DG TREN
Development of Transport Policy
Research and Development

Concerted Action: CARISMA Transport

Concerted Action for the Interconnection of Transport Systems in the Member States in Association with the European Commission

Project Contract No: PL97-2242

POLIS and TRANSVER

Interconnection of Trans-European Networks (Long Distance) and Regional / Local Networks of Cities and Regions

Final Report

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Concerted Action: CARISMA-Transport - Final Report
Interconnection of Trans-European Networks (Long Distance) and Regional (Local) Networks of Cities and Regions

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1 Introduction

The Concerted Action CARISMA-Transport (Concerted Action for the Interconnection of Transport Systems in the Member States in Association with the European Commission) addressed the inter-connection of long distance transport networks with local/regional transport networks of all modes. Special emphasis was given to the Trans-European Transport Networks (TEN-Transport), to the urban and inter-urban interface/transition zone and in particular to inter-modal passenger transport.

This was achieved through a concertation activity, which was designed to bring the relevant DG TREN projects and other RTD and pre-deployment activities at the Community level together with other EU and national actors, in order to inform and raise awareness on key issues.

The action was managed in close co-operation with the DG XIII project CARISMA-Telematics of the Transport Telematics Programme Sector Transport (TAP-T), on the deployment of transport telematics in metropolitan areas.

Objectives

The objective of CARISMA-Transport was to investigate the interaction between and facilitate the inter-connection of long-distance transport networks (e.g. Trans-European Networks) with local and regional transport networks by, specifically:

- providing logistical, administrative and technical co-ordination for the synthesis, analysis and presentation of research results in this field;
- structuring and categorising the results of deliberation with local, regional, national and European policy-makers on these issues in the form of thematic brochures;
- disseminating these brochures and other project results to the outside world, in particular targeting a broad range of decision-makers in the field of transport at all levels.

Through this concerted action a more systematic flow between European, national and local/regional policy makers on issues related to the inter-connection of transport networks of different scales and modes was achieved addressing policy, legal, design, planning, technical and deployment aspects.

By including partners from Eastern European countries the new requirements for the structure of the European Networks with respect to infrastructure, design and management were given special attention.

Final Report

The objective of this Final Report is to document the **design of approach** adopted for the CARISMA-Transport project and to provide a **state of the art** review of the inter-connection of transport networks considered in the Member States, at selected case cities and the R+D work of the European Commission.

2 Nature and General Approach of the Project

CARISMA-Transport - Project Approach

The key activities undertaken to achieve the project objectives were:

- the provision of a **co-ordination office** and 'help desk' at the POLIS office in Brussels;
- the production of an **inception report** to show progress, integrate results on the state of the art and identify and explore key issues, and;
- the preparation and guidance of **meetings** of Members States' representatives and related organisations on the basis of the concepts produced in the inception report;
- the organisation of a range of dissemination and awareness-raising activities on project results in the form of **technical workshops, a high-level policy forum and publications** and targeting a broad range of actors in the transport field, specifically policy-makers at all levels.

The state of the art review was used as a basis for producing background discussion papers and setting agendas for meetings of a **Management Committee**. This was a strategic consultative body set up by the project to incorporate representatives of the 15 EU Member States as well as a number of relevant international organisations. The Management Committee explored the issues related to the inter-connection of long distance and local / regional transport networks, exchanged experiences, assessed current practices and proposed future requirements and actions to be taken.

The background for the inception and final report and the issues presented to the Management Committee were the results of the **projects of DG TREN and DG IS** of the TAP. These included the interconnectivity of transport networks and systems, as well as the existing and planned projects and facilities in the Member States.

A small **scientific advisory group** comprising individuals with expertise in the field, was established to monitor the work of the Management Committee. The group's role was to moderate the discussions and report on the conclusions and to synthesise and analyse the results of deliberations for further dissemination in a wider context to policy-makers at all levels.

The conclusions of the concerted action have been published in the form of both thematic **brochures and the final report** for wider dissemination to policy-makers at local, regional and national level, as well as to the research world. Awareness-raising activities, including a **forum** and presentations at relevant events, were organised, targeting policy-makers and international organisations.

Case Cities and On-Site Visits

A key element of the CARISMA-Transport approach was the inclusion of site visits to selected case cities, in order to gain an inside view and to acquire data and informa-

tion from public authorities, institutions and facilities which are faced with the issue of interconnectivity of networks. The case cities either provided examples of best practice or a broad insight into existing impediments and future requirements.

Members of the CARISMA consortium visited selected sites to collect information and discuss with experts from the local / regional level and the private sector. In addition, discussions took place with representatives of the Member States and the European Commission on particular issues surrounding the interconnection of long distance and urban / regional networks. The direct exchange of experience and knowledge with key actors on political, organisational, technical and financial topics of each specific site, provided the consortium with the background necessary to identify the priorities for further consideration by the Management Committee.

Based on the experience of the CARISMA Consortium members, examples of best practice, existing facilities in the Member States and the review of EU DG TREN R+D-projects **5 qualified sites** had been identified in agreement with the Management Committee (MC). These areas were:

- Budapest in Hungary
- Frankfurt and the Rhein / Main Area in Germany
- Lille in France
- London in Great Britain and
- Trieste in Italy.

For all selected sites the quality and efficiency of the transport networks and their interfaces have a high impact on the future growth of their regions.

CARISMA Reporting and Priority Themes

The background for the CARISMA concertation process was provided by the transport plans and implementations of transport infrastructures for interconnecting the long-distance (i.e. TEN-Transport) road, rail and air networks with local / regional transport networks at both the EU and national level. The activities and achievements of the past and current R&D projects in this area also provided contextual information.

The **thematic brochures** and the **final report** reflect European transport and mobility issues and a review of the state of the art of interconnecting networks of the road, rail and air sector for passenger transport.

A number of **priority themes** were selected to be considered in the development of the concerted action

- Planning infrastructures and Interchanges
- Operations and services of multi- / intermodal interchanges
- Policy environment for interconnectivity.

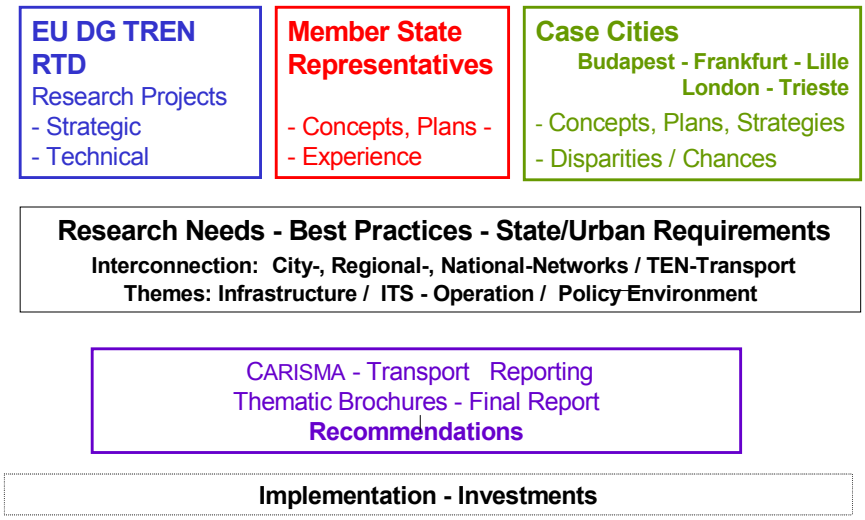

Fig. 2-1: The CARISMA Transport Approach

Fig. 2-1 summarises the CARISMA Transport approach, with the main input areas from the Member state representatives, the RTD Projects and the best practice from the site visits to the case cities.

3 Categories of Transport Networks and their Interconnections

Transport Demand

CARISMA Transport focuses on passenger transport. The interrelation between transport demand, transport supply, traffic and its effects is shown in Fig. 3-1.

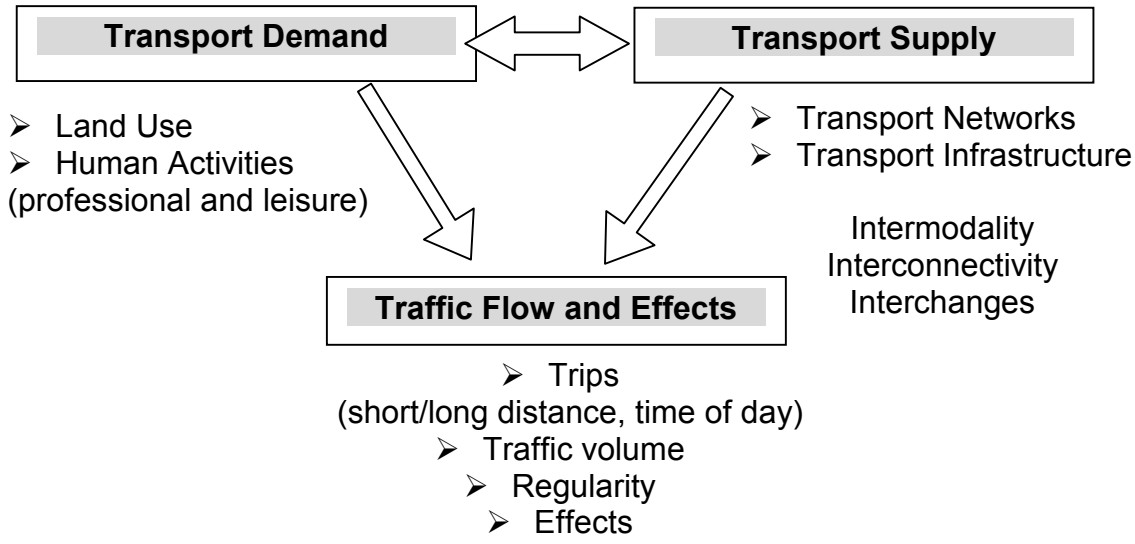

Fig. 3-1 Transport Demand, Supply and Effects

Transport demand, in terms of paths or trips or trip chains, is typically differentiated by

- origin and destination
- mode of travel or a combination of modes
- time of departure
- choice of route

Inter-modal transport can be relevant for nearly all trips.

Transport models allow for the estimation of transport demand by mode for different trip purposes, time periods and environments as a function of cost, e.g. time of travel in transport supply.

Inter-modal Travel - Transport Supply

Transport supply can be considered from the viewpoint of the traveller, the infrastructure owner and the service provider.

The **traveller's trip chain** may consist of several elements using different transport modes and different interfaces for the exchange of modes during the trip, see Fig. 3-2. The horizontal bars in this graph represent the time and / or distance, while the

vertical bars represent the transfer activities at the modal interchange points of the transport networks.

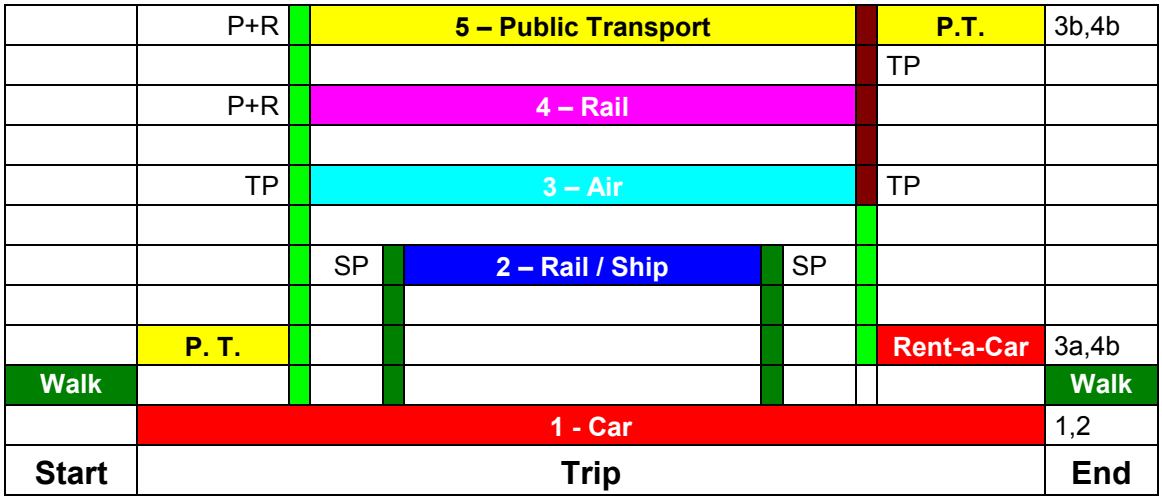

Fig. 3-2: Inter-modal Trip Chain of a Traveller (KELLER, 1999)
[P+R Park-and-Ride, P.T. Public Transport, TP Transfer Point, SP Service Point]

The structure of the **transport supply** can be differentiated into networks consisting of links and nodes, the intra-modal as well as inter-modal interchanges and the vehicles or fleets, with institutional and organisational dimensions for the owners and operators, see Table 3-1.

Mode	Network	Interchanges	Vehicle Fleet
Air	Air-routes	Airports	Aircraft
Waterborne	Waterways	Ports	Ships
Rail	Rails	Stations	Trains
Public Transport	Rails, Roads	Stops	Trams, Busses, Metro, Taxi
Road	Roads, Streets	Nodes	Cars, Motorbike
Foot, Bike	Roads, Paths	Nodes	Bikes

Table 3-1: Elements of Transport Supply by Mode

Depending on the **structure of ownership** of the network (public or private or both), the interchanges and the vehicle fleet exist or have to be developed to achieve an operable and inter-operable system of transport. Transport system design and its optimal operation are therefore necessary to deliver seamless journeys. This includes the following components:

Policy and legal issues

- Co-operation agreements, and
- Institutional procedures

Planning, design and location process

- Planning, financing, design, construction of hardware
- Maintenance, operation, services (software)
- Management and co-ordination

Network classification

- Links
- Nodes
- Size, coverage, and distance.

This can be further specified for:

Interchanges

- Inter-modal infrastructure
- Inter-modal interchanges

Services

- Information, booking, ticketing, payment, transfers with ITS applications

Management

- Network control, control centres with intelligent transport systems
- Level of management (local, regional, national, European)

Inter-modal Interchanges – User Requirements

Specification of the user requirements for the design and operation of network interchanges must consider the interests of the traveller, the network owners and operators, as well as the service providers. This is especially true for inter-modal trips to reach acceptance of the supply and services by the end user.

The criteria of the **traveller** carrying out an inter-modal trip include

- available time,
- information, ticketing, booking
- baggage handling
- comfort.

