

**THEMATIC SYNTHESIS OF
TRANSPORT RESEARCH RESULTS**

PAPER 5 OF 10

URBAN TRANSPORT

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**European Commission
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EXECUTIVE SUMMARY

This paper provides a structured guide to the findings and policy implications of research relating to urban transport carried out in the Transport RTD Programme¹. (See Section 1 for advice on how to use the paper.)

There is a common perception that urban transport systems need to be improved. Congestion is a serious problem in many cities and set to get worse under current trends for growth in traffic. Air quality hotspots remain an issue, despite substantial reductions in vehicle tailpipe emissions. Public transport services have declined in the face of increasing use of cars, reducing the mobility of disadvantaged groups. Therefore policy action is needed to promote economic activity and quality of life for the 80% of the European Union's people who live and work in urban areas. RTD is providing a vital foundation for this, developing guidelines and tools to support the implementation of policy measures, and demonstrating their likely impacts.

In this paper, results are reviewed for "clusters" of research projects in ten inter-related areas:

Pricing

The work has identified the potential for optimising road user charges, parking fees and public transport tariffs to influence transport demand and travel patterns. Practical guidelines and calculation methods have been devised to support this, and demonstration projects have shown the likely impacts.

Traffic management

Case studies have provided real-life evidence of the effects of using urban traffic control systems, information systems, parking/access restrictions and other measures to improve traffic flows and encourage modal shift. Combinations of measures were shown to have the greatest effect, and good practice guides have been provided on their implementation, to help cities learn from each other's experiences.

Land-use/transport planning

Studies of existing practices have shown that aligning land-use and transport services, particularly through the application of planning controls, can reduce the need to travel in the longer-term. The work also highlighted the importance of accompanying measures to discourage car use, and the scope for improving the planning systems in many Member States.

Mobility management

Mobility management entails providing information services and co-ordination mechanisms to make better use of existing transport facilities. This can minimise the number of vehicle trips to major sites such as workplaces, for instance through car sharing. Projects in the Transport RTD Programme have been influential in raising the awareness of mobility management practices across Europe, through demonstration schemes in various cities and the preparation of good practice guides. Guides have also been provided on the use of information and awareness campaigns.

¹ Part of the Fourth Framework Programme for Community activities in the field of research, technological development and demonstration for the period 1994 to 1998.

Interchanges/interfaces

Guidance has been developed on good practice aimed at optimising the places where people change between transport modes. This supports the planners, designers and managers of interchanges, and includes significant recommendations on the use of consumer research and stakeholder participation in the planning process.

Infrastructure

Detailed results have been published on the effectiveness of physical traffic management measures such as parking management and bus priority in reducing car usage and modifying traffic flows, as a guide to city transport planners. Environmental benefits have also been estimated.

Non-motorised transport

Guidelines and other information tools have been developed to help city authorities in giving greater priority to safe cycling and walking. These include a review of good practice in the design of infrastructure and guidance on the implementation of a wide range of measures.

New transport concepts

The promotion of cleaner vehicles, freight distribution systems and innovative technologies can help to reduce congestion and environmental damage. In the freight area, significant RTD has focused on the potential for introducing freight transshipment terminals, capturing the lessons from European experiences and disseminating them to a wider audience. Similarly, software and good practice guides have been developed to help vehicle operators and policy-makers introduce cleaner vehicles and fuels.

Organisational strategies

Research into the organisational framework for urban public transport has concluded that “limited competition”, where authorities invite tenders for specified services, is to be preferred over full regulation or full deregulation. This work has been influential in the development of Commission proposals to revise regulations in this area. Guidance has also been developed on quality standards, to support the tendering process.

Indicators, tools and methods

Generic and specialist research has provided support for policy development. For example, RTD has provided modelling methods for the appraisal of pricing policy and traffic control systems. One of the most significant developments has been a handbook on the self-assessment of quality by transport operators, with anonymous results being fed into a public database for benchmarking purposes. This supports continual improvement by operators and also the tendering of public transport services by local authorities.

Highlights of RTD results

Pricing

The research found that pricing policy should be based on “marginal social costs”, charging users for the additional costs they cause through infrastructure use, including externalities such as accidents, air pollution, global warming and noise. Practical guidelines have been produced on the evaluation of these costs and the financing of urban transport systems, aimed at policy-makers, planners and transport operators.

In general, existing pricing mechanisms and levels were found to be failing to provide appropriate signals to influence behaviour. For example, greater differentiation in charges by time period and area is necessary to cope with congestion resulting from heavy peaks in travel demand. Electronic road pricing may form one part of the solution, but other pricing measures such as parking and cordon charges can be more cost-effective and practical in many situations. In general, pricing reform to reflect marginal social cost is likely to involve an increase in the price of urban road travel (particularly for the private car), although this varies according to the local situation.

Pricing at marginal social cost was shown to reduce traffic levels by up to 30% at peak periods, mainly by encouraging drivers to travel at different times or by different routes (in preference to switching to public transport). Public acceptance is low, but can be improved by earmarking revenue for public transport. This action can also help to sustain accessibility. The equity effects of pricing were estimated to be moderate.

Surveys have indicated that the legal and institutional frameworks required to implement marginal cost-based pricing for urban transport have, so far, not been put in place. This will require action at a national level, for instance to introduce institutions with the powers to control transport pricing across urban regions and across transport modes.

Traffic management

Studies have shown that incentive (“pull”) measures such as an increased public transport service, if applied alone, are rather ineffective in stimulating a switch from private cars. By comparison, “push” measures such as parking and cordon charges alter the modal split significantly. But the greatest reductions in car trips result from *combinations* of pull and push measures (e.g. Park & Ride facilities, parking controls plus restricted access zones). A good practice guide has been developed for the selection and implementation of such strategies by city authorities. This covers some 30 measures, illustrated by case studies.

Advanced traffic management systems also yield the greatest benefits if used in an integrated way. For example, combined urban traffic control, public transport management and driver information systems have cut travel times and reduced emissions by 20%. A guidebook on such systems has been compiled for transport managers and local authorities, summarising their effects, infrastructure requirements, factors affecting the benefits, and other implementation issues. Also, a new low-cost approach to the design of traffic signal timings has been developed and demonstrated. In contrast to current design tools, this takes account of travellers’ responses to changes in signal timings (such as re-routing), and allows signal timings to be optimised to meet a variety of traffic management goals.

To help cities learn from each other, a web-based database has been developed covering experiences with over 200 legal and regulatory measures used in 41 European cities. It enables stakeholders at a city level to search for examples of experiences with measures that interest them. However, certain measures may require amendments to national legislation or new local regulations before they can be implemented effectively

Of course, in applying case study results elsewhere in Europe, it is essential to note that benefits must be estimated for the *local* situation. But the research *has* shown that simulation can provide a cost-effective means of *screening* alternative solutions prior to pilot-scale or full-scale implementation, as well as pointing to promising options. In addition, guidelines have been devised to aid cities in assessing the transfer of experiences to their own situation.

Land-use/transport planning

Scenario analysis has shown that the likely travel reductions from traffic management and pricing measures are only of the order of one or two years' growth in demand. Policy actions are still desirable (e.g. to encourage a more efficient use of the transport system), but the lesson is that there is no *simple* strategy that will dramatically affect levels of urban congestion in the short to medium term. Therefore there has been strong interest in the use of policy to change patterns of land-use *in the longer term*, aimed at reducing the extent of vehicle movements.

A review of existing practice in the combined planning of land-use and transport indicated that:

- These policies are only successful in reducing travel distances and the share of car travel if they make car travel less attractive (more expensive or slower).
- Land-use policies to increase urban density or mixed land-use (e.g. locating homes near factories and services) without accompanying measures to discourage car use have only little effect.
- Policies to make car travel less attractive depend on trip start and end points not being excessively dispersed already. For instance, the increase in multiple worker households sets limits on the co-ordination of work places and residences.
- Large dispersed retail and leisure facilities increase the distances travelled by cars and the share of car travel. Land-use policies to prevent the development of such facilities are more effective than land-use policies favouring high-density mixed-use development.
- Fears that policies to constrain the use of cars in city centres are detrimental to the economic viability of those centres have in no case been confirmed by reality, except where massive out-of-town retail developments have been approved at the same time.
- Planning systems in many Member States fail to integrate spatial development with transport and environmental aspects.

Mobility management

Mobility management aims to make more efficient use of existing transport and minimise the number of vehicle trips to traffic-generating sites (such as schools and workplaces) through strategies such as better information on transport options and the co-ordination of car-pooling.

Projects in the Transport RTD Programme have been influential in raising the awareness of mobility management practices and promoting their acceptance across Europe. This has been done through demonstration schemes in various cities and the preparation of good practice

guides. The latter include a user manual aimed at the initiators and managers of new schemes, and a brochure for policy-makers and the owners of major sites.

The demonstrations showed that mobility consultants and mobility centres can achieve some modal shift and are effective in encouraging the adoption of Mobility Plans and Green Commuter Plans. The greatest success was obtained with the largest organisations and sites (500+ employees), and such organisations should be targeted first. For example, car-pooling was most successful for employees from the same workplace, whereas *general* promotion campaigns for car-pooling were found not to be effective.

The provision of high-occupancy vehicle lanes was shown to be an effective way of increasing car occupancy. “Matching centres” to put drivers and passengers in touch are also effective, provided sufficient people join the database. Preferential parking for car-pool vehicles at the workplace has limited impact though, especially where parking is readily available and free of charge.

In many countries, success in mobility management requires national action to remove obstacles and enact supporting legislation. For example, the tax treatment for reimbursement of costs between car-poolers may need to be defined and the insurance situation for car-pooling clarified.

The change in behaviour required by mobility management is strongly dependent on communication tools. More than 100 previous transport information and publicity campaigns have been reviewed and included in a software tool, and good practice guidelines developed for local authorities, public transport operators, site managers and cycling and walking groups. The analysis of previous experiences shows that:

- Communications *as part of an integrated transport plan* can enable changes in travel behaviour. However, many organisations have failed to achieve good practice in the past.
- General awareness campaigns need to be repeated at regular intervals – otherwise they lose their “power” to influence behaviour. Campaigns targeted on specific groups (such as schools, workplaces and neighbourhoods) have stronger and longer-lasting effects.

Interchanges/interfaces

Guidance has been developed on good practice in the functional specification and design aspects of passenger interchanges, based on case study evidence. This is available on the web. The outputs are aimed at planners, designers and managers. They include advice on consumer research methods and on involving users and non-users in the process of planning facilities. Guidance is also available on improving transport connections to terminals.

Specific policy actions were recommended to reinforce good practice in interchange design:

- Central and regional governments need to oversee the location, planning and co-ordination of interchanges. This will help to synchronise services through the interchanges and guide investment priorities for public transport.
- Authorities should consider setting up a single body to be responsible for timetable co-ordination, information and through-ticketing.
- Authorities should extend the guidance they give to public transport designers and operators to include good practice for the design of interchanges.
- A Europe-wide standard should be developed for the basic elements of signing schemes that would cover all public transport modes.

Infrastructure

Detailed findings have been published on the effectiveness of *physical* transport measures, as a guide to city transport planners. It was shown that:

- schemes to restrict road space and parking space for private cars have a significant impact on travel behaviour;
- traffic calming reduces overall traffic speeds and noise at a local level;
- parking management and guidance are successful in reducing circulating traffic at a local level;
- public transport priority does not have a strong influence on modal split, but improves the speed and reliability of bus services;
- measures to favour cyclists and pedestrians have only limited effect on modal shift when used in isolation, but are perceived by users to improve safety.

The greatest environmental benefits are achieved where road space is closed to private cars or where traffic volumes are reduced. Park-and-ride and parking restrictions are successful in this respect. However, measures that lead to slower speeds and increased journey times, such as traffic calming and bus priority, result in an increase in pollutant emissions.

City experiences show that physical measures are not easy to introduce. The most common barriers include conflicts of interest between the institutions involved, a lack of funds, and opposition from affected stakeholders such as shopkeepers. Also, it is apparent that there are no “off-the-shelf” solutions for cities to apply. For example, bus lanes have had good success in some cities and little in others. Nevertheless, physical measures are important because they can improve the performance and perceived advantages of public transport. This is an essential precursor for a change in travel behaviour, whatever the levers (pricing, green commuter plans etc.) used to induce that change.

Non-motorised transport

Guidelines and other information tools have been developed to help city authorities in promoting cycling and walking instead of short car trips in cities. These include:

- catalogues of basic and innovative measures, and practical guidance on their implementation;
- an evaluation tool in the form of interactive software, for assessing the appropriate measures in a certain area;
- a review of good practice in infrastructure design and traffic management from the perspective of cyclists and pedestrians, focusing on safety.

Policy recommendations included:

- the provision of networks of direct routes for pedestrians and cyclists, segregated from motorised vehicles;
- increasing the number of (secure) parking places for bicycles and decreasing the number for cars in inner city areas;
- targeting travellers to/from schools and educational centres, in order to influence transport habits at an early stage;
- area-wide speed reduction (with a maximum speed of 30 kph), except on roads with a flow function for motorised traffic;

- introducing direct financial incentives for employees not to use cars, such as taxation of workplace parking spaces;
- developing local and national policies for walking and cycling, including design standards for infrastructure, and appointing local authority staff to promote change in the city.

New transport concepts

Research has focused on freight terminals, the introduction of cleaner vehicles, and more innovative concepts such as underground freight systems.

Freight platforms are transshipment areas involving many transport companies and ideally at least two transport modes. There is only limited experience and knowledge of how such platforms perform. Therefore a database of 96 European freight platforms and their key characteristics has been created, and a handbook developed for local authorities and companies providing guidance on establishing new freight platforms. In addition, computer simulation has illustrated the potential benefits – such as a 15% reduction in urban truck kilometres and 10% cost savings.

To reduce congestion due to urban freight distribution, a system has been devised for “load zone management”, which is the automatic reservation of space in a city centre zone for loading and unloading lorries. The design is based on Internet access, making it available to a wide range of users without them needing special software. In addition, ways of improving road haulage to and from freight terminals have been identified, based on test site experiences. Organisational solutions are dominant, requiring improved communications and co-operation.

Cleaner vehicles and alternative fuels provide another means of improving the urban environment, but they face barriers such as high costs and a lack of refuelling infrastructure. Software tools and guidelines have been provided on the web to help project managers and policy-makers develop appropriate strategies towards cleaner vehicles. This includes a good practice guide to setting up and running pilot and demonstration projects. Priorities for policy actions include:

- fiscal incentives to kick-start the market for individual fuels, and incentives in the longer term based on relative environmental damage;
- funding of demonstration projects;
- eco-labelling and green fleet certification schemes;
- green procurement by public authorities;
- standards for vehicles and fuels;
- Low Emission Zones that allow city centre access only for clean vehicles, and Quality Contracts and Partnerships between local authorities and fleet operators.

New transport concepts could also help to tackle urban congestion. High capacity elevated passenger transport systems and underground freight systems were found to offer good potential in this area, although the infrastructure needs and total costs are high. In contrast, airships appear promising for direct urban delivery of bulky and heavy items, and their costs are not particularly high.

Organisational strategies

Research into the legal and organisational frameworks for urban public transport has concluded that a regime of “limited competition” (where authorities define the transport service to be delivered and invite tenders for its execution by candidate operators) is to be

preferred over full regulation or full deregulation. A fully deregulated system was found not to address policy objectives and system integration in an adequate way. This work has been influential in the development of Commission proposals to revise Regulation 1191/69 on the organisation of public transport.

Limited competition requires the agreement of contractual standards for public transport services. To support this, quality categories have been developed for inclusion in the guidelines for tendering and contracting procedures issued by public authorities.

There are also specific organisational issues for the operation of *interchanges* within the public transport system. Stakeholder consultation showed that there is a need to define the authorities responsible for the interconnection of long distance, regional and local transport networks. This is to ensure effective planning to cope with traffic generation in the vicinity of interchanges, the efficient management of interchanges, and a fair allocation of financial responsibilities.

Indicators, tools and methods

Generic and specialist research has been conducted to provide a basis for assessment of policy options. For example, a set of indicators, methods and sample data has been provided for city planners to support the growing interest in combined transport and land-use planning.

A modelling methodology has also been developed, allowing optimal transport strategies to be defined for specific cities according to criteria such as sustainability and economic efficiency. The value of the methodology, for many cities, lies in its ability to identify optimal strategies that can be *fully funded from user charges*. For other cities where private finance is needed for capital investment, the optimisation procedures can identify the appropriate modifications to the strategy to achieve the best performance within the financial constraint.

Simulation software has been developed to support traffic planners and network managers in the design and operation of urban traffic control systems. This allows real-time simulation of traffic movements in the road network, and faster than real-time prediction of the consequences of events such as traffic accidents or operator intervention.

New market research methods have been devised, aimed at improving urban public transport through a better matching of service characteristics with the requirements of different groups of users. One important result from testing these methods is that the correlation between delivered and perceived quality is weak. Direct measurement of user satisfaction will remain the most reliable indicator of transport service quality, rather than the measurement of performance indicators.

However, measuring quality through customer surveys is unlikely to be cost-effective as a method of *continuous* assessment of the performance of public transport. Therefore there has been strong interest in providing indicators to benchmark performance between operators. For this purpose, a handbook on the self-assessment of internal quality by transport operators has been devised. This supports the provision of (anonymous) data for benchmarking purposes. A public database of these benchmarking results has been created, which operators can use when setting targets for improving their own performance. These data will also be important for local authorities when tendering for public transport services, following the revision of Regulation 1191/69 on the organisation of public transport.

1. INTRODUCTION – HOW TO USE THIS PAPER

This paper provides a structured guide to the results of Research and Technical Development (RTD) projects relating to *urban transport*, carried out in the European Community's Transport RTD Programme. It is one of a series of papers:

| Paper no. | Theme |
|-----------|--|
| 1 | Sustainable mobility – integrated perspective |
| 2 | Sustainable mobility – economic perspective |
| 3 | Sustainable mobility – social perspective |
| 4 | Sustainable mobility – environmental perspective |
| 5 | Urban transport |
| 6 | Efficiency and quality |
| 7 | Safety and security |
| 8 | Human factors |
| 9 | Interoperability |
| 10 | Freight intermodality |

Of the 275 projects within the Programme, 52 dealt (partly or fully) with the issues of urban transport. Most of these projects were finalised in the year 2000.

How to use this paper:

You are recommended to use this paper to locate RTD results on topics where you have a particular interest, rather than reading the paper from start to finish:

- Start in Section 5 to get an overview of the topics addressed by “clusters” of RTD projects.
- Read the part of Section 6 that summarises the findings for each topic of interest to you.
- Use Annex 1 to identify the individual projects relating to that topic.
- Use Annex 2 to review the key results from each of these projects.

Further details on individual projects can be obtained from their web sites (noted in Annex 2, where available) and from the following Commission web sites:

- <http://europa.eu.int/comm/transport/extra/home.html>, which includes summaries and the full final reports of individual projects, as well as a variety of analyses and publications prepared by the EXTRA project;
- <http://cordis.lu/transport/src/project.htm>, which provides the project objectives and summary results as compiled by the RTD project teams.

The other Sections of this paper can help you to gain an overall picture of the urban transport theme, associated policy issues and the objectives for RTD.

The analysis in this paper is the responsibility of the EXTRA project team, and does not represent the official viewpoint of the European Commission.

2. SCOPE OF THEME

2.1 Definition of urban transport

The urban transport system provides access and mobility for people and goods, linking origins and destinations both internal and external to the urban area. It has many elements, including:

- public transport (collective transport);
- non-motorised transport (pedestrians, cyclists);
- freight and business traffic;
- motorised private traffic.

These transport services in combination cover a range of important social and economic activities:

- leisure trips;
- business journeys;
- commuting;
- shopping;
- trips to places of education;
- freight distribution.

The targeted objectives for urban transport are to fulfil the demand for accessibility with an efficient and quality service, whilst at the same time promoting sustainable patterns and levels of traffic that take account of economic, social, environmental and safety concerns.

2.2 Topics included in the theme

Developments in urban transport are being driven by a series of perceived needs. These are:

- to change the modal split in favour of public transport and non-motorised transport;
- to increase safety and security for users and non-users;
- to improve environmental quality and reduce health impacts;
- to improve the quality and human aspects of transport services;
- to increase the efficiency and competitiveness of transport services;
- to enhance the economic and social dimensions of city life;
- to explore the scope for reducing the scale of overall movement.

Associated strategies include:

- traffic management measures to limit transport demand, reduce congestion and influence modal split;
- fair and efficient pricing within and between modes to promote economically efficient decision-making e.g. concerning modal choice and trip selection ;
- promotion of new transport concepts and technologies, such as car-sharing and alternative fuels;
- promotion of mobility management strategies based on information, dissemination of good practice, and convergence of public and self-interest;
- use of land-use planning to modify the need for transport;
- improvements in infrastructure to influence modal choice, assist modal interchange, and control traffic flows;

- adaptation of organisational structures and institutional frameworks, including new approaches to financing urban infrastructure;
- measures to ensure appropriate competitive pressure.

2.3 Significance of the theme

Effective urban transport systems are essential to economic activity and quality of life. They open up opportunities to access essential services as well as social and leisure activities. Business depends on transport systems to enable its customers, employees and suppliers to travel. Some 80% of the Union's people live in urban areas, hence good sustainable transport is vital.

Public transport is a key element of this. It is particularly important for those who have no access to private cars. For example, it is estimated that at least 50% of older people have to rely on public transport.

However, a number of problems can be recognised in urban transport today:

- *Congestion.* According to OECD estimates, vehicle speeds have declined by 10% over the last 20 years in major OECD cities¹. Congestion is spreading out to peripheral urban areas as traffic continues to increase in step with economic growth, particularly the use of private cars. This also creates bottlenecks for long-distance transport, especially during peak periods for commuting. This problem can only be expected to worsen under current trends.
- *Pollution.* Many European cities suffer exceedences of health-based air quality standards, and traffic is increasingly seen as a major contributor to this. Although tighter standards for vehicle emissions and fuel quality are reducing the overall problem, "hot spots" are forecast to remain in some cities. Noise is also an issue as traffic continues to increase.
- *Suburbanisation.* The separation of residential areas, workplaces and commercial/service locations has increased the need to travel, and made it difficult to establish effective public transport as an alternative to the use of private cars.
- *Public financing problems.* The increased use of private cars has created a downward spiral of under-investment in increasingly less attractive public transport. This can reduce mobility for those without access to a car (some 40% of households across the EU), thereby increasing social exclusion.
- *Travel patterns.* 50% of all trips are shorter than 5km, where cars can be particularly damaging to environmental quality and non-user safety. Again, this can create a downward spiral, for example encouraging parents to take their children to school by car instead of allowing them to walk or cycle, which merely aggravates the problem.
- *Behavioural choices.* It has been estimated that at least three in every ten car journeys in urban areas in Europe could be made by a more environmentally friendly means of transport.
- *Safety.* About 32% of EU road user deaths occur within urban areas, about half of them are cyclists and pedestrians. The risk of being killed in a road accident is more than six times higher for cyclists and walkers than for car users.

National transport statistics are not commonly derived for urban areas, so there is only limited hard evidence on the extent of urban transport problems. The following data provide some insights.

In 1995, passenger car transport (vehicle-kilometres) was split 34% to 66% between urban and non-urban transport respectively (across the EU as a whole) [MEET project data]. Passenger cars accounted for around 80% of total passenger-kilometres travelled (across all modes). The corresponding split for heavy goods vehicles was 19% to 81%.

A key concern is the effect of transport on urban air quality. For example:

- in 1990, road transport accounted for around 90% of particulate matter emissions in London, compared to a national average of less than 30% [UK Quality of Urban Air Review Group, 1996];
- in Stuttgart, emissions from goods vehicles have been estimated to account for 47% of NO_x and 82% of soot particles [quoted in THERMIE project report on Alternative urban freight strategies, 1996];
- in France, 65% of carbon monoxide emissions due to transport come from urban traffic [quoted in THERMIE project report], and transport itself causes over half the emissions of CO Europe-wide;
- transport represents a major source of ozone precursor emissions. Of the 379 stations monitoring ozone in the EU-15 in 1997, 41% reported at least one exceedance of the threshold for public information on adverse levels.

3. POLICY CONTEXT

3.1 Policy objectives related to the theme

The Common Transport Policy Action Programme 1995-2000² includes two key areas with direct relevance to urban transport:

- improving quality by developing integrated and competitive transport systems based on advanced technologies which also contribute to environmental and safety objectives;
- improving the functioning of the single market in order to promote efficiency, choice and a user-friendly provision of transport services while safeguarding social standards.

Action areas include:

- better integration of transport modes, to provide greater recourse to environmentally-friendly and energy saving modes;
- stimulation of new technologies and applications;
- infrastructure improvements to shift traffic from roads;
- promotion of a Citizens' Network³, providing high quality collective transport of all kinds, including appropriate interfaces for the car user;
- land use planning to influence the determinants of transport demand such as business location and residential development;
- costs and charges, setting the regulatory framework, technical harmonisation and infrastructure to influence modal shift from the car;
- convergence in the charging regimes applicable to the different modes;
- improvements in accessibility for persons of reduced mobility;
- ensuring clear contracts and appropriate competition in public transport.

The Citizen's Network Green Paper³ identified the role of the EU as:

- disseminating know-how and setting targets;
- aligning R&D priorities with user needs;
- making Community instruments effective;
- modernizing the regulatory framework;
- improving standards.

