%) and travel time (23%).

### **7.1.3 Key Requirements of the Chinese Operators**

The Public Transport Operators also identified what they felt were the key requirements of any system. These include for the on-board devices:

- GPS Position function
- Voice Announcement and LED/LCD display in text.
- Keyboard operation through buttons and infrared remote display
- Ability to display messages sent by control centre
- Mobile communication to the control centre through GPS or CDMA
- Integration with other on-board devices.
- Ability to identify malfunction

These include for the Control Centre:

- Communication with vehicles and stops
- Data processing and analysis
- Monitoring and scheduling in real time
- Scheduling and line optimisation
- Passenger information service
- Network management
- Mechanism for Reporting and thus evaluation

These include for the Intelligent Stops:

- Receiving information from the centre through mobile communication network.
- Providing real-time passenger information particularly on arrival time and line information

## 7.2 Background of the adaptation process

Although advanced IPTS Technologies are now common within many areas of Europe, they have not been widely used within China. Therefore it was important to ensure that whichever technology is to be used in the MAIN demonstration is appropriate for the Chinese conditions. To do this the MAIN Consortium, lead by GIT and BPV analysed several leading edge technologies from different European Suppliers. The following are the key criteria used:

- Max. use of relevant European standards (e.g. DATEX, TRANSMODEL, etc);
- State of the art technology (e.g. open architecture, continuing monitoring of vehicle position and conditions, high-speed mobile communication, real-time passenger information on board and at the stop, etc);
- Strong interest of the system provider for the Chinese market and his willingness for business co-operation with local partners;

The selection has been based on in-depth surveys and analysis of five major European IPTS providers have been contacted and interviewed by Dr Xiwen Zhang, BPV, and the related technologies have been comparatively analysed by the above criteria.

The three principle suppliers that were contacted and interviewed by Xiwen Zhang are:

- telematica e trasporti (t&t), Gorizia, Italy
- GMV, Valladolid, Spain
- INIT, Karlsruhe, Germany

Further information was gathered from through a process of consultation with the European Partner Cities.

At the conclusion of this analysis it was decided that the EXBUS system of the Italian supplier, t&t (telematica e trasporti), met the requirements best. Therefore it has been selected as the basis for the MAIN IPTS demonstration in the City of Ningbo. The system will have to be modified to meet the needs of the Chinese users; the modification of the system will be done GIT with guidance from NBJ and input from BPV and t&t.

The EXBUS has been already installed in several European cities; most notably this system is in use in Rome. Figure 7.1 (\*taken from t&t website) shows the system in use in Rome.



Fig. 7-1 EXBUS System in action in Rome\*.

### 7.3 Technological features of the EXBUS System

The key features of the adapted EXBUS system should include the following:

#### On-board devices with the following major functions:

- On-board computer
- Mobile communication based on GPRS
- GPS positioning
- PC104 processor
- Interface to connect 6 additional on-board devices, e.g. ticket validator, passenger counter
- Voice announcement
- Driver terminal including alarm button
- LED display of real-time passenger information (one line with 8 Chinese characters)

#### Intelligent Stop with the following major functions:

- LED display of real-time passenger information (2 lines, each 6 Chinese characters)
- GPRS
- Power supply through Mains Supply (AC) or battery back up.

#### Control Centre Software with the following major functions:

- Localisation, monitoring and real time control of the bus fleet
- Vehicle condition monitoring
- Intelligent stop management
- Overall reporting on the bus service
- Emergency functions
- HMI in Chinese

Figure 7.2 provides an overview of the system used in the Ningbo Demonstration and the relationships between the various systems.