The view of the system / facility infrastructure **owner (public and/or private)**

- is to connect the long distance networks to the city / metropolitan area, e.g. an airport to be connected to a city using the train or the car and continue with public transport and/or the car, e.g.:

Long Distance Network – Metropolitan Region / City				
long distance		*- interconnection -*		*short distance*
Airport	⇔	**Local interchange**	⇔	**City network**
via Rail and/or Motorways		Rail station Road-interchange		Public Transport Urban Streets

- or to interconnect long distance networks to other long distance networks and the metropolitan region/city, e.g. an airport connecting to a rail station and then to the city network, e.g.:

Long Distance Network – Long Distance Network – Metropolitan Region / City			
long distance - interconnection -long distance - interconnection - short distance			
Airport ⇔	**Rail Station** ⇔	**Local interchange** ⇔	**City network**
via Rail and/or Motorways	via regional Rail and/or Roads	Rail station Road-interchange	Public Transport Urban Streets

This means that to further define the requirements for intermodal interchanges it is necessary to look at the existing long and short distance networks and the connections between and / or within the subset of TEN-Transport, the regional and the local network (s. Fig. 3-3). In addition, current traffic volumes and the estimation of future demand in different scenarios including policy objectives must be taken into consideration for planning and future policy decisions.

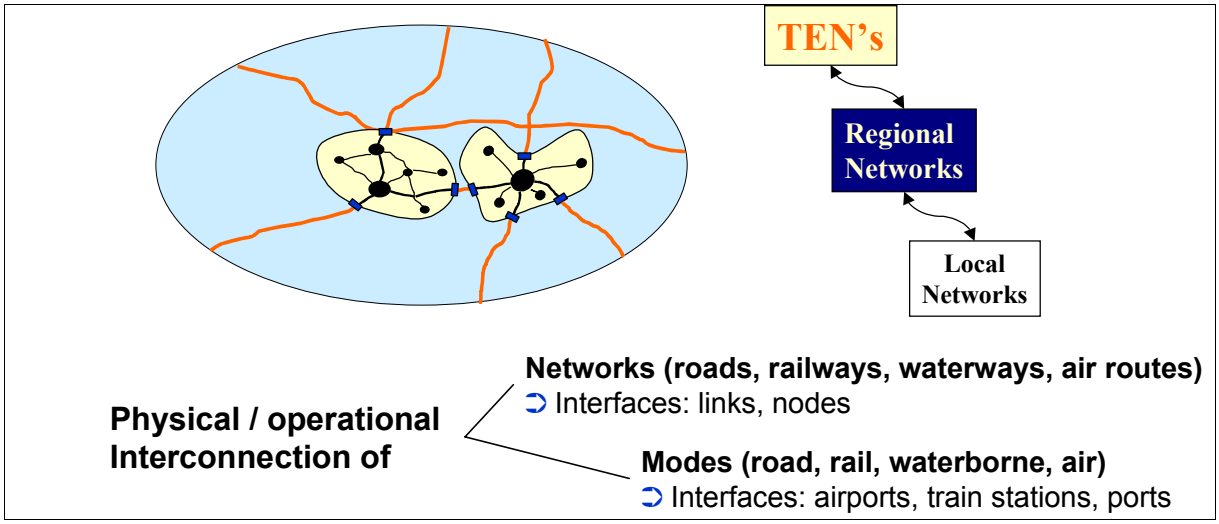

Fig. 3-3: CARISMA Transport: Levels of interconnection

Interconnection Philosophy

The share of Europe's population living in settlements defined as 'urban' continues to increase, with the largest cities continuing to house a very significant proportion of the population.

The European Union is the most urbanised region in the world, with 79% of the total population in 1992 living in urban areas (CEC, 1994a, DGXI, 1996), The greatest proportion of urban traffic and expected traffic growth is outside the inner cities, consisting largely of commuter and other inter-connective traffic resulting from deregulated land use planning, high accessibility to private cars and spatial detachment of working and housing.

A study found that over the last 20 years, average traffic speeds in large OECD cities reduced by 10%. In one third of the cities surveyed, the early morning speeds in the city centres were below 19 km/h (OECD/ECMT, 1995). Considering that typically 10 to 15% of the area of large cities in Europe is taken up by road infrastructure and assuming that new or improved infrastructure will generate traffic, promoting more environmentally efficient and less space consuming modes such as public transport, seems to be one of the only ways to sustain mobility in urban areas.

Broad acceptance of the need to change mobility patterns must be accompanied by measures to reduce reliance on the private car by promoting alternative modes, and reducing competition by integrating all existing modes. Traffic management measures should also facilitate efficient use of the road network for trips by private car that cannot be replaced by public transport for accessibility or economic reasons.

An unavoidable bi-product of the Commission's efforts in developing the Trans-European Transport Network to assist regions and facilitate the development of the Single Market is further increases in the amount of road transport. Therefore accompanying measures must be taken into account combining economic development, spatial and environmental planning with transport planning.

Fig. 3-4 shows the two potential paths of transport planning, which can be transport demand and transport supply oriented, depending on the type of disparities encountered in the planning process.

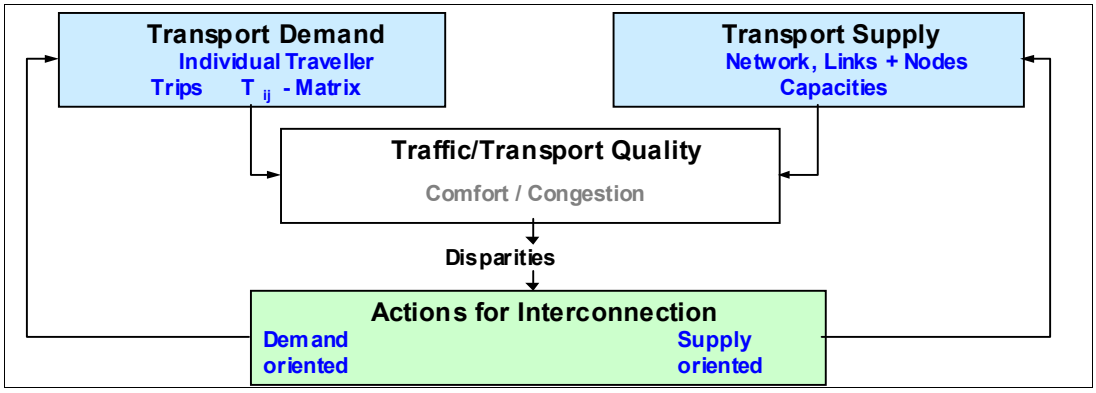

Fig. 3-4: Demand and Supply oriented Interconnection Philosophy for Transport

Three types of action on different impact horizons are identified that show a high relevance to the interconnection of networks.

Macroscopic Action:

⇒ Land use Planning:
Balanced location of homes and working places

Mesoscopic Action:

⇒ Infrastructure Planning:
Design and Location of network links and interchanges

Microscopic Action:

⇒ Operation and Services:

Information, control and management of networks and for trips

Integrative measures require the promotion of efficient interconnection between long distance and local and regional networks. They should also contribute to promoting one or more of the following properties of the transport system:

Harmonised interfaces between transport systems and high level of service

⇒ Interoperability

Physical interconnection of networks by new design and expansion of the transport infrastructure and interchanges

⇒ Interconnectivity

Competition of different modes and / or balancing the use of different modes in the same corridor

⇒ Multimodality

Integration of different modes in the same transport chain

⇒ Intermodality

Efficient technical co-operation between different systems

⇒ Compatibility

In order to use widely applicable and accepted terms the definitions used above have been chosen in line with those recommended by the TENASSESS and MINIMISE projects.

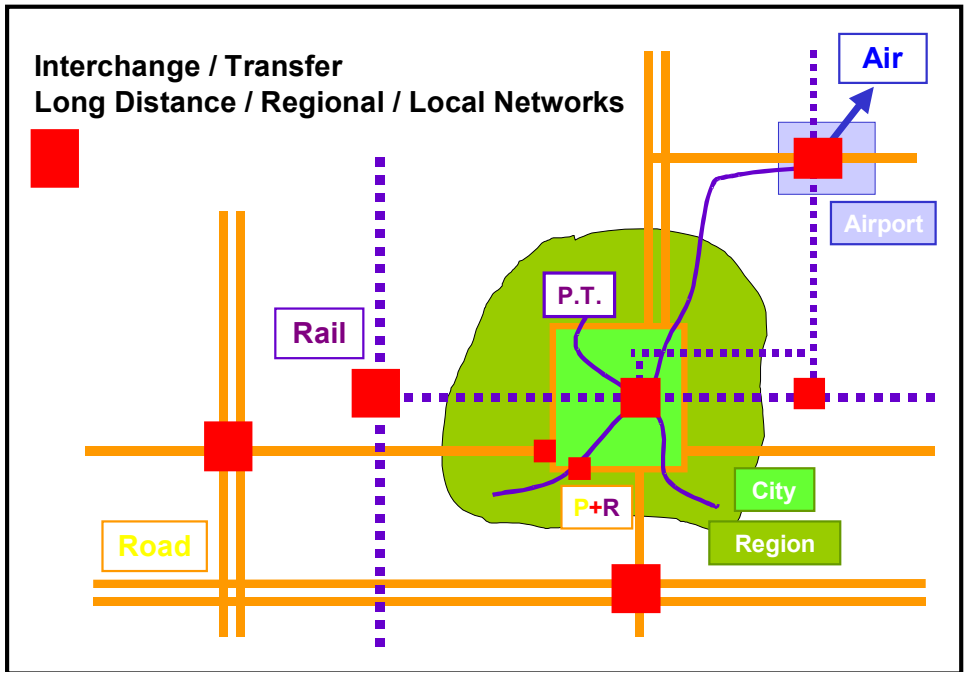

Fig. 3-5: Interconnection of Long Distance and Regional / Local Transport Networks

Considering the high proportion of the European population living in urban areas, the focus should be on the interconnection of the networks, i.e. the transport of people

between and within metropolitan areas. Fig. 3-5 provides an idealised vision of the interconnection of long distance and regional / local transport networks within a metropolitan region.

One of the barriers to inter-connection of modes is the fact that the field of transport management is still dominated by a spirit of competition, e.g. of public transport operators between and within modes. Therefore complementary operation of different modes in an integrated multi-modal transport system should be a major policy objective at all levels. At the same time the design of transport supply has to offer opportunities for those inhabitants living in more rural areas or in smaller cities.

In summary, promoting the interconnection of long distance and regional / local networks requires measures related to policies, land use planning and infrastructure development, as well as traffic management (operation and services) and raising public awareness.

4 European RTD-Projects on Network Connectivity

To support the development and integration of European transport systems, DG TREN supported a number of strategic and technical type research projects, each focusing on particular aspects of integrating transport systems on a local, national and European scale. A set of projects have been identified, see following Table 4-1, as being of relevance to the CARISMA-Transport project. Each of them considers at least one important aspect in establishing the Trans-European Transport Networks and / or integrated local/urban networks.

Project	Duration	Focus
Strategic		
EUROSIL	**1/97 – 12/98**	**Intermodality**
MINIMISE	**2/96 – 2/99**	**Interoperability (Economic Measures)**
SORT-IT	**1/96 – 12/98**	**Interoperability (Policy Measures)**
TENASSESS	**5/96 – 4/99**	**Transport Policies**
INTRAMUROS	**1/97 – 2/98**	**Intermodality in Urban Transport**
Technical		
GUIDE	**1/98 – 3/99**	**Urban Public Transport Interchanges**
MIMIC	**1/98 – 6/99**	**Passenger Interfaces between Modes (except HSR)**
PIRATE	**1/98-6/99**	**Establish Design Features for P. T. Interchanges**
EMOLITE	**1/97-6/98**	**Location of Passenger and Freight Terminals**
HSR-COMET	**1/96-3/97**	**Intermodal Connection of HSR Terminals**

Table 4-1: RTD projects relevant to the CARISMA scope

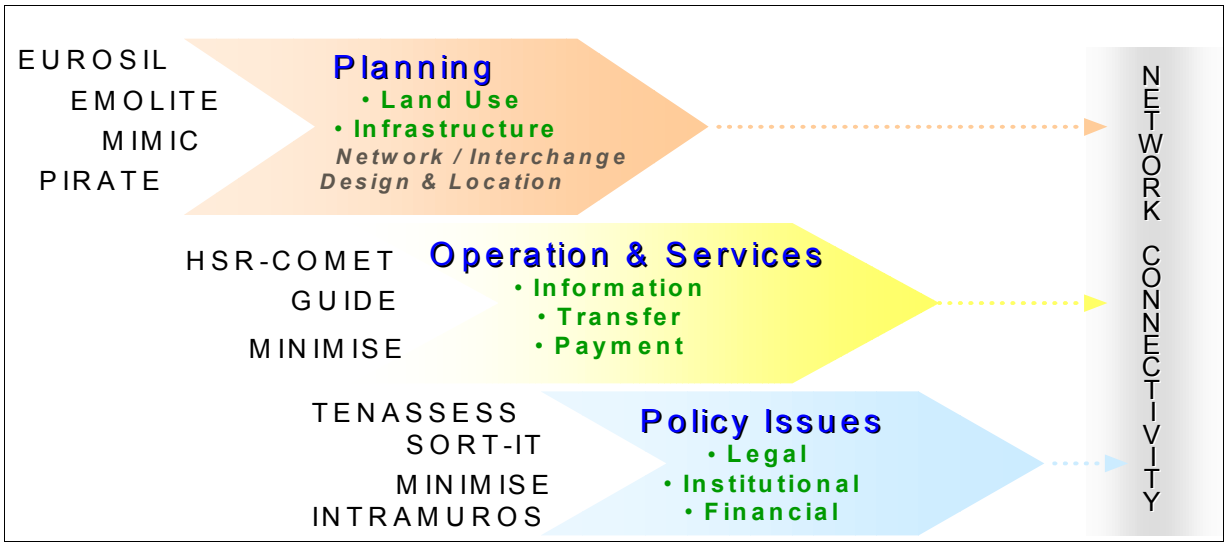

Fig. 4-1: DG TREN RTD projects and focal issues

In order to promote a transfer of knowledge and experience between these projects and with Member States' projects they are incorporated in the CARISMA-Transport concertation process. The respective approaches and main research results to date

are reported here, while results of particular relevance to the CARISMA-Transport project can be found later in the report.

4.1 Project Summaries

4.1.1 Strategic Assessment Projects

EUROSIL (European Strategic Intermodal Links)

The aim of EUROSIL was to develop a Spatial European Set (SES) of Guidelines, modelling and evaluation tools based on an overall Spatial Evaluation Framework. The approach was based on a common methodology for the Trans-European and Pan-European Networks (TEN+PEN) for Transport.