This has been elaborated further in the Communication on Developing the Citizens' Network⁴, which states the following as key points:

- good local and regional passenger transport is an essential part of Europe's transport system;
- local and regional transport is primarily a matter for local, regional and national authorities, working with transport operators and users;
- the Commission's role is to provide useful tools for authorities, operators and user groups, and to establish the right policy framework for sustainable mobility.

To establish this policy framework, the Commission is developing various measures which:

- address the transport aspects of land use planning;
- encourage mobility management schemes;
- support fairer and more efficient transport pricing;
- promote applications of transport telematics;
- set harmonised standards for vehicle design;

- ensure appropriate competition in public transport; and
- address the transport needs of women and of people with reduced mobility.

This policy approach is underpinned by initiatives on information exchange, support for benchmarking based on self-assessment, and the targeted use of structural funds, research funds and the trans-European transport network developments.

Environmental policy objectives also affect the urban transport system:

- urban road transport contributes around 40% of transport sector CO₂ emissions – the Kyoto agreement calls for an 8% cut in such emissions (economy-wide) by 2008-2012 compared to 1990 levels, compared to a 50% increase under business-as-usual trends;
- European Directives on air quality underpin the drive towards cleaner vehicles, cleaner fuels and non-technical measures to reduce emissions. Such changes are particularly needed in urban areas, where high pollutant concentrations and high population densities combine to create significant health concerns.

The Communication on transport and CO₂⁵ identifies a series of urban-specific measures to reduce CO₂ emissions, such as:

- promotion of intermodality in the passenger and freight sectors – such as city logistics schemes and improved terminals;
- mobility management schemes, and the promotion and improvement of public transport and non-motorised modes;
- urban traffic management measures to improve flow;
- demand management measures such as parking controls and access restrictions;
- land-use planning to minimise the need to travel and facilitate collective transport.

The Communication notes that the economic justification and political acceptability of such measures is enhanced in the urban context, where traffic growth has already given rise to an unsustainable situation. Non-technical measures may simultaneously reduce CO₂ and local pollutant emissions, ease congestion and reduce noise, and thereby offer a good cost-benefit performance.

The Commission's action programme 1998-2004 for transport⁶ identifies as an important challenge the improvement in quality of local public transport. The programme will target areas such as the promulgation of best practice, integrated intermodal services and benchmarking. The Commission will also review how the regulatory framework for domestic public transport might be updated⁷, for example through the use of clear contracts including quality targets.

Most recently, the Commission has adopted policy guidelines⁸ for a new White Paper on the Common Transport Policy, due in 2001. The aim is to provide the European Community with a programme of actions to gradually decouple growth in traffic from economic growth. For the urban transport sector, the Commission proposes to place the emphasis on exchanges of good practice aimed at making better use of public transport and existing infrastructure. In addition, policy will be adopted on charging for transport, particularly to make charges reflect the real costs.

3.2 Policy issues related to the theme

The key policy issue lies in reconciling two major objectives: minimising traffic and its adverse impacts, yet fulfilling the demand for accessibility (and its associated economic and social benefits). For this reason, solutions that contribute simultaneously to both objectives have a high priority. These include:

- promoting a switch to collective transport (through improvements in public transport, infrastructure technology, information and other measures);
- pricing to induce decision-making which is both economically and environmentally sound – while ensuring equity for less advantaged groups in society.

A second issue concerns subsidiarity. There needs to be clarity on the relative role of actions at European, national and local levels. As an example, vehicle emissions standards are being tightened at a European level to improve overall air quality, yet it would not be cost-effective to solve all local air quality problems by uniform measures. Instead, cities with specific pollution risks will need to adopt traffic management and other measures appropriate to their own circumstances. The Commission's own role has been defined in this respect⁴, as described above.

4. RTD OBJECTIVES

In broad terms, the main objectives of urban transport RTD are to develop tools and demonstrate measures aimed at:

1. Enabling the implementation of transport policy *push* measures (for demand management and promotion of alternatives to private car use)
 - fair and efficient urban transport pricing
 - network/system management
 - integration of transport and land-use planning
 - mobility management
2. Enabling the implementation of transport policy *pull* measures (to support the emergence, further development and market take-up of alternatives to the sole use of private car and road freight traffic)
 - modal interchanges and passenger terminals
 - infrastructure measures, including integration of transport information, payment and management systems at a network level
 - infrastructure for non-motorised modes
 - new vehicle and transport concepts for passenger and freight traffic
 - organisational changes in transport services
 - integration between urban and extra-urban networks
3. Facilitating the successful introduction and application of policy measures
 - awareness and publicity
 - indicators and benchmarking
 - selection, design and assessment methods for transport measures.

The underlying approaches across all three of these RTD categories are:

- to support the sharing and transfer of knowledge, evidence and good practice, especially to local actors;
- to develop new basic knowledge for future concepts and strategies;
- to raise the awareness of decision-makers and professionals concerning the need and options for change, in order to accelerate the take-up of innovative policies and solutions.

5. SUMMARY OF RESEARCH CLUSTERS

5.1 Overview

The RTD projects contributing to the urban transport theme can be considered within ten topic areas or “clusters”, each relating to one of the three categories of RTD identified in Section 4. These clusters are:

| RTD category | Clusters |
|----------------------|--|
| Policy push measures | <i>Pricing</i> <i>Traffic management</i> <i>Land-use/transport planning</i> <i>Mobility management</i> |
| Policy pull measures | <i>Interchanges/interfaces</i> <i>Infrastructure</i> <i>Non-motorised transport</i> <i>New transport concepts</i> <i>Organisational strategies</i> |
| Policy facilitation | <i>Indicators, tools, methods</i> |

The research on *Land-use/transport planning* is closely linked with both push and pull policies, since there is an increasing trend to control urban development either to reduce its impact on transport demand or to make best use of more sustainable transport options.

One cluster can be identified where projects have had the *primary* objective of developing *Indicators, tools and methods*, such as simulation models, scenarios and databases. Nevertheless, similar aspects are common throughout the urban transport RTD projects in the other clusters, including:

- evaluation of strategy options;
- provision of case study information;
- preparation of good practice guides, complemented by tools and datasets; followed by
- dissemination to targeted audiences.

5.2 RTD clusters

This Section defines the scope of research in each cluster. More specific objectives are given in Section 6. The titles and objectives of relevant RTD projects are listed in Annex 1, together with a Table identifying the cluster(s) to which each project contributes most strongly.

Pricing

In the area of *pricing*, the research aims to show that pricing measures are an efficient and viable way of influencing transport demand and travel patterns in the urban area. Such measures include road user charges, parking fees, fuel taxes, vehicle taxes, and public transport fares and subsidies.

Traffic management

RTD on *traffic management* covers measures such as urban traffic control systems, information systems, parking/access restrictions, park-and-ride, pricing measures, vehicle prioritisation and other regulatory approaches. The focus is on *packages* of measures working in combination.

Land-use/transport planning

Projects on *land-use/transport planning* look beyond the optimum management of traffic towards measures that reduce the need to travel. One approach is to constrain urban development so as to minimise traffic volumes and facilitate public transport. Once again, *packages* of measures covering pricing, infrastructure and traffic management are seen as essential. Complementary work is being done in COST Action 332 on Transport and Land-use Policies.

Mobility management

Another contribution to transport sustainability comes from making more efficient use of the existing transport facilities and minimising the number of vehicle trips. This is *mobility management*. Mobility management includes strategies such as the co-ordination of car sharing and load sharing on trucks. The measures are usually based on information, communication, organisation, co-ordination and promotion/marketing. A number of RTD projects have been promoting best practice in this area.

Interchanges/interfaces

Switching between modes in favour of collective transport is an important component of urban passenger transport strategies, reducing both congestion and emissions. Quality interchanges between modes are required in order to complement demand-side measures. Research into *interchanges/interfaces* aims to provide good practice guidance on how to achieve this.

Infrastructure

A reduction in car usage can also be targeted through physical measures. Research on *infrastructure* concerns policy instruments and physical traffic management measures in the areas of parking management and guidance, traffic calming and bus priority measures.

Non-motorised transport

A switch to *non-motorised transport* is particularly favoured in urban areas, where many trips are shorter than 5 km and the cold-start emissions of cars are particularly damaging. Moreover, there can be a virtuous circle, whereby reducing car traffic increases the actual or perceived safety of pedestrians and cyclists, thereby encouraging further use of the “soft” modes. Research in this area aims to support initiatives to promote walking and cycling instead of short car trips.

New transport concepts

In the area of *new transport concepts*, the research is assessing the potential contribution of new ways of organising urban transport. This covers both passenger and freight transport. Three main approaches are considered:

- new modes to alleviate surface congestion - such as airships, underground freight systems and urban waterways;
- innovative urban transport solutions based on new propulsion systems - such as rental fleets of electric cars and electric bikes;
- city logistic schemes and freight platforms where goods are transferred at terminals to a highly efficient delivery system.

Related work has been carried out in COST Action 321 on Urban Goods Transport.

Organisational strategies

As a complement to research into *new* concepts for transport, projects on *organisational strategies* are identifying improved ways of structuring and implementing *current* operations.

Indicators, tools and methods

Finally, underpinning all of this applied research, a number of projects are developing *indicators, tools and methods* to provide a basis for assessment of policy options.

6. SYNTHESIS OF FINDINGS FROM COMPLETED PROJECTS

This Section provides a synthesis of the research objectives and main findings from completed projects for each of the RTD clusters defined in Section 5. The key results, policy implications and achievements of individual projects are summarised in Annex 2.

Results from the following projects have been included in the current version of this thematic paper:

| Clusters | Relevant RTD projects |
|------------------------------------|---|
| <i>Pricing</i> | AFFORD, CAPRI, CONCERT-P, FISCUS, TRANSPRICE |
| <i>Traffic management</i> | AIUTO, DIRECT, INCOME, LEDA, MUSIC, PRIVILEGE |
| <i>Land-use/transport planning</i> | DANTE, START, TRANSLAND |
| <i>Mobility management</i> | ARTIST, CAMPARIE, ICARO, INPHORMM, MOMENTUM, MOSAIC |
| <i>Interchanges/interfaces</i> | EMOLITE, GUIDE, HSR-COMET, MIMIC, PIRATE |
| <i>Infrastructure</i> | CAPTURE, OPIUM |
| <i>Non-motorised transport</i> | ADONIS, PROMISING, WALCYNG |
| <i>New transport concepts</i> | IMPREND, LEAN, RECONNECT, REFORM, UTOPIA |
| <i>Organisational strategies</i> | CARISMA, ISOTOPE, QUATTRO, VIRGIL |
| <i>Indicators, tools, methods</i> | EQUIP, EUROMOS, FATIMA, HIPERTRANS, INTRAMUROS, MOTIF, OPTIMA, SESAME |

6.1 Pricing

Research objectives

The projects on *pricing* cover a spectrum of inter-related objectives:

- to show that pricing based on marginal social cost can, in practice, ensure that users take account of the costs they cause (such as congestion and environmental impacts) in their trip decisions;
- to identify the societal, institutional and political barriers to the implementation and acceptance of pricing measures, and show how they can be overcome;
- to evaluate the effects of pricing schemes on modal split, traffic volumes and traffic behaviour, including the effects of combining pricing with other transport management measures;
- to demonstrate technical solutions, such as the use of integrated pricing and payment systems covering multiple transport modes.
- to compile and disseminate good practice in the design and implementation of pricing and associated financing schemes.

Main findings

The research concluded that, in principle, pricing policy should be based on “marginal social costs”, charging users for the *additional* costs they cause through infrastructure use, including externalities such as accidents, air pollution, global warming and noise.

All of the main externalities can be taken into account in pricing structures, even though some uncertainty exists in their estimation. Specific evaluation methods have been recommended for particular impacts, and a handbook has been prepared giving practical guidelines on evaluation, aimed at policy-makers, planners and transport operators. This handbook also advises on how to finance urban transport systems, covering new mechanisms (such as private finance and taxing land values) as well as the application of user charges and public budgets.

The projects commonly found that existing pricing mechanisms and levels are failing to provide appropriate signals to influence behaviour. For example, greater differentiation in road charges by time period and area is necessary to cope with congestion resulting from heavy peaks in travel demand. Electronic road pricing may form one part of the solution, but other pricing measures such as parking and cordon charges can be more cost-effective and practical in many situations.

The effects of road pricing measures in urban areas have been demonstrated. In one city, charging for road use during peak periods according to the level of congestion reduced traffic levels by more than 10%. This was mainly due to drivers changing their time of travel, with a smaller decrease in the total number of trips due to trip suppression or modal shift. In another city, 15-20% reductions in daily car travel could be largely attributed to drivers switching to public transport. Nevertheless, the overall conclusion is that drivers tend to travel at different times or by different routes before considering switching to public transport.

Demonstrations and modelling work in other cities confirmed that road pricing *can* change modal split from private car to public transport and Park & Ride, giving city centre traffic reductions of 5-30%. Cordon pricing is particularly effective when applied to congested central areas and over peak periods (reducing car trips by up to 25%). Pricing of parking also restrains car trips, provided enforcement is effective. Integrated payment systems (such as smartcards) have a small impact on modal split on their own (especially for Park & Ride), but more importantly support pricing measures that are co-ordinated across different transport modes.

Public acceptance of road pricing *in isolation* is low, particularly among motorists, even though pricing is perceived to be an effective tool. To increase acceptability, the introduction of pricing should be staged, starting with simple systems with low charge levels. In addition, the revenue should be earmarked (or “hypothecated”) for specific spending programmes such as public transport. These findings have been substantiated by the results of user surveys in various cities.

Modelling work has shown that packages of pricing measures based on marginal cost pricing can give rise to substantial welfare benefits for the urban population. Annual gains may be up to 400 Euro per capita, depending on the city context and measures applied, and may be dominated by the environmental benefits. A major part of this gain may depend on the effective use of the revenues, for instance allowing a reduction in labour taxes.

The equity effects of pricing are estimated to be moderate (either negative or positive). Overall, accessibility is reduced, particularly for car users, due to the reduction in trips. However, if revenues are used to subsidise public transport services, then accessibility may even be increased for most of the population.

Surveys have indicated that the legal and institutional frameworks required to implement marginal cost-based pricing *for urban transport* have, so far, not been put in place. This will require action at a national level, for instance to introduce institutions with the powers to control transport pricing across urban regions and across transport modes (rather than trying to construct complex relationships across multiple local authorities).

The existing range of pricing policies in EU Member States is so varied that the impacts of introducing marginal cost pricing have to be assessed on a case-by-case basis. The extent and direction of any price changes will depend strongly on current levels of taxation and charging. Nevertheless, as a broad conclusion, pricing reform to reflect social marginal cost is likely to involve:

- an increase in the price of urban road travel (particularly for the private car);
- greater peak/ off-peak differentials, and also an element of public funding for urban rail services.

6.2 Traffic management

Research objectives

The work on *traffic management* has several aims:

- to identify the most effective traffic management measures and packages of measures, including their socio-economic and user benefits and their effects on congestion and modal choice;
- to provide guidance to local authorities on how to implement these measures, including strategies for integrating traffic control, driver information and public transport within an overall traffic management system;
- to help city managers to incorporate safety improvements in their transport strategy and give priority to vehicles of particular user groups when managing a congested road network;
- to assess the potential for exploiting traffic management technologies to inform long-term transport planning, through the sharing of data on traffic and travel behaviour.

Main findings

The effects of measures to manage transport patterns and traffic flows have been evaluated through detailed modelling for a number of cities:

- Incentive (“pull”) measures such as an increased public transport service, if applied alone, were found to be rather ineffective in stimulating a switch from private cars. By comparison, “push” measures such as parking and cordon charges altered the modal split significantly.
- Combinations of pull and push measures (e.g. Park & Ride facilities, parking controls plus restricted access zones) yielded the greatest reductions in car trips. Restricted access alone could also have a substantial effect.

These results point to the importance of applying *packages* of traffic management policies, rather than individual measures. Packages increase the modal switching benefits, and are perceived to increase the social acceptability of car trip reduction.

Evidence has also been obtained of the additional benefits from using advanced traffic management *systems* in an integrated way. Simulation modelling and field trials were used to evaluate combinations of urban traffic control, public transport management systems and driver information systems. A guidebook has been compiled for transport managers and local authorities, summarising the results, infrastructure requirements, factors affecting the benefits, and other implementation issues.

Examples of the potential benefits include:

- *Bus priority in urban traffic control.* Public transport achieved journey-time savings of around 5-15% with a payback period of less than two years.
- *Integration of UTC priority and automatic vehicle location for buses.* This allows selective priority to be given to buses that are running late, thereby improving reliability. Predicted improvements in bus regularity and in passenger waiting times are around 10%.
- *Bus gating at traffic signals.* This involves holding back queues of private vehicles at traffic signals on strategic routes, allowing buses to overtake along segregated bus lanes. The bus lanes doubled the savings in bus delay compared to bus priority alone at traffic signals.
- *Fully integrated traffic management systems.* Sharing of data and control signals between sub-systems in Turin has reduced travel times for both general traffic and public transport by 20%, with an accompanying modal shift of 3% to public transport. Local pollutant emissions were estimated to fall by 21%.

Of course, the integration of traffic management systems requires data to be shared. Often this is between organisations, and requires software tools, data standards and agreed procedures. Therefore recommendations have been made and tested for a decentralised data sharing structure, using web-based links.

In related work on traffic control, a new low-cost approach to the design of traffic signal timings has been developed and demonstrated. In contrast to current design tools, this takes account of travellers' responses to changes in signal timings (such as re-routing), and allows signal timings to be optimised to meet a variety of traffic management goals. For example, in one city demonstration, traffic timings were designed to enhance the benefits of a new bus lane on a Park & Ride route. As a result, bus journey times decreased and reliability of travel time increased. Peak-hour patronage increased by 25%, while remaining constant on the city's other Park & Ride routes.

In applying such findings elsewhere in Europe, it is essential to note that benefits must be estimated for the *local* situation. For example, public transport journey-time savings are dependent on congestion levels and the number of traffic junctions where systems can be used, and heavy congestion reduces the scope for some forms of bus priority. But the research has shown that simulation can provide a cost-effective means of *screening* alternative solutions prior to pilot-scale or full-scale implementation, as well as pointing to promising options.

As noted above, *restrictive* policy measures are seen as effective in managing traffic. To use them, city authorities need to assign different levels of priority to different user groups (such as public transport). A good practice guide has been provided for this purpose, setting out 31 individual measures for urban road traffic priority management. The catalogue includes implications for enforcement and skeleton plans for the introduction phase.

For a number of these and other measures, the legal framework has not yet been put in place. This situation varies from country to country. Certain measures may therefore require legislative amendments (to remove barriers) or new local regulations before they can be implemented effectively – such as car sharing, demand-responsive public transport and mobility management services. For example, it may not be possible to grant preferential parking to vehicles that are used for car sharing, and information and awareness campaigns are often not covered by legislation.

To help cities learn from each other, a web-based database has been developed covering experiences with over 200 legal and regulatory measures used in 41 European cities. It enables stakeholders at a city level to search for examples of experiences with measures that interest them.

There was found to be no simple correlation between city characteristics and the transferability of measures between cities. Therefore guidelines have been devised to aid cities in assessing the transfer of experiences to their own situation. The most significant barriers to transfer are political and public acceptance. The keys to gaining acceptance include a thorough consultation process and a targeted public awareness campaign.

6.3 Land-use/transport planning

Research objectives

The research in this area aims to identify:

- good practice in the integration of transport and land-use planning;
- the most effective strategies for trip reduction, travel avoidance and mode switching;
- the best ways to implement such strategies and increase acceptance, and the effects on infrastructure financing and cost recovery.

Main findings

The problems of traffic congestion in cities have increased interest in strategies to *reduce the demand for travel*, as a complement to policies aimed primarily at the efficient management of traffic (which were considered in the previous Section). Research has indicated that the most cost-effective measures for reducing demand are based on pricing. Road pricing per kilometre or at a city cordon performs well, while parking charges have a less direct impact and may not work where there is extensive private off-street parking within the congested area. Subsidies to urban public transport are considerably less effective.

A good practice guide has been developed for the selection and implementation of such strategies by city authorities. This covers some 30 measures, illustrated by case studies. As reported previously, “push” measures to deter the use of vehicles (e.g. road pricing) are seen as more effective than “pull” measures (e.g. improving alternative modes). But travel

reduction is found to be most likely where both “push” and “pull” measures work together in a package, with the revenue from the former being used to fund the latter.

Experience has also shown that a mix of different types of measure works best. For example, land use planning measures are needed to constrain the decentralisation of population and economic activity to locations beyond the area in which the restrictive policies apply. Fuel taxes, vehicle taxes and road pricing need to be co-ordinated so that the right signals are sent to vehicle users in congested areas, while avoiding inefficiently high taxation in rural areas. Public awareness messages are needed to encourage a change in travel behaviour, as well as providing information on the available alternatives. Measures to reduce congestion need to consider the travel-encouraging consequences.

Scenario analysis has shown that, in the short and medium term, the likely travel reductions are only of the order of one or two years’ growth in (unconstrained) demand. Policy actions may still be desirable, but the lesson is that there is no *simple* strategy that will dramatically affect levels of urban congestion in the short to medium term. Therefore there has been strong interest in the use of policy to change patterns of land-use *in the longer term*, aimed at reducing the extent of vehicle movements.

A review of existing practice in the combined planning of land-use and transport has led to the following conclusions:

- Combined land-use and transport policies are only successful in reducing travel distances and the share of car travel if they make car travel less attractive (more expensive or slower).
- Land-use policies to increase urban density or mixed land-use (e.g. locating homes near factories and services) without accompanying measures to discourage car use have only little effect.
- Transport policies to make car travel less attractive depend on trip start and end points not being excessively dispersed already. Co-location of specialist businesses in certain areas and the increase in multiple worker households also set limits on the co-ordination of work places and residences.
- Large dispersed retail and leisure facilities increase the distances travelled by cars and the share of car travel. Land-use policies to prevent the development of such facilities are more effective than land-use policies aimed at promoting high-density mixed-use development.
- Fears that policies to constrain the use of cars in city centres are detrimental to the economic viability of those centres have in no case been confirmed by reality, except where massive out-of-town retail developments have been approved at the same time.
- Transport policies to improve the attractiveness of public transport have in general not led to a major reduction of car travel, but have contributed to further suburbanisation of the population.

Overall, transport policies have been found to be more direct and efficient than land-use planning controls in moving towards a sustainable urban transport system. However, land-use policies are seen as an essential accompanying strategy for creating less car-dependent cities in the long run. Information policies are an additional tool, important for influencing behaviour and increasing social acceptance of other tougher measures.

Despite this interest in land-use controls, research has shown that planning systems are often weak, in that they fail to integrate spatial development with transport and environmental aspects. For example, planning approvals may not require new developments to be sited adjacent to public transport or to have limited parking provision. The Netherlands and the UK were identified as examples of promising practice in this respect.

It was also found that traffic reduction measures create a problem for policy towards the financing of transport infrastructure. In order to develop private sector interest in the financing and management of road infrastructure projects, the public sector will need to develop new ways to pay for roads. Otherwise, would-be investors will be deterred by the sensitivity of income projections to new traffic reduction initiatives.

6.4 Mobility management

Research objectives

Mobility management aims to make more efficient use of existing means of transport and minimise the number of vehicle trips to traffic-generating sites (such as schools, companies, hospitals and shopping centres) through the use of organisational, information and awareness tools. It includes strategies such as better information on sustainable transport solutions, improving collective transport for specific user groups, the co-ordination of car-pooling and public awareness campaigns. Projects in the Transport RTD Programme have been influential in raising the awareness of mobility management practices and promoting their acceptance across Europe.

Research into mobility management and associated information measures has aimed at:

- demonstrating and evaluating new mobility management concepts, strategies and tools;
- providing guidelines on measures and instruments at local and national levels that can support mobility management;
- disseminating best practice.

Main findings

Based on a survey of mobility management approaches in use across Europe and beyond, integrated concepts have been defined for mobility management strategies and “mobility centres”, and for the transfer of strategies between locations. These concepts address all types of traffic and trip purposes.

Certain strategies were demonstrated in a number of cities across Europe. These focused in particular on the use of mobility centres and the targeting of commuter trips. From these experiences, a number of good practice guides have been prepared. These include a user manual aimed at the initiators and managers of new schemes, a brochure for policy-makers and the owners of major traffic-generating sites (hospitals, companies etc.), and a CD-ROM defining the different elements of mobility management.

The following general lessons were drawn on the implementation of mobility management strategies at a site level:

- The creation of partnerships between stakeholders (including transport operators, community groups, local councils and local businesses) is crucial.

- Target efforts onto selected users (such as companies or young people) rather than spreading efforts across a wide range of user groups.
- Use networking opportunities such as the European Platform on Mobility Management (EPOMM) to learn from other people's experiences.
- Select the strategy according to the national context, such as the attitudes of users and their reaction to "push" measures such as car parking restrictions.
- Use promotion and awareness-raising campaigns as a key element in the delivery of new schemes.

The demonstrations showed that mobility consultants and mobility centres can achieve some modal shift and are effective in encouraging the adoption of Mobility Plans and Green Commuter Plans. The greatest success was obtained with the largest organisations and sites (500+ employees), and such organisations should be targeted first. An additional benefit of mobility management was seen to be the raising of awareness of transport alternatives – which may then be stimulated more strongly by other policy measures such as pricing.