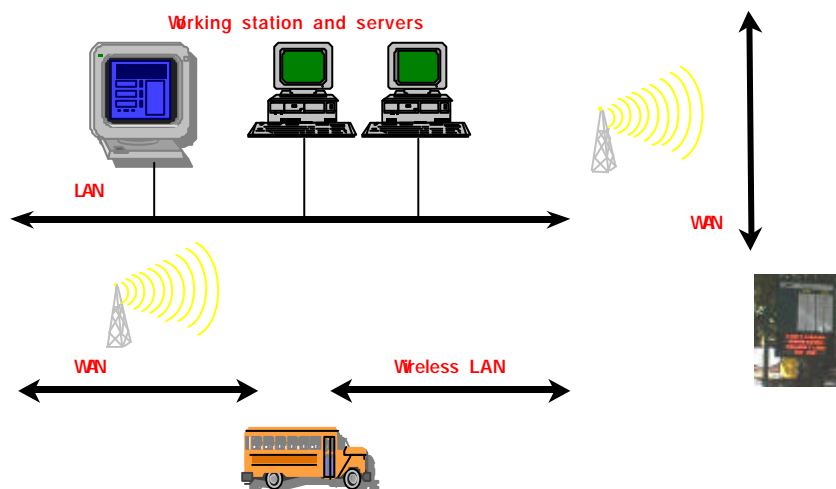


Fig. 7-2 Overall Proposed Intelligent Public Transport System Scheme

## 7.4 Description of the MAIN Demonstration

The adapted EXBUS system will be installed and tested on the Ningbo Bus Line 357 with a bus fleet of 32 buses and more than 30 stops in total. About 10 of the stops will have the IPTS solutions installed to them, NBGJ will use their knowledge and understanding of the network to decide which are the optimal stops to locate the IPTS Solutions at. These stops will be at a combination of heavily used stops, at modal interchanges and prestigious locations. The modifications to the IPTS have been made by GIT in close consultation with NBGJ and t&t, the supplier.

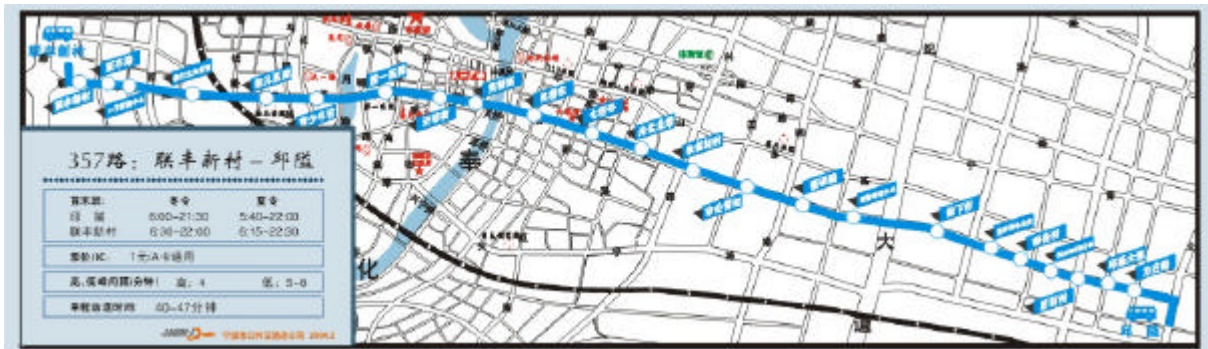


Fig. 7-3 MAIN demonstration route in Ningbo

Figure 7.3 shows the route that the demonstration bus route will operate on; it dissects the principle business area and connects together, several residential areas, schools and a hospital.

## 8 Conclusions

This report has presented progress with the Capacity Building aspect of MAIN in the first 18 months of the project. During this period:

- Desk reviews have been undertaken of IPTS technologies and sustainable mobility policies in Europe.
- The Chinese partners have benefited from detailed discussions with their European colleagues both at the Seminar in Ningbo and through visits to Germany, Denmark, UK and Italy.
- The work of MAIN has been publicised through the website and in the Chinese media.
- IPTS technologies have been chosen for the Ningbo demonstrator after consultation with politicians, local authorities, public transport users and operators in Ningbo and other cities in China.

The usage of IPTS as a development tool is very innovative. In Europe, IPTS is often identified as a method of increasing the quality and convenience of public transport as part of a package to attract the car user back onto buses, or indeed onto public transport for the first time. MAIN is pioneering the concept of improving service quality before the majority of the population has daily access to cars and is still using more sustainable modes. China at present has a relatively sustainable modal split with high dependency on public transport and cycling; the idea of the MAIN demonstration is to help end users to maintain that modal choice once they have the financial ability to choose to do otherwise.

Concerning sustainable mobility, it is to be hoped that China will also learn from European experience by implementing suitable policies and measures before serious problems arise with traffic congestion, environmental degradation and increased energy consumption.

The next steps in MAIN are:

- To implement the IPTS demonstration systems in Ningbo
- To develop the MAIN vision as an aid to the process of building sustainable mobility policies for China.
- To organise the Final Conference in order to disseminate the project results as widely as possible within China.