Overall the EUROSIL project covers the following topics in its research:

- Passenger and Freight Transport.
- Travel Modes (road, rail, air and waterborne, including short sea shipping and inland waterways, and pipelines).
- Infrastructure and networks, taking into account not only existing but also new elements of all networks (communication, information, etc.).
- Organisational structure, with the consideration of the legal and institutional framework and the level of regulation and harmonisation.
- The requirements of potential end users (e.g. passengers), intermediate users (e.g. operators, customers) and public authorities.
- The economic issues, i.e. allocation of infrastructure and external costs, tax regimes (including tolls and other forms of pricing) and return of investment.
- The impact of new technologies

In the early stages of the project, European projects were analysed with regard to the key issues of multimodality, intermodality, interoperability and developmental impact. The conclusions drawn largely represent the current developments in transportation within the European Community (EUROSIL, 1997):

- *Multimodality* had been seriously considered in all projects under investigation. Single mode thinking was thought to be outdated.
- The majority of projects had not taken *intermodality* into account with some exceptions, such as freight centres and accessibility to airports. The relatively new concept of intermodality is not yet considered to be well established in Europe.
- The *interoperability***,** which must be distinguished as clearly as possible from intermodality, had not been sufficiently considered in most of the European projects investigated, with few exceptions.
- The *impact of traffic on the area development* had only been examined in a few cases, such as the High Speed Trains (HST) and combined freight transport. The issue requires more consideration in the TEN-Transport development.

The project concluded that the interconnection, intermodality and interoperability issues for networks had not been addressed in a thorough manner in recent European

projects. Another main conclusion from the EUROSIL project was that the impact on the area development must be studied more thoroughly in future European projects.

The aspects analysed by EUROSIL provide a broad overview of current transport practice and an input to future requirements of transport projects concerning the interconnection of long distance and metropolitan networks. The project results most relevant to CARISMA are presented in more detail in sections 4.2.1.1 and 4.2.1.4 of this report.

MINIMISE (Managing Interoperability by Improvements in Transport System Organisation in Europe)

The main objective of the MINIMISE project was to identify measures that could lead to an improvement in the interoperability of the different transport sectors. Relevant measures in the fields of market economics, system organisation and capacity management were analysed, encompassing all components of the transport system, i.e. different modes, interfaces and infrastructure. Statistical indicators were used to quantify the magnitude of impediments to interoperability. The Case studies included public transport and rail, road and waterborne freight transport.

In order to arrive at common conclusions and recommendations for the improvement of the European Transport System, both a common evaluation of policy measures and an evaluation of the specific findings of case study investigations were conducted.

The effects of changes to the three core topics Competition / Deregulation / Privatisation, Capacity Management and System Organisation on interoperability and economic efficiency were investigated using an Analytical Framework.

Besides freight transport issues European passenger rail and urban and regional public transport were analysed.

The research included:

- impact of deregulation and privatisation on interoperability in transport operations, infrastructure and telematics
- key problems of efficiency and interoperability
- influence of system organisation on interconnectivity and interoperability
- definitions of key quality factors
- analysis of transport system capacity and development of a capacity management framework including a list of properties regarding capacity and an integrated capacity model.

MINIMISE covered a wide range of interconnectivity issues in the areas of infrastructure planning (see section 4.2.1.3, 4.2.1.4), operations (section 4.2.2.4) and policy environments (section 4.2.3.2). The main contribution of the MINIMISE research work for CARISMA-Transport was the analysis of the impact different economic and organisational measures have on passenger transport.

SORT-IT (Strategic Organisation and Regulation in Transport)

Similar to the MINIMISE project, this strategic RTD projects addressed the impact of different economic measures, mainly deregulation and privatisation. In contrast to MINIMISE, the project focused on the field of transport infrastructure and operations both in the EU and the EFTA. The aim was to identify infrastructure and operational barriers in the EEA and Switzerland and suggest appropriate management structures and performance criteria.

Due to the close interrelation with MINIMISE, a link was established between the two projects and a combined final report was produced.

The MINIMISE project's main relevance to the CARISMA project was in the analysis of barriers to the implementation of the TEN (section 4.2.3.1) and the identification of policy measures for the improvement of intermodality and interchanges (section 4.2.3.3).

TENASSESS (Policy Assessment of the Trans-European Network and the Common Transport Policy)

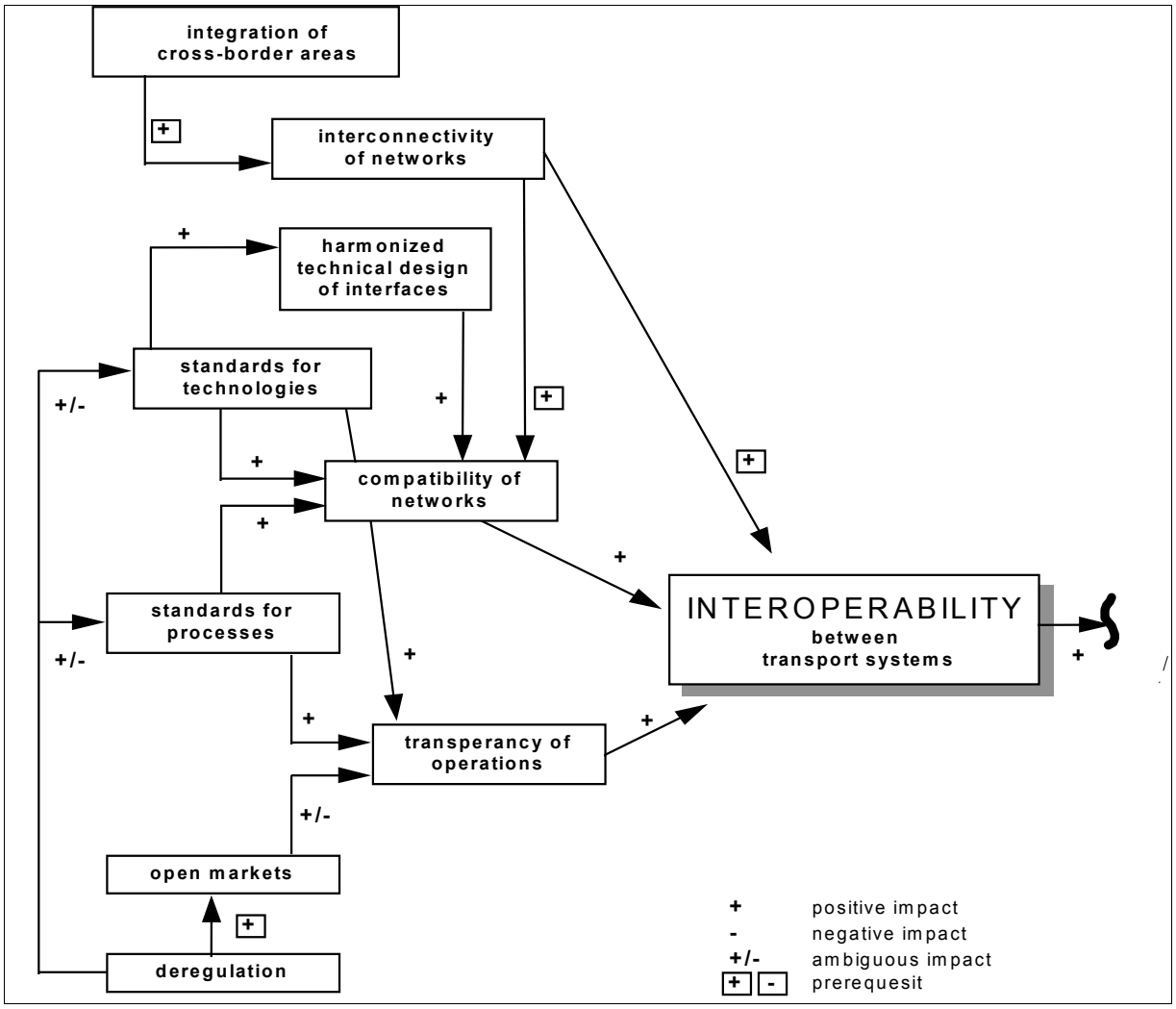

Fig. 4-2: Interaction Diagram of Cause and Effect Chains in the Field of Interoperability (TENASSESS, 1999)

The TENASSESS project's main focus was:

- providing a policy assessment methodology for large infrastructure investments
- providing a policy assessment approach to identify barriers to the implementation of the CTP
- developing a barrier model as guidance for regional transport policies and
- providing advice on best utilisation of research by transport policy-makers.

The research undertaken into policy processes was designed to derive basic knowledge for the development of decision support tools. Two such tools were developed: the TENASSESS Policy Assessment (PAM) tool; and the TENASSESS Barrier Model.

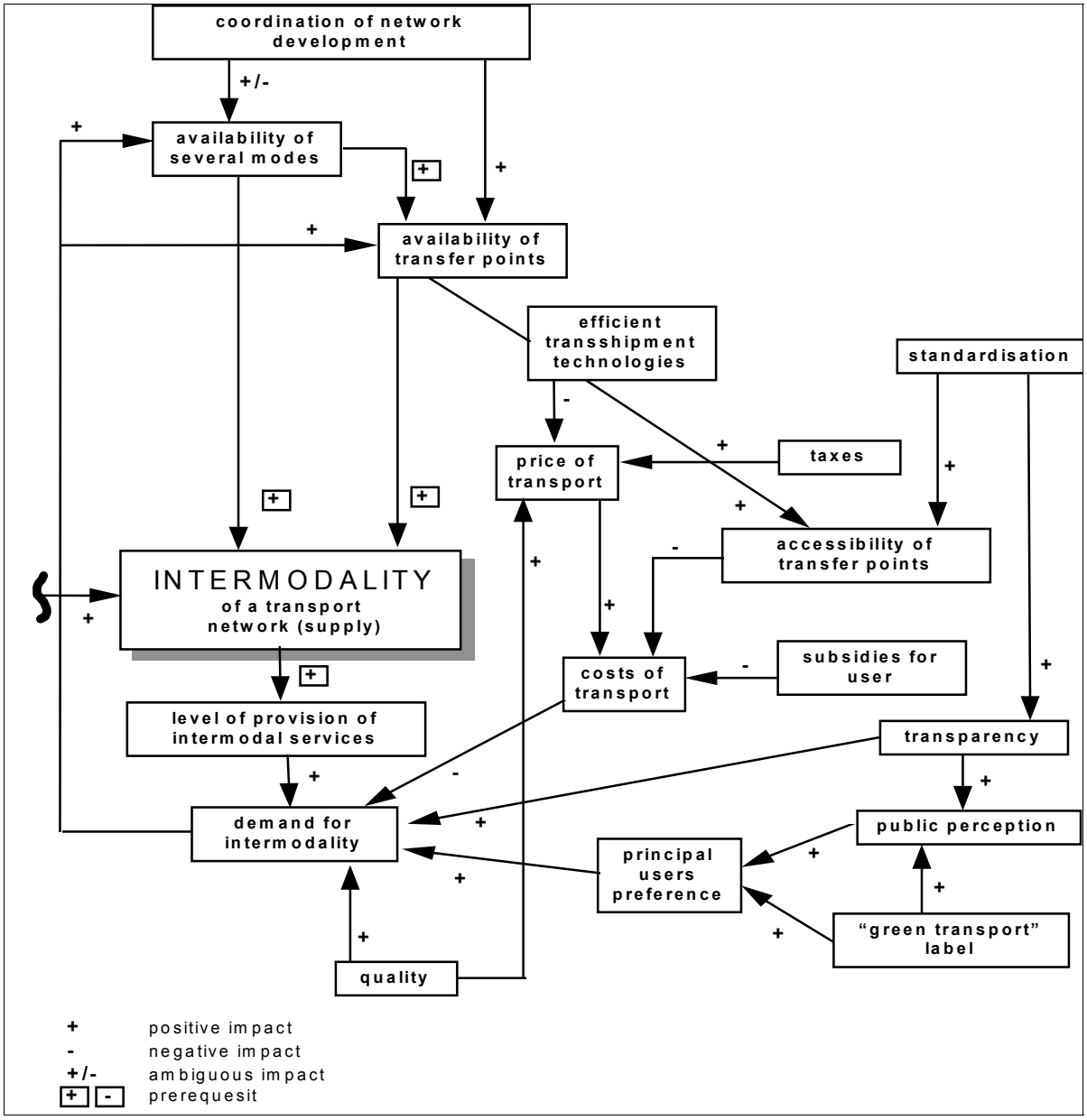

Fig. 4-3: Interaction Diagram of Cause and Effect Chains in the Field of Intermodality (TENASSESS, 1999)

The *TENASSESS PAM* may be used to assess the degree of congruence between any one project's objectives and those of transport policy from the perspective of different actors' viewpoints –it provides an interface between project appraisal and policy assessment. The *TENASSESS Barrier Model* assists in the identification and anticipation of barriers likely to occur during the implementation of any transport policy initiative. It is a dynamic model which may be used in an interactive manner to assist planning and which help make planners and policy-makers more aware of the consequences of their actions in particular planning contexts.

The particular relevance of TENASSESS for CARISMA Transport lies in its analysis of political and institutional impediments to integrated transport policies (see sections 4.2.3.1 and 4.2.3.2 of this report) and the fact that such integrated policies are the precondition for future improvements in the interconnectivity of networks. Fig. 4-2 and Fig. 4-3 provide interaction diagrams of cause and effect chains in the field of interoperability and intermodality as identified by the TENASSESS project.

INTRAMUROS (Integrated Urban transport concepts and market orientated urban transport systems/on demand urban transport systems)

The project's aim was to study the integration of the different actors involved in Urban Transport and develop a tool for the assessment of this integration. To this end, a conceptual methodology was developed and validated. The aspects considered including strategic, organisational, institutional, legal and financial ones were mainly of a non-technological nature.

New technologies have been taken into account wherever there is potential for them to support integration.

In the course of the project the following steps were performed:

- *Review of current status of Integrated Urban Transport Concepts*, with special attention being paid to the sites and users associated with the consortium, as they provide a set of varied and representative test cases.

  Concepts, tools and techniques developed within EU Research Programmes, were studied. A large review of relevant articles, publications and studies was undertaken in order to find out the most appropriate approach for INTRAMUROS in terms of the methodology adopted. IUTC official documents from Authorities such as Ministries, Regional and Local Governments, and any other interesting sources were reviewed to gain the maximum knowledge. In addition, other projects under European Programmes have been studied. For the assessment of the selected demo sites (Athens, Brescia, Kuusankoski, London, Toulouse and Valencia) the state-of-the-art with regard to the main actors and related organisational and institutional structures as well as socio-economic and legal issues and telematics applications.
- *Development of strategies* and concepts for co-ordinating the various actors and operators, with special attention to urban traffic control, interurban traffic control and public transport.
- *Development of a methodology, which* will allow the different urban actors (local authorities, public transport operators, regional authorities, user groups, technology providers, etc.) to assess the level of integration within their urban area.