A more focused study on car-pooling found that this is most successful for employees from the same workplace. Therefore initiatives to promote this behaviour are best targeted on the workplace, particularly by working with companies. In contrast, *general* promotion campaigns for car-pooling were found not to be effective.

The willingness to car-pool increases with the distance between home and work. However, flexible working hours can pose a serious obstacle. (Nevertheless, other research has shown that staggered working times across companies and flexibility of working hours within companies can decrease pollution by cutting congestion at peak periods.)

The provision of high-occupancy vehicle lanes was shown to be an effective way of increasing car occupancy. "Matching centres" to put drivers and passengers in touch are also effective, provided sufficient people join the database. Preferential parking for car-pool vehicles at the workplace has limited impact though, especially where parking is readily available and free of charge. No convincing evidence was found for guaranteed ride home schemes influencing the decision of people to car-pool.

In many countries, success in mobility management requires national action to remove obstacles and enact supporting legislation. For example, the tax treatment for reimbursement of costs between car-poolers may need to be defined and the insurance situation for car-pooling clarified. Regulations for high occupancy vehicle lanes still need to be included in national traffic regulations in various Member States. Linked to this, a harmonised European car-pooling sign for high occupancy vehicle infrastructure should be agreed.

The change in behaviour required by mobility management is strongly dependent on communication tools. A review of over 120 transport information and publicity campaigns has been compiled, and good practice guidelines developed which target a range of organisations. These include recommendations for local authorities, public transport operators, major institutions and their site managers, and environmental, cycling and walking groups. Three types of campaign are described in detail – public awareness campaigns; campaigns for targeted groups and settings (such as schools and workplaces); and campaigns aimed at individual travellers and households.

In addition, a software tool has been developed that provides information on more than 100 previous campaigns (mainly concerning public transport). It is designed to help practitioners identify experiences relevant to their own situation. The software is complemented by guidelines on the *process* of designing a campaign.

The analysis of previous experiences shows that:

- Communications as part of an integrated transport plan *can* enable changes in travel behaviour. However, many organisations have failed to achieve good practice in the past.
- Practical advice and ongoing support are essential to maintain such changes.
- The success of a campaign is maximised when combined with one or more specific policy measures (such as traffic restrictions or a new public transport service).
- Mixes of measures and mixes of campaigns seem to have an increased effect relative to isolated efforts.
- General awareness campaigns need to be repeated at regular intervals – otherwise they lose their “power” to influence behaviour. Campaigns targeted on specific groups (such as schools, workplaces and neighbourhoods) have stronger and longer-lasting effects.
- Among the most effective campaigns are those co-ordinated by partnerships (such as between operators, site owners and local authorities). Co-ordination of national and local campaigns is also important, leading to greater media coverage.
- Times of change for individuals, organisations and communities are worth targeting. Examples include people moving house or changing jobs, businesses moving site and new housing developments.
- Most of the campaigns studied can be transferred to other locations, with appropriate adaptation.

Gaps have been identified in the understanding of how to manage transport flows associated with tourism. This affects the people in charge of managing tourism/transport policies and those who operate tourism/transport facilities. In particular, a global theory explaining the behaviour of travellers is lacking. Data are needed to allow a better use of existing programmes of policy support, particularly the EC Structural Funds that subsidise tourism activities under the control of local authorities in Member States.

6.5 Interchanges/interfaces

Research objectives

Research into *interchanges/interfaces* aims to provide advice on the location, planning, design, implementation, financing and management of passenger interfaces with the public transport system. This includes the provision of best practice guides and decision support tools for operators, developers, financiers and policy-makers, and the identification of the barriers to transfer between transport modes.

Main findings

A cluster of projects have developed guidance on good practice in the functional specification and design aspects of passenger interchanges, based on case study evidence. This is available on the web at <http://www.interchanges.co.uk/>.

The outputs include a series of surveying and modelling tools and guidelines that can help planners, designers and managers to systematically analyse interchanges, taking into account

the various kinds of barriers to their use by passengers. The tools will have their main application in the design stage of interchanges. They include guidance on consumer research methods and on involving users and non-users in the process of planning new or improved facilities.

In a separate development, prototype software has been prepared to support decision-making on the choice between potential sites for passenger (and freight) terminals.

Key factors influencing the effectiveness of interchanges have been identified as:

- *logistical and operational* factors, such as the failure to synchronise services between different modes;
- *psychological* factors, notably the fear of crime in the area around the interchange;
- *institutional and organisational* factors, particularly due to poor co-ordination between the many stakeholders;
- the functional quality of the *physical design* and layout;
- the *ease of access* to the interchange and the availability of parking;
- *economic and social* factors, such as cost of travel and the development of commercial services at the interchange;
- the availability of pre-trip and real-time *information*.

A gap analysis revealed the perceptions of various stakeholder groups towards the importance and performance of the various aspects and features of an interchange. The analysis showed general agreement about the high importance of safety/security, information and car parking. However, infrastructure design experts emphasised the aspects of layout, location and the quality of connections, while users had more uniform concerns across all characteristics of interchanges, with preference for comfort and safety issues. Certain characteristics – surveillance, toilets, traffic and travel information, cleanliness and security against theft and vandalism – were perceived to perform poorly at a number of sites.

It was concluded that improving interchanges *at a network-wide level* requires:

- a definition of the strategic public transport network, which identifies the demand for interchanges;
- an overall information strategy for the network, covering pre-trip and real-time information;
- a system of quality standards to monitor the performance of interchanges;
- fare and ticketing policies that minimise the barriers to interchange between services;
- organisation and management structures that can take an integrated view of the interchange within the network as a whole;
- the promotion of co-ordination arrangements at the location-specific level.

By comparison, improving interchanges *at individual locations* requires:

- matching the design and layout to user needs;
- developing the interchange to promote *access* to the public transport network, which is often a more important role than transfer between services;
- improving accessibility for those with special needs;
- commercial exploitation to finance the infrastructure and provide facilities and an attractive image;
- good signs and other information services within the interchange area;

- design features and staffing to combat crime and the fear of crime;
- co-ordination between operators to provide through-ticketing, synchronised services and information, and a unified management.

Specific policy actions were recommended to reinforce good practice in interchange design:

- Central and regional governments need to oversee the planning and co-ordination of interchanges. This will help to synchronise services through the interchanges and guide investment priorities for public transport.
- Authorities should consider setting up a single body to be responsible for timetable co-ordination, information and through-ticketing.
- Authorities should extend the guidance they give to public transport designers and operators to include good practice for the design of interchanges.
- An independent body should be given the task of developing a Europe-wide standard for the basic elements of signing schemes that would cover all public transport modes.

The work showed that travellers attach great importance to the interchange when they choose whether to make intermodal trips. However, there are circumstances where the land-use and transport network characteristics of a city can substantially influence passengers' choices, much more than barriers at the interchange. So good design is a necessary condition for a successful interchange, but not a sufficient one.

Related research has looked specifically at the needs for modal interconnection at high-speed rail (HSR) terminals. Typically one-third of connection trips to and from the terminal are by private car (including "kiss-and-ride"), one-third by public transport, and roughly 15% each by taxi and walking.

A multi-criteria evaluation tool was developed to identify the priorities for improvements in the urban transport services to and from HSR terminals. An increase in the frequency of metro services during HSR peak periods (where available) emerged as a strong candidate. Preferential access for taxis also scored reasonably well, as did the integration of taxi tariffs with train fares (for example by joint ticketing). In addition, there seems to be a potential market for a special taxi or minibus service specifically dedicated to meeting the needs of HSR users.

It was concluded that the promotion of high-speed rail needs improvements in the transport connections to the terminal and the customer services available in the terminal. Since cars are the most significant means of access, policies should aim to address the environmental and congestion effects without discouraging travellers. This could mean greater provision of short-term parking spaces for drop-off and pick-up, or a good park-and-ride system. Taxis should also be promoted, with preferential fast close access to trains.

Terminals should provide high-quality basic services, since most passengers spend relatively little time there. (The quality and variety of services on board the train are arguably more important, given the length of HSR trips.) Improvements are needed to speed up transit through the terminal and advise the passenger on what to do. These include:

- integration of pricing systems between local transport services and HSR;
- reservation systems (e.g. to book train plus taxi);
- timetables that facilitate making connections;

- complete travel information on the trip to the final destination;
- simple improvements such as clear and visible signs.

6.6 Infrastructure

Research objectives

Research on *infrastructure* aims to assess and recommend policy instruments and physical traffic management measures in the areas of parking management and guidance, traffic calming and bus priority measures. Specific objectives are to evaluate the impacts on transport efficiency, safety and modal split, and to test promising strategies at demonstration sites.

Main findings

Detailed findings have been published on the effectiveness of *physical* transport measures designed to manage traffic and restrict or encourage the use of different modes. These include bus lanes, public transport prioritisation, improvements to junctions and interchanges, area access restrictions and controls on central area parking.

Schemes to restrict road space and parking space for private cars have proved very successful in terms of their impact on travel behaviour and consequent environmental benefits. The main difficulty lies in opposition from shopkeepers, although residents and visitors are generally supportive.

Traffic calming reduces overall traffic speeds and noise at a local level. This is perceived to benefit vulnerable users and could reinforce measures to promote modal shift. However, there may be negative effects on vehicle emissions unless overall car use is restricted.

Parking management and guidance appear successful in reducing circulating traffic at a local level, and could influence modal split if implemented widely across a city. Parking measures are generally self-financing.

Public transport priority does not have a strong influence on modal split, but improves the speed and reliability of bus services. Greater modal shift might be achieved if priority measures are implemented more extensively or integrated with traffic restrictions and improvements to bus services.

Measures to favour cyclists and pedestrians have only limited effect on modal shift when used in isolation, but are perceived by users to improve safety.

The greatest environmental benefits are achieved where road space is closed to private cars or where traffic volumes are reduced. Park-and-ride and parking schemes are successful in this respect. However, measures that lead to slower speeds and increased journey times, such as traffic calming and bus priority, result in an increase in pollutant emissions.

Individual measures can yield benefits in their own right, even if used only locally, but their deployment as part of an integrated strategy has the potential to yield significantly greater benefits. In particular, public transport priority and bicycle measures are increasingly effective at larger scale.

Overall, it was concluded that physical measures do not *in themselves* generally have a major short-term impact on modal split, unless they are large in scale. However, they may encourage a change in behaviour when people periodically re-assess their travel decisions – either due to changing circumstances (such as a job or house move) or due to other policy changes (such as pricing measures).

City experiences show that physical measures are not easy to introduce. The most common barriers are conflicts of interest between the institutions involved, a lack of funds, diversion of attention to alternative schemes, and opposition from affected stakeholders. Small-scale, low-visibility cheap solutions are the most readily implemented. However, these run the risk of failing to achieve large-scale change, unless introduced as part of an overall vision and strategy.

It is apparent that there are no “off-the-shelf” solutions for cities to apply. For example, bus lanes have had good success in some cities and little in others. Changes must be planned individually, taking into account local conditions, the ease of implementation and user reactions. City size is not a major factor in determining the most appropriate measures, but city type (historic versus modern) may be significant.

The research concluded that modal change requires a package of measures in a well thought-out strategy. Physical measures are important because they can improve the performance and perceived advantages of public transport. This is an essential precursor for a change in travel behaviour, whatever the levers (pricing, green commuter plans etc.) used to induce that change. Public consultation and consensus building between stakeholders are required, and it should be noted that physical restrictive measures are probably more acceptable than road pricing measures.

At the national and European policy levels, good practice examples need widespread dissemination, particularly to counter popular perceptions about the effects of access restrictions and pedestrianisation on city centre trade.

6.7 Non-motorised transport

Research objectives

Research in this area aims to provide recommendations and guidelines for initiatives to promote walking and cycling instead of short car trips. There is a particular focus on how to improve safety. The work considers technical and infrastructure measures as well as supporting policies and information strategies.

Main findings

Guidelines have been developed regarding good practice to promote cycling and walking instead of short car trips in cities. These include catalogues of basic and innovative measures, and practical guidance on their implementation. Recommendations include:

- the extension and improvement of pedestrian areas and bicycle lanes (which are the most common measures to be found in European cities);
- activating employers and shops to provide secure types of bicycle parking;
- introducing bicycle registration programmes;

- making it possible to insure bicycles against theft;
- increasing the number of parking places for bicycles and decreasing the number for cars in inner city areas – this is commonly seen as important;
- providing maps of the bicycle network and communicating the availability of new facilities such as secure parking;
- using awareness and incentive campaigns aimed at behavioural and attitudinal changes towards cars, such as Car Free Days to make drivers experience the benefits of cycling and walking;
- stimulating the creation and participation rates of cyclist and pedestrian organisations;
- targeting travellers to/from schools and educational centres, in order to influence transport habits at an early stage;
- enforcing a maximum speed of 30 kph on streets where walking and cycling are significant;
- developing pilot and demonstration projects involving big companies, for instance establishing mobility management plans that emphasise non-motorised transport;
- introducing direct financial incentives for employees, such as taxation of workplace parking spaces;
- promoting complementary public transport and home delivery services;
- developing local and national policies for walking and cycling, and appointing local authority staff to promote change in the city.

In addition, an evaluation tool has been produced in the form of interactive software. This is for use by city authorities in assessing the appropriate measures to promote walking and cycling in a certain area.

Surveys of people's behaviour and attitudes to mode choice showed that:

- walking is mainly considered for trips under 1 km, while cycling competes with cars for trips up to 5 km;
- the main factor which appears to encourage the use of the car is comfort;
- safety and bicycle security are major concerns, while non-cyclists also fear an increase in travel time if they switch to cycling.

To address the issue of safety for vulnerable road users, a review of good practice in infrastructure design and traffic management has been prepared. For example, the costs and effects on safety and mobility of around 100 measures for pedestrians have been evaluated. It was concluded that walking and cycling need to be planned as transport modes in their own right – whereas current urban traffic planning systems in Europe commonly focus on cars, buses and trucks, for instance making provisions for cycling merely as additional features of the traffic system for motor vehicles.

Cost-benefit analysis identified the following measures as the most important in promoting safety for pedestrians and cyclists:

- a separate network of direct routes for pedestrians and a separate network of direct routes for cyclists, segregated from motorised traffic and with a fair share of priority at crossings;
- a categorisation of roads to separate flow traffic from distribution traffic and access traffic;
- area-wide speed reduction, except on roads with a flow function for motorised traffic;
- development and implementation of design standards for infrastructure for pedestrians and cyclists;

- regulations giving priority to pedestrians and cyclists in urban areas and technical measures that support priority;
- education and driver training that focuses on respect for other road users.

6.8 New transport concepts

Research objectives

The aims of the research into *new transport concepts* have been:

- to assess the technical, economic and environmental feasibility of such concepts and the requirements for their introduction;
- to develop policy guidelines on how to promote these concepts and remove policy/market barriers;
- to provide local actors with good practice guidance on the design, introduction and operation of innovative concepts;
- to test concepts through demonstration and case study work.

The focus has been on freight terminals, urban transport concepts using cleaner vehicles, and more innovative concepts such as underground freight systems.

Main findings

Freight platforms are transshipment areas where many transport companies (such as forwarders and logistic service providers) are located, and ideally where at least two transport modes are connected. They allow the efficient consolidation of loads, reducing the number of vehicle movements to distribute goods within the city centre. However there is only limited experience and knowledge of how such platforms perform. Therefore a database of 96 European freight platforms and their key characteristics has been created, and a handbook developed for local authorities and transport sector companies.

The handbook provides guidance and evaluation methods for establishing new freight platforms. Topics include:

- financial and organisational issues, and their impact on the efficiency of platform operations;
- the impact of technology, equipment and design on platform efficiency;
- evaluation of potential impacts on urban traffic and the environment.

These impacts have been tested by computer simulation at sites in Berlin, Brussels, Rome and Madrid. Depending on the local situation, the introduction of freight platforms would have different levels of benefit, for example reducing truck kilometres by 15% in Rome. Other studies have illustrated the potential to offer cost savings to freight service providers (e.g. around 10% for a proposed scheme in Vienna).

To support the operation of such “city logistic” schemes, information technologies will be increasingly important. For example, a system has been devised for “load zone management”, which is the automatic reservation of space in a city centre zone for loading and unloading lorries (supported by stricter enforcement of regulations to prevent illegal parking by private cars in that zone). It aims to reduce traffic jams due to parked cars and lorries blocking the street. The design is based on Internet access, making it available to a wide range of users without them needing special software.

The urban impact of freight platforms is, of course, dominated by road haulage to and from the terminals. Interviews showed that the most significant problems are time delays (associated with restricted opening times of terminals, consequent road traffic congestion and the poor punctuality of trains) and a lack of co-operation (e.g. poor exchange of electronic data and a lack of return loads).

Twenty-five solutions were identified to help overcome problems. Organisational solutions are dominant, based on improved communications and co-operation. However, successful implementation requires win-win benefits to be identified by the actors – in many cases, road hauliers are not the *direct* customers of a terminal, and therefore receive lower priority than the shippers and railway operators.

Demonstration projects showed that co-operation *between* road hauliers typically fails, due to mutual competition. However, the introduction of round-table meetings of actors *along* the transport chain generated some co-operation. For instance, this can improve data exchange and the organisation of return loads. Information and communication technologies appeared to have major potential, but the presence of many small independent road hauliers makes it difficult to get them to participate in a large overall information system unless there is very strong evidence that benefits will outweigh the costs.

Freight platforms focus on improving the *efficiency* of transport. A complementary means of improving the urban environment is the use of *cleaner vehicles and alternative fuels*. There are many barriers to the introduction of these new technologies, such as high capital and lifetime costs and a lack of refuelling infrastructure. However, certain niche applications such as public sector fleets can provide a way of lowering some of the barriers, supported by policy actions. In addition, demonstration projects are important in developing market acceptance.

Software tools and guidelines have been developed to help project managers and policy-makers develop appropriate strategies towards cleaner vehicles, based on test site experiences across Europe. These are available on the web at <http://utopia.jrc.it/>, and include:

- an assessment of the most promising applications for cleaner vehicles and supporting measures, from a city perspective;
- recommendations on policy actions at the European and national levels to promote or facilitate market introduction and demonstration;
- a good practice guide to setting up and running pilot and demonstration projects, aimed at potential project champions;
- a software tool which provides information and assessment methodologies covering clean transport solutions, to support city planners and vehicle operators.

Key conclusions on the role of supporting policies were as follows:

- The most important policy measures are *fiscal incentives*. A distinction is needed between incentives to kick-start the market for individual fuels, and efficient incentives in the longer term that are not technology-specific (e.g. differential rates of fuel taxation based on relative environmental damage).
- *Demonstration projects* have an important role in testing technologies, stimulating the market and raising consumer awareness.
- *Eco-labelling* and *green fleet certification schemes* are important, especially where the label remains on the vehicle in everyday use.

- *Green procurement* by Governments, whether voluntary or mandatory, can be significant in creating an initial market for new fuels and providing a signal to private consumers that these fuels are serious.
- *Standards* for vehicles and fuels are important in creating a unified market and ensuring consumer confidence.
- *Low Emission Zones* that allow city centre access only for clean vehicles, and *Quality Contracts and Partnerships* between local authorities and fleet operators, are new powerful tools for encouraging cleaner vehicles at a local level. Governments may need to provide the regulatory framework for their implementation and enforcement.

New transport concepts could also help to tackle *urban congestion*. For example, comparative assessment showed that high capacity elevated passenger transport systems (such as the H-Bahn Dortmund and the Wuppertaler Schwebebahn) offer good potential for reducing congestion as the backbone of a public transport system. Nevertheless, the infrastructure needs and total costs are high. For freight, underground concepts (such as the Underground Logistics System proposed in Amsterdam) provide an efficient means of distribution. Again, infrastructure costs are fairly high, but can be reduced using new small-bore tunnelling technologies.

In contrast, airships are promising for point-to-point operations in both passenger and freight transport, and their costs are *not* particularly high. For example, they may allow bulky and heavy items to be taken to the final destination, replacing a whole shipment chain.

Financial and commercial hurdles pose the biggest obstacle to these new concepts, particularly for public transport. However, tailor-made transport services such as airships are proving more attractive to private investors. Regulatory barriers are also significant, particularly for automated and driver-less vehicle concepts.

To overcome the barriers to market penetration, the priority is to make “seed” funding available. Public-private partnerships are seen as one way forward on this. Regulatory barriers need stakeholder consultation at an early stage, and would benefit from Government agencies (such as strategic rail authorities) being assigned responsibility to tackle the legal issues.

6.9 Organisational strategies

Research objectives

The aims in this area were to provide strategic and practical recommendations concerning:

- the legal and organisational structures for public transport operations;
- the organisation of interconnections between long distance transport networks and local/regional networks of all modes;
- best practice in tendering/contracting urban public transport operations, including the use of quality indices;
- the organisation of transport in rural areas, for efficient interfacing to the urban transport system.

Main findings

Research into the legal and organisational frameworks for urban public transport (UPT) has concluded that:

- the initiative for creating and specifying the UPT network should rest with local authorities – a fully deregulated system was found not to address collective goals and system integration in an adequate way;
- traffic management and parking should be controlled by the same authority as UPT, in order to integrate the management of urban mobility;
- a regime of "limited competition" (where authorities define the transport service to be delivered and invite tenders for its execution by candidate operators) is to be preferred over full regulation (monopoly supply) or full deregulation;
- partnerships between operators and authorities should be established that include clear definitions of standards of service and responsibilities.

These findings have been influential in the development of Commission proposals to revise Regulation 1191/69 on the organisation of public transport. It was concluded that reductions in unit operating costs of around 15% are feasible over fully regulated operations, even with no redundancies or wage reductions. However, the transition costs may be significant, with improved data collection needed for the assessment of the quality of services provided.

In support of such a transition, quality categories for UPT have been developed together with experts from CEN (the European Committee for Standardisation). Recommendations specific to policy-makers and contracting/tendering authorities were:

- to issue guidelines for tendering and contracting procedures that encourage the introduction of quality in the specification and monitoring of tenders and contracts;
- to be clear about what can best be done in-house and what can be contracted out to others;
- to use quality partnerships with operators in addition to tenders and contracts;
- to commit authorities to the achievement of targets under their own control and if necessary to submit authorities to penalty-and-reward mechanisms so as to reassure the bidders/contractors on the credibility of these commitments and to compensate them for the costs they might incur as a result of any failure by the authority.

There are specific organisational issues for the operation of *interchanges* within the public transport system. Stakeholder consultation showed that there are gaps between the responsibilities of planning agencies at various levels, which can act as impediments to the effective planning and running of interchanges. Therefore there is a need to define the authorities responsible for the interconnection of long distance, regional and local transport networks, for instance to ensure effective planning to cope with traffic generation in the vicinity of interchanges.

In parallel with this, the financial responsibility for interchanges needs to be defined. A key issue is the extent to which the largely profitable long-distance operators or the often-subsidised local operators should pay. Also, to what extent should the revenues from rising land prices and economic development around the interchange be captured to fund the basic infrastructure? It was concluded that there is no standard solution, but that legislation is needed to ensure that decisions are in line with public policy objectives.

Interconnection to the urban transport system is also a topic for the development of *rural transport*. Low population density often means that conventional approaches to passenger

transport, which are based on significant numbers of passengers travelling together, lose their viability in rural areas. Therefore, to assist transport planners, a database with over 100 case studies of European experiences in arranging rural transport services has been compiled on the web. In addition, a good practice guide proposes twelve schemes for providing innovative services.

6.10 Indicators, tools, methods

Research objectives

Work on *indicators, tools and methods* covers generic and specialist research to provide a basis for assessment of policy options. The targeted outputs have included:

- scenarios of future mobility trends and their implications for policies and services;
- guidelines on financing approaches for urban transport, with particular regard to private sector interests and constraints;
- guidelines and data concerning policies for land use and transport planning;
- a simulator for traffic control in congested urban networks;
- improved market research methods for public transport;
- a handbook for the self-assessment of quality in urban passenger transport.

Main findings

Land-use planning measures are perceived as an important means of influencing transport demand and trip patterns in the longer-term. However, relatively little is known about the effects of such measures. Therefore a common set of indicators and methods has been provided for city planners to facilitate more effective policy decisions. (This complements the work described in Section 6.3.) A sample database of values for those indicators has been created, covering 40 European cities. Recommendations have been made concerning the extension and harmonisation of future data collection, such as travel demand surveys and parking surveys.

The collected data indicate some significant relationships:

- Lower population densities and a higher concentration of jobs in urban sub-centres tend to increase the use of the car relative to public transport. Small cities have a higher share of car use than larger cities.
- The frequency of service in public transport has a strong effect in increasing patronage and decreasing the use of private cars. The extent of public transport routes is not the key issue.
- Greater provision of primary road kilometres is associated with a higher share for cars in the modal split. Parking management, traffic calming, cycle promotion and public transport strategies seem to reduce car use.

In parallel with such data collection work, *modelling methods* have been developed to assess urban transport strategies. These methods allow theoretically optimum strategies to be defined for specific cities, according to different criteria such as sustainability and economic efficiency. It was found that optimal strategies involve a *combination* of measures. Also, there is no *single* best measure or strategy for general application. Nevertheless, some general recommendations could be drawn:

- *Economically efficient* strategies can be expected to include low cost improvements to road capacity, improvements in public transport (increased service levels or reductions in

fares), and increases in the cost of car use (either road pricing or increased parking charges).

- Public transport infrastructure investment is not likely, in most cases, to be a key element in these strategies.
- Reductions in capacity to discourage car use are not likely to be economically efficient.
- The optimal changes in service levels and fares for public transport will depend on the current level of subsidy - in some cases a reduction in service levels or an increase in fares may be justified on economic grounds.
- The optimal increase in costs of car use will depend in part on current levels of congestion.
- In general, there should be a greater distinction between peak and off-peak charges and fares.
- In most cases, economically efficient strategies can be designed which are financially feasible, provided that revenues can be used to finance other strategy elements.
- “Value capture” (e.g. taxing land values that benefit from transport infrastructure investment) may help to raise additional finance in cases where strategies are not self-funding and require private financing.
- Private sector operation of public transport reduces the net social benefits of the optimal transport strategy, particularly under deregulation. If a city authority decides that private operation of public transport *is* beneficial, it should ideally use a franchising model in which it specifies the objectives and the optimal service levels and fares.

The value of the optimisation methodology, for many cities, lies in its ability to identify optimal strategies that can be *fully funded from user charges*. For other cities where private finance is needed for capital investment, the optimisation procedures can identify the appropriate modifications to the strategy to achieve the best performance within the financial constraint.

Application of the methodology also shows that the pursuit of *sustainability* (rather than pure economic efficiency) is likely to justify investment in public transport infrastructure, further improvements to public transport services and/or fares, and further increases in the cost of car use. However, the availability of finance will be a major barrier to implementation of many strategies that are optimal for sustainability.

Nevertheless, some new transport services can be expected to emerge. Scenarios have been developed for travel patterns in European cities for the year 2010, looking at the introduction of 16 types of new mobility service. These include:

- private services, such as transporting children to and from school;
- demand management, such as the sale of capacity on private road infrastructure;
- car leasing and sharing arrangements.

Strong traffic demand management, restriction of individual motorised transport in the central business district and support for other modes would favour the development of these new services. However, regional planning may be needed to inhibit the dispersion of homes and businesses to areas outside the traffic management zone. Otherwise the collective transport services may not remain financially economic. Policy-makers will also need to look at the conditions for competition between traditional public transport, the new mobility services and private taxis.

Integration of policy measures is becoming a common theme of urban transport strategies. This requires co-ordination between decision-makers with overlapping responsibilities. Therefore a multi-criteria decision support system has been developed, aimed at city and regional traffic planners. This is designed to help the various organisations responsible for different aspects of urban transport systems to identify areas where greater co-operation is possible between them. It was concluded from test applications that there is no single organisational, financial and legal structure that will best encourage transport integration for all the different types and sizes of urban areas in Europe. Therefore this tool allows local actors to input indicators and criteria relating to their *own* situation in order to prioritise changes.

Another new tool for traffic planners and network managers is simulation software to support the design and operation of urban traffic control systems. This allows real-time simulation of traffic movements in the road network, and faster than real-time prediction of the consequences of events such as traffic accidents or operator intervention.

New market research methods have been devised, aimed at improving urban public transport through a better matching of service characteristics with the requirements of different groups of users. The trial application of these methods showed that:

- Passenger priorities differ substantially between countries, with only punctuality/reliability commonly achieving a high ranking. The postulated importance of travel speed in modal choice may be over-rated. Therefore user needs must always be confirmed locally.
- Previous market research has often focused on frequent travellers, and thereby failed to spot the different needs of other user groups. For example, only low importance is attributed *on average* to pre-trip information, but this aspect is significant for infrequent and potential users.
- The correlation between delivered and perceived quality is weak. Direct measurement of user satisfaction will remain the most reliable indicator of transport service quality as seen by the customer, rather than the measurement of performance indicators.

Of course, measuring quality through customer surveys is unlikely to be cost-effective as a method of *continuous* assessment of the performance of public transport. Therefore there has been strong interest in providing indicators for benchmarking performance between operators (as proposed in the EC Communication on “Developing the Citizens’ Network”). For this purpose, a handbook on the self-assessment of internal quality by transport operators has been devised. This is available both on paper and in electronic format. There are five separate but compatible versions of the handbook for five public transport modes (bus, trolley bus, tram/light rail, metro and local heavy rail), plus a short version with 27 “super indicators” to provide benchmarking data.

A database of these benchmarking results has been created, accessible to the target audiences. All commercially sensitive information placed on the open database is in an anonymous format. Using the database, operators can target feasible improvements in performance by reference to the industry standard. Perhaps more significantly, these data will also be important *for local authorities when tendering for public transport services*, following the revision of Regulation 1191/69 on the organisation of public transport.

7. REFERENCES

1. "Urban travel and sustainable development", OECD-ECMT, 1995.
2. "Common Transport Policy Action Programme 1995-2000", COM(95)302, 1995.
3. "The Citizen's Network", Green Paper, COM(95)601, 1995.
4. "Developing the Citizens' Network", COM(98)431, 1998.
5. "On Transport and CO₂", COM(98)204, 1998.
6. "The Common Transport Policy. Sustainable mobility: perspectives for the future", COM(98)716, 1998.
7. "Proposal for a Regulation of the European Parliament and of the Council on Action by Member States concerning Public Service Requirements and the Award of Public Service Contracts in Passenger Transport by Rail, Road and Inland Waterway", COM(2000)7, 2000.
8. "Memorandum to the Commission on the Policy Guidelines of the White Paper on a Common Transport Policy", 18 July 2001.

ANNEX 1 RTD PROJECTS CONTRIBUTING TO THE THEME

This Annex lists (in alphabetic order) the titles and objectives of RTD projects relevant to the urban transport theme. The following Table identifies the RTD cluster(s) to which each project contributes most strongly.

| Clusters | Relevant RTD projects |
|------------------------------------|---|
| <i>Pricing</i> | AFFORD, CAPRI, CONCERT-P, FISCUS, TRANSPRICE |
| <i>Traffic management</i> | AIUTO, DIRECT, DUMAS, INCOME, LEDA, MUSIC, PRIVILEGE, SWITCH |
| <i>Land-use/transport planning</i> | DANTE, START, TRANSLAND |
| <i>Mobility management</i> | ARTIST, CAMPARIE, ICARO, INPHORMM, MOMENTUM, MOSAIC |
| <i>Interchanges/interfaces</i> | EMOLITE, GUIDE, HSR-COMET, MIMIC, PIRATE |
| <i>Infrastructure</i> | CAPTURE, OPIUM |
| <i>Non-motorised transport</i> | ADONIS, PROMISING, WALCYNG |
| <i>New transport concepts</i> | CATRIV, IDIOMA, IMPREND, INTERCEPT, LEAN, RECONNECT, REFORM, UTOPIA |
| <i>Organisational strategies</i> | CARISMA, ISOTOPE, QUATTRO, VIRGIL |
| <i>Indicators, tools, methods</i> | EQUIP, EUROMOS, FATIMA, HIPERTRANS, INTRAMUROS, MOTIF, OPTIMA, SESAME |

| Project acronym | Title | Objective(s) |
|------------------------|--|--|
| ADONIS | Analysis and development of new insight into substitution of short car trips by cycling and walking | The project aims to provide recommendations and guidelines for initiatives to promote walking and cycling instead of short car trips. Best practice examples of cycle-friendly and pedestrian friendly infrastructure elements and other measures will be reviewed. Behavioural factors affecting modal choice and car-cyclist and car-pedestrian accidents will be identified. |
| AFFORD | Acceptability of fiscal and financial measures and organisational requirements for demand management | The project aims to show that marginal cost based pricing measures are both efficient and feasible. The pricing methods to be considered include road user charges, parking fees, fuel taxes, vehicle taxes, and public transport fares and subsidies. In particular, it is intended to show that marginal cost pricing in combination with other fiscal and financial measures can in practice effectively internalise transport externalities such as congestion and environmental impacts, and can regulate demand in a way that is socially efficient and equitable. An equally important aim is to identify the institutional and political barriers to the implementation and acceptance of such pricing measures in Europe, and to show how they can be overcome. |
| AIUTO | Models and methodologies for the assessment of innovative urban transport systems and policy options | The aim is to develop models and methods for planning and evaluating transport demand measures, and to assess the socio-economic and user benefits of a range of policy packages (including pricing, parking/access restrictions, car pooling, park-and-ride and new transport concepts). |
| ARTIST | Agenda for research on tourism by integration of statistics/strategies for transport | The goal of ARTIST is to demonstrate how tourism statistics can be related to transport data, as well as providing lessons for urban and transport planners in managing tourism flows. Specific objectives are: <ul style="list-style-type: none"> • to analyse the share and dynamics of tourism in total mobility; • to review existing visitor management practices, especially in European cities with large tourism flows; • to demonstrate the need for a Community transport initiative on this issue. |
| CAMPARIE | Campaigns for awareness using media and publicity to assess the responses of individuals | The aim is to recommend strategies for information management and awareness campaigns aimed at influencing travel behaviour in favour of sustainable transport modes. This will include the provision of guidelines on campaign design and implementation, and the production of a computer-based tool for strategy optimisation and impact evaluation. |
| CAPRI | Concerted action for transport pricing research integration | The aim is to facilitate dissemination to Member States of the results of projects dealing with the pricing of transport and to attempt to build up a consensus on the policy implications. |

| Project acronym | Title | Objective(s) |
|------------------------|---|---|
| CAPTURE | Cars to public transport in the urban environment | The aim of the project is to assess and recommend policy instruments and strategies using physical measures designed to encourage travellers to use public transport, cycling and walking as opposed to public motoring in EU urban areas. Information on the most appropriate strategies and decision support will be provided to decision-makers; policy strategies will be tested in demonstration sites, singly or in combinations; and tools and databases will be developed to ascertain the transferability of results to other urban areas. |
| CARISMA | Co-ordinated architectures for the interconnection of networks for suitable mobility with telematics applications | The project aims to support consensus formation on transport issues related to the interface and interconnection between long distance transport networks and local/regional transport networks of all modes. In the longer term, a more systematic flow of information between European, national and local policy levels is targeted. |
| CATRIV | Conceptual analysis for transportation on rivers | The project aims to gauge the technical, economic and environmental feasibility of transporting passengers and goods on short distances in urban areas via inland waterways with a view to reducing road congestion. |
| CONCERT-P | Co-operation for novel city electronic regulating tools | The general aim of the project is the assessment of demand management policy instruments such as pricing/restraint measures. The potential of the different measures will be assessed, the impact of integrated pricing/restraint measures on urban travel behaviour evaluated, the public acceptability of different forms of pricing/restraint tested, and the obstacles to their implementation examined. |
| DANTE | Designs to avoid the need to travel in Europe | The aim of the project is to determine the most effective strategies for trip reduction, travel avoidance, switching and substitution - for both urban and inter-urban travel. The main outcome will be a "Good Practice Guide" for cities and national governments, which will summarise the opportunities for strategies to avoid the need to travel and the conditions for their implementation. |
| DIRECT | Data integration requirements of European cities for transport | The project aims to provide recommendations and guidelines on the various aspects of the development, implementation and operation of transport data sharing structures. This is to facilitate integration between long/medium term transport planning and short term traffic management. Prototype systems will be evaluated, and the institutional, legal, organisational and financial aspects will be elaborated. |

| Project acronym | Title | Objective(s) |
|------------------------|---|---|
| DUMAS | Developing urban management and safety | The aim of the project is to establish a methodology to demonstrate how safety can be improved as part of a package of measures meeting wider urban objectives; produce a framework and guidelines for design and assessment of urban safety management schemes; and demonstrate the validity of the methodology. |
| EMOLITE | Evaluation model for optimal location of intermodal terminals in Europe | The aim of EMOLITE is to develop and demonstrate a decision support system for evaluating the optimal location of intermodal passenger and freight terminals. |
| EQUIP | Extending the quality of public transport | The project aims to develop a handbook for the self-assessment of quality in urban passenger transport. The handbook will be used as a basis for establishing benchmarking activities amongst public transport operators and authorities. |
| EUROMOS | European road mobility scenarios | The aim of the project is to develop scenarios as a tool for evaluating future mobility trends and the impacts on policies and services, for conurbations and national transport. |
| FATIMA | Financial assistance for transport integration in metropolitan areas | The project aims to provide recommendations on financing approaches, with particular regard to the private sector role, for optimal urban transport strategies. The benefits to the private sector of optimal urban transport strategies, and the potential for obtaining private sector funding to reflect those benefits will be identified. The differences between strategies optimised using public funds and those optimised within the constraints imposed by private funding initiatives will be determined. Mechanisms by which private sector funding can be provided will be proposed. |
| FISCUS | Cost evaluation and financing schemes for urban transport systems | The project aims to analyse existing cost allocation methodologies and financing schemes for urban transport, and conceive new ones in response to identified gaps and weaknesses. The expected output is a European handbook for evaluating real urban transport costs and designing financing schemes. |
| GUIDE | Group for urban interchanges development and evaluation | The project aims to assess and disseminate best practice in the functional specification and design aspects of the interchange between passengers and urban public transport systems. A best practice guide will be developed, and a research network established. |
| HIPERTRANS | High performance transport network modelling and simulation | The aim of the project is to develop a visually interactive simulator for a road transportation network within a high-performance computing environment. The simulator will have real time interfacing with urban traffic control systems, and will enable traffic forecasting for the network in order to make better use of the existing infrastructure and reduce congestion levels. |

| Project acronym | Title | Objective(s) |
|-----------------|--|--|
| HSR-COMET | Interconnection of the high speed rail network with other transport modes: Connection in metropolitan areas of HSR terminals | The project aims to provide policy guidelines for supporting the improvement of interconnections between urban transport modes and High Speed Rail (HSR) terminals. This will include recommending priorities for the development of these interconnection options, on the basis of an impact assessment analysis. Policy guidelines will address economic, land use, financing, tariff, interconnection services and legal/institutional issues. |
| ICARO | Increase of car occupancy through innovative measures and technical instruments | The project aims to provide guidelines on measures and instruments at local and national levels that can increase car occupancy. Best practices concerning technical instruments and organisational measures will be identified; the institutional, legal and cultural framework necessary for increasing car occupancy will be identified; and a methodology for selecting the right measures and instruments will be set up and disseminated. |
| IDIOMA | Innovative distribution with intermodal freight operation in metropolitan areas | The success of intermodal transport depends strongly on the managerial and organisational performance of the pre- and end-haulage of the intermodal transport leg. The project will show how distribution of goods in metropolitan areas can be improved. |
| IMPSEND | Improvement of pre-and end-haulage | The main objective is to define and test a number of ways of improving pre- and end-haulage at terminals, with a view to increasing the efficiency of intermodal transport chains. The project will provide policy recommendations as well as advice to market actors. |
| INCOME | Integration of traffic control with other measures | The aim of the project is to develop and integrate strategies for the optimisation of Urban Traffic Control, Driver Information Systems and Public Transport Systems within Urban Traffic Management Systems (UTMS). EU, national and local policy/user requirements for integrated UTMS will be established; existing UTMS will be reviewed, field trials evaluated, and guidelines on the effectiveness of different strategies provided. |
| INPHORMM | Information and publicity helping the objective of reducing motorised mobility | The project aims to produce guidelines showing how to use various kinds of information and publicity campaigns in order to reduce dependence on the car and levels of motorised mobility. A comprehensive review of different kinds of information and publicity campaigns will be provided, with illustrations of good and bad practice. A general model setting out relationships between objectives, information and publicity strategies, use of specific tools and likely behavioural outcomes will be developed; and a number of "concept campaigns" will be produced. |

| Project acronym | Title | Objective(s) |
|-----------------|---|--|
| INTERCEPT | Intermodal concepts in European passenger transport | Technologies and measures developed and implemented in previous demonstration projects will be drawn together into a toolbox for promoting intermodal transport concepts. This toolbox of measures will then be demonstrated in cities across Europe. |
| INTRAMUROS | Integrated urban transport concepts and market orientated urban transport systems/on-demand urban transport systems. | The project aims to develop tools for co-ordinating the various actors involved in urban transport management systems (local authorities, public transport operators, regional authorities etc.), covering strategic, organisational, institutional, legal and financial issues. Special attention will be paid to urban traffic control, inter-urban traffic control and public transport. |
| ISOTOPE | Improved structure and organisation for transport operations of passengers in Europe | The project aims to identify how organisational structures for urban public transport may be improved, in order to increase the role of public transport in European urban areas. The existing legal status and organisational structures for public transport operations in the European countries will be compared. The pros and cons of various organisational forms in terms of effectiveness and efficiency will be analysed; and a strategic approach to the development of public transport operations will be provided to political decision makers, transport planning authorities, public transport authorities and operators. |
| LEAN | Integration of lean logistics in urban multi-modal transport management to reduce space demand and optimise use of transport mode | <p>The project aims to develop and demonstrate new concepts to distribute and collect goods in urban areas. Current European city-logistic schemes will be reviewed and the feasibility of new concepts analysed, including testing of new systems. The following topics will be studied:</p> <ul style="list-style-type: none"> • logistics to improve productivity in the transport organisation; • city terminal operation to improve forwarding processes, even with additional goods transfer points and handling costs; • telematics to improve control of the goods distribution process; • policy measures to influence transport without radical disruption of economic activities; • measures to support significant modal shift to rail. |
| LEDA | Legal/regulatory measures to influence the use of the transport system | The project aims to study legal and regulatory measures to promote sustainable city transport, with a focus on passenger transport. Current legal/regulatory measures will be reviewed, and guidelines developed for urban authorities on how to implement the most effective measures. Recommendations will be provided to regional, national and European authorities on possible changes in the legal framework. |

| Project acronym | Title | Objective(s) |
|------------------------|---|---|
| MIMIC | Mobility intermodality and interchanges | The project aims to identify and evaluate from different actors' perspectives (users, operators, developers) key issues in planning, design, implementation and management of passenger interchanges with the public transport system. Barriers to intermodality and to transfers at interchanges will be assessed. The effect of the institutional context on infrastructure financing and operations will be studied. Guidelines for planning, design and management of interchanges will be provided. |
| MOMENTUM | Mobility management for the urban environment | The project aims to develop mobility management concepts, strategies and tools for the efficient use of current transport facilities and the avoidance of trips. Such strategies include information on available public transport, arranging of new collective transport, co-ordination of goods transport, co-ordination of car pooling and communication strategies. Strategies and tools will be demonstrated and evaluated in a number of mobility centres; and concepts for the transfer of mobility management strategies will be identified and disseminated. |
| MOSAIC | Mobility strategy applications in the community | The project aims to improve understanding and promote best practice in mobility management concepts. Such concepts will be demonstrated and evaluated, and the potentials for wider implementation assessed and disseminated. |
| MOTIF | Market orientated transport in focus | The project aims to provide guidelines on how to design better market-oriented urban transport systems as part of a set of pull measures aimed at balancing modal split more in favour of collective transport systems. The guidelines will be aimed at authorities, transport operators and the transport supply industry, and will cover improvements in the market orientation of, respectively, the overall urban transport system, individual transport systems and transport components. |
| MUSIC | Management of traffic using traffic flow control and other measures | The project aims to demonstrate that novel methods of traffic control can be used cost-effectively, alone or in combination with other measures (park & ride, reallocation of road space to public transport, road pricing, information...), to reduce congestion, improve the efficiency/cleanliness of urban travel and influence modal choice. Guidelines for simulation modelling will be developed which would allow cost-effective application of the novel traffic control techniques in a range of networks. |

| Project acronym | Title | Objective(s) |
|------------------------|---|--|
| OPIUM | Operational project for integrated urban management | The project aims to develop physical traffic management measures in the areas of parking management and guidance, traffic calming and bus priority measures. The impact of the measures on transport efficiency, safety and modal split in urban areas will be evaluated, with particular reference to the impact on vulnerable road users. Recommendations will be made for the future development of urban transport policies. |
| OPTIMA | Optimisation of policies for transport integration in metropolitan areas | The project aims to identify optimal urban transport and land use strategies for a range of urban areas within the EU. The acceptability and feasibility for implementing these strategies, both in case study cities and more widely in the EU, will be assessed; and guidelines for urban transport policy within the EU will be provided. |
| PIRATE | Promoting interchange rationale, accessibility and transfer efficiency | The project aims to develop recommendations, guidelines and standards for the design of transport interchanges based upon the stated requirements of users and non-users. The outputs will be aimed at those involved in financing or developing new or extended interchanges. |
| PRIVILEGE | Priority for vehicles of essential user groups in urban environments | The aim of the project is to put various categories of private and public transport in order of priority, in terms of guaranteeing their mobility in overcrowded road networks. |
| PROMISING | Development and promotion of measures for vulnerable road users with regard to mobility integrated with safety taking into account the inexperience of the different groups | The objective of the project is to show the potential for reduction in casualties of vulnerable road users (like pedestrians, cyclists, motorised two-wheelers and young drivers) by technical measures that do not restrict mobility or directness of travel - in contrast to previous restrictive safety measures. |
| QUATTRO | Quality approach in tendering urban public transport operations | The project aims to provide strategic and practical recommendations on the introduction of quality initiatives in public transport services. Present and emerging practices including quality performance in tendering/contracting urban public transport (UPT) operations will be identified and evaluated. Guidelines for best practice will be proposed to public authorities and operators. Trends in quality management in UPT will be identified. A link between the quality indices identified in tenders/contracts and the perception of quality by the customers will be established; and a strategic assessment of the impact of quality initiatives on European UPT industry will be performed. |

| Project acronym | Title | Objective(s) |
|------------------------|---|---|
| RECONNECT | Reducing congestion by introducing new concepts of transport | The aim is to identify the potential of new concepts such as underground logistics and airships in alleviating surface congestion, and to assess the requirements for their introduction. |
| REFORM | Research on freight platforms and freight organisation | The project aims to provide guidelines and criteria for designing, locating and organising freight platforms in urban areas. The project focuses on co-ordination of long-distance traffic with city terminals, organisational and operational requirements for successful freight platforms, multi-modality, and the operational improvements to be expected from co-operation schemes. |
| SESAME | Derivation of the relationship between land use, behaviour patterns and travel demand for political and investment decisions; construction of a European database | The project aims to provide an operational framework to support decision-making on local policies for land use and transport planning. The relationships between traffic, land use and externalities will be defined, and recommendations provided to planners on how to elaborate specific strategies using the SESAME tools and database. |
| START | Development of strategies designed to avoid the need for travel | The aims of the project are: <ul style="list-style-type: none"> • to quantify the impact of road travel reduction strategies and analyse their wider impacts in order to highlight barriers to implementation and find ways of making the strategies more acceptable; • to assess the extent to which pricing and other travel reduction strategies may affect infrastructure financing and cost recovery plans, with particular emphasis on the road TEN; • to produce an Action Plan of policy packages to reduce road-based travel, covering all levels of decision making. |
| SWITCH | Sustainable workable intermodal transport choices | SWITCH aims to provide and test guidelines for the development of intermodal initiatives in both urban and inter-urban contexts. |
| TRANSLAND | Integration of transport and land-use planning | This project aims to identify and recommend good practice in the integration of transport and land-use planning. It will cover both the choice of policies and measures, and the effectiveness of procedures and institutional arrangements. |
| TRANSPRICE | Trans modal integrated urban transport pricing for optimum modal split | The project aims to evaluate the technical/financial options for integrated pricing/payment measures across modes of transport. Political acceptability and effects on modal split will be evaluated; a comprehensive impact assessment of integrated pricing/payment scenarios will be provided; and integrated pricing/payment demonstrations in selected European cities will be evaluated. |

| Project acronym | Title | Objective(s) |
|------------------------|--|--|
| UTOPIA | Urban transport options for propulsion systems and instruments for analysis | The main objective of the UTOPIA project is to provide decision-makers with the necessary tools and guidelines for hastening the market introduction of the most appropriate urban transport solutions based on new propulsion systems. The lessons from existing demonstration projects will be identified. Key outputs will include policy guidelines, a best practice guide to introduction methods for local transport operators, and an assessment of the most promising solutions. |
| VIRGIL | Access to transport services in rural areas | The aim of the project is to improve the access to transport and services in rural areas by identifying and analysing good practices and experiences, disseminating the results and identifying needs for further research after a broad consultation with stakeholders. |
| WALCYNG | How to enhance walking and cycling instead of shorter car trips and make these modes safer | The aim of the project is to develop a conceptual marketing model for enhancing walking and cycling in order to replace shorter car trips and to make the walking and cycling modes safer. Existing 'products' for pedestrians will be evaluated and new products developed. Supporting soft policy measures (advertising, lobbying) will be defined in the guidelines. |

ANNEX 2 MAIN FINDINGS FROM COMPLETED RTD PROJECTS

This Annex summarises the findings from completed projects for which the Final Report has been approved or made available (in alphabetic order of project acronyms). Project web page references are provided where known. Summaries of all projects are available from the two web sites given in Section 1 of this paper.

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Project acronym and title**ADONIS:**

Analysis and development of new insight into substitution of short car trips by cycling and walking

Key results and policy implications**KEY RESULTS**

ADONIS has provided general recommendations and guidelines regarding good practice to promote cycling and walking instead of short car trips in cities. It has produced a report and CD-ROM which include:

- the first comprehensive European catalogue of (42) measures concerning walking;
- a compilation of (60) innovative measures to promote cycling, as a complement to existing catalogues of basic measures.

These measures include both technical solutions (such as infrastructure changes) and non-technical actions (such as education and planning). The relevance of measures is mapped onto specific situations by considering:

- the extent to which a city already has certain measures in place;
- the extent to which cycling and walking are already used;
- the need to address two distinct groups – those who are, and are not, accustomed to cycling and walking.