- *Provision of guidelines* for the harmonisation of information provided to car drivers and passengers and the allocation of tasks corresponding to the different information providers.

Using Multi-Criteria Analysis techniques, the degree of integration of urban transport systems was assessed.

The INTRAMUROS findings offer an extensive overview of the state of the art in non-technological issues influencing intermodality in urban transport. Although aimed mainly at providing public actors with a methodology for assessing integration levels within their specific sites rather than recommending measures, the analyses of transport mode interaction could form the basis for setting an agenda on promoting intermodality within the CARISMA-Transport context.

4.1.2 Implementation Advice Projects

GUIDE (Group for Urban Interchanges Development & Evaluation)

Incorporating a group of representatives of public transport operators in major cities across Europe, GUIDE was a platform for establishing collaborative research on interfaces in the public transport sector.

Acknowledging the importance of interchange accessibility and quality for the attractiveness of public transport the main objectives of the GUIDE initiative were to:

- analyse and summarise European research on the issue of public transport interfacing
- promote co-operative research on PT interchanges between transport planners and operators across Europe
- assess design and functionality of interfaces in selected case studies
- disseminate information on project activities

The quality of interconnection between networks largely depends on that of the nodal points allowing users of one network easy access to another interfaced network. Covering the specific area of public transport interfaces and therefore one important component of network interconnection, the GUIDE group's activities and findings are incorporated in sections 4.2.1.4, 4.2.2.2 and 4.2.2.3 of this report.

MIMIC (Mobility, Intermodality and Interchanges)

MIMIC was closely interrelated to both the GUIDE project and the PIRATE project (see overleaf)..

Whereas GUIDE provided a co-operation platform for public transport operators and planners, MIMIC specifically addressed a variety of basic implementation issues related to public transport interchanges. Similar to GUIDE and PIRATE, MIMIC addressed local interchanges as opposed to HSR Terminals.

The project's overall objective was to 'break down the barriers to intermodality' at passenger interchanges. Barriers are defined as all interchange-specific factors that influence travellers' to choose single-mode (generally car-based) rather than intermodal journeys.

Research was conducted in four main areas:

- Door-to-door factors and demand responses.
- Catchment areas.
- Types of barriers.
- Implementing cost-effective local solutions.

Site studies were conducted for six major cities: Bilbao, Copenhagen, London, Rome, Tampere and Warsaw.

The project helped to develop a series of tools that can help planners, designers and managers to systematically analyse interchanges, taking into account several kinds of barriers (logistical and operational, psychological, institutional and organisational, physical design, local planning and land use, economic and social, information).

The main focus of the project was on:

- analysing present and potential effectiveness of public transport interchanges and
- providing recommendations as well as developing guidelines for the design, implementation and assessment of public transport interchanges.

Project results on the design and operation of interchanges are to be found in sections 4.2.1.4 and 4.2.2.1 of this report.

Economical issues such as public and private infrastructure financing and public-private-partnerships were addressed in a state of practice overview and case study assessment (4.2.3.3).

PIRATE (Promoting Interchange Rationale, Accessibility and Transfer Efficiency)

PIRATE aimed to incorporate user and non-user requirements into guidelines for the design of transport interchanges and produce a handbook for the construction and operation of the “European Public Transport Interchange of Tomorrow”. The types of interchange considered were Walk ’n' Ride, Park ’n' Ride, Bike ’n' Ride and Bus/tram/train ‘n' Ride. The methodology used was based on previous research work in an exploratory award and validated in sites in Belgium, Germany, Spain, England, Latvia, and Sweden.

By means of focus group discussions 65 characteristics of interchanges of relevance to all user groups were identified.

Aspects considered were

- connecting modes (e.g. walk environment overall quality, bike parking quality, car parking quality, etc.),
- total impression (e.g. accessibility, attractiveness personal security, etc.),
- equipment and services (catering ticket machines, etc.),
- information (information about current traffic, travel, etc.) and
- the station and the city (entrance accessibility, location)

Via a questionnaire survey the importance of all characteristics were assessed by site and reference group. As a measure of performance, the 'gap' between importance and satisfaction was derived for all characteristics. The relationship of importance and satisfaction was then classified into

- poor performance or worse than expected zone,
- ideal performance zone and
- over-performance or better than expected zone.

According to this analysis approximately half of all characteristics were found to be in the poor performance category. On average the more important characteristics perform better than the less important.

Comparing reference groups (users, non-users, employees, and experts) and their assessment of the importance of various characteristics, there was close agreement on the importance of car park security. However the experts in general viewed bike-parking facilities as more critical than the other groups. Non-users were most concerned with comfort aspects.

At the disaggregate level of reference groups and intermodality (i.e. users grouped by access mode) different performance levels were attached to each characteristic.

Overall the analysis revealed that the appearance of an interchange was ranked as being most important by all respondent groups while its equipment and services were considered least important. Experts considered location aspects of interchanges a priority.

Security was found to be equally important for all reference groups with each of them displaying slightly different priorities:

users $\Rightarrow$ security

non-users $\Rightarrow$ safe road crossings

experts $\Rightarrow$ P&R issues

workers $\Rightarrow$ personal security

Following the analysis of user needs, the Planning Approach was applied in selected test sites in order to harmonise the divergent interests of different user groups. In the first step of the approach used each user group was confronted with the divergent priorities of others. In the subsequent discussions conflicts requiring reconciliation were identified.

The findings of the PIRATE project provided a detailed overview of user needs arranged by reference group as well as different access modes. The analysis of 'Performance Gaps' demonstrated that user needs are to date not sufficiently accounted for when designing and constructing PT interchanges.

The results may form the basis for interchange design and construction guidelines harmonising the needs of all relevant user groups. Some of the project's results are considered in section 4.2.1.4 of this report.

The methodology was planned to be disseminated across Europe to enable relevant users to define their own specific user requirements, which will later be used to update the guidelines.

EMOLITE (Evaluation Model for the Optimal Location of Intermodal Terminals in Europe)

The strategic aim of the project was to contribute to the development of efficient intermodal transportation networks by integrating all relevant supply and demand requirements of intermodal distribution and transhipment centres as well as passenger terminals, in order to improve the development of the European, regional and city networks for the transport of goods and passengers.

The project specifically aimed to develop a Decision Support System for the evaluation of the optimal location of intermodal terminals for freight and passenger transport in Europe. To this end, an Evaluation Model for the Optimal Location of Intermodal Terminals in Europe (EMOLITE) was developed, which allows the evaluation of terminals using criteria relevant to both private and public decision-makers. Developed as a computer simulation model, EMOLITE enables decision-makers to assess and compare different terminal locations.

HSR-COMET (Intermodal Connection of HSR terminals in Metropolitan areas)

The focus of the HSR research was on the interconnection of HSR terminals with other transport modes. As high-speed trains usually interconnect with large metropolitan areas, the terminals have to be highly efficient in accommodating and interconnecting large passenger volumes to other transport modes. In order to identify user demand features for modal interconnection at HSR terminal, an exhaustive demand analysis was carried out, including medium and long-term forecast scenarios. Different interconnection options were developed taking into account socio-economic as well as political aspects.

The main assessment criteria used were innovation, complexity, multidimensionality, variability and interdependence.

In summary the project was conducted using the following 6-step approach:

- Analysing HSR demand (demand features, users)
- Selecting a transport mode/option for interconnection of HSR terminals which best meets user requirements
- Defining policy guidelines to implement interconnection options
- Distinguishing user groups by corresponding demand features
- Developing of a multi-criteria evaluation model
- Devising recommendations for the cities of Rome, Paris and Frankfurt.

High-speed trains serve as an attractive alternative to air and car travel. The expansion of the European HSR network is therefore one of the highest priorities of the European Union’s transport policy. The integration of HSR with other transport modes, allowing passengers to easily interchange to other modes at an HSR terminal in order to reach their final destinations is vital for the efficiency of the interconnective transport chain and the attractiveness of HSR itself.

Aspects of HSR are incorporated in sections 4.2.1.4 and 4.2.2.1 of this report.

4.2 Synthesis of RTD Results

On the basis of the RTD project review themes were identified including issues of common concern and issues that have not yet been addressed.

This paragraph sets the framework and establishes the focal points for the projects' activities and outlines the relevance to local, regional, national and European interests.

4.2.1 Planning Issues for Interchanges

The effectiveness and nature of development control varies greatly among Member States, and different policies relate to different regions within the Member States. Where strict development control measures are applied, as in the case of towns surrounded by green belts or other sensitive environmental areas where development is tightly controlled, land use changes will be concentrated within existing city areas or within clearly defined new development areas such as new towns.

Regions of little or weak planning control on the other hand are subject to spatial sprawl, the main factor influencing spatial development often being the presence of road infrastructure serving the town or city with a High Speed Train (EUROSIL, 1997).

In general the way in which multimodality, intermodality and interoperability are taken into account in regional and local plans, largely effects future spatial development.

There is common political agreement that a more sustainable transport strategy for the regions, including more investments in rail infrastructure and rolling stock, greater restrictions on developments which are inaccessible by attractive public transport and investigations into demand management strategies has to be developed.

The following key issues concerning recent peri-urban transport projects have been identified (EUROSIL, 1997):

- Regional projects have tended, in the past, to be predominantly road-orientated and often reflect, and reinforce, the process of counter-urbanisation;
- In the absence of planning controls the spatial impact of such projects, in terms of development of the rural-urban fringe, may be substantial;
- The traffic generation and longer-term land-use effects of peri-urban projects may create significant transport problems - congestion, environmental pollution, the decline of public transport etc. - over a wide region surrounding the central city;
- These problems have prompted a policy shift by European Governments in recent years to a new approach emphasising control of decentralised development, effective integrated planning of transport and land-use, as well as the promotion of multimodality and intermodality.

4.2.1.1 Land Use

The greatest proportion of urban traffic in the European Union and the expected growth are outside the inner cities, consisting largely of commuter and other interconnective traffic being generated in part by *deregulated land use planning*.

In order to avoid a further increase in road transport, a combined approach has to be taken between transport, spatial, and environmental planning. Accompanying measures in the area of land use planning therefore are of great relevance to the interconnection of networks.

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Where *strict development control measures* are applied, as in the case of towns surrounded by green belts or other sensitive environmental areas where development is tightly controlled, land use changes will be concentrated within existing city areas or within clearly defined new development areas such as new towns.

Regions of little or *weak planning control* on the other hand are subject to *spatial sprawl*, the main factor influencing spatial development often being the presence of road infrastructure serving the town or city with a High Speed Train (EUROSIL, 1997).

4.2.1.2 Road Infrastructure

Due mainly to radial networks, many European conurbations are experiencing increasing difficulties in accommodating *increasing traffic demand*. In addition to growing traffic volumes, transport systems have to meet the need of *decentralised populations*.

The trend towards urban industrial and residential decline in the centre and *suburban dispersion* on the other hand has made it difficult to establish public transport means as an effective alternative to the use of private cars.

The current policy in road infrastructure planning in most European metropolitan areas is to promote regional traffic by building orbital roads and constrain construction of inner roads. These *accessibility improvements*, extending labour markets and catchment's areas for goods and services have profound economic and social benefits for the areas affected, substantially increase their attractiveness to people and businesses keen to decentralise from the cities (EUROSIL, 1997).

As a rule *the building of new road infrastructure* should be limited to those cases where a reduction of traffic load in appropriate areas can be achieved, for example orbital roads around conurbations as described above.

4.2.1.3 Rail Infrastructure

The impediment to interoperability was identified in MINIMISE as being “a nationally fragmented European rail system that leads to efficiency losses by higher costs and expanded trip duration” (MINIMISE, 1999). The lack of compatibility in both infrastructure and rolling stock, such as the railway gauge, the loading gauge, electrification systems, axle weight limits, signalling system, coupling and braking systems are the main reason for this.

MINIMISE concluded that the introduction of multi-system High Speed Trains would improve the interoperability of European cross-border passenger transport. Although multi-system High Speed Trains generally have higher capital costs and sometimes also higher operating costs than equivalent single-system High Speed Trains, these

costs may be offset by productivity gains for both staff and rolling stock compared to services which need to change the locomotives.

4.2.1.4 Location and Design of Interchanges

The sustainable interconnection of networks implies the combination of two or more transport means, making efficient interchanges a vital prerequisite for the functioning of the whole interconnective transport chain. Considering that transport users' general preference is a comprehensible and accessible transport system with as few interfaces as possible (EC, 1997), the customer-oriented design and operation of interchanges is an important task.

Transport interfaces play an important role in the achievement of multimodality and intermodality. They are by definition points enabling people or goods to change from one mode to another. Therefore, many characteristics of transport interfaces such as their location, number per area, transport modes covered, services offered, physical accessibility etc. influence their usage and thus the modal split.

Multimodal terminals that allow for a fast and easy exchange between modes are an important prerequisite for promoting the use of public transport. For example, La Defense in Paris integrates urban, suburban and regional buses, metro, RER, suburban trains, private cars, taxis, tourist coaches and the TGV.

The major aim of transport interfaces in the regional context of European transport is to guarantee effective accessibility of long-distance transport modes. Therefore, the following interfaces can be regarded as access points from metropolitan areas to the long-distance transport networks:

- Freight centres (freight traffic centres or freight distribution centres) for freight transport
- Airports for passenger and freight transport
- Railway stations/HSR terminals for passenger and freight transport
- Ports for passenger and freight transport
- Park and Ride for passenger transport.

Extensive research on a whole range of different technical and operational aspects related to public transport and HSR interchanges has been carried out in the RTD projects GUIDE, MIMIC, PIRATE, EMOLITE (see chapter 4.1) and HSR-COMET. The basic findings of these projects, which have been selected due to their general applicability to all passenger interchanges, are presented below.

Modal split

In the HSR-COMET project, the utilisation of the different transport modes as a means to reach HSR terminals was analysed. The car was found to be the vehicle most used (approximately one third of total demand) followed by approximately 30 to 35% use of public transport (bus, metro). 14 to 17% reach the HSR stations by taxi. A similar split can be applied to trips from HSR terminals to the travellers' final destinations. Some examples of good practice (e.g. Marseille, Avignon) demonstrate that the *modal split can be shifted* from private car to public transport if public transport is competitive by offering high standards in comfort and services closely considering the user requirements.

The same or similar can be said for all other interchanges. For airports, an analysis conducted in the EUROSIL project (EUROSIL, 1997), found that the proportion of PT utilisation greatly depends on the quality of the public transport service provided. The airports of Munich and Frankfurt are referred to as examples of good practice, as they display a relatively high patronage of the PT service provided (42% and 29% respectively).

The adequate location of interchanges is a basic prerequisite for attracting users to travel on multimodal routes. The main aspects to be considered in terms of the design and location of the interchange are accessibility, land-use density and diversity, and the transport network with competitive uni-modal routes.

User-friendly Design

In HSR-COMET several measures to improve intermodal connections between the larger metropolitan areas were identified by assessing relevant influence factors. The realisation of intermodal connection by subway was attributed first priority. Safety, comfort and flexibility were identified as the corresponding influence factors to be improved by measures such as employment of safety agents, supply of more comfortable HSR dedicated vehicles and increase in frequency during HSR peak periods respectively. Similarly improvement options were identified for other modes.

Regarding the design and functional scheme of interchanges, two main criteria were identified (EC, 1997):

- Minimise and simplify pedestrian routes to ensure good user orientation
- Separate different flows and transport systems to avoid mutual interference and delays

Other design features to be considered include for example safety aspects such as:

- Psychological influence of interchange design (must give passengers a safe feeling)
- Elimination of dark corners, minimise number of columns, maximise the use of glass
- Powerful lighting systems, use of coloured lights
- Good station cleaning
- Reception should be easily visible from the entrance
- Location of ticketing machines along principal entrances
- Provision of customer services areas

In close relation to the MIMIC project, PIRATE's primary objective was to incorporate *user and non-user requirements* into guidelines for the design of transport interchanges and produce a handbook for the construction and operation of the "European Public Transport Interchange of Tomorrow".

By means of focus group discussions 65 characteristics of interchanges of relevance to all user groups were identified.

Aspects considered were:

- connecting modes (e.g. walk environment, overall quality, bike parking quality, car parking quality, etc.),
- total impression (e.g. accessibility, attractiveness personal security, etc.),
- equipment and services (catering ticket machines, etc.),
- information (information about current traffic, travel, etc.) and
- the station and the city (entrance accessibility, location)

Via a questionnaire survey the importance of all characteristics were assessed by site and reference group. As a measure of performance the "gap" between importance and satisfaction was derived for all characteristics.

According to this analysis approximately half of all characteristics were found to be in the poor performance category. On average the more important characteristics performed better than the less important.

Comparing *reference groups* (users, non-users, employees, and experts) and their assessment of the various characteristics' importance there was close agreement on the importance of car park security. On the other hand the experts in general viewed bike parking facilities as more critical than the other groups. Non-users were most concerned with comfort aspects.

On the disaggregate level of reference groups and intermodality (i.e. users grouped by access mode) different performance levels were attached to each characteristic.

Overall the analysis showed that the appearance of an interchange was ranked as most important by all respondent groups, while its equipment and services were considered least important. Experts considered location aspects of interchanges to be a priority.

Security was found to be equally important for all reference groups with each of them demonstrating slightly different priorities.

Following the analysis of user needs, the Planning Approach was applied in selected test sites in order to *harmonise the divergent interests of different user groups*. In the first step of the approach used, each user group was confronted with the divergent priorities of others. In the subsequent discussions conflicts that required reconciliation were identified.

For the evaluation of the optimal location of intermodal terminals for freight and passenger transport in Europe, a simulation model developed in EMOLITE may be used as a Decision Support System. The system enables the evaluation of terminals using criteria relevant to both private and public decision-makers. Developed as a computer simulation model, EMOLITE enables decision-makers to assess and compare different terminal locations.

In summary there is common political understanding that a *more sustainable transport strategy for the region*, including more investments in rail infrastructure and rolling stock, greater restrictions on developments inaccessible by attractive public transport and investigations into demand management strategies has to be developed.

Interoperability

Several measures and corresponding costs for a typical European city were identified by MIMIC and MINIMISE for the improvement of interoperability in European regional and urban passenger transport.

- Park & Ride was recommended to improve access to public transport for commuters and leisure travellers from outside the city. Both the total and the public benefit -cost ratio are estimated to be around 2,0 (MINIMISE, 1999).
- "Restrictive infrastructure" such as segregated tramlines, guided bus ways or bus lanes were regarded as "beneficial to public transport interoperability by enabling services to by-pass road congestion".
- The introduction of bookable taxies improves the door-to-door character of urban and regional public transport. High utility assumed for 1% of all trips. (Total benefit-cost ratio: 1:4; public benefit-cost ratio: > 20 because of no public investment).
- The introduction of low floor vehicles improves the physical access to the public transport system and reduces the average trip time of buses and trams through a reduction of dwell times at individual stops. As there are no significant additional implementation costs if the new vehicles replace life-expired stock on a like-for-like basis the total benefit-cost ratio is > 20.
- The Introduction of dual light rail vehicle systems as they improve the interconnection between different public transport modes (rail and trams). Time savings arise for users as change of mode is avoided. (Total benefit-cost ratio: 2,6; public benefit-cost ratio: 2,6).

Intermodality

MIMIC (1999) identified several *barriers to intermodality* issues concerning planning and physical design of interchanges (MIMIC, 1999) and provides guidelines and recommendations regarding how to overcome them:

Barriers

- interchanges often develop in an unplanned manner according to availability of resources
- Interchanges are often not designed in a functionally optimal manner (aesthetics over functionality) (e.g. poorly situated ticket offices, lack of lifts and ramps, lack of waiting areas).
- Some improved interchanges create a contrast between very high-quality concourses and any unimproved platforms or waiting areas, or consist of different parts, which do not match well together.
- Distances to be walked between services often exceed 200 m, with generally poor protection from rain or sun.
- Many routes between modes require level changes, with often no ramps, escalators or lifts available.
- Facilities provided to passengers are generally poor; lack of seating and poorly maintained toilets are a common concern expressed by most users.

- The needs of special groups (e.g. disabled, elderly) are often not adequately addressed: steps and staircases and lack of guided routes for blind people make access to station and vehicles difficult to a large proportion of users.
- Pedestrian access to interchanges very often involves difficult access over busy roads or through unpleasant (often unsafe) areas and in many cases requires long distances to be walked.
- Cyclists often experience difficulties in terms of access to the interchange (lack of cycle lanes), handling a bike in the interchange (presence of steps and staircases), and cycle parking (non-lockable cycle stands).
- Bus feeder services are often infrequent and uncomfortable.
- The capacity of parking areas at park-and-ride interchanges is generally inadequate, often with no dedicated areas for dropping off and picking up of passengers (kiss-and-ride).

Guidelines

- consider aesthetic design aspects throughout the whole interchange if part of it is being improved.
- Where distances to be walked between modes exceed 200 m, short-distance transport systems can be a solution.
- Protection from rain or sun should be provided along all walking links.
- Level changes should be avoided. Where they are required, ramps, spacious lifts and escalators should be available
- Alternative secondary, ‘stair-free’ routes, with lifts or escalators, need to be signed.
- Comfortable and safe waiting areas are always needed, with good access to real-time travel information and such amenities as toilets (baby-changing facilities and disabled access) and shops.
- It is also important to provide drivers and staff with reserved areas for rest, eating and drinking during layovers.
- Local signalised intersections should be provided with acoustic signals, and guided routes for the blind should be available inside and outside the interchange site.
- Low-floor vehicles, automatic ramps and at-level entry should be available for wheelchair users.
- Better pedestrians' links, possibly sheltered and physically separated from motorised traffic can encourage local use by walking.
- Cycle lanes, physically separated from motorised traffic and pedestrian flows, should be provided in the area surrounding any interchange site.
- Quality cycle storage, possibly guarded and covered, should be available at any interchange site.
- Frequent and reliable feeder services, with high-density pick up points, are important factors to encouraging patronage in the local catchment's area and reducing car use.
- Where interchanges are located in low-density areas, dial-a-ride services are an alternative to the construction of huge parking areas at the interchange site.

- The capacity of parking areas should be adequate to the demand of parking spaces; multi-level car parks over public transport stations, in particular, increase the capacity of parking areas,
- Reduce distances to be walked to change modes and provide indoor, sheltered connections between transport means.
- Dedicated areas for dropping off and picking up of passengers (kiss-and-ride) should be provided at any interchange site.
- Close co-operation with the local community, by means of public consultation and participation, can be a cost-effective solution to build successful interchanges.

4.2.2 Operation of Interchanges

Apart from the infrastructure planning and design, system operation and provision of services to the user in general largely determine the quality of the transport systems. The interconnection of the TEN-Transport and the local regional network requires harmonisation of two transport networks using two or more transport modes. Efficient, integrated travel chains therefore require high standards of operation and services of the transport systems involved.

Operation and services include the following general categories:

- System maintenance:

  All technical and organisational measures aimed at ensuring functioning of the transport systems. Measures include maintenance of the road and rail infrastructure and vehicle fleets, organisation of maintenance works minimising interference on traffic.

- Performance optimisation (Control systems and strategies):

  All measures aimed at improving capacity levels, balancing capacity utilisation and minimising safety risk, travel time and environmental impact in the network, such as the use of VMS in road transport. Performance optimisation can be largely supported by advanced technologies such as developed in the Transport Telematics sector (subject of CARISMA-Telematics). Real time traffic information provided to the user enroute, e.g. via information panels in order to influence his route choice is closely related to the aforementioned objectives of performance optimisation and can therefore be defined as an operational measure rather than a service.

- Information services:

  All measures providing users on- or pre-trip with dynamic or static information related either directly or indirectly to their planned or current travel.

- other services:

  All services improving comfort and ease of travel.

While system maintenance is equally vital for all transport modes, requisite efforts and potential for optimising system performance largely differ between modes, depending on factors such as infrastructural prerequisites, capacity utilisation and human factors. The importance of services in general can be said to increase with the

complexity and uncertainty level of the travel chain (e.g. the number of transport modes involved) and decrease with the performance and corresponding utility attribution by the user.

User utility assessment in transport is apart from direct cost, basically a function of system performance, i.e. speed, travel time, accessibility and frequency. Having to serve aggregate rather than individual travel needs, public transport can often not compete with the private car in spite of optimisation measures being taken. In order to promote the competitiveness of rail and public transport against car travel, provision of high quality services ensuring reliability, comfort, and security for those modes are therefore of particular importance.

For **railway services** factors influencing user attraction can be divided into factors relevant to (HSR-COMET, 1997):

- railway services (service frequency, punctuality, travel time, speed, reliability, cost) services and infrastructures (efficiency and speed of the offered services, comfort level, advanced technologies and innovative services)
- interconnecting modes (frequency, punctuality, access, speed, quality, personal safety, costs)
- services on board.

The **quality of services at interchanges** plays an equally important role in attracting users to public transport and HSR. HSR-COMET provides a classification of services at HSR terminals (HSR-COMET, 1997), which can be applied to public transport interchanges in general:

- Direct Support Services, e.g. departures, baggage mobility, passenger flows
- Indirect Support Services, e.g. refreshment and dining, assistance, safety features, administrative procedures, non trip related information systems
- System operational services, i.e. services, offices and equipment needed for system functioning and employees.
- Services in the surrounding area, i.e. services and equipment located outside the terminal but related to the service
- Services on board, e.g. catering assistance, information.

4.2.2.1 Information

Information provision is a vital prerequisite to attract users to public transport and enable intermodal travel. MIMIC identified the following barriers and measures:

Barriers:

- Lack of information proved to be a serious barrier to intermodality. Pre-trip information is generally lacking, and many potential users are intimidated by the ‘unknown’ or by the complexity of journeys.
- Real-time information on vehicles' arrivals, departures and delays is rarely provided at interchanges, and many people find great difficulty in reading timetables and maps, especially foreigners, local ethnic minorities and people with learning difficulties.

- Staff are not generally trained in providing information about onward connections, and staff who know sign language are rarely available for people with hearing problems.
- Signing is generally judged unclear, and many people have difficulty with it. Acoustic signals and Braille maps are rarely available for the visually impaired.

Guidelines:

- Personalised pre-trip information should tell people exactly where to start, the times of each link, and such useful information as platform or bus stop numbers. Pre-trip information should be available as widely as possible: telephone enquiry lines, internet, televideo, radio bulletins, kiosks, etc.
- Real-time information on delays, as well as on vehicles' arrivals and departures, should be provided at any interchange site.
- Clear maps detailing transport routes/services are needed and should be available at stations and bus stops and visitor information centres.
- Staff should be well trained in providing information about all modes in the transport system and should be kept up to date with the current situation.
- Signing needs to be clear; information should be provided in a simple symbolic, pictorial and colour-coded manner.
- Acoustic signals and Braille maps can significantly help blind passengers.
- Staff who know sign language, induction loops in front of ticket counters and flashing lights on TV screens to call attention for those with hearing problems or big coloured signs would be very helpful.

4.2.2.2 Interchange patterns across Europe

Within the GUIDE project status surveys were conducted to allow for a fuller understanding of how patterns of interchange vary, and what city characteristics tend to be associated with different levels of interchange.

In order to identify the current state of practice across Europe in the development and evaluation of passenger interfaces and collate information on network, operational, physical and institutional characteristics of passenger interfaces, public transport operators and authorities in different cities across Europe were approached.

Some of the main survey results reported with regard to quality of interchange and integration were:

- *Timetable integration* is only carried out in one of the cities under investigation (Copenhagen)
- *All-mode timetables* are issued in three cities (Copenhagen, Munich, Amsterdam) and currently piloted by one (London)
- Around half of the cities explicitly *promote interchanges*
- Provision for *mobility impaired passengers* is quite varied, but increasing
- Buses provide the majority of service in most of the cities

Analysing the interchange facilities provided it was found that:

- basic facilities were provided at virtually all interchanges
- seating is provided at 87% of the interchanges

- timetables are provided at 89% of the interchanges
- Public telephones are very common as are weather protection facilities.
- Stairs are the principle means of access with lifts or escalators being provided at over half the interchanges.

4.2.2.3 Users' perceptions

Surveys of passengers' perceptions, albeit on a rather small scale were carried out in France in order to investigate users' perceived quality of transport interfaces and comparing it to the actual quality characteristics.

According to GUIDE the three main elements determining *users' perceived quality of mode transfer* are:

- routing conditions
- characteristics of the places crossed
- activities and services provided.

From the survey results the following conclusions were drawn with regard to these quality criteria.