Recommendations for all cities include:

- improving home delivery services;
- introducing secure types of bicycle parking;
- introducing bicycle registration programmes;
- making it possible to insure bicycles against theft;
- increasing the number of parking places for bicycles and decreasing the number for cars;
- using awareness campaigns aimed at behavioural and attitudinal changes towards cars;
- stimulating the creation and participation rates of cyclist and pedestrian organisations;
- targeting travellers to/from schools and educational centres, in order to influence transport habits at an early stage.

Surveys of people's behaviour and attitudes to mode choice in Amsterdam, Barcelona and Copenhagen showed that:

- walking is mainly considered for trips under 1 km, while cycling competes with cars for trips up to 5 km;
- the main factor which appeared to encourage the use of the car was comfort;
- safety and bicycle security are major concerns, while non-cyclists also fear an increase in travel time if they switch to cycling.

POLICY IMPLICATIONS

The project concluded that walking and cycling require clear recognition within local and national transport policies and plans. This particularly requires changes with regard to walking, which enjoys little public advocacy (e.g. by lobbying groups).

The choice of measures is largely dependent on the local situation. However certain recommendations can be made regardless of situation:

- for Government
 - develop specific policies for walking and cycling, especially in terms of urban traffic priority and support for complementary public transport
 - activate employers, factories and shops to provide sufficient and safe cycle parking
 - activate shops to provide (free) delivery of goods
- for transport planners

Project acronym and title**Key results and policy implications**

- use catalogues such as ADONIS to understand what package of measures would be most appropriate in a particular local situation, in what order of introduction.

Measures specifically highlighted were:

- to appoint a pedestrian and cyclist officer to advocate and promote change in the city
- to promote incentives that make drivers experience the benefits of cycling and walking (e.g. Car Free Days)
- to control car speeds by appropriate restrictions and/or enforcement.

AFFORD:**KEY RESULTS****Acceptability of fiscal and financial measures and organisational requirements for demand management**

The aims of AFFORD were to define practical measures to implement marginal cost pricing for transport in cities, to assess the potential problems and to provide policy guidelines for introducing such measures.

The project evaluated “first-best” and “second-best” policy packages based on marginal cost pricing, rather than assessing individual pricing measures. Results from modelling in four European cities (Athens, Edinburgh, Helsinki and Oslo) suggested that such packages give rise to substantial welfare benefits for the urban population. Annual gains typically vary between 100 and 400 Euros per capita, depending on the city context and measures applied. A major part of this gain may result from the effective use of the revenues, for instance allowing a reduction in labour taxes. (The benefits are therefore quite sensitive to the value or “shadow price” attributed to helping a government meet budget constraints without the need for distortionary taxation elsewhere in the economy.)

The equity effects of pricing were estimated to be moderate (negative or positive). Environmental benefits constitute a significant part of the welfare gain, ranging between 15 and 95% depending on the city. Reductions in trips by private car range between 5 and 30%. Overall, accessibility is reduced, particularly for car users. However, if revenues are used to subsidise public transport services, then accessibility may even be increased for most of the population.

Case studies and surveys in five cities indicated that the legal and institutional frameworks required to implement marginal cost-based pricing for urban transport have, so far, not been put in place. For example, these are different to the frameworks needed for road pricing on inter-urban motorways.

Surveys of public, political and business acceptability of pricing were carried out in several cities. These showed a high awareness of the underlying pollution, congestion and parking problems, but relatively little knowledge of pricing instruments. In general, pricing was perceived to be effective, but likely to lead to disadvantages to stakeholders. A majority of motorists did not accept the proposed packages of pricing measures.

POLICY IMPLICATIONS

The dependence of the welfare benefits of pricing on how the revenue is used implies that urban transport pricing is a general policy issue that goes beyond the local policy level and also beyond the transport sector. AFFORD concluded that the introduction of marginal cost-based pricing will require the creation of supporting institutions and laws, and the removal of inconsistencies in national-level policies. For example, strong institutions are needed with the powers to control multi-modal transport pricing

Project acronym and title**Key results and policy implications**

across urban regions, rather than trying to construct complex relationships across multiple local authorities.

Successful pricing will also need effective communication to overcome public opposition. Marginal cost pricing, especially prior to implementation, will be regarded with a lot of scepticism and even hostility. It may be politically vital to redistribute a significant majority of revenues to the local or regional population that pays, whether or not the funds are used for transport.

PROJECT WEB PAGE: <http://www.vatt.fi/afford/>

AIUTO:**KEY RESULTS****Models and methodologies for the assessment of innovative urban transport systems and policy options**

For the analysis of Transport Demand Management (TDM) methods, AIUTO has defined a set of key indicators as the minimum comparison level for sites across Europe, and a common framework of recommended modelling methods.

Alternative approaches to modelling of local transport demand were shown to give results that were not significantly different. However, in the case of modelling traffic flows on the road network, models with greater disaggregation were found to be essential for:

- assessing the effects of traffic-responsive control signals;
- accurately estimating air pollution and safety indicators.

Hypothetical packages of TDM measures were evaluated for six test sites across Europe. The findings are site-specific, but give some indications of lessons for other cities. For example:

- Incentive (“pull”) measures such as an increased public transport service, if applied alone, were found to be rather ineffective in stimulating a switch from private cars. By comparison, “push” measures such as parking and cordon charges altered the modal split significantly.
- Combinations of pull and push measures (e.g. Park & Ride facilities, parking charges plus restricted access zones) yielded the greatest reductions in car trips – more than 21% in Salerno. Restricted access alone also had a substantial effect.
- Staggered working times across companies and flexibility of working hours within companies were found to decrease vehicle-kilometres and especially the levels of exhaust pollution.

POLICY IMPLICATIONS

Although AIUTO has demonstrated that adequate modelling capabilities to analyse TDM measures are generally available, some test site results have shown significant discrepancies in the modelling predictions (e.g. for air pollution). This suggests that validation tests would be useful for a better assessment of the accuracy of such models.

Existing software tools typically are heavily data intensive and require substantial investment in user training. AIUTO has recommended the development of a set of common user-friendly tools that would permit quicker and easier analysis of TDM measures in any European city.

The test site results point to the importance of applying *packages* of TDM policies, rather than individual measures. Packages increase the modal switching benefits (e.g. through synergistic effects), and are perceived to increase the social acceptability of car trip reduction.

Project acronym and title**Key results and policy implications****ARTIST:****KEY RESULTS**

Agenda for research on tourism by integration of statistics/strategies for transport

The goal of ARTIST was to demonstrate how tourism statistics can be related to transport data, as well as providing lessons for urban and transport planners in managing tourism flows.

Through an assessment of existing data and policies, the ARTIST project developed two sets of proposals, concerning:

- the organisation of a research programme to underpin efficient and evaluated action in the tourism and transport sector, both at the European level and at the urban level;
- research themes which can fill the major gaps in the know-how of those who are in charge of managing tourism/transport policies and those who organise and run the tourism/transport facilities.

Concerning the first set of proposals, the project highlighted the lack of a global theory explaining the behaviour of travellers. Methods were proposed to investigate the different aspects of this behaviour, including data acquisition, analysis of travel patterns and analysis of impacts. Tools and models were investigated for monitoring and evaluating policies, strategies, measures and services, in order to steer the decision making process.

For the second set of proposals, the ARTIST project selected 21 research themes. These cover a full range of concerns, ranging from the development of a set of adequate definitions, through survey and forecasting methods, to the design of information systems and safety policies. For each of the research themes, ARTIST described the problem, the objectives, the steps to be performed, the expected results and their possible use.

POLICY IMPLICATIONS

Consistent management of tourism statistics and related research activities across Europe will impact a wide range of policy areas: employment, regional development, education, environment, consumer protection, health, safety, culture, new technology, transport, finance and taxation, to name but a few.

At a local level, such data management will allow a better use of existing programmes of policy support, particularly the EC Structural Funds that subsidise tourism activities under the control of local authorities in Member States.

CAMPARIE:**KEY RESULTS**

Campaigns for awareness using media and publicity to assess responses of individuals in Europe

CAMPARIE aimed to collate and disseminate strategies for information and awareness campaigns in the transport sector, based on real-life experiences, in order to provide decision support for future initiatives.

The project developed a software-based tool that provides information on more than 100 previous campaigns (mainly concerning public transport). It is designed to help practitioners identify experiences relevant to their own situation. The software is complemented by guidelines on the process of designing a campaign.

A survey confirmed that local authorities usually use transport planners and engineers rather than communications experts for designing and running campaigns. Conversely, the professional agencies that are sometimes employed to support such

**Project acronym
and title****Key results and policy implications**

campaigns often have little or no experience of transport-related issues. The CAMPARIE outputs aim to bridge this gap by broadening the knowledge base on both sides.

General public awareness campaigns tend to be undertaken by regional and national authorities. Impacts cannot readily be assessed, and a long time period is necessary to obtain reliable results. In contrast, local authorities and operators seem to prefer targeted campaigns and more individualised marketing. This requires some knowledge of user needs, and much could be learnt from the latest developments in market segmentation techniques, computer applications and the targeted use of incentives.

Detailed evaluation of six campaigns generated the following insights:

- The success of a campaign is maximised when combined with one or more specific policy measures (such as traffic restrictions or a new public transport service).
- Mixes of measures and mixes of campaigns seem to have an increased effect relative to isolated efforts.
- General awareness campaigns need to be repeated at regular intervals, otherwise they lose their “power” to influence behaviour. Campaigns targeted on specific groups have stronger and longer-lasting effects.
- Most of the campaigns studied by CAMPARIE can be transferred to other locations, with appropriate adaptation.

POLICY IMPLICATIONS

CAMPARIE concluded that marketing is not being used to its full potential in the transport sector to support policy-induced changes in behaviour. This may be due to decision-makers not being comfortable with how to design and evaluate campaigns. The consequence is that they are missing a low-cost approach to increasing the impact of high-cost measures.

CAMPARIE found that there is a need to distinguish a campaign coming from a local authority to that of a private enterprise aimed at promoting a particular product or service. Target audiences often discard material that they consider pure advertising, and therefore need to be warned about “public service” information.

Children need to be addressed by campaigns. It is likely that someone will develop less car-centred travel behaviour and attitudes if their awareness of the issues has been raised from an early age.

For the future, the issue remains as to how to make tools such as the CAMPARIE software available to users and up-to-date. This suggests that future applications of this sort need to be Web-based.

CAPRI:***KEY RESULTS*****Concerted Action
on transport
pricing research
integration**

The purpose of CAPRI was to facilitate the transfer of information from research projects dealing with the pricing of transport. Key objectives were:

- to aid dissemination of results to Member States and other stakeholders;
- to develop a synthesis of research findings;
- to help to build a consensus on the implications for policy.

CAPRI drew conclusions in six areas (pricing principles, valuation of externalities, road pricing, rail and other public transport, air transport, and the likely impacts of

**Project acronym
and title****Key results and policy implications**

pricing policy). These were based on EC-funded research as well as other evidence from inside and outside the EU.

Pricing principles: Pricing policy should be based on an understanding of marginal social costs, where the user pays the costs that they cause through additional infrastructure use. This will not deter trips that offer a net benefit to society, but it will discourage trips where the benefit to the individual user is less than the cost to society as a whole. Marginal social costs should be used as the starting point for price determination, with other important considerations such as financial needs incorporated in a way that does least damage to society's welfare. One of the main implications of pricing based on social costs is that prices should vary to a greater extent according to location and travel time.

Valuation of externalities: All of the main externalities (air pollution, global warming, congestion, accidents etc.) can be taken into account in pricing structures, even though some uncertainty exists in their estimation. CAPRI recommended specific evaluation methods for particular impacts.

Road pricing: Greater differentiation in road charges by time period and area is necessary to cope with congestion resulting from heavy peaks in travel demand. The main impact is likely to be travel at different times or by different routes, rather than a change in mode. To increase acceptability, the introduction of pricing should be staged, starting with simple systems with low charge levels, and the revenue should be earmarked for specific spending programmes such as public transport.

Rail and other public transport: Efficient pricing is likely to require greater peak/off-peak differentials, and also an element of government funding (particularly for short-distance urban services). Improving the service quality and investment in infrastructure may be the most important measures for improving modal shares, as opposed to internalisation of externalities for all modes via the pricing mechanism – this is particularly the case for freight transport.

Air transport: Environmental pricing can be based on kerosene consumption and/or landing and take-off operations, but policy development in this area requires further research.

Likely impacts of implementing efficient pricing: Pricing based on marginal costs may result in price reductions for some modes as well as price rises for some others. For example, inter-urban passenger travel in uncongested conditions, by road or rail, is typically *over-priced* at present. For inter-urban freight transport, evidence suggests that there is often significant *under-charging* for both road and rail. Finally, urban transport by means of road-based modes is typically *dramatically under-charged*, particularly in congested conditions.

POLICY IMPLICATIONS

The existing range of pricing policies in EU Member States is so varied that the impacts of marginal cost pricing have to be assessed on a case-by-case basis. The extent and direction of any price changes will depend strongly on current levels of taxation and charging, and will not necessarily imply lower travel demand. Nevertheless, as a broad conclusion, pricing reform to reflect social marginal cost would involve:

- a decrease in prices for inter-urban road and rail passenger transport and an increase in the price of urban road travel (particularly for the private car);
- an increase in prices for both road and rail freight.

Project acronym and title**Key results and policy implications**

Regulatory policy may often be more powerful than pricing policy in the control or reduction of some categories of environmental emission, such as noise. For emissions of greenhouse gases, CAPRI recommended that pricing should be based on political decisions about target emission levels, given the lack of consensus about the values to be placed on each tonne of pollutant.

PROJECT WEB PAGE: <http://www.its.leeds.ac.uk/projects/capri>

CAPTURE:**KEY RESULTS****Cars to public transport in the urban environment**

The aim of CAPTURE was to collate and evaluate data on the effectiveness of *physical* transport measures designed to restrict or encourage the use of different modes (such as parking management, bus priority schemes and restriction of road space for private cars).

Based on the evidence of demonstrations of packages of measures in 11 cities, the project has published detailed findings on the performance and impacts of different measures. Major elements of these packages included bus lanes, public transport prioritisation, improvements to junctions and interchanges, area access restrictions and controls on central area parking.

The project found that physical measures do not *in themselves* generally have a major short-term impact on modal split, unless they are large in scale. Nevertheless, CAPTURE identified positive effects on the performance of public transport (such as lower journey times and better timekeeping). This means that the smaller schemes may encourage a change in behaviour when people periodically re-assess their travel decisions – either due to changing circumstances (such as a job or house move) or due to other policy changes (such as pricing measures).

Physical measures are not easy to introduce. In the CAPTURE cities, the most common barriers were conflicts of interest between the institutions involved, a lack of funds, diversion of attention to alternative schemes, and opposition from affected stakeholders. Small-scale, low-visibility cheap solutions were found to be the most readily implemented. However, these run the risk of failing to achieve large-scale change, unless introduced as part of an overall vision and strategy.

Measures that reduce traffic levels in *areas* of cities are difficult to implement, but are effective when carried through. However, there are no “off-the-shelf” solutions for cities to apply. For example, bus lanes have had good success in some cities and little in others. Changes must be planned individually, taking into account local conditions, the ease of implementation and user reactions. City size is not a major factor in determining the most appropriate measures, but city type (historic versus modern) may be significant.

POLICY IMPLICATIONS

CAPTURE concluded that modal change requires a package of measures in a well thought-out strategy. Physical measures are important because they affect the capacity and efficiency of public transport. This is an essential precursor for a change in travel behaviour, whatever the levers (pricing, green commuter plans etc.) used to induce that change.

Experience suggests that only two or three institutions need to be involved in the implementation process for serious conflict to arise. This worrying conclusion highlights the importance of building consensus and commitment throughout the

Project acronym and title**Key results and policy implications**

process.

If area-wide changes are targeted, the following recommendations can be made:

- Carry out public consultation and, preferably, public participation in the scheme design.
- Note that physical restrictive measures are probably more acceptable than road pricing measures.
- In cities where such changes have not previously been attempted, start small or experimentally in order to build up public support.

For the national and European levels, CAPTURE concluded that:

- A national or regional body needs to assess local plans with respect to their overall impact on longer-term policy goals (including broader issues such as reducing social exclusion).
- Good practice examples need widespread dissemination, particularly to counter popular perceptions about the effects of access restrictions and pedestrianisation on city centre trade.
- Telematics measures can generally be implemented without delay, but the benefits are often greater to private motorists than to public transport passengers.

CARISMA:**KEY RESULTS****Concerted Action for the interconnection of networks**

CARISMA brought together experiences from across Europe to provide a state-of-the-art review of approaches to network inter-connection. The main focus was on interchanges within the public transport system and terminals connecting public transport to private road journeys.

Policy towards the location of major interchanges was identified as one key issue. Such infrastructure has tremendous influence on land-use and land values close to the site, and consequently can generate much traffic locally. Strong co-operation is therefore needed between transport and regional planners. CARISMA proposed that the TEN-T guidelines should be updated with new procedures to support decisions on interchange location, taking account of different stakeholder interests.

Financing of interchanges is another problem area. A key issue is the extent to which the largely profitable long-distance operators or the often-subsidised local operators should pay. Also, to what extent should the revenues from rising land prices and economic development around the interchange be captured to fund the basic infrastructure? CARISMA concluded that there is no standard solution, but that legislation is needed to ensure that decisions are in line with public policy objectives. Even in those countries where formalised procedures exist for network planning, there is often a lack of criteria and clear responsibilities for decisions on the location of interchanges.

CARISMA found that short transfer and waiting times are crucial for passenger satisfaction with an interchange. This requires harmonised schedules for all modes available at the interchange, through-ticketing for multi-modal journeys, and co-operation between modes in handling system interruptions. These requirements may be at odds with the priorities of the interchange operator, more interested in generating revenue through retail and other services. Thus there is a need for unified management of the facility, supported by good co-operation from the connected transport systems – which may in turn require public intervention.

**Project acronym
and title****Key results and policy implications*****POLICY IMPLICATIONS***

CARISMA concluded that there appear to be gaps between the responsibilities of planning agencies at various levels that can act as impediments to the effective planning and running of interchanges. Therefore there is a need to define the authorities responsible for the inter-connection of long distance, regional and local transport networks. In parallel with this, the financial responsibility for interchanges needs to be defined.

The project noted that deregulation of public transport does not facilitate smooth and seamless travel, whatever the other benefits. Therefore deregulation needs to be accompanied by effective legislative and planning frameworks to encourage co-ordination of services.

PROJECT WEB PAGE: <http://www.polis-online.org>

CATRIV:

The final results of this project were not available when this Thematic Paper was prepared.

**Conceptual
analysis for
transportation on
rivers****CONCERT-P:*****KEY RESULTS*****Co-operation for
novel city
electronic
regulating tools**

Demonstrations of road pricing measures to change modal split in urban areas were conducted at three sites:

- In Trondheim, car drivers incurred peak period charges that varied over short time intervals to reflect different levels of congestion.
- In Bristol, charges applied throughout the day, with additional incentives for using public transport and higher charges during days of poor air quality.
- In Barcelona, zone access control was implemented.

Key findings were:

- Trondheim: reductions in peak period traffic exceeded 10% (mainly due to drivers changing their time of travel), with a smaller decrease in the total number of trips – indicating some trip suppression or modal shift.
- Bristol: 15-20% reductions in daily car travel could be largely attributed to drivers switching to public transport.
- Barcelona: the viability of technical implementation was shown to be acceptable to enforcement authorities.

It was clear that drivers tended to re-schedule trips before considering switching to public transport, and that individual drivers responded very differently to the charges. This has to be borne in mind when tariff structures are being designed.

Public acceptance of road pricing was found to be higher if revenue hypothecation (e.g. to improve public transport) is introduced.

POLICY IMPLICATIONS

The project made a series of recommendations:

Pan-European level

Urban demonstrations of multi-modal charging regimes with integrated payment

Project acronym and title**Key results and policy implications**

systems should be intensified. Projects should:

- combine road pricing with public transport alternatives;
- use technology to collect evaluation data and provide a feedback loop to drivers on the financial implications of their daily decisions;
- demonstrate the benefits of revenue hypothecation.

National level

Governments and relevant authorities should:

- introduce enabling legislation so that revenues from road user charging can be re-invested locally to improve the travel alternatives where road charges are introduced;
- encourage local authorities to integrate public transport services in their pricing schemes;
- co-ordinate initiatives to develop multi-modal payment systems.

DANTE:**KEY RESULTS****Designs to avoid the need to travel in Europe**

The project has produced a good practice guide for the selection and implementation of strategies to reduce the need for travel, particularly aimed at cities. This covers some 30 measures, illustrated by case studies. These include mode switching (from cars), time switching (from peak periods), destination switching (to closer places), and trip substitution and avoidance.

The main finding is that travel reduction is most likely where several policy measures work together in a package. For example, restraint on car use has been combined successfully with promotion of alternative modes, while “pure” reduction measures seem to have been relatively unsuccessful. The scale of reduction is often difficult to quantify, which will make policies difficult to justify ex-post. Also, it has been seen that restraint in one area of a city can lead to increased use of cars elsewhere (e.g. outside the city centre), unless policies are well co-ordinated.

Resource barriers (whether financial, human or physical) have been the most common problems, particularly for alternative modes. These have hindered implementation in almost 20% of the cases studied. Restrictions on car travel more commonly meet social barriers. Land-use planning measures aimed at traffic reduction generally seem to encounter serious barriers.

POLICY IMPLICATIONS

The project concluded that “push” measures are essential – the perceived advantages of car use are so great that there will only be a minimal transfer from car driving while car use remains unrestricted.

The most effective strategies for traffic reduction seem to involve the promotion of alternative modes. It remains to be seen whether trip substitution/avoidance and time/destination switching hold greater potential in the future, starting from a baseline of limited experience and success, or whether further investment in mode switching is the most cost-effective approach.

Public awareness messages are needed to encourage a change in travel behaviour, as well as providing information on the available alternatives. Authorities themselves, as employers, are in a good position to lead by example. This can be done through parking policies, provision of bicycle facilities and the use of teleworking methods.

It is important to co-ordinate policies (e.g. within a local transport plan) to reinforce

Project acronym and title**Key results and policy implications**

the objective of traffic reduction. For example, measures to promote the efficiency of the traffic system need to consider the travel-encouraging consequences, and the creation of out-of-town centres (which encourage longer, car-based trips) requires careful control.

DIRECT:**KEY RESULTS****Data integration requirements of European cities for transport**

The aim of DIRECT was to develop a Transport Data Sharing Structure (TDSS), providing software tools and a procedural framework to permit the exchange of information between organisations. The project made recommendations on the technological, institutional, legal and financial aspects of operating a TDSS, based on case study investigations in Turin, Southampton, Brussels and Rotterdam. These recommendations were then tested on prototype systems in Barcelona (sharing information on park-and-ride facilities between potential users, bus operators, the parking operator and planning authorities) and in Lille (providing interfaces to various existing databases through a “Mobility Observatory”).

The project found that the most cost-effective solution for a TDSS to support transport planning involves providing common access to a set of databases linked through a local network. In contrast, for traffic management applications, the TDSS has to manage connections between distant databases on the Internet.

Non-technical recommendations for setting up and running a TDSS included:

- Create a framework establishing a common goal between the partners, specific responsibilities and a clear leader.
- Establish contracts to ensure that all partners adhere to their promises.
- Establish the position on data liability, data privacy, copyright and the ownership of data in public databases such as traffic information.
- Explore opportunities for funding through Private Public Partnerships and from income gained through sales of data.
- Establish a maintenance plan for the data, as well as clear structures and procedures for operating the TDSS.

POLICY IMPLICATIONS

At the start of the project, it was envisaged that different stakeholders would cooperate to pool their data in a central database with common access. However, DIRECT subsequently concluded that recent developments in information technology favour distributed architectures that enable each stakeholder to remain in control of their own data. Nevertheless, the sharing and commercial exploitation of public and private data will remain a policy issue that has to be resolved in each application.

The project found that tools and standards for data sharing are best developed for road-based traffic management. The benefits of real-time data sharing will not be fully realised until other modes can be integrated. This is likely to require the development of new standards for data elements, which may emerge particularly from work on web-based applications.

PROJECT WEB PAGE: <http://www.simulog.fr/iprojf.htm>

Project acronym and title**DUMAS:****Developing urban management and safety****EMOLITE:****Evaluation model for the optimal location of intermodal terminals in Europe****EQUIP:****Extending the quality of public transport****Key results and policy implications**

The final results of this project were not available when this Thematic Paper was prepared.

PROJECT WEB-PAGE: <http://www.trl.co.uk/dumas/>

KEY RESULTS

EMOLITE aimed to develop a decision support system integrating all relevant supply and demand requirements of intermodal distribution and transshipment centres as well as passenger terminals.

EMOLITE defined the framework for a PC based decision support system that provides comprehensive strategic information on the quality and suitability of potential terminal locations. The project then produced the prototype of a user-friendly software (implemented in MS Access) that consists of a database and a simulation module, offering the following capabilities

- ranking of alternative terminal locations according to weighted values and criteria,
- flexibility in handling terminal attributes,
- algorithms for solving the rating and ranking based on a fuzzy multiple attribute model,
- an interactive and user-friendly interface;
- visualisation and presentation facilities, such as charts, reports, graphs and maps.