- Transfer paths are judged by users in terms of :
- length and walking time required,
- facilities offered for this purpose (escalators, lifts, etc.)
- obstacles or unpleasant conditions encountered along the way.

As far as the *appearance and general characteristics of the interchanges* are concerned, travellers were found to be indifferent to "*aesthetics*" while very sensitive to issues related to *security* and the *activities* existing within the places.

The fact that 'services provided' is ranked last in importance implies that users' requirements for interchanges are still primarily or almost exclusively travel related, i.e. speed and simplicity of transfer ("mono-functionality" of interchanges).

Optimising intermodal transfer nodes would therefore have to involve *mainly reduction of transfer time* and only secondary an increased provision of activities and services such as shops, restaurants, etc. Moreover the use of non-travel related services is suggested to be conditioned by the waiting time and consequently the transport mode used. Thus users waiting for buses or trains, i.e. travel modes with lower frequencies of arrival and departure are more prone to use shops and other services than for instance travellers taking the metro.

In particular travellers only occasionally using an interchange depend on the visual *references* inside the station. Among the elements described as "references" are:

- directions along the path
- display of bus schedules
- quality (length, decoration, etc.) of corridors, stairways, passages, etc.

Main elements determining the "*atmosphere*" of interchange poles were found to be their characteristics in terms of transparency, visibility and brightness. Dark corridors, poorly lit bus stops, small, enclosed waiting rooms, etc. undermine users' feeling of safety and therefore their perception of the quality of these interchanges.

Moreover there seems to be from the travellers' point of view an optimum ratio between the size of the interface or the hall and the number of people around.

The *management* of the places, which appears to be an important element in the evaluation of the interfaces, refers to:

- maintenance and cleaning provisions;
- the existence and the visibility of supervisory personnel
- presence of people in the shops and at the ticket windows.

It is concluded that the objective and subjective qualities of the interface should always be considered alongside with the quality of the transport modes offered to users as the efficiency of the public transportation modes determine to a great extent opinions regarding the quality of the interface.

4.2.2.4 Interoperability

MINIMISE identified impediments to interoperability in the three areas of accessibility, individual transport services and interchanges. Measures to overcome them are provided as follows:

- Through ticketing is obviously an important factor for interoperability at interchanges, and new smartcard technology can assist in implementing this.
- Real-time information systems are recommended to help in journey planning and improving connections at interchange points. Although there is stated to be no measurable physical effect of introducing real time information systems, a 5% reduction in waiting time for the public transport users is estimated. (Total benefit-cost ratio: 3,5; public benefit-cost ratio: 3,5).
- The "Karlsruhe solution" - connecting rail and tramway networks with the operation of dual-system light rail vehicles - is recommended to facilitate seamless public transport networks.

Other suggestions made by MINIMISE are as follows:

- A Common EU Public Transport Accessibility Standard is recommended to guarantee accessibility to all public transport vehicles for mobility-impaired groups such as the elderly, the handicapped or parents with pushchairs. Accessibility grants for new vehicles and infrastructure are suggested for speeding up the implementation of such measures.
- Door-to-door services should be encouraged and further research into innovative solutions should be carried out, as the lack of such services is regarded as "a serious impediment to public transport interoperability in relation to the convenience afforded by the private car.

The evaluation of various investment scenarios within MINIMISE indicated that the following improvements in the area of operation and services would make the largest contribution to a high benefit-cost ratio:

- *door-to-door services* ("bookable taxis"): The introduction of bookable taxis improves the door-to-door character of urban and regional public transport. High utility assumed for 1% of all trips. (Total benefit-cost ratio: 1,4; public benefit-cost ratio: > 20 because of no public investment).

- *improved information for public transport drivers*: Giving drivers of public transport vehicles dynamic information regarding the current status (e.g. arrival time) of the interconnected public transport services facilitates more efficient interconnective travel by reducing the average waiting time for public transport users using more than one PT service. (Total benefit-cost ratio: > 20; public benefit-cost ratio: > 20).
- *harmonisation of fares*: The harmonisation of fare structures in public transport reduces ticketing cost and the time users need to transfer from one PT mode to another. Harmonisation of fare structures can be implemented at marginal additional cost.

National reviews within SORT-IT have been used by the project for sectoral reviews, which resulted in a number of recommendations with regard to interoperability and interconnection (SORT-IT, Del 5).

In assessing the *impact of telematics* on the interoperability and interconnection of transport systems, SORT-IT identified some generic issues that need to be addressed to ensure that telematics systems are themselves interoperable. These relate to research and development, harmonisation and standardisation and evaluation. Four areas were identified where telematics may make particular contributions:

- Information systems are required that combine static and dynamic data on public and private modes (trip planning systems)
- Public Transport management systems are required that can assist in co-ordinating services and promoting interchanges.
- Fleet management systems are required that can facilitate load consolidation and back hauls in the road freight industry and locate the nodal centres that are required for this.
- Traffic management systems are required for all modes that maximise the use of existing infrastructure whilst maintaining acceptable safety margins.

4.2.3 Policy Environments

As a result of increasing deregulation in public transport and emerging services to transport network users institutional issues have come to play a vital role in the interconnection of different networks and modes often involving a number of operators. While some decisions are to be made on a European level in harmony with all Member states, many solutions can only be developed and applied on a local level. The way in which political directives of the European Commission are interpreted or transposed into national law differs largely across Member States. Therefore in order to demonstrate best practice techniques and promote their emulation, vital importance lies in the exchange of experience and dissemination of options through a concertation process.

4.2.3.1 Barriers to Implementing the TEN-T and the Common Transport Policy

Some of the institutional impediments towards fulfilling the CTP have been summarised in the TEN-ASSESS project (TEN-ASSESS, 1997):

Problems in implementing the TEN-T and Common Transport Policy stem from the variation of institutional and organisational structures and diverging policy priorities.

Although generally complying with the CTP objectives in theory, in practice national policies face numerous barriers (institutional, linguistic, technical, cultural, etc.) towards their implementation.. In order to analyse those barriers and elaborate future options for eliminating them, CARISMA-Transport in line with the TEN-ASSESS project (see chapter 4.1.4) has involved relevant project partners in the concertation process. The main aspects, which were identified as barriers towards harmonising the TEN and transport policies among Member States, are summarised in the following (TEN-ASSESS, 1997).

TENASSESS grouped the relevant obstacles to the implementation of the CTP under the two headings 'policy environment' and 'transport policy issues'. In addition, the project listed specific problems with the implementation of the TEN, although these problems often interrelate with obstacles to the CTP.

Policy Environment

- *Conflicting interests between economic development and environmental concerns*

  Regarding policy objectives, the main conflicts stem from the demands of economic development on the one side and environmental concerns on the other. While economic development requires ever improved transport flows, environmentalists request a reduction in transport volumes, and in particular a reduction of road transport.

- *Conflicts on highest political level*

  At the highest political level, one important source of conflict stems from the fact that "the European Union represents neither the sole nor the first attempt at harmonisation at policy level". In particular, there are frequent conflicts between the EU on the one side and the ECMT on the other

- *Variation in the distribution of administrative responsibility and competencies at the national level*

  A major institutional obstacle lies in the large variation in the distribution of administrative responsibilities and competencies at the national level. While in most countries the principal responsibility lies with a single ministry, in other countries such as Austria, Italy, Spain, Ireland and Finland transport competencies do not fall under one single ministry. Dividing all responsibilities from the outset increases the complexity of the decision-making process.

  Furthermore, the development of cross-sectoral policies brings a greater number of actors into play in all countries, in particular those responsible for environmental affairs. Finance ministries have traditionally influenced transport investment decisions, but current budget restrictions compound the restraints that they impose everywhere in Europe.

  The number of relevant actors is further increased by the growing trends towards decentralisation, which is caused both by the growing demand of the regions for more autonomy and the wish of central governments to involve the regions in the financing of major infrastructure investments. In some cases, however, the existence of EC policy initiatives has been regarded as helpful in reducing conflicts between central and regional governments.

- *Variation in the degree of planning of transport policy in the form of master plans but also assessment and/or evaluation frameworks*

  Although most Member States have elaborated a master plan for transport, they largely vary in scale and integrative quality. Whereas some are embedded in wider planning frameworks which also encompass socio-economic, environmental and spatial development (e.g. in Denmark, the Netherlands, Sweden and Germany) others, namely Greece and Luxembourg have no form of general transport policy document.. Italy's general master plan dating back to 1986 is becoming lass relevant in the fast-evolving transport world of today. TENASSESS found that the CTP has had the greatest impact on national transport policy, especially with respect to harmonisation, in those countries, which do not have general guiding policy documents.

Where the CTP was confronted with established policy objectives and instruments, a number of conflicts arose where there was little or no match between European and national policies.

- *Variation in the degree of centralisation or decentralisation, especially with respect to the role assigned to the regions*

  The distribution of competencies among the different territorial authorities varies across the European Member States depending on their respective constitutions. Typically the relationship between the national and regional transport authority is hierarchical, giving regions the responsibility for infrastructure planning in urban and regional transport networks but leaving the decision mandate with the national authority. It is only in Germany and Belgium that regions are given jurisdiction over both planning and financing of the urban and regional road, rail and public transport network.

  Other countries like France, Italy and Spain are moving towards a higher autonomy of their regions reinforcing the need of co-ordinating transport policies on the European, national and regional level.

- *Variation in the degree of negotiation with relevant actors, including citizens' movements or the public at large.*

  The degree of involvement of the public and trade unions in the decision-making process varies largely between Member States: the former is best developed in the Netherlands, Germany and Austria, while the latter is well demonstrated in Italy.

- Public-Private Partnerships

  The public-private partnerships envisaged develop at a slow pace and therefore have not yet reduced the public finance burden. However, where private finance comes into play through liberalisation and deregulation, this does not only increase the number of actors, but also creates new conflicts between the public interest and the financial interest of the private investors. Furthermore, subsidies to one transport sector are often regarded as harmful by competing sectors.

Despite diverging institutional prerequisites across the European Community, a general trend towards increasingly harmonising the national transport planning actions with the European Common Transport Policy objectives has been identified.

General conflicts identified in the TEN-ASSESS project as common to all European Member States were:

- Competencies
- Environment vs. Economic development
- Re-structuring of the transport market.

A number of committees have been established at all levels to resolve conflicts. In a series of expert interviews carried out by TENASSESS, the existing frameworks were regarded as "insufficient to advance at the necessary pace and to achieve satisfying comprises". TENASSESS declared in their first deliverable that they intended to work further on this aspect; suggestions for new frameworks may therefore be expected in the final TENASSESS report.

Transport Policy Issues

The principal problem areas and concerns for transport policy at the national level match the European policy objectives (TEN ASSESS, 1997). This isachieving a sustainable transport system, decentralisation and regionalisation, improving public participation, resolving bottlenecks in financing large projects, preparing transport operators for competition in a free market, and – most relevant for CARISMA Transport – realising one integrated, interoperable and intermodal transport network.

- *Integration of the Transport Networks*

  Concerning the creation of an integrated network, two of the major obstacles are the lack of interoperability of European railways and the different road pricing systems.

- *Creation of an Intermodal Network*

  Concerning the creation of an intermodal network it has to be acknowledged that in spite of the fact that combined and intermodal transport is high on most political agendas, in practice, few advances have been made in recent years in the realisation of intermodal interfaces, and competition among modes still dominates the field of transport management. No operational political concept is so far available to ensure fair competition on the one hand and co-operation at the intermodal and intramodal level in a deregulated environment on the other. Furthermore, the existing intermodal competition is even regarded as the main reason for the lack of progress in the calculation of charges that take appropriate account of both internal and external costs.

Traffic Safety

Although the improvement of traffic safety is a generally accepted objective, a common European approach does not exist. Member States could not agree on a target for reducing road casualties; neither could differences in national attitudes towards speed limits and alcohol limits be resolved. Differences in road signing further prevent common initiatives.

Specific problems concerning TEN implementation

The four main problems stated by TEN ASSESS (1997) are as follows:

- Financial constraints and diverging priorities

  Strict limitations to public budgets make it difficult to fund the implementation of TENs, in particular in those countries, which have not accorded them priority status, but are concentrating instead on projects that have national priority.

Despite a general call for the promotion of combined and rail transport, the building of additional road infrastructure is still the main priority in Spain, Greece, the new 'Länder' of Germany and in parts of Italy. Apart from in Italy, no significant progress has been achieved towards improving combined transport.

Given the lack of public funds, new types of public-private partnerships are required to provide the necessary long-term investment:

- Financial constraints and diverging priorities

The absence of open and competitive markets is regarded as hampering the optimal use of existing networks and their completion.

- Planning Procedures

The sluggishness of planning procedures and regulatory obstacles hamper the implementation of large projects.

All of the above points are, however, not just specific to the TENs and have already been mentioned as impediments to the CTP implementation above. Other issues of relevance to CARISMA Transport mentioned by TEN ASSESS (1997) are:

- Some opponents to the TENs, in particular in Central Europe, insist that a Europe-wide solution to the question of pricing must be found, before going ahead with further corridor development.
- Lack of harmonisation or even of co-ordination between assessment techniques is regarded as an impediment.

4.2.3.2 Policy measures to improve interoperability

MINIMISE (1999) made a series of recommendations regarding areas of activities to improve interoperability in the European Transport system under the following headings (only those recommendations, which have relevance for CARISMA are listed):

Stimulation of telematics use:

Investigations in *MINIMISE* have shown a lack of telematics use in several transport sectors.

Several policy measures that could facilitate a higher use of telematics were identified as follows:

- *Internalisation of the mode specific external costs of transport*

Increase incentives for transport operators to apply telematics by introducing taxation measures that aim at the internalisation of the external costs of transport.

- *Subsidies for the telematics use in transport operations*

Reward reduction of external cost by granting subsidies for use of telematics (internalisation of external costs is stated to be in general preferable).

- *Financial incentives*

Support development of cheaper technologies and increased market penetration by financial incentives:

- Expanding R&D projects in the field of telematics. It is admitted though that the possibility of influencing general technological progress through policy measures is limited
- Provide financial incentives in the market penetration phase for telematics applications in order to reach the critical mass.
- Increase the market transparency in the field of telematics

Transport operators and shippers were often found to be ill-informed of the potential benefits of telematics use in their particular field. Therefore different measures to increase the market transparency in the field of telematics are recommended:

- Information dissemination through publishing (web pages, papers, etc.). More extensive dissemination of R&D results of completed European research projects in the field of telematics.
- Organisation of telematics information seminars for transport operators and shippers in European information agencies (e.g. EUROSPORTELLO in Italy or Euro Info Centre in Germany).
- Establishing pilot projects for demonstration purposes. This should be done in co-operation with the telematics industry and transport operators.
- Development of technical standards for telematics equipment

Lacking compatibility between different telematics systems undermine the efficiency of telematics' use. Developing technical standards for telematics equipment through the CEN/CENELEC/ETSI are a basic requirement to achieve a high level of compatibility.

Improve the interconnectivity and interoperability of transport networks:

In order to give higher importance to interconnectivity and interoperability in infrastructure planning and project evaluation, the following recommendations are provided:

- Development of guidelines for European transport infrastructure projects

Guidelines should define the minimum level of interconnectivity and provide guidance on improving co-operation between infrastructure planners and transport operators.

- Use of new types of evaluation models

The aspects of interconnectivity and interoperability should be considered in transport infrastructure project evaluation using new types of evaluation models (various European research projects are aimed at developing evaluation models that include the aspects of interconnectivity, e.g. the TENASSESS project).

- Expansion of the intersection capacity

Expansion of intersection capacity wherever required in order to improve integration of different modes.

- Realisation of a more flexible infrastructure design

Infrastructure should be designed in a way that allows for adjustment to dynamic innovation processes at low cost.

Stimulation of the use of modern transport equipment:

A number of policy measures can influence investment decisions of transport operators and their use of modern equipment:

- Promotion *of further privatisation accompanied by rules for the deregulation process*

There is evidence that the privatisation of former public owned transport companies has improved investment behaviour (e.g. DB AG: Cargo-sprinter, Thalys).

As significant benefits are expected from privatising public transport services (regional and urban transport) and transport infrastructure such as sea- and inland ports or combined transport terminals, Further privatisation programmes in the transport industry are recommended. Rules for a deregulated transport market environment should be established as Accompanying measure to privatisation strategies to reduce the negative side effects for interoperability in the deregulated sectors (e.g. technical or financial capability of transport operator).

It is pointed out that deregulation and privatisation of urban and regional public transport services improve the cost efficiency of the public transport companies significantly. A major conclusion of the MINIMISE analysis is, that different forms of market liberalisation lead to different levels of interoperability. The open access deregulation leads to maximum cost efficiency but occasionally to a poor level of interoperability between the different operators. In comparison, the franchise approach to deregulation leads to more interoperable structures but may have lower cost efficiency gains because of the lack of on-road competition although off-road competition does occur between operators bidding for individual franchises. Moreover franchising enables public authorities to maintain a degree of control over the public transport network and introduce measures (e.g. harmonisation of fare structures) through the conditions of the franchise agreement.

Overall MINIMISE identifies a general European trend towards deregulation, but comes to the conclusion that a franchised system is better than an open access deregulation for an interoperable transport network, because it maintains allows local authorities to impose conditions concerning transport network harmonisation in the franchise.

- Reform of the financing system for public transport

Creation of independent financial resources, more subsidiary regarding the investment decisions, subsidies for investing in modern equipment, and allowing the responsible authorities to chose between different public transport providers (establishing the right to impose rules and standards) are suitable measures to support investment of PT operators in modern equipment.

Harmonisation of organisational structures:

Transport policy measures can greatly contribute to the harmonisation of organisational structures within a transport system:

- Stimulation of co-operation

Various measures can stimulate the co-operation between the different actors in transport:

  - exemption from the anti-trust-law in transport operations
  - creating common institutions for different actors. (European capacity agency in the rail sector)
  - improving the communication and co-ordination between the different public authorities, shippers and transport operators involved in the transport process about the design of the regulative framework for the European Transport System.

- *Prevention of separation strategies*

To prevent transport companies from developing their individual organisational and technical structures and thus adversely affect interoperability the following separation strategies are recommended:

  - use of anti-trust law to prevent discrimination against newcomers
  - introduction of special forms of deregulation strategies in public transport (e.g. Franchise).

- Development of common European price building guidelines for transport infrastructure use
- Privatisation of interchanges and the deregulation of transport related markets

MINIMISE found that privatisation of interchanges within the European transport system such as terminals for intermodal transport and seaports as well as the de-regulation of transport related markets stimulate the development of common organisational structures.

Harmonisation of the regulatory framework:

Several aspects are recommended for consideration in planning a harmonisation strategy:

- Realisation of the harmonisation strategy as co-operative agreement between policy makers and other actors
- Support of the harmonisation strategy by legislative guidelines to avoid negative side effects
- Combination of harmonisation strategies with a reduction and simplification of regulatory norms to reduce bureaucratic efforts
- Achievement of an optimal regulatory level. that outperforms the national regulations.

However, it should be noted that while it may be possible to apply many of the above recommendations to passenger transport in principle, within the MINIMISE report most of the recommendations are aimed at long-distance transport in general and freight transport in particular.

Some intermodal analysis was undertaken in the SORT-IT framework, which indicates that consumers gain when coach and train services are co-ordinated but these may be offset by some disbenefits to providers. However, it was found to be likely that the net benefits to society may be considerably less than the internalisation of

external effects, particularly for car traffic, which should be the policy priority. Nonetheless, further cost-benefit analyses of integrated policies are found to be useful, whilst it would be worth examining the impact quality partnerships, in both the passenger and freight industries, could have on obtaining integration benefits.

4.2.3.3 Policy Measures to improve intermodality and interchanges

Specific institutional and economic issues with relevance to intermodality at interchanges were investigated within the MIMIC project. The main conclusions drawn regarding barriers and respective guidelines are:

Barriers

- Cost of travel can be a serious deterrent to travelling by public transport, and can be a reason for social exclusion of people with low incomes
- Potential business opportunities at the interchange site are often not exploited, with the consequence of a lack of shopping facilities within the interchange.
- Opportunities of joint development, involving the private sector, are often generally missing.
- large numbers of key players and bodies generally make the planning and building of interchanges more complex, protracted and costly.
- Deregulation and privatisation, without careful public control and co-ordination, have generally exacerbated integration problems.
- Marketing opportunities (e.g. of new interchanges) are often missed; most public transport marketing is of companies, or links in the network, rather than the intermodal aspects.

Guidelines

- Cost of travel as a barrier can be overcome by introducing through-ticketing or using concessionary fares and free tickets for those with low incomes.
- Shops and retail activities within an interchange can generate income for interchange owners and operators and reduce passengers' fear of crime (a busy and lively environment is perceived as a safer one).
- Rents for shops should reflect each store's contribution to the overall revenues. The cheaper rent of the large department stores is repaid by the benefits given to the other shops (in terms of more revenues) and to the community as a whole (in terms of a livelier and busier environment).
- A joint development project should be planned to generate revenue for the transit system. This revenue may take the form of a one-time cash payment for the sale of land, air or subterranean rights, or it may be a revenue stream from an instalment sale, lease or ground rent.
- Careful consideration of historic preservation requirements is imperative in the planning of an interchange. The preservation of a historic facility can bring financial benefits to a community through neighbourhood revitalisation, increased property values and tourism.
- An integrated strategy for interchange planning and building is essential. Interchange development should never be ad hoc as opportunities arise. Integrated interchange management is needed in all cases, with one person in charge.

- Clear guidelines for responsibility, easily understood by the travelling public, are needed; the public must understand to whom to direct complaints and be able to distinguish security staff from rail staff.
- Excessive competition between transport operators should be discouraged;
- a single super-partner body should be responsible for timetable co-ordination and through-ticketing
- A marketing plan needs to be prepared (possibly by a super-partner body) to promote travel/amenity benefits of the new interchange.
- Marketing strategies should be developed alongside development plans.

5 Best Practice of Network Connectivity in CARISMA Case Cities

Valuable sources of insight into real-world situations concerning the interconnection of networks have been provided via study visits paid to five selected European cities. The cities – Trieste, Lille, Budapest, Frankfurt Region and London – were selected for different reasons. These include outstanding solutions in the field of interconnection of transport systems, strategic location with respect to the TEN-T, a multitude of transport modes available within one community as well as ongoing research or ambitious goals for future improvements of interoperability and interconnection.

The Commission agreed that on-site visits to five European cities (showcases of best practice) would provide practical input to the issues of the project that could not be acquired from RTD project outputs. A local transport expert (chosen and monitored by the city administration) was appointed on-site to study the interchange in the city in question and prepare a site visit of an average of 2 days. This period included technical workshops as part of the on-site meetings of European, national and local decision-makers and transport operators and experts to exchange information on their respective cities to bring added-value to the site visits).

Generally the two-day on-site trips began with opening presentations by local experts, administrative and operating staff, followed by technical visits of best practice applications for interconnection of networks. The second day was usually dedicated to political round table discussions. Participants were members of the CARISMA Transport project team, local representatives of transport providers, administration, research institutions and political representatives and national appointees to the CARISMA Transport management committee in some cases.

Project rapporteurs were responsible for the collection and consolidation of important facts and figures, which may help in disseminating best practice of interconnection of transport systems within Europe and especially to the Central and Eastern European countries (CEEC) seeking EU membership in the near future. Compiled from the information acquired, this chapter provides a comprehensive chronological report of the five on-site visits conducted for the CARISMA transport project, while essential experiences contribute to the final project conclusions elaborated in chapter 7.

5.1 Trieste

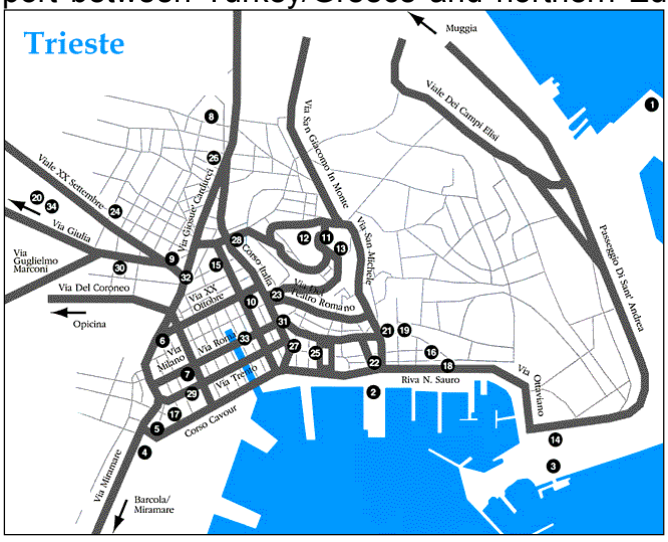
Located on the northern shore of the Adriatic Sea, the Italian city of Trieste is almost landlocked by Slovenia. For many decades of communist rule in Yugoslavia, Trieste's hinterland was reduced to its very province. With just 220,000 inhabitants (province of Trieste: 250,000) this is the smallest of the selected cities for on-site visits.

Interconnection of networks is of major concern to Trieste from its historic role as a rail-oriented seaport in the Austro-Hungarian Empire on one hand and its location at the touching point of TEN corridor V with the Adriatic Sea on the other. Trieste's port has been developed at a time, when railways provided the best quality in passenger land transport and the sole means for bulk freight land transport. Historically, the harbour has been very well connected to the railway network. Locked in by Yugosla-

via after World War II economic development of Trieste was strangled and the importance of its port diminished. When rail transport almost ceased as a result oil became a major commodity that could be shipped to Austria and Germany by pipeline. Following the changes of 1989, Trieste is struggling to regain its strategic position in trade with Central and Eastern European countries (CEEC), now accessible again. With rail infrastructure deteriorated and out-of-date, road transport is proving more flexible and competitive in providing access to Slovenia, Croatia, Hungary, Ukraine and Slovakia.

Trieste is located on the West-Eastern corridor V, connecting Spain, France and Italy to the CEEC. However, while the TEN-T usually follow existing transport links in the European Union, they are merely lines on the map in the CEEC, still facing debate in the respective national assemblies responsible for their implementation. With the road and railway link to Venice still in dismay and the eastern part of the corridor not developed at all, Trieste hopes to benefit from any input to the realisation of the TEN-T.

The increasing demand for freight transport as a result of the regained accessibility of the CEEC is the major challenge for Trieste in the immediate future. While rail transport remains low due to the limitations of its infrastructure, road transport, especially trucking, multiplies regardless of the quality of the highway and road network. The most important tasks include developing and upgrading the highway links comprising TEN corridor V as well as improving the infrastructure linking the highway network to the port facilities of Trieste and neighbouring Koper and Rijeka. The same is true for the immediate Slovenian hinterland, where roads cannot cope with the sharp increase in traffic demand, especially in freight traffic. The privately operated port of Trieste is expanding successfully, offering attractive services for freight transport between Turkey/Greece and northern Europe. Limitations are set by the land-



side capacity of roads connecting the port facilities to the Italian (and European) highway network. Rail transport and combined transport do not yet meet their expectations for relieving pressure on the roads (and the environment).

With low tourist potential and a small commuter catchment area, public transport of Trieste consisted mostly of a rather extensive bus network for many decades. Only recently new schemes have emerged with plans

for a metro line along the seafront and to Ronchi airport. Upgrading of existing railway lines to Venice city and Venice airport and the introduction of emission free electric buses, designated bus lanes and fast passenger ferries at the coastline will improve the performance and attraction of local public transport. Proper interconnection of all these modes is a major topic, touching every aspect from scheduling, mutual travel documents and physical layout of interchanges, but no final results are available yet. Ronchi airport seems to provide adequate services for Trieste, hoping to gain additional market shares as an alternative to the repeatedly congested Venice airport. A vital prerequisite is a powerful and reliable rail link between the two airports, Trieste and Venice city.

The proximity to the Slovenian border (and also to Croatia) provides yet another challenge for trans-national public transport. Easy access could help spread Trieste's economic sphere of influence far beyond the actual Italian borderline. Institutional co-operation is the pivot point for successful implementation of a multi-national public transport network. Unfortunately at the moment even institutional co-operation between the city and the region of Trieste and the province of Friuli-Venezia-Giula is poor concerning co-ordinated transport policies and financing strategies. The same is true for the relationship of Italian state railways and the public transport company of Trieste.

Similar to all cities visited private cars cause environmental problems and traffic congestion in the historic centre of Trieste. The city council plans to restrict public on-street parking and reorganise downtown parking with underground facilities and residential zones. New pedestrian areas and bicycle facilities will make environmentally friendly modes more attractive and improve the overall appearance of the historic districts. Several park and ride schemes are planned to provide alternatives for car drivers travelling to the city centre. On the other hand it is inevitable to improve road access to the ferry terminals, even requiring the construction of a new road tunnel.

Always being at the cutting edge of technical research, Trieste is advancing several ambitious IT projects to improve services to its citizens. An extensive fibre optics network is the backbone for a number of advanced IT services such as tele-working, tele-learning, and tele-medicine but also advanced transport management. Automatic vehicle location systems provide the basis for online information at bus stops and electronic information kiosks.