POLICY IMPLICATIONS

The approach developed by EMOLITE allows an accurate evaluation of potential sites for passenger and freight terminals, based upon internal (technical, operational, costs) and external (public, private) requirements. Some improvements are anticipated, e.g. in the fuzzy model by creating more fine-tuned algorithms, in the user interface by including additional functionality, or in the database structure to accommodate more consistent data handling. Hence, a ready to use decision tool can be derived from the EMOLITE prototype.

KEY RESULTS

The major result of EQUIP is a handbook for self-assessment of internal quality performance of local transport operators, available both on paper and in electronic format. There are five separate but compatible versions of the handbook for five public transport modes (bus, trolley bus, tram/light rail, Metro and local heavy rail) plus a short version of 27 “super indicators” to provide an entry to benchmarking.

The handbook is composed of two parts. Part I contains the method, which describes the rationale for benchmarking and the data handling methodology used in EQUIP. Part II is divided into two sections: a list of 91 indicators (subdivided into 11 clusters, e.g. revenue and fare structure, safety and security, company profile) and a separate Guide to Completion to assist users. Validation and feedback have been provided by the EQUIP Network of operators and users (authorities and passenger interest groups).

A publicly accessible database of benchmarking results has been created. All confidential information placed on the public database is in an anonymous format. Using the database, operators can achieve an improvement in performance through anonymous comparison with other operators.

**Project acronym
and title****Key results and policy implications*****POLICY IMPLICATIONS***

The EQUIP project has played an important role in providing public transport organisations with relevant, measurable and comparable indicators for benchmarking, in line with the EU Commission's recommended actions to improve transport systems ('Developing the Citizens' Network', COM(98)431 final).

The project's results are mainly addressed to persons responsible for managing the self-assessment and benchmarking actions within public passenger transport organisations. Nonetheless a shorter document on Conclusions and Recommendations has been generated for policy makers and other interested readers.

The handbook is suitable for land-based local public transport operators in diverse operating environments. It can be used for self-assessment and for comparing with other operators using an anonymous centralised database. The handbook is suitable for internal, national and international benchmarking, although the level of application varies according to the individual indicators.

PROJECT WEB-PAGE: <http://www.euoprojects.ie/equip/>

EUROMOS:***KEY RESULTS*****European road
mobility scenarios**

EUROMOS aimed to produce scenarios of mobility conditions in European cities for the year 2010, identify promising new mobility services and evaluate their impacts on policy.

Three scenarios were developed. These may be characterised as continuation of current trends, a widening of the spread of household incomes, and the application of strong traffic demand management policies. Their impacts on the cities of Barcelona, Bordeaux, Gothenburg, Munich, Southampton and Turin and the success of new mobility services were shown to correlate strongly with local factors. Such factors include political tradition, social attitudes, city morphology and size, and the regional economic activities.

Potential was identified for 16 mobility services concerning:

- private needs, such as transporting children to and from school;
- demand management, such as the sale of capacity on private road infrastructure;
- car leasing and sharing arrangements.

Across all scenarios and cities, the restriction of individual motorised transport in the central business district emerged as a general strategy, combined with measures to support other modes. Strong traffic demand management boosted the development of all mobility services relative to the other two scenarios.

New technologies were seen as critical to the adequacy of new services, to provide user information, control vehicle operations, and make payment easy. Unwillingness to share data between organisations was identified as a potential barrier.

POLICY IMPLICATIONS

The new mobility services provide new forms of public transport. These services will need regulation and may merit public funding. Policy-makers will need to look at the conditions for competition between traditional public transport, these new intermediate services, and private taxis.

Project acronym and title**Key results and policy implications**

Innovative freight services are seen as a contribution to economic competitiveness while improving the attractiveness of central areas in a city. In general, this is thought to require public/private partnerships. Public authorities have an important role in setting up institutional arrangements, monitoring the schemes and providing financial support to overcome initial market barriers.

Regional planning may be needed to inhibit the dispersion of homes and businesses to areas outside the zone of traffic management controls. Otherwise the conditions for financially economic use of collective transport by people and goods going into and out of the city may not be met.

FATIMA:**KEY RESULTS****Financial assistance for transport integration in metropolitan areas**

The aim of FATIMA was to identify the differences between urban transport strategies optimised using public funds and those requiring private funding, and to provide guidance on how best to use private sector funding.

Conclusions were drawn from modelling studies in nine cities: Edinburgh, Eisenstadt, Helsinki, Merseyside, Oslo, Salerno, Torino, Tromso and Vienna. In six of these cities, optimal policies could be funded by road pricing or increased parking charges with no net additional financial support (over a 30-year time horizon), allowing public transport services to be increased or fares decreased.

In the other three cities, the optimal strategy would require greater funding than the do-minimum case. Where cities face constraints on capital investment, private sector finance could be used, with part of the cost being met from public funds and part from user revenues. However, if the private sector requires a higher rate of return than the public sector, the optimal strategy may well be constrained, resulting in lower social benefits. In this case, an alternative is to raise additional finance through value capture (such as taxing land values that benefit from transport infrastructure investment). However, the modelling suggested that value capture is beneficial in only a limited range of city situations.

FATIMA also studied the merits of private sector operation of public transport, whether implemented through deregulation, in which operators are free to determine service levels and fares, or through franchising, where the city authority specifies them. Results indicated that private sector operation reduces the net social benefits of the optimal transport strategy, particularly under deregulation. No convincing evidence was found for a reduction in operating costs, for a given level of service, due to private operation. Moreover, sensitivity tests indicated that such cost savings would have relatively little impact on social benefit.

POLICY IMPLICATIONS

FATIMA made a series of recommendations for the design of optimal transport strategies, the involvement of the private sector, methodology for strategy optimisation and priorities for further research. These included the following:

- Strategies should be based on combinations of measures, with public transport measures and car user charges as key elements.
- There should be a greater distinction between peak and off-peak charges and fares.
- In many cities it will be possible to identify optimal strategies that can be fully funded from user charges, using the FATIMA methodology.
- If private finance is needed for capital investment, optimisation procedures can identify the appropriate modifications to the strategy to achieve the best

Project acronym and title**Key results and policy implications**

performance within the financial constraint. However, such a strategy will usually have smaller social benefits than in the absence of the constraint.

- Value capture may help to raise additional finance in cases where strategies are not self-funding and require private financing.
- If a city authority decides that private operation of public transport is beneficial, it should ideally use a franchising model in which it specifies the objectives and the optimal service levels and fares.
- However, if national law requires deregulation, the city authority should identify which of the possible combinations of fares and frequency (at a given level of profitability) best support public policy objectives.
- Future development of the optimisation procedure should incorporate issues of equity. This means that transport models need to output values for appropriate indicators.
- A comprehensive assessment of the consequences of private sector operation of public transport is required.

PROJECT WEB PAGE: <http://www.its.leeds.ac.uk/projects/pastpres.html>

FISCUS:**KEY RESULTS****Cost evaluation and financing schemes for urban transport systems**

FISCUS has produced a handbook giving practical guidelines on evaluating the costs of urban mobility and selecting ways to finance it. This is intended particularly for policy-makers, planners and the managers of operating companies. The handbook covers two main issues: who pays for what, and who puts up the money (e.g. for new investments).

Seven types of cost are addressed, i.e. those associated with infrastructure, vehicle-related operations, congestion, accidents, emissions, noise and other external effects. The reader is given a step-by-step method of estimating these costs for their own city, with worked examples. Given that the availability of data may vary from city to city, the handbook offers two levels of assessment with different data input requirements (light and full). The results show the extent to which users bear the costs they cause – whether full costs, external costs (such as environmental damage) or variable costs.

FISCUS reported evidence that existing pricing mechanisms and levels are failing to provide appropriate signals to influence behaviour. For example, prices need to show greater differentiation according to the time of day and current traffic levels. Also, existing financing mechanisms (which typically rely on user charges and public budgets) are often not providing sufficient funding for the infrastructure and services that would support an optimal mix of traffic. Therefore the relative merits of new mechanisms such as private finance, value capture (such as taxing land values that benefit from transport infrastructure investment) and cross funding (e.g. from private to public transport) are explained.

FISCUS identified three financing *packages* for consideration, each combining various pricing mechanisms and sources of finance. The circumstances in which each package might work well are described.

- One is based on electronic road pricing, parking/cordon charges and public transport tariffs all being differentiated by time of day, with public budgets providing subsidies and capital as necessary.
- Another is again based on differentiated charges, but with private finance and value capture.
- The third is based on making each mode commercially viable, with no subsidies or cross financing.

Project acronym and title**Key results and policy implications**

The first two packages are given preference (against criteria of economic efficiency, acceptability and practical feasibility), with the choice depending primarily on the adequacy of funds for investing in the transport system.

POLICY IMPLICATIONS

The FISCUS handbook aims to provide practical support for both long-term mobility planning and short-term operational decisions. By promoting the harmonisation of the knowledge base for policy decisions across Europe, it should increase efficiency and fair competition between operators and modes.

Electronic road pricing is often seen as the most powerful way of implementing efficient pricing. However, this will not necessarily be the most cost-effective or practical solution in many situations. Therefore FISCUS gives advice on simpler pricing solutions (such as parking and cordon charges), depending on city characteristics such as size, severity of environmental problems and the financial position of public transport.

FISCUS concluded that there will be many cases where marginal cost pricing leaves a need for additional funding. In most cases a mix of financing measures will be required, and FISCUS gives advice on when each mechanism is most likely to be appropriate. Public funding is seen as having many attractions, but may not provide adequate resources for investment, in which case a mix of private sector funding and simple approaches to value capture are recommended.

GUIDE:***KEY RESULTS*****Group for urban interchanges development and evaluation**

GUIDE developed and disseminated guidance on good practice in the functional specification and design aspects of passenger interchanges, based on case study evidence.

GUIDE concluded that improving interchanges at a network-wide level requires:

- a definition of the strategic public transport network, which identifies the demand for interchanges;
- an overall information strategy for the network, covering pre-trip and real-time information;
- a system of quality standards to monitor the performance of interchanges;
- fare and ticketing policies that minimise the barriers to interchange between services;
- organisation and management structures that can take an integrated view of the interchange within the network as a whole;
- the promotion of co-ordination arrangements at the location-specific level.

By comparison, improving interchanges at individual locations requires:

- matching the design and layout to user needs;
- developing the interchange to promote *access* to the public transport network, which is often a more important role than transfer between services;
- improving accessibility for those with special needs;
- commercial exploitation to finance the infrastructure and provide facilities and an attractive image;
- good signs and other information services within the interchange area;
- design features and staffing to combat crime and the fear of crime.

GUIDE has presented these and other recommendations in a guide to good practice, available on the web. Case studies are also reported, concerning London, Birmingham

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and Manchester (UK), Utrecht and Amsterdam (NL), Paris (FR), Athens (GR) and Stockholm (SE).

POLICY IMPLICATIONS

The GUIDE handbook identifies public-private partnerships as an increasingly important factor in the development of interchanges, in line with the increasing interest in such partnerships in other areas of urban public transport.

GUIDE recommended the development of a European standard for signing schemes that would cover all public transport modes. The standard might provide a moderate number of pictograms, colour schemes, font designs and sizes. Individual operators would then incorporate these basic principles when developing their individual signage schemes.

PROJECT WEB PAGE: <http://www.interchanges.co.uk/>

HIPERTRANS:***KEY RESULTS*****High performance transport network modelling and simulation**

The HIPERTRANS project aimed at developing traffic simulation software to support the design and operation of Urban Traffic Control (UTC) systems.

The project has provided the following software products:

- a real-time simulator able to provide the operator with the current state of traffic in the road network and interact with UTC systems at real-time speeds;
- a real time predictor using high-performance computing able to warn the network manager of the potential development of traffic conditions.

The HIPERTRANS products are innovative in several respects:

- the powerful Graphical User Interface (GUI) for entering the model, configuring the simulation and visualising the result;
- the real-time traffic simulator has been interconnected with two types of UTC: SCOOT and STU;
- the predictor can execute prediction runs faster than real-time; the use of scalable parallel computing has shown that faster than real-time criterion can be met irrespective of the size and complexity of the modelled network, e.g. in dealing with traffic incidents and events and evaluating the consequences of emergencies or operator intervention.

POLICY IMPLICATIONS

The HIPERTRANS project has shown that microscopic simulation can be one of the most effective tools in the specification, design, commissioning and operation of UTC systems. The results of the real-time simulator and predictor will be useful for traffic consultants and policy makers to rapidly assess and visualise the effects of new strategies and novel policies in the planning and management of networks. The tool enables transportation network and UTC operators to assess the performance of their network under a variety of operational conditions and behavioural patterns. It also allows them to examine the future effect of their selected actions fast enough to be able to revise and re-test the performance before selecting the best action to take.

The market analysis and evaluation of the product and service opportunities emerging from the project have shown promising results in terms of potential market for both the SCOOT- and STU-based UTC systems. The availability of powerful but cheap personal computers is expected to make easy the use of the predictor tool. Further

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research should be carried out into the effective exploitation of distributed computing to speed up the simulation further in realistic road networks. Future projects should aim at integrating the distributed executions with more user-friendly graphical and animation interfaces, and the simulation technology with the technology of real-time UTC systems.

HSR-COMET:**KEY RESULTS****Intermodal connection of high-speed railway terminals in metropolitan areas**

HSR-COMET has provided an analysis of demand for high-speed rail (HSR) services, particularly concerning the needs for modal interconnection at HSR terminals, as a guide to further research and policy action in this area.

From on-site surveys in France, Germany and Italy, HSR-COMET identified the principal characteristics of transport demand. There is significant variation between Member States. For example, in Italy and Germany professionals and managers account for around 50% of passengers, whereas in France two-thirds of users are not in this category. In Italy, more than half the trips are for business purposes, whereas private trips form the majority in France and Germany. In Germany, the average trip length ranges from 95 km to 265 km according to trip purpose, whereas in Italy and France the average trip is considerably longer – 465 km in France, while more than 70% of trips in Italy exceed 300 km.

Average trip frequencies by HSR are higher than by standard rail services, showing their importance in attracting passengers from other modes. In Italy, over half the passengers make more than 5 trips per year. This figure drops to around 20% in France.

Typically one-third of connection trips to and from the terminal are by private car (including “kiss-and-ride”), one-third by public transport, and roughly 15% each by taxi and walking.

The project developed a multi-criteria evaluation tool to identify the priorities for improvements in the transport services to and from terminals. An increase in the frequency of metro services during HSR peak periods (where available) emerged as a strong candidate. Preferential access for taxis also scored reasonably well, as did the integration of taxi tariffs with train fares (for example by joint ticketing). In addition, there seems to be a potential market for a special taxi or minibus service specifically dedicated to meeting the needs of HSR users.

POLICY IMPLICATIONS

HSR-COMET concluded that the promotion of high-speed rail needs improvements in the transport connections to and from the terminal and in the customer services available in the terminal. Since cars are the most significant means of access, policies should aim to address the environmental and congestion effects without discouraging travellers. This could mean greater provision of short-term parking spaces for drop-off and pick-up, or a good park-and-ride system. Taxis should also be promoted, with preferential fast close access to trains.

Terminals should provide high-quality basic services, since most passengers spend relatively little time there. (Indeed, the quality and variety of services on board the train are arguably more important, given the length of HSR trips.) Improvements are needed to speed up transit through the terminal and advise the passenger on what to do. These include:

- integration of pricing systems between local transport services and HSR;

Project acronym and title**Key results and policy implications**

- reservation systems (e.g. to book train + taxi);
- timetables that facilitate making connections;
- complete travel information on the trip to the final destination
- simple improvements such as clear and visible signs.

ICARO:**KEY RESULTS****Increase of car occupancy through innovative measures and technical instruments**

The aims of ICARO were to evaluate measures for increasing car occupancy rates in European countries and to provide guidelines for policy development and implementation strategies. Through surveys, demonstrations and modelling in eight countries, the project identified the success factors for car-pooling (also known as car-sharing in the UK), including the effectiveness of supporting measures such as parking restrictions/incentives and high occupancy vehicle (HOV) lanes.

Car-pooling was found to be the most successful for employees from the same work place. Therefore initiatives to promote this behaviour are best targeted on the workplace, particularly by working with companies. The willingness to car-pool increases with the distance between home and work.

The majority of people looking to car-pool were found to be drivers, particularly those with regular working hours. Experience with matching centres, set up to put drivers and passengers in touch, showed that they need at least 500-800 clients to provide an effective service – or at least 100 clients in a single company scheme.

One of the most effective ways of increasing car occupancy is through the provision of infrastructure measures such as HOV lanes. Test site experience showed that car-poolers cut their travel time by 3.5 minutes using a 1.5km HOV lane in Leeds. Preferential parking for HOV's at the workplace has limited impact, especially where parking is readily available and free of charge. ICARO found no convincing evidence that guaranteed ride home schemes are influential on the decision of people to car-pool. Public acceptance is greater for incentive measures than for restrictions like HOV lanes or banning single occupancy vehicles from the city centre

ICARO estimated that perhaps 30% of car users have the freedom to choose car-pooling as an option. However, this potential is reduced particularly where there is a tendency towards flexible working hours, which is a serious obstacle to car-pooling.

POLICY IMPLICATIONS

Test site experiences showed that general promotion campaigns for car-pooling are not effective. ICARO recommended focusing on companies and commuters at the workplace, by embedding car-pooling in "Green Commuter Plans" or "Travelwise" campaigns.

There are various legal barriers to car-pooling and the development of HOV lanes that need to be overcome. ICARO recommended that:

- The terms car-pooling and HOV should be defined in national legislation for policy and insurance use.
- In many countries, the tax treatment for reimbursement of costs between car-poolers needs to be defined.
- The insurance situation for car-pooling should be clarified.
- For most countries, HOV lane regulations still need to be included in the national traffic regulations. Linked to this, a harmonised European car-pooling sign for HOV infrastructure should be agreed.

Project acronym and title**Key results and policy implications**

Project results indicated that measures to make car-pooling more attractive run the risk of attracting people from public transport. However, restrictive measures tend to promote both car-pooling *and* public transport, and are more effective in increasing the car occupancy rate than incentives alone.

PROJECT WEB PAGE: <http://www.boku.ac.at/verkehr/icaro.htm>

IDIOMA:

The final results of this project were not available when this Thematic Paper was prepared.

Innovative distribution with intermodal freight operation in metropolitan areas

PROJECT WEB-PAGE: <http://www.idioma.gr/>

IMPRED:**KEY RESULTS****Improvement of pre- and end-haulage**

IMPRED identified current problems and possible solutions for pre- and end-haulage by road to and from freight terminals, and then tested and evaluated promising solutions at demonstration sites.

Interviews showed that the most significant problems were time delays (associated with restricted opening times of terminals, consequent road traffic congestion and the poor punctuality of trains) and a lack of co-operation (e.g. poor exchange of electronic data and a lack of return loads).

Twenty-five solutions were identified to help overcome problems. Organisational solutions are dominant, based on improved communications and co-operation. However, successful implementation requires win-win benefits to be identified by the actors – in many cases, pre- and end-hauliers are not the *direct* customers of a terminal, and therefore receive lower priority than the shippers and railway operators.

Demonstration projects showed that co-operation *between* pre- and end-hauliers typically fails, due to mutual competition. However, the introduction of round-table meetings of actors *along* the transport chain generated some co-operation. Information and communication technologies appeared to have major potential, but the presence of many small independent road hauliers makes it difficult to get them to participate in a large overall information system unless there is very strong evidence that benefits will outweigh the costs.

POLICY IMPLICATIONS

IMPRED concluded that the shipper is the most important actor in the intermodal transport chain. However, it is difficult to influence the decisions of shippers, which form a large and diverse set of companies. IMPRED would recommend fostering better communication and co-operation between them, and this is an area where policy initiatives need to be tested.

Other areas where co-operation should be promoted are:

- co-ordination of opening times at terminals, shippers, forwarders and container depots, which should cut costs for hauliers;
- regular communication between terminal operators and other actors in the transport chain to identify bottlenecks and efficiency savings at terminals;
- co-operation between hauliers and intermodal operators to improve planning, data

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exchange and the organisation of return loads.

This requires the co-ordinated development of transport policy on European, national and regional levels. Possibilities for further consideration are:

- pilot funding for shippers to experiment with intermodal transport;
- the initiation of regular roundtable meetings between companies in the sector;
- further demonstration projects to identify and promote good practice in pre- and end-haulage;
- providing information infrastructure for data sharing.

In addition, further liberalisation of the rail sector is expected to improve the organisation and efficiency of intermodal transport.

INCOME:**KEY RESULTS****Integration of traffic control and other measures**

The goal of INCOME was to provide decision-useful information on the performance of integrated urban traffic management systems (UTMS) combining urban traffic control (UTC), public transport management systems (PTS) and driver information systems (DIS).

Various combinations of UTMS components were tested and evaluated through simulation studies and field trials in London, Piraeus, Turin and Gothenburg. A guidebook has been compiled for transport managers and local authorities, summarising the results, infrastructure requirements, factors affecting the benefits, and other implementation issues.

Highlights among the wealth of quantitative results were:

- *Public transport priority in UTC.* Public transport achieved journey-time savings of around 5-15% across three cities and similar improvements in journey-time reliability. In all cases the payback period was less than two years.
- *Integration of UTC priority and automatic vehicle location for buses.* This allows selective priority to be given to buses that are running late, thereby improving reliability. Predicted improvements in bus regularity and in passenger waiting times are around 10%.
- *Bus gating at traffic signals.* This involves holding back queues of private vehicles at traffic signals on strategic routes, allowing buses to overtake along segregated bus lanes. The bus lanes doubled the savings in bus delay compared to bus priority alone at traffic signals.
- *Integration of UTC with variable message signs (VMS).* These applications transferred data from UTC to VMS. The clearest benefits came from the earlier re-routing of traffic in response to incidents, activated by the automatic incident detection function of a UTC, increasing drivers' journey-time savings due to the VMS from 23% to 28%.
- *Intelligent speed adaptation.* This is a new in-vehicle technology aimed at reducing or preventing speeding, which can be integrated with UTC systems. Simulation results indicated a 50% reduction in accidents at speeds above 45 km/h, and speed reductions of up to 20%.
- *Integration of PTS and DIS.* Variable message signs can be used to suggest alternative routes to encourage drivers not to use important bus routes in congested areas. Simulations showed that reductions in bus delays could exceed 20%, although this is dependent on the local situation (e.g. if the alternative routes are also bus routes, the net benefits can be negative).
- *Fully integrated traffic management systems (UTC, PTS and DIS).* Sharing of data and control signals between sub-systems in Turin has reduced travel times for both general traffic and public transport by 20%, with an accompanying modal

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shift of 3% to public transport. Local pollutant emissions were estimated to fall by 21%. Modelling work for Gothenburg indicated a 9% modal shift, but smaller improvements in other indicators.

POLICY IMPLICATIONS

Urban traffic management systems are one of the key tools under the control of city authorities that can be used to support local policy objectives for mobility and the environment. Moreover, they can be implemented in the short term. INCOME has provided evidence of the additional benefits that can be achieved by using advanced systems in an *integrated* way.

Nevertheless, one of the lessons from INCOME is that the benefits must be estimated for the *local* situation. For example, public transport journey-time savings are dependent on congestion levels and the number of traffic junctions where systems can be used, and heavy congestion reduces the scope for some forms of bus priority. Simulation can provide a cost-effective means of screening alternative solutions prior to pilot-scale or full-scale implementation.

INPHORMM:***KEY RESULTS*****Information and publicity helping the objective of reducing motorised mobility**

INPHORMM aimed to bring together existing knowledge on the use of communication tools to influence travel behaviour, evaluate the effectiveness of previous actions, and provide a general model for developing campaigns in the future.

The project compiled a review of over 120 transport information and publicity campaigns, mainly European in origin. Good practice guidelines were developed for such campaigns, targeting a range of organisations. These include recommendations for local authorities, public transport operators, major institutions and their site managers, and environmental, cycling and walking groups. Three types of campaign are described in detail – public awareness campaigns; campaigns for targeted groups and settings (such as schools and workplaces); and campaigns aimed at individual travellers and households.

The analysis of previous experiences showed that:

- Communications as part of an integrated transport plan can enable changes in travel behaviour.
- Practical advice and ongoing support are essential to maintain such changes. Complementary measures to restrain traffic may also be required.
- Among the most effective campaigns are those co-ordinated by partnerships (such as between operators, site owners and local authorities).
- There is evidence of success in carefully targeted sectors, such as schools, workplaces and neighbourhoods. Mass media campaigns targeting the general public are receiving less emphasis.
- Times of change for individuals, organisations and communities are worth targeting. Examples include people moving house or changing jobs, businesses moving site and new housing developments.
- Many organisations do not adequately assess the effects of campaigns.

Critical success factors for campaigns and programmes include:

- building support for the campaign itself;
- co-ordination between stakeholders and linking to other measures;
- providing evidence of success, both to sustain political and financial support and to fine-tune the campaign process.

**Project acronym
and title****Key results and policy implications*****POLICY IMPLICATIONS***

The project found that co-ordination of national and local campaigns and their messages leads to greater media coverage and contributes to building a climate for change.

Information, marketing and community education programmes need to become an integral part of transport policy and planning, to raise public acceptance of other (restraint) policies and increase knowledge of travel alternatives. This includes writing campaign budgets into the broader strategy to which they relate, such as the traffic reduction or city regeneration budgets.

Good practice in the formulation of campaigns needs to be disseminated. Many organisations have failed to research the needs of their target audiences, and messages are often communicated without pre-testing. Evaluation of campaigns is often lacking.