5.2 Lille

The French city of Lille is located in the northeastern French region of Nord-Pas de Calais close to the Belgian border. Transport policy is the responsibility of the Lille

Metropolitan Area (Lille Métropole Communauté Urbaine: LMCU), which covers 87 communities and about 1.1 million inhabitants.

The basic goal of LMCU transport policy is doubling the use of public transport from 100 million journeys in 1998 to 200 millionmillionmillionmillion in 2015. Interconnection of modes and promotion of intermodality have been identified as key elements to its realisation. This seems to be a reasonable approach, since Lille already has a great variety of public transport modes. Physical integration has been achieved to some extent, with institutional and operational issues still lagging behind. An action programme has been established which focuses on five themes:

- optimisation of transport availability,
- intensive use of tariff integration,
- development of journey connection centres,
- integration of information systems,
- joint management of security measures.

The principal hub of public transport in Lille metropolitan area is located around the centre Euralille, where all rail modes meet in close proximity. The Gare SNCF Lille Flandres is the main station for conventional SNCF lines and the regional rail network (3.5 and 11.5 million. passengers p.a. respectively).while The Gare TGV Lille Europe, within walking distance of Gare SNCF Lille Flandres, provides a stop for the Northern Europe TGV Network, connecting Lille with high speed rail links to Paris, London and Brussels (2.6 millionmillion. passenger p.a.). Both lines of the driverless Metro system VAL intersect at the station Metro Gare Lille Flandres, with the terminal point of the tramway also nearby. Bus and taxi services are present as much as parking facilities for private cars. This is an impressive connection point in the heart of the city.

While physical integration is well underway, institutional and operational aspects still leave room for improvement. Long distance rail services are operated by SNCF under the French national administration, while regional rail (and some coach) services are provided by the Nord-Pas de Calais region. The Nord department is responsible for a number of department bus services and the Lille Urban Community administers the metro, tramway, bus and coach services jointly operated by approved private companies in the Transpole urban transport network. Tariff integration already is a reality within the urban services and the latter three authorities have agreed on a common research effort to investigate more thorough integration of their services. Major goals are the restructuring of the bus net-

work as a subsequent reaction to the advances of the second metro line, a new departmental transport network, regional fare integration and the development of 21 multimodal exchange centres. The development of new information and communication technologies will allow for the employment of multimodal information services that could lead to the installation of an intermodal mobility centre in the future. There are thoughts of cross-border public transport links leading into Belgium with even the extension of the metro line under consideration.

Lille's central and most important interchange is at the Gare Lille Europe TGV Nord station, where passengers from Paris, London and Brussels have convenient access to a specially designed metro station for onward travel to destinations in and around the city. Since neither the French Government nor SNCF (French Railways) originally supported routing of the TGV Nord via the heart of Lille, the city had to lobby vigorously on the basis of the development potential of the contiguous Euralille business zone, and to agree to share the excess costs with the French Government and the Nord-Pas de Calais Region.

The negotiations also included provision for direct TGV services to smaller towns, within Nord-Pas de Calais, without which Lille might not have gained the necessary regional support. The finally-chosen route runs parallel to the A1 motorway and, to benefit the region of Picardie which lies immediately south of Nord-Pas de-Calais, and which had to accept an alignment bypassing two of its major cities, SNCF agreed to provide a regional TGV station as a Park-and-Ride interchange.

In the end, therefore, the policy implications of the decision to build a new central express rail/metro interchange in Lille have provided intermodal transport benefits over a large area of Northern France. Within the Lille Metropolitan Area, the new local interchanges play an important role in encouraging intermodal travel by commuters and shoppers.

Lille-Lesquin airport is 10 km to the south, connected to motorway A1 but without a connecting rail link, although the terminal point of metro line 1 Villeneuve D'Ascq is not far away. The regional airport offers around 21 regular and 26 charter flight destinations and handles about 1 millionmillion passengers p. a.

5.3 Budapest

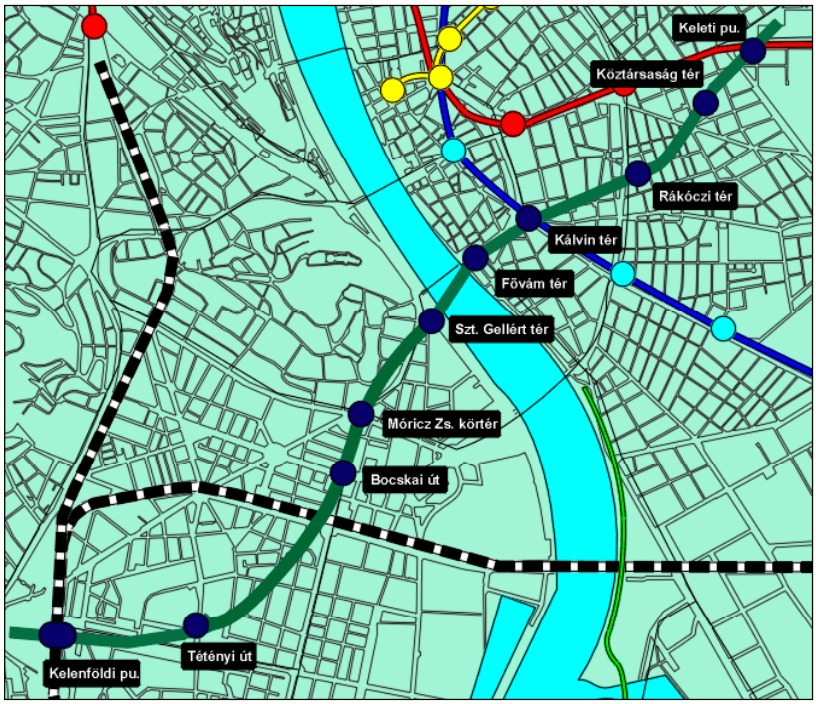
The Hungarian capital of Budapest is the only CEEC case city considered in CARISMA Transport. Budapest is at the very heart of Hungary, not only from a cultural or emotional point of view, but also considering the transport networks focused at the capi-

tal. Currently, 30% of the Hungarian population lives in the Budapest agglomeration and the percentage is growing, with no other town even close to its size. With the exception of deep-sea services, just about every mode of transportation known in Europe is available in Budapest. Four TEN-T corridors meet here to provide a perfect location for a case study of interconnection of transport networks.

In contrast to the other case cities, Hungary and Budapest in particular have undergone dramatic political, economical and corresponding social changes within the past ten years, touching almost every aspect of life. In the field of transport this is illustrated by two major developments:

- Economic liberalisation, development of small, flexible and internationally competitive enterprises and the successive expansion of an economically successful middle class within the Hungarian society lead to a dramatic increase in car ownership.
- In the communist era, the government provided an extensive, subsidised public transport supply that could be utilised almost for free. Although the quality of services was not impressive, there was no real competition of private modes due to the shortfall of private vehicles. As the government reduces subsidies nowadays, services are cut down, while at the same time fares had to be raised.

Both of these developments led to a dramatic change in modal shares, quickly adapting to Western European figures. While private transport subsequently suffers from congestion, air pollution and lack of parking facilities, public transport is not competitive due to outdated infrastructure and rolling stock, poor alignment of lines, inefficient services and a lack of integration and harmonisation of different modes.



Local experts and the Municipality of Budapest are aware of these developments and ready to apply best practice solutions, but face a lack of funds. While in Western Europe the changes in transport behaviour mentioned above took place over five economically successful decades, situations change so much faster in CEEC cities like Budapest. Both the road and highway network for private transport and all of the public transport services require massive infrastructure investments and compete for the scarce financial resources.

Budapest is located in the centre of the Hungarian motorway network, easily accessible from every part of the country. At present all the motorways existing or planned in Hungary simply merge with the capitals local road network. As they are not interconnected properly, through traffic is forced to find its way through the very city cen-

tre. The same holds true for commuter traffic, which often has to intersect the historic city centre on its way from one side of the capital to the other. Though plans for a ring motorway date back as far as 1942, first sections of the M0 ring have been constructed only in 1988 to 1994. Alignment and construction plans for further sections have been approved by now, but construction is slow due to limited resources. Once finished the M0 motorway ring will provide interchanges with all of the radial motorways entering Budapest, many important main roads and major city roads. The ring is planned to separate through traffic from inbound traffic, distribute traffic within the Budapest agglomeration and provide the desperately needed interchange between long distance networks (motorways, in particular) and the Budapest local road network.

In the rail sector, Hungarian State Railways (MÁV)'s 11 lines entering Budapest account for almost half its passenger business, but the network is concentrated in the Pest side of the city and the busiest lines bypass the central business district (CBD). Transport officials acknowledge the importance of a powerful backbone system made up of rail services. Yet the current infrastructure needs upgrading and physical as well as operational integration and interconnection with the local transport services (tram, suburban rail, underground rail and bus) operated to a large extent by the Public Transport Company of Budapest (BKV). For the moment, services between MAV and BKV are not coordinated and sometimes even competing.

BKV alone still accounts for more than half of all motorised trips within Budapest. Services and connections within the company are even coordinated to some extent. Still there is need for further co-operation with all public transport providers operating in the capital city, e. g. MÁV and VOLÁBUSZ, which is the largest bus operator in Pest County. A major step toward this will be the creation of an overall Budapest Transport Association (BTA). Immediate goal should be an integrated fare system, allowing for an easier multimodal journey through the capital. Work on this is already in progress, with the participants currently waiting for approval of their plans and searching for funds to cover the expected deficits stemming from the adjustment of the fares.

Further steps in the integration of the public transport networks would be realignment of certain services to avoid parallel supply, implementation of missing links especially to integrate the national rail services by MÁV into the system and the creation of many passenger oriented transfer points to facilitate multimodal journeys. In the long term, bus routes would be converted to tram lines and multi-powered, multi-function

locomotives and coaches would travel on a range of rail networks, whether tram, suburban rail, underground or state railways.

For the moment it can be seen that the number of intermodal points is very low and only few of them satisfy acceptable standards. In most cases the conditions are poor, the timetables are not harmonised and the walking distance is long. Both for the improvement of existing interchanges and the planning of new ones the co-operation between public transport operators, the removal of legal and financial barriers and the improvement of personal and property safety is required. Intermodal centres should be organised in network junctions – to the extent possible in the external or transient zones of Budapest, which have

- high standard track based links to the agglomeration ring,
- fast train connections to the urban centre,
- (horizontal) tram connections to other districts of the town and
- direct bus connections to the region.

To improve access to Budapest, the increase in the city's international role demands that the key objectives of development policy include the improvement of the quality of MÁV railway stations, the development of the land-based service of the Ferihegy airport and the establishment of the navigation along the River Danube, making use of the available possibilities.

The Park & Ride system could be one of the key elements of an intermodal network and may contribute to an increase in public transport usage. Currently, 27 car parks are appropriate for P & R, providing 4,000 places. Yet surveys show, that their usage as transport interchanges was negligible – largely because 50 per cent of drivers using them were already close to their destinations. In addition, half of the drivers surveyed were not prepared to pay for the facility. Considering that the best locations for P & R are properties also very suitable for commercial utilisation (shopping centres or supermarkets) and landowners try to maximise their profits, 1,000 million HUF (~4,5 million earmarked by the Municipality of Budapest for future improvement of P & R seems small in comparison. Responsibility for P & R operation could be assigned to the Budapest Transport Association, once founded.

While the Budapest agglomeration is growing constantly, the actual city of Budapest is loosing population since the late '80s. It is not just the homes of people that move to the outskirts, but also jobs. The well-known phenomenon of suburbanisation leads to longer average distances travelled to work and a demand structure difficult to

serve by public transport. Though results sometimes seem marginal, the city of Budapest is trying to face the situation with the tools of demand management:

- encouragement of multi-pole development in the main development axes,
- establishment of compact urban space of proper density and
- mixed functions in land use planning,

which help to reduce travel demand and provide a better structure for public transport supply.

5.4 Frankfurt and RheinMain Region

Housing more than 5 million inhabitants, the polycentric Frankfurt RheinMain Region covers 17.000 km^2. It considers itself in a most favourable geographic location both in the centre of Germany and Europe. The continuing suburbanisation processes observed in all the conurbation areas in the region (also including Wiesbaden, Offenbach or Darmstadt), accounting for an ever-increasing transport demand, imply the need to facilitate interconnectivity within and between all traffic modes. Partly due to this high demand in interconnective networks and its location on important trans-European corridors of road, rail, air and water travel, the Frankfurt RheinMain region has long been among the first in actively promoting intermodality and multimodality measures.

Transport policy in Germany is structured at national and state levels. In the National Transport Network Plan a major focus is put on the improvement of east-west links in Germany, regarding all transport networks. In the eastern part of Germany there is still a general layback of transport infrastructure to be overcome. Another major goal is the expansion of the high-speed rail network. In contrast the state transport policy of Hessen puts more emphasis on proper interconnection of different transport modes and the implementation of advanced traffic control and management technologies. As a consequence of these policies there are no additional network links planned or under construction in Frankfurt RheinMain region, with the exception of the Frankfurt-Cologne high speed rail link, ready for operation in 2001.

Unlike most other locations visited within CARISMA Transport, the TEN-T mostly already exist in Frankfurt RheinMain region. Only the high-speed rail link from Frankfurt-Cologne is still under construction. According to the National Transport Network Plan two more rail links are marked for upgrading, to make them feasible for high-speed trains. The TEN-T consider them upgraded already, since they are used by German high speed trains even now, although at lower speeds but local debate calls for a new alignment for this. There are no plans to expand the conventional rail network.

Frankfurt RheinMain region is endowed with a dense network of motorways and high capacity trunk roads. Three of the motorways (A3, A5 and A60/A66) are mentioned in the TEN-T, with no additional motorway links suggested above that. Apart from the slight mismatch concerning two rail links mentioned above, the TEN-T and the National Transport Network Plan are consistent for Frankfurt RheinMain region. Still the National Transport Network Plan acknowledges that capacity is far from sufficient on many of the TEN-T links, so upgrading and removal of certain bottlenecks is due especially for a number of motorway links and interchanges. Even though railway stations are not listed in the TEN-T outline plan they are an essential part of the trans-European transport network. They provide general access to the HST network and connect it to regional and urban public transport. There are nine railway stations in Frankfurt RheinMain region providing access to long-distance rail and HST services, with Frankfurt am Main – Central Station and the new Airport Frankfurt am Main – AIRail Terminal being the most important ones.

The HST link from Frankfurt-Cologne is the German contribution to the European high-speed rail link Paris