PROJECT WEB PAGE: <http://www.wmin.ac.uk/INPHORMM>

INTERCEPT:

The final results of this project were not available when this Thematic Paper was prepared.

**Intermodal
concepts in
European
passenger
transport****INTRAMUROS:*****KEY RESULTS*****Integrated urban
transport
concepts and
market orientated
urban transport
systems / on-
demand urban
transport systems**

INTRAMUROS has produced and site-tested a multi-criteria decision support tool that helps organisations responsible for different aspects of urban transport systems to identify areas where greater co-operation is possible. The current situation in a city is assessed against best and worst case scenarios according to selected criteria and objectives. A set of indicators relating to cost, operational performance, environmental impact, socio-economic effects and safety consequences has been developed. The criteria can be weighted according to the value judgements of individual actors in each city, although default weights provide a useful means of cross-city comparison. The assessment helps users to prioritise potential changes to the urban transport system. At the same time, it is a tool to enhance co-operation between the local actors.

A survey together with investigations at six test sites showed that:

- most organisations perceive the need for co-operation, and some are installing institutional arrangements and common procedures as a result;
- competition between operators often acts as a brake on technical and financial integration;
- the efficiency benefits of public-private partnerships have been demonstrated.

POLICY IMPLICATIONS

The INTRAMUROS decision support tool provides city and regional traffic planners with a means of comparing quantitatively the relative benefits of different local strategies for improving the co-ordination and integration of the urban transport system. It has been designed as a flexible tool that can be applied to any city situation, or even for cross-city comparison (in support of national and European policy making).

Project acronym and title**Key results and policy implications**

The project concluded that there is no single organisational, financial and legal structure that will best encourage transport integration for all the different types and sizes of urban areas in Europe. Activity-based organisation, where actors have powers extending over different transport modes and across wide geographic areas, may be regarded as the most likely to induce better transport integration. However, such a structure cannot be imposed abruptly, and major transition may not be as sensible as lesser modifications to existing structures.

ISOTOPE:**KEY RESULTS****Improved structure and organization for urban transport operations of passengers in Europe**

ISOTOPE concluded that:

- the initiative for creating and specifying the urban public transport (UPT) network should rest with local authorities – a fully deregulated system was found not to address collective goals and system integration in an adequate way;
- network design should be under the *control* of the administrative authority, although the design work may be contracted out;
- a UPT authority must include representation from the communities directly affected by the UPT system;
- traffic management and parking should be controlled by the same authority as UPT, in order to integrate the management of urban mobility;
- a regime of "limited competition" (where authorities define the transport product to be delivered and invite tenders for its execution by candidate operators) is to be preferred over full regulation (monopoly supply) or full deregulation;
- in order to tackle urban mobility problems, partnerships between operators and authorities should be established that include clear definitions of standards of service and responsibilities.

Overall, the project found support for the Citizens' Network (EC Green Paper) preference for some form of limited competition. Various forms of contract appropriate to this regime were identified, with special consideration to the case of rail-based systems. ISOTOPE concluded that reductions in unit operating costs of around 15% are feasible over fully regulated operations, even with no redundancies or wage reductions.

POLICY IMPLICATIONS

The project presents limited competition as a preferred regime. However, it is acknowledged that transition costs are significant.

Policy goals like fare integration, concessionary fares and employment of minorities can be accommodated within the tender conditions of limited competition. Improved access to development areas, congestion and pollution issues can be handled by retaining public control of network design.

Any move to comprehensive competitive tendering would require improved data collection, to enable value for money to be assessed in the use of taxpayers' money.

Project acronym and title**LEAN:****Introduction of lean logistics into urban multi-modal transport management****Key results and policy implications****KEY RESULTS**

Concepts for city logistics were studied in abstract and with reference to approaches being considered in eight cities (Seville and Cordoba, Spain; Norwich, UK; Vienna, Wiener Neustadt and Linz, Austria; Regensburg and Halle, Germany). Estimates of utility value showed that integrated strategies combining infrastructure, information technologies and the provision of door-to-door freight services are the most effective in meeting stakeholder objectives. In Vienna, the introduction of a city freight terminal was estimated to offer a cost saving of 10% to freight service providers.

Two concepts were developed in greater detail – load zone management and electronic logistic management.

Load zone management is a system for automatic reservation of space in a city centre zone for loading and unloading lorries, supported by stricter enforcement of regulations to prevent illegal parking by private cars in that zone. It aims to reduce traffic jams due to parked cars and lorries blocking the street. A system was designed based on Internet access, making it available to a wide range of users without them needing special software. Messages would be transferred from the central reservations system to a display panel at the loading zone via the mobile phone network.

A logistic management system provides a basic structure for electronic data processing from source to destination along a logistic chain, to facilitate integrated planning, monitoring and control of the movement of goods. This can support the consolidation of goods into fewer vehicles. A prototype system was developed, tailored to the needs of a logistic service provider. The system was shown to manage the required tasks with full functionality.

POLICY IMPLICATIONS

LEAN concluded that public administrations need to give active support in promoting the co-operation between market actors that is essential in establishing city logistic solutions and providing multi-modal hubs for freight transfer. The setting-up of regular stakeholder meetings is one aspect of this. In addition, promotional and restrictive measures may be needed to control freight traffic, such as the enforcement of loading zone regulations. A change in modal split between road and rail and the use of low-emission vehicles are also likely to need some policy-based encouragement.

However, the case studies suggested that city authorities have only limited understanding of freight transport issues, and focus their planning effort instead onto passenger transport. Therefore LEAN recommended a Europe-wide information campaign targeted on city planners to address this problem.

LEDA:**Legal and regulatory measures for sustainable transport in cities****KEY RESULTS**

To help cities learn from each other, LEDA developed a database covering experiences with over 200 legal and regulatory measures used in 41 European cities. This is available at the project Web-site identified below. It enables stakeholders at a city level to search for examples of experiences with measures that interest them. A downloadable brochure is also available, covering 20 less well known but effective measures.

Analysis of national political systems showed large variations in the legal, financial and administrative powers granted to city authorities. For example, UK cities are subject to comparatively tight control from central government, whereas Swiss and

Project acronym and title**Key results and policy implications**

Scandinavian communities exercise greater autonomy. There is a discernible trend towards delegation of power from the national to the regional level.

There was found to be no simple correlation between city characteristics and the transferability of measures between cities. Therefore LEDA devised a set of guidelines to aid cities in assessing the transfer of experiences to their own situation. The most significant barriers to transfer proved to be political and public acceptance (which themselves are often closely related). The keys to gaining acceptance include a thorough consultation process and a targeted public awareness campaign.

POLICY IMPLICATIONS

Certain gaps were noted in national frameworks that inhibit the introduction of alternative transport concepts – such as car sharing, demand responsive public transport and mobility management services. For example, it may not be possible to grant preferential parking to vehicles that are used for car sharing, and information and awareness campaigns are often not covered by legislation.

The lack of region-wide co-ordinated public transport was also noted. This can result from the lack of funding authorities at a regional level. The observed shift towards greater competitive tendering of public transport services is likely to have made co-ordination more difficult.

Planning systems were noted as often being weak, in that they fail to integrate spatial development with transport and environmental aspects. For example, planning approvals may not require new developments to be sited adjacent to public transport or to have limited parking provision. The Netherlands and the UK were noted as examples of promising practice in this respect.

LEDA made a number of recommendations for policy action:

- to seek greater consistency between transport policies at national, regional and local levels;
- to transfer competencies to the local level, including decision-making authority and the power to use income from transport measures such as parking tariffs;
- to avoid a *rigid* link between government funding and strict compliance with government guidance on how to implement measures (such as traffic calming);
- to focus on structures that would improve regional transport development and encourage joint working between local authorities.

The project identified the need for research results such as the LEDA database to be placed on a central European Web-based platform, with some infrastructure for stimulating and accepting new inputs from cities.

PROJECT WEB PAGE: <http://www.ils.nrw.de/netz/leda>

MIMIC:**KEY RESULTS****Mobility, intermodality and interchanges**

MIMIC developed and tested a series of surveying and modelling tools that can help planners, designers and managers to systematically analyse passenger interchanges, taking into account the various kinds of barriers to their use by passengers. The tools will have their main application in the design stage of interchanges.

The key factors influencing the effectiveness of interchanges are:

- *logistical and operational* factors, such as the failure to synchronise services between different modes;

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- *psychological* factors, notably the fear of crime in the area around the interchange;
- *institutional and organisational* factors, particularly due to poor co-ordination between the many stakeholders;
- the functional quality of the *physical design* and layout;
- the *ease of access* to the interchange and the availability of parking;
- *economic and social* factors, such as cost of travel and the development of commercial services at the interchange;
- the availability of pre-trip and real-time *information*.

Recommendations and good practice guidelines were developed in each of these seven areas. For example:

- co-ordination between operators is vital to provide through-ticketing, synchronised services and information;
- commercial development of the site should be encouraged to generate income and reduce the fear of crime;
- integrated management of interchanges is needed, rather than multiple stakeholders taking decisions independently.

POLICY IMPLICATIONS

MIMIC highlighted significant gaps in knowledge about improving intermodality by optimising interchanges. The project made a series of recommendations for policy actions to reinforce good practice in interchange design:

- Central and regional governments need to oversee the planning and co-ordination of interchanges. This will help to synchronise services through the interchanges and guide investment priorities for public transport.
- Authorities should consider setting up a single body to be responsible for timetable co-ordination, information and through-ticketing.
- Authorities should extend the guidance to public transport designers and operators to include good practice for the design of interchanges, especially focusing on the barriers facing people with special needs.
- An independent body should be given the task of developing a Europe-wide standard for interchange signing and information.

MIMIC has shown that travellers attach great importance to the interchange when they choose whether to make intermodal trips. However, there are circumstances where the land-use and transport network characteristics of a city can substantially influence passengers' choices, much more than barriers at the interchange. So good design is a necessary condition for a successful interchange, but not a sufficient one.

PROJECT WEB PAGE: <http://www.interchanges.co.uk/>

MOMENTUM:**KEY RESULTS****Mobility management for the urban environment**

MOMENTUM compiled a survey of mobility management approaches in use across Europe, and beyond. From this, together with its sister project MOSAIC, integrated concepts were defined for mobility management strategies and mobility centres, and for the transfer of strategies between locations. These concepts address all types of traffic and trip purposes.

A range of strategies were demonstrated at 13 test sites (Leicester, UK; Leuven, Namur, BE; Graz, AT; Munster, Essen, Potsdam, DE; Bologna, IT; Corfu, GR; Coimbra, PT; Zurich, Zug, SU; Goteborg, SE). These focused in particular on the use of mobility centres and the targeting of commuter trips. The successes and problems

Project acronym and title**Key results and policy implications**

at each site have been documented in detail to provide guidance to other cities.

The following general lessons were drawn on the implementation of mobility management strategies at a site level:

- The creation of partnerships between stakeholders (including transport operators, community groups, local councils and local businesses) is crucial.
- Target efforts onto selected users (such as companies or young people) rather than spreading efforts across a wide range of user groups.
- Establish networking opportunities such as the European Platform on Mobility Management (EPOMM) to learn from other people's experiences.
- Treat the implementation as an ongoing process rather than a discrete project, for instance building political support over time.
- Select the strategy according to the national context, such as the attitudes of users and their reaction to "push" measures such as car parking restrictions.
- The use of promotion and awareness-raising campaigns is a key element in the successful delivery of mobility management schemes.

Project outputs have included a user manual aimed at initiators of mobility management and scheme managers, and a brochure for policy-makers and the owners of major traffic-generating sites (hospitals, companies etc.). (Dissemination has been developed jointly with the project MOSAIC – see <http://www.rwth-aachen.de/isb/Ww/mosaic/>).

POLICY IMPLICATIONS

MOMENTUM and the parallel project MOSAIC have been influential in raising the awareness of mobility management practices and promoting their acceptance across Europe. Many of the demonstration sites are continuing to operate and expand, and mobility management is being incorporated in local and regional transport strategies in the EU.

MOMENTUM concluded that the procedures for evaluating the success of mobility management projects need further development. This is to facilitate learning from cross-comparison of projects, but also to give a broad picture of the current and future return on the investment.

PROJECT WEB PAGE: <http://www.ils.nrw.de/forsch/96-vi-3.htm>

EPOMM WEB PAGE: <http://www.epomm.org/>

MOSAIC:**Mobility strategy applications in the Community****KEY RESULTS**

Mobility management aims to make more efficient use of existing transport facilities and minimise the number of vehicle trips through strategies such as better information on available public transport and the co-ordination of car pooling and public awareness campaigns. MOSAIC has produced a brochure, user manual and CD-ROM that define the different elements of mobility management. In particular, roles are identified for:

- a Mobility Manager, responsible for introducing initiatives within a particular area;
- a Mobility Consultant, responsible for providing mobility management services at an urban/regional level, and encouraging their adoption at site level (e.g. business park, major company, school);
- a Mobility Centre, offering information services to the public;
- a Mobility Co-ordinator and Mobility Office, promoting activities at a particular site according to an agreed Mobility Plan.

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and title****Key results and policy implications**

Demonstration projects were run in Germany, the UK and The Netherlands:

- the Wuppertal Mobility Centre achieved a small shift from private to public transport;
- the Mobility Consultant in Nottingham persuaded more than 20% of organisations with more than 200 employees to develop Green Commuter Plans;
- initiatives in Utrecht and Leiden achieved some modal shift and increased company involvement in mobility management.

The project concluded that Mobility Consultants appear to be most successful with the largest organisations (500+ employees), and such organisations should be targeted first. On sites employing over 1000 staff and where there are severe access or parking problems, it is suggested that little progress will be made unless a full-time Mobility Co-ordinator is employed (preferably in the Estates or Facilities Management functions at the site). The voluntary approach to encouraging Mobility Plans is favoured (rather than political mandate or pressure), in order to ensure a longer-term sustainable drive for implementation.

POLICY IMPLICATIONS

MOSAIC has concluded that mobility management is a long-term approach that requires long-term political support as well as bottom-up local initiatives. In itself, it will probably make a measurable but not really significant impact on the choice of transport modes. However, it also raises awareness of transport alternatives that may then be more strongly stimulated by other policy measures such as road pricing.

At the European level, MOSAIC recommended:

- the setting up of an umbrella organisation offering information on best practice in mobility management;
- support for demonstration initiatives in the freight transport sector.

At the national level, MOSAIC recommended:

- enactment of supporting legislation and fiscal policies;
- research into the national obstacles to implementation of mobility management;
- initiation of freight sector actions;
- promotion of mobility management at leisure and retail sites (to extend previous work-site experience).

PROJECT WEB PAGE: <http://www.rwth-aachen.de/mosaic>

MOTIF:***KEY RESULTS*****Market
orientated
transport in focus**

The aim of MOTIF was to find ways of improving the market orientation of urban public transport, through a better matching of service characteristics with the requirements of different groups of users.

Through the analysis of previous practice and 33 city case studies, MOTIF identified market research methods and segmentations that will allow effective discrimination and valid conclusions to be drawn when targeting improvements in public transport services.

Important findings included:

- Passenger priorities differ substantially between countries, with only punctuality/reliability commonly achieving a high ranking. The postulated importance of travel speed in modal choice may be over-rated. Therefore user

**Project acronym
and title****Key results and policy implications**

needs must always be confirmed locally.

- Previous market research has often focused on frequent travellers, and thereby failed to spot the different needs of other user groups. For example, only low importance is attributed *on average* to pre-trip information, but this aspect is significant for infrequent and potential users.
- The dependence of passenger requirements on socio-economic and journey characteristics is rather small, with only a 3-6% variation in the perceived importance of service attributes.
- A useful definition of good practice operation (i.e. indicators and benchmarks) on a European level is hard to find. This reflects the weakness of the correlation between delivered and perceived quality. Direct measurement of satisfaction will remain the more reliable indicator of product quality as seen by the customer.

POLICY IMPLICATIONS

MOTIF concluded that:

- If a detailed segmentation of consumer preferences is required, the survey should be carried out *on a local basis*. There are no standard European solutions.
- Market studies should ensure that adequate *discrimination* is obtained between different user groups and service attributes. Otherwise, crucial information disappears in the mean values. For feasibility reasons, the extent of segmentation must be limited. Pilot tests with the methodology can help to avoid wasting effort on low quality results. For example, primary and secondary requirements can be distinguished, so that secondary needs such as passenger information are not under-estimated.
- The level of fares is important, but users *are* prepared to pay for good quality on important features. Therefore surveys should be geared towards quantifying the willingness of the customer to pay for certain improvements.

Further work is needed to improve the ability of public transport operators to use market research effectively. For example, a standardised set of dimensions/segments would aid comparability of results and cross-operator learning, even though the finer detail of each survey must be determined locally. Also, a better understanding is needed of the relations between results from different market research methods, between delivered and perceived quality, and between perceived quality and modal choice.

MUSIC:**Management of
traffic using
traffic flow
control and other
measures****KEY RESULTS**

MUSIC developed a novel method of traffic flow control, showing that it was effective in taking account of travellers' responses to changes in signal timings, while allowing signal timings to be optimised to meet a variety of traffic management goals.

This low cost approach to the design of traffic signal timings across an entire road network was demonstrated in three European cities. Details of the methodology have been published in a handbook. The methodology uses existing network models of city traffic, and provides new timings to programme the existing set of signals.

In York, traffic timings were designed to enhance the benefits of a new bus lane on a Park & Ride route. As a result, bus journey times decreased and reliability of travel time increased. Peak-hour patronage increased by 25% during the test period, while remaining constant on the city's other Park & Ride routes. The data showed that the benefits were due to the MUSIC timings and not the associated changes in infrastructure.

Project acronym and title**Key results and policy implications**

In Thessaloniki, timing plans were calculated for 129 traffic signals, and gave a measurable reduction in congestion. Similarly in Porto, delays to vehicles on certain routes were reduced. However, not all objectives were met in these two cities, partly because not all the traffic signals could be adjusted as desired.

The results of the on-street demonstrations strongly suggest that drivers do change their routes in response to traffic signal timings. It is therefore vital that design tools for traffic plans take this into account. The re-routing process may take more than one month to complete, which has to be considered in any before-and-after evaluation.

POLICY IMPLICATIONS

It is clear that traffic signal control has great potential to be used as a low-cost tool for traffic demand management and the achievement of related policy objectives. The MUSIC approach can be transferred to other towns and cities that have an existing traffic network model.

The project highlighted the need for traffic control policy to take account of drivers' route choice behaviour in response to policy implementation. Most traffic modelling tools currently available either take no account of re-routing or make the assumption that drivers re-route until a new equilibrium state is achieved. MUSIC showed that equilibration is a very slow process, and that more research is needed in this area.

PROJECT WEB-PAGE: <http://gridlock.york.ac.uk/music/>

OPIUM:**KEY RESULTS****Operational project for integrated urban management**

OPIUM evaluated a range of physical measures for traffic management through their practical implementation in a number of cities (Gent, Heidelberg, Liverpool, Nantes, Patra and Utrecht).

Schemes to restrict road space and parking space for private cars proved very successful in terms of their impact on travel behaviour and consequent environmental benefits. The main difficulty lay in opposition from shopkeepers, although residents and visitors were generally supportive.

Traffic calming reduced overall traffic speeds and noise at a local level. This was perceived to benefit vulnerable users and could reinforce measures to promote modal shift. However, there may be negative effects on vehicle emissions unless overall car use is restricted.

Parking management and guidance appeared successful in reducing circulating traffic at a local level, and could influence modal split if implemented widely across a city. Parking measures were generally self-financing.

Public transport priority did not have a strong influence on modal split, but improved the speed and reliability of bus services. Greater modal shift might have been achieved if priority measures were implemented more extensively or integrated with traffic restrictions and improvements to bus services.

Measures to favour cyclists and pedestrians had only limited effect on modal shift when used in isolation, but were perceived by users to improve safety.

The greatest environmental benefits were achieved where road space was closed to private cars or where traffic volumes were reduced. Park-and-ride and parking

Project acronym and title**Key results and policy implications**

schemes were successful in this respect. However, measures that led to slower speeds and increased journey times, such as traffic calming and bus priority, resulted in an increase in pollutant emissions.

All the schemes within OPIUM had a positive cost-benefit ratio, with payback periods of ten years or less.

POLICY IMPLICATIONS

OPIUM concluded that public consultation needs to play an increasingly important role in the development of traffic management measures. It is needed to gauge public opinion during scheme design and implementation, to educate the public about the likely benefits, and to take account of the needs and concerns of specific stakeholder groups such as shopkeepers. Stakeholder opposition proved to be the main hurdle to the schemes tested by OPIUM.

Individual measures can yield benefits in their own right, even if used only locally, but their deployment as part of an integrated strategy has the potential to yield significantly greater benefits. In particular, public transport priority and bicycle measures are increasingly effective at larger scale.

OPIUM recommended a number of areas for further research, particularly in relation to public consultation and the evaluation of user needs.

OPTIMA:**KEY RESULTS****Optimisation of policies for transport integration in metropolitan areas**

Optimal city transport strategies involve a combination of measures. Also, there is no single best measure or strategy for general application. Nevertheless, some general recommendations can be drawn:

- economically efficient strategies can be expected to include low cost improvements to road capacity, improvements in public transport (increased service levels or reductions in fares), and increases in the cost of car use (either road pricing or increased parking charges);
- public transport infrastructure investment is not likely, in most cases, to be a key element in these strategies;
- reductions in capacity to discourage car use are not likely to be economically efficient;
- the optimal changes in service levels and fares for public transport will depend on the current level of subsidy - in some cases a reduction in service levels or an increase in fares may be justified on economic grounds;
- the optimal increase in costs of car use will depend in part on current levels of congestion;
- in most cases, economically efficient strategies can be designed which are financially feasible, provided that revenues can be used to finance other strategy elements;
- the pursuit of sustainability is likely to justify investment in public transport infrastructure, further improvements to public transport services and/or fares, and further increases in the cost of car use;
- availability of finance will be a major barrier to implementation of many sustainability-optimal strategies.

POLICY IMPLICATIONS

The main implications are:

- legislation will be needed to enable implementation of road pricing and to control

Project acronym and title**Key results and policy implications**

parking charges; in the UK and Italy there is also a case for changing legislation to permit economically more efficient public transport strategies;

- public acceptability will be a significant barrier with those measures which reduce service levels or increase costs - this implies the need for effective public relations campaigns, and carefully designed implementation programmes;
- detailed local measures to improve the environment and provide better facilities for cyclists, pedestrians and disabled people should be determined once the optimal strategy has been defined at a more aggregate level.

PIRATE:**KEY RESULTS****Promoting interchange rationale accessibility and transfer efficiency**

PIRATE analysed a sample of European interchanges to assess the extent and efficiency with which the needs of the various stakeholders are actually being met, and then developed and tested an innovative approach to defining and providing for those needs. This approach would directly involve stakeholders in the improvement or redevelopment of interchanges.

A gap analysis revealed the perceptions of various stakeholder groups towards the importance and performance of all aspects and features of an interchange. The views of four groups were considered:

- people involved in the planning and construction of interchanges;
- people who work in an interchange (including managers, vehicle drivers and subcontractor service staff);
- people who use an interchange for travel, shopping or social purposes, categorised as
 - walk and ride users
 - park and ride / kiss and ride users
 - bike and ride users
 - ride and ride between the same or different public transport modes;
- people who are non users or potential users.

The analysis showed general agreement at all sites and across all stakeholder groups about the high importance of safety/security, information and car parking. However, infrastructure design experts emphasised the aspects of layout, location and the quality of connections, while users had more uniform concerns across all characteristics of interchanges, with preference for comfort and safety issues. Certain characteristics - surveillance, toilets, traffic and travel information, cleanliness and security against theft and vandalism - were perceived to perform poorly at a number of sites.

PIRATE then developed an innovative "planning approach", in which the users and non-users are involved in the process of planning new or improved facilities.

Application of the "planning approach" again showed significant differences between the priorities of infrastructure designers and users. The divergences are greater on matters of design, location and internal layout of the interchange than on security and operational matters. However, effective solutions to these design issues should be achievable through consultation processes.

PIRATE has produced a handbook in hard copy and CD-ROM format detailing the planning methods and the case study results.

POLICY IMPLICATIONS

PIRATE has demonstrated the potential for more efficient and successful development of public transport interchanges by involving various stakeholder groups in the design

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processes, and has developed a cost-effective method of user research to assist the providers of interchanges in improving their services.

PROJECT WEB PAGE: <http://www.interchanges.co.uk/>

PRIVILEGE:**KEY RESULTS****Priorities for vehicles of essential user groups in urban environments**

PRIVILEGE has defined "default" levels of priority to be accorded to different road user groups when they are competing for road space in congested urban areas. It is recognized, however, that cities will need to adjust these weights according to local conditions. Public transport commonly receives the highest priority in the cities studied.

A catalogue has been provided covering 31 individual measures for urban road traffic priority management. This includes implications for fleet management, information management, enforcement and integration into the existing system. Skeleton plans for the introduction of various packages of measures have been devised. Specific city case studies have been developed, showing how a package of measures can be tailored to a given situation

The potential impacts of the various measures have been characterised, and implementation issues described. Critical local conditions and obstacles were identified. All this information is provided in a structured format as a guide to local authorities considering prioritising certain user groups.

POLICY IMPLICATIONS

In order to prioritise the use of the existing road network, regulations have to be considered which result in restrictions in general road use. Thus this is essentially a political issue, depending in part on social acceptance.

For a number of measures, the legal framework has not yet been put in place. This situation varies from country to country. Certain measures may therefore require legislative amendments (to remove barriers) or new local regulations before they can be implemented effectively.

As a result of interviews with local transport policy makers and practitioners, PRIVILEGE also found wide variations in the political and social acceptability of the various measures, including differences between countries. In all cases, public awareness campaigns to inform drivers and residents about the benefits of such schemes were found to be essential.

PROMISING:**KEY RESULTS****Promotion of mobility and safety of vulnerable road users**

PROMISING has:

- presented an overview of current legislation regarding walking, cycling and the use of powered two-wheelers with respect to traffic regulations, infrastructure design standards and legal limitations to vehicle use for young drivers and riders;
- highlighted best practice examples of innovative traffic concepts from Sweden and the Netherlands that aim to increase the safety of vulnerable road users;
- summarised design criteria for roads and traffic management schemes based on a knowledge of the specific mobility needs of pedestrians and cyclists;
- performed cost-benefit analyses for a set of twenty infrastructure (design) and organisational measures, ranging from roundabout design, upgrading of pedestrian

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crossings, design of dedicated bicycle lanes to e.g. the daytime use of lights on vehicles;

- outlined an implementation strategy that aims at a better balance between the interests of different road users, improved co-operation between local and national traffic authorities, and direct involvement of road users in planning and design processes.

POLICY IMPLICATIONS

A future, more mode-specific transport policy, addressing the particular requirements of pedestrians and cyclists, will have to come up with a set of practical criteria for traffic flow management, right of way regulations and other safety improvements for vulnerable road users. Cost-benefit analyses, evaluating improvements from the perspective of walkers and cyclists, are needed to avoid further bias towards the dominating motorised traffic.

QUATTRO:**KEY RESULTS****Quality approach in tendering urban public transport operations**

One way to guarantee value for money and promote quality for transport users and local tax payers in the urban public transport is to introduce quality indicators into tendering and contracting procedures linked with programmes for the improvement of service quality.

Together with experts from CEN (European Committee for Standardisation), QUATTRO developed a standardised set of quality indicators for urban public transport (UPT).

The most significant general recommendations were:

- to consider quality management as a continuous search for better service and organisation, rather than as the pursuit of a rigid and specific level of quality;
- to be customer-oriented;
- to benchmark performance against others, within the transport sector or with other sectors.

The most significant recommendations specific to public and contracting/tendering authorities were:

- to define a comprehensive urban development strategy;
- to be clear about what can best be done in-house and can be contracted out to others;
- to use quality partnerships with operators in addition to tenders and contracts;
- to commit authorities to the achievement of targets under their own control (concerning for example the availability and quality of road infrastructure) and if necessary to submit authorities to penalty-and-reward mechanisms so as to reassure the bidders/contractors on the credibility of these commitments and to compensate them for the costs they might incur as a result of any failure by the authority.

Recommendations specific to operators are:

- to seek to establish a visible professional competence by reaching standards set for formal qualification (ISO 9000) and/or by implementing total quality management principles;
- to develop a customer satisfaction measurement system and to use its results in connection with those of the internal quality monitoring system;
- to continuously assess customer satisfaction;
- to listen to the staff, communicate with them on their working conditions, on the results of their work and on the practical consequences for them of the

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management's decisions.

POLICY IMPLICATIONS

The EC should intensify support to the public transport sector at all levels, notably, by exerting a positive influence on Governments, citizens and groups of opinion formers. More specifically, it should:

- set principles and issue clear recommendations and guidelines for tendering and contracting procedures, by regulations or other appropriate instruments. The Commission should encourage the introduction of quality in the specification and monitoring of tenders and contracts;
- support research in public transport to foster innovation;
- publicise and support good practice in networks, including contract and quality management practices;
- monitor results Europe-wide, educate those who are failing and stimulate comparability of results.

PROJECT WEB-PAGE: <http://www.eur.nl/quattro/>

RECONNECT:***KEY RESULTS*****Reducing congestion by introducing new concepts of transport**

RECONNECT aimed to identify and assess new means of transport that have potential to ease congestion, including their feasibility, suitable areas of application, impacts and needs for policy intervention.

The project provided a structured overview of the potential of new transport concepts, with a particular focus on innovative concepts that are already significantly advanced (such as elevated public transport, underground freight systems and airships). Some 100 concepts were surveyed, and 21 concepts were selected for comparative assessment (as representatives of classes of new means of transport).

High capacity elevated passenger transport systems (such as the H-Bahn Dortmund and the Wuppertaler Schwebebahn) offer good potential for reducing congestion in urban environments, as the backbone of the public transport system. Nevertheless, the infrastructure needs and total costs are high. Guided and road-based people movers are seen as complementary solutions for feeder and shuttle services.

Underground concepts (such as the Underground Logistics System proposed in Amsterdam) provide an efficient means of freight distribution. They rely on automated and driver-less electric vehicles that run in tunnels. Again, infrastructure costs are fairly high, but can be reduced using new small-bore tunnelling technologies.

Finally, airships are promising for point-to-point operations in both passenger and freight transport, and their costs are not particularly high. For example, the CargoLifter allows bulky and heavy items to be taken to the final destination, replacing a whole shipment chain. Other versatile airships may contribute to traveller intermodality in remote regions.

Financial and commercial hurdles pose the biggest obstacle, particularly for public transport. However, tailor-made transport services such as airships are proving more attractive to private investors. Regulatory barriers are also significant, particularly for automated and driver-less concepts.

**Project acronym
and title****Key results and policy implications*****POLICY IMPLICATIONS***

To overcome the barriers to market penetration, the priority is to make “seed” funding available. Public-private partnerships are seen as one way forward on this. Regulatory barriers need stakeholder consultation at an early stage, and would benefit from Government agencies (such as strategic rail authorities) being assigned responsibility to tackle the legal issues.

Further RTD is needed to reduce uncertainties and technology costs. Important areas for research are:

- vehicle automation and guidance systems, communications and control systems;
- development of standards (e.g. for the safety requirements for new vehicle concepts);
- in-depth assessment of the environmental, noise and safety impacts of new concepts;
- the development of technologies for underground infrastructure (ground exploration, tunnel driving, tunnel lining and standardisation of dimensions).

RECONNECT proposed that demonstration projects be funded for the most promising ground level concepts ready for market introduction in the near future: road-based people movers, on-demand rental cars (like Praxitele), automated vehicle guidance for cars on public roads, and man-wide cars.

PROJECT WEB PAGE: <http://www.etsu.co.uk/reconnect/reconnect.html>

REFORM:***KEY RESULTS*****Research on
freight platforms
and freight
organisation**

Freight platforms are transshipment areas where many transport companies (such as forwarders and logistic service providers) are located, and ideally where at least two transport modes are connected. A database of 96 European freight platforms was created by REFORM, identifying key characteristics such as transshipment volumes, infrastructure, on-site company interactions and financial arrangements.

Based on this analysis, a handbook was developed for local authorities and transport sector companies. The handbook provides guidance and evaluation methods for establishing new freight platforms. Topics include:

- financial and organisational issues, and their impact on the efficiency of platform operations;
- the impact of technology, equipment and design on platform efficiency;
- evaluation of potential impacts on urban traffic and the environment.

The guidelines were successfully tested by computer simulation at sites in Berlin, Brussels, Rome and Madrid. Depending on the local situation, the introduction of freight platforms was estimated to have different levels of benefit:

- In Rome, a network of platforms could reduce the total truck-kilometres driven within the city by 15%;
- In Brussels, transshipment from heavy trucks to vans would actually increase vehicle-kilometres and pollutant emissions, although action against illegal parking would significantly reduce congestion and fuel use;
- In Madrid, the number of delivery trips would be reduced by higher load factors and a cut in the number of empty truck movements, although traffic levels would rise in the vicinity of the platform (reducing speeds by 3%);
- In Berlin, the location of freight forwarders within the city would reduce their truck mileage by more than 40%, yield cost savings for the forwarders and increase the competitiveness of intermodal transport.

**Project acronym
and title****Key results and policy implications*****POLICY IMPLICATIONS***

City-based freight platforms can reduce urban delivery traffic and emissions, as well as facilitating a switch from road to rail. However, experience to date has shown a need for better design work to improve efficiency and financial viability. Many local authorities and operators had requested an evaluation scheme – the REFORM project has met this need.

The handbook does not replace a detailed analysis of the regional characteristics, which is essential for the optimal design of freight platforms. Rather, it provides a structured framework of how to plan platforms according to the specific regional issues. Similarly, the handbook supports, but does not replace, the critical interaction processes between public and private partners to reach agreement on their individual and mutual interests.

Freight platforms support economic as well as traffic policy objectives. Logistic centres may help to attract industry. Transport operators can achieve cost savings through co-operation agreements with other on-site companies. The provision of on-site services also increases operational efficiency.

The role of local authorities, guided by the handbook, would include the provision of:

- suitable sites;
- appropriate regulations;
- transport infrastructure;
- subsidies for other infrastructure, such as the establishment of bi-modal transshipment terminals.

SESAME:**Derivation of the relationship between land use, behaviour patterns and travel demand for political and investment decisions*****KEY RESULTS***

SESAME has provided:

- A recommended set of indicators on transport and land-use.
- A sample database of values for those indicators, covering 40 European cities.
- Analysis of the relationships between indicators.
- Recommendations concerning data collection methods and policy measures.

The main findings concerning land-use/transport interactions are as follows:

- **Use of modes:** the car faces strong competition from non-motorised modes, particularly in the city centre and for trips of less than 5 km. Lower population densities and a higher concentration of jobs in sub-centres tend to increase the use of the car relative to public transport. Small cities have a higher share of car use than larger cities
- **Public transport provision:** the level/frequency of service in public transport has a strong effect in increasing patronage and decreasing the use of private cars. The length of public transport lines is not the key issue.
- **Vehicle ownership:** car ownership per household is strongly correlated with car use. A similar relationship holds for bicycle ownership and use.

Recommendations about data collection mainly concern availability, harmonisation and zoning:

- Travel demand surveys should be harmonised, should include all age groups, weekend days and the separate transport modes, and should be repeated every five years.
- Data are needed concerning the travel behaviour of people coming from outside the urban area.

Project acronym and title**Key results and policy implications**

- Public transport suppliers should use a single definition for vehicle-kilometres, with a complete tram or train defined as a single vehicle.
- Improved data are needed on parking places.
- Data about the built-up surface should be collected on the basis of a common definition.

POLICY IMPLICATIONS

Provision of new transport infrastructure clearly affects the pattern of travel and therefore urban form. SESAME has shown that the supply of primary road kilometres is associated with a higher share for cars in the modal split. In contrast, cities actively promoting public transport seem to be achieving higher shares for this mode. SESAME has particularly pointed to the benefit of improving service levels, without the need for additional service lines, in encouraging a modal switch. Strategies such as benchmarking and the provision of better information can be effective low-cost measures in this respect.

Cities with parking management and traffic calming policies seem to be associated with lower shares of car use. Cycle promotion policies seem to have had a similar effect in the cities studied.

One of the major outputs of SESAME has been to illustrate the relationship between urban form and mode use. Mode share is especially related to city density, the concentration of urban activities and the concentration of jobs in sub-centres. City planners therefore have a powerful means of influencing mobility through their control of new developments.

START:**KEY RESULTS****Development of strategies designed to avoid the need for road travel**

START found that the most cost-effective policies to deal with congested traffic in cities are based on pricing. Road pricing per kilometre or at a city cordon is favoured, while parking charges have a less direct impact and may not work where there is extensive private off-street parking within the congested area. Subsidies to urban public transport are considerably less effective.

On inter-urban roads, the use of tolls to reduce traffic is more problematic. The dominant response from users is likely to be a diversion to alternative routes rather than a switch to alternative modes or a reduction in the total amount of travel. This is likely to be counter-productive in terms of environmental and congestion costs. In addition, it would create a barrier to the use of private finance in the development of road infrastructure, requiring the public sector to take on the financial risk associated with uncertainties in future traffic levels.

In general, “push” measures to deter the use of vehicles (e.g. fuel taxes) are seen as more effective than “pull” measures (e.g. improving alternative modes). Nevertheless, successful strategies are likely to contain a mixture of both “push” and “pull” measures, with the revenue from the former being used to fund the latter. Experience has also shown that a mix of different types of measure works best – pricing, capacity management, public transport, telecommunications and land use planning.

“Push” measures face problems of public acceptance. However, research has indicated that as people become better informed about the likely cost-effectiveness of ways of dealing with transport problems, their opposition to restraint measures tends to decrease.

Project acronym and title**Key results and policy implications**

The project devised four scenarios of traffic reduction in the short and medium term, identifying packages of measures required to achieve certain economic and environmental objectives. Compared to “do-minimum” and “green” strategies, the best outcome was assessed to result from a strategy based on internalisation of congestion costs and environmental costs by the road user.

Most of the reported travel reductions are only of the order of one or two years’ growth in (unconstrained) demand. Policy actions may still be desirable, but the lesson is that there is no *simple* strategy that will dramatically affect levels of urban congestion.

POLICY IMPLICATIONS

The design of packages of measures is the key to success in travel reduction. Evidence suggests that a combination of constraints on vehicle use and provision of attractive alternative modes work well. In addition, land use planning measures are needed to constrain the decentralisation of population and economic activity to locations beyond the area in which the restrictive policies apply. Fuel taxes, vehicle taxes and road pricing need to be co-ordinated so that the right signals are sent to vehicle users in congested areas, while avoiding inefficiently high taxation in uncongested rural areas.

Within a policy framework that aims to reduce growth in road traffic while maintaining private sector interest in the financing and management of road infrastructure projects, the public sector will need to develop new ways to pay for roads. Otherwise would-be investors will be deterred by the sensitivity of income projections to new traffic reduction initiatives.

PROJECT WEB PAGE: <http://fpiv.meap.co.uk/fpiv/START.htm>

SWITCH:

The final results of this project were not available when this Thematic Paper was prepared.

Sustainable workable intermodal transport choices

PROJECT WEB-PAGE: <http://www.iuav.it/citiesonwater/switch/>

TRANSLAND:**KEY RESULTS****Integration of transport and land-use planning**

TRANSLAND had two main objectives:

- to identify examples of (transferable) good practice in combined planning of land-use and transport;
- to advise on planning practice for the future and recommend further research.

A detailed review of 26 case studies and previous research led to the following conclusions:

- Combined land-use and transport policies are only successful in reducing travel distances and the share of car travel if they make car travel less attractive (more expensive or slower).
- Land-use policies to increase urban density or mixed land-use (e.g. locating homes near factories and services) without accompanying measures to discourage car use have only little effect.
- Transport policies to make car travel less attractive depend on trip start and end points not being excessively dispersed already. Co-location of specialist businesses in certain areas and the increase in multiple worker households also set limits on the co-ordination of work places and residences.

Project acronym and title**Key results and policy implications**

- Large dispersed retail and leisure facilities increase the distances travelled by cars and the share of car travel. Land-use policies to prevent the development of such facilities are more effective than land-use policies aimed at promoting high-density mixed-use development.
- Fears that policies to constrain the use of cars in city centres are detrimental to the economic viability of those centres have in no case been confirmed by reality, except where massive out-of-town retail developments have been approved at the same time.
- Transport policies to improve the attractiveness of public transport have in general not led to a major reduction of car travel, but have contributed to further suburbanisation of the population.

POLICY IMPLICATIONS

Overall, TRANSLAND concluded that transport policies are more direct and efficient than land-use planning controls in moving towards a sustainable urban transport system. However, land-use policies are essential as an accompanying strategy for creating less car-dependent cities in the long run. Information policies are an additional tool, important for influencing behaviour and increasing social acceptance of other tougher measures.

The institutional possibilities for co-ordinating land use and transport policies at the urban or regional level vary between EU Member States. Ten countries have formal regional planning with binding plans, and these have the highest potential for implementing effective policies and exchanging examples of good practice.

TRANSLAND identified 16 areas for further study, ranging from the modelling of land use/transport interactions, to target setting and the redesign of the planning process.

PROJECT WEB PAGE: <http://www.inro.tno.nl/transland/>

TRANSPRICE:**KEY RESULTS****Trans modal integrated urban transport pricing for optimum modal split**

TRANSPRICE assessed pricing strategies that are co-ordinated across the modes, identifying effects on modal split and public acceptance.

User surveys in eight cities showed that public acceptability of *isolated* pricing measures is low. This can increase substantially when pricing is presented as the cornerstone of a package of measures that include revenue allocation to public transport investments and non-motorised modes. Hypothecation of road use pricing revenues is also becoming more acceptable to politicians.

Demonstrations and modelling work in five cities showed that road use pricing is an effective way of changing modal split from private car to public transport and Park & Ride, giving city centre traffic reductions of 5-25% (for charge levels of 1-3 EUR). Cordon pricing is particularly effective when applied to congested central areas and over peak periods (reducing car trips by up to 25%). Pricing of parking is also effective in restraining car trips, provided enforcement can be maximised. It works best as an accompanying measure rather than in isolation.

Integrated ticketing and smartcard integrated payment systems have a small impact on modal split on their own (especially for Park & Ride), but more importantly support trans-modal pricing measures. Pricing of High Occupancy Vehicle lanes has a marginal impact on modal split, and seems applicable in special cases only (such as

Project acronym and title**Key results and policy implications**

severe congestion).

Various forms of road use pricing were assessed to be the most promising approach, followed by cordon pricing, in a multi-criteria evaluation across a range of policy objectives.

POLICY IMPLICATIONS

Transport pricing has potential for yielding significant changes in urban modal split towards public transport, Park & Ride and non-motorised modes, as well as providing substantial revenues.

TRANSPRICE concluded that road use pricing should be considered when parking pricing measures alone have been found to have exhausted their effectiveness. Road use pricing should be promoted as part of a package of demand management measures, with hypothecation of revenues towards local transport and environmental improvements. This would substantially increase the potential public acceptability, as well as helping to overcome the resource problems that face demand management investments.

UTOPIA:**KEY RESULTS****Urban transport: options for propulsion systems and instruments for analysis**

The UTOPIA project aimed to provide project managers and policy-makers with the necessary information base, tools and guidelines to support the introduction of promising urban transport solutions based on cleaner vehicles.

The project developed four major outputs (available on the web at <http://utopia.jrc.it/>):

An assessment of the most promising applications for cleaner vehicles and supporting measures, from a city perspective

This report assesses fuel options and applications for cleaner vehicles, and describes how best to introduce clean vehicles into cities using well-targeted demonstration projects backed by policy actions. It is illustrated by examples drawn from across Europe.

Recommendations on policy actions at the European and national levels to promote or facilitate market introduction and demonstration

This report examines the potential benefits of cleaner vehicles, including the results of European-level modelling. It looks at government activities across Europe: programmes of pilot and demonstration projects, and supporting measures such as tax incentives, emissions standards and green procurement. Finally it presents recommendations for:

- best practice in the design of programmes of pilot and demonstration projects;
- key supporting policies which can make a major impact on the introduction of cleaner vehicles in European cities.

A good practice guide to setting up and running pilot and demonstration projects, aimed at potential project champions

These guidelines cover the decision points and evaluation phases through the entire lifecycle of a demonstration project. Guidance is given on what to do and consider at each stage. This is supported by examples and good practice recommendations derived from a wide variety of European project experiences. The guidelines focus on urban applications of two-wheelers, cars, buses, vans and trucks.

Project acronym and title**Key results and policy implications*****A software framework (“NAVIGATE UTOPIA”) which provides information and assessment methodologies covering clean transport solutions***

This is primarily to support people at the local level (such as city transport planners) in pre-screening options and building the arguments in favour of a local initiative. It is a user-friendly web-based tool. Within its structured framework, it provides a wide range of information, case studies and decision aids generated within the wider UTOPIA project. It also incorporates a multi-criteria tool for assessing the promising transport options for a specific city situation according to *local* policy objectives.

POLICY IMPLICATIONS

UTOPIA concluded that there is a need for alternative and renewable transport fuels. However, their current costs and other limitations in vehicle applications mean that market entry will be typically be via particular niches such as urban buses. Supporting policies were evaluated:

- The most important policy measures are *fiscal incentives*. A distinction is needed between incentives to kick-start the market for individual fuels, and efficient incentives in the longer term that are not technology-specific (e.g. differential rates of fuel taxation based on relative environmental damage).
- *Demonstration projects* have an important role in testing technologies, stimulating the market and raising consumer awareness.
- *Eco-labelling* and *green fleet certification schemes* are important, especially where the label remains on the vehicle in everyday use.
- *Green procurement* by Governments, whether voluntary or mandatory, can be significant in creating an initial market for new fuels and providing a signal to private consumers that these fuels are serious.
- *Standards* for vehicles and fuels are important in creating a unified market and ensuring consumer confidence.
- *Low emission zones* that allow city centre access only for clean vehicles, and *Quality Contracts and Partnerships* between local authorities and fleet operators, are new powerful tools for encouraging cleaner vehicles at a local level. Governments may need to provide the regulatory framework for their implementation and enforcement.

PROJECT WEB PAGES:

<http://utopia.jrc.it/> (NAVIGATE UTOPIA decision support system)

<http://www.utopia-eu.com/> (project description and results)

VIRGIL:***KEY RESULTS*****Verifying and strengthening rural access to transport services**

The project objectives were to inventory and assess existing and past experiences on rural access to transport in several European countries.

A database containing past and present experiences on rural access to transport has been developed and can be consulted on the project's web site. The database includes a total of 134 books and articles and over 100 case studies, providing an extensive overview of rural transport systems in Europe.

Twenty-eight case studies (both passenger and freight transport) were analysed in depth with regard to: i) resource inputs and service delivery outputs, ii) legal base and preconditions for operation, iii) use of telematics, iv) experience with integrated passenger and freight transport. A Good Practice Guide targeted at rural communities presents 12 different transport schemes providing innovative rural services across Europe.

Project acronym and title**Key results and policy implications**

A report on future research needs has been prepared, based on extensive consultation with key stakeholders and validated during an international seminar. The report addresses several topics, including the integration of local services, the licensing environment for demand responsive services, the institutional and legal barriers, and the role of telematics.

POLICY IMPLICATIONS

Improving rural transport services is part of a development and wealth redistribution policy. On the development side, the policy gives traditionally isolated areas potential mobility not dependent on the private vehicle. With respect to wealth redistribution, the policy favours public transport “captives” and “poor” demand segments, such as elderly people and young people. VIRGIL has highlighted problems of rural transport and ideas to improve it, providing a Europe-wide overview. The project’s results are of immediate interest both for the local/regional/national authorities promoting rural transport and for the operators providing such services.

The project specifically highlights the tremendous possibilities that ICTs offer in improving rural transport. The need for telematics is largely dependent on the need for flexibility of rural transport. The deployment of telematics in rural transport is still relatively new and most countries have little experience. Comprehensive research is needed into the viability and operational characteristics of using ICTs in integrated ticketing (e.g. multi-purpose contactless smart cards), pre-booking, real-time passenger information and route-planning systems. The research should not focus on developing new, high-technology tools, but should concentrate on the adaptation of already existing telematic tools. Experience from the VIRGIL project has shown that, compared to urban transport, simpler and lighter software systems could be in place for the needs of rural transport.

Rural services carrying both goods and passengers can provide environmental benefits due to better capacity utilisation, economical benefits for providers and users, and an image gain for the region by focusing on environmentally sensitive tourism. There is only a limited experience with such services in most European countries, but VIRGIL proposed that such a possibility should be researched. The main issues in preventing the integration of freight and passenger transport are the legislative barriers (e.g. in Italy).

PROJECT WEB PAGE: <http://www.bealtaine.ie/virgil>

WALCYNG:***KEY RESULTS*****How to enhance walking and cycling instead of shorter car trips and to make these modes safer**

WALCYNG has produced an evaluation tool to show how walking and cycling can be promoted as an alternative to short car trips. This interactive software is intended for use by city authorities in assessing the preconditions for walking and cycling in a certain area, and as a support when developing measures. It provides:

- an inventory of solutions;
- a structured checklist of all relevant aspects to be considered;
- practical guidance on implementation, with examples of successful initiatives;
- advice on how to motivate change.

The project has provided practical support for stakeholders seeking change, such as:

- incentive and communication strategies;
- briefings and counter-arguments to assist proponents of walking and cycling in meeting the anticipated barriers/opposition;
- advice on lobbying – which is particularly important given that pedestrians

**Project acronym
and title****Key results and policy implications**

currently lack an organised lobbying movement.

In a survey of European cities, the most common measures were found to be the extension and improvement of pedestrian areas and bicycle lanes.

POLICY IMPLICATIONS

The promotion of walking and cycling primarily requires policy action. Parking restrictions in inner city areas and improvements in public transport are commonly seen as important. Infrastructure measures to improve facilities for walking and cycling are also emphasised by city planners, together with public relations measures such as providing maps of the bicycle network and communicating the availability of new facilities.

Three incentive strategies are proposed by WALCYNG:

- incentives such as tax reductions for employers to establish mobility management plans for their employees;
- incentives for the general public, such as Car Free Days and reduced entry fees;
- direct incentives to employees, such as taxation of parking spaces.

A particular policy concern would be the increase in accidents if walking and cycling were promoted without corresponding action to enhance safety levels for walkers and cyclists. One of the most important measures recommended is to ensure a maximum speed of 30 kph on streets where walkers and cyclists are present.

The project recommended public support for pilot and demonstration projects, particularly to assess integrated packages of measures. Co-operation with big companies and institutions would be important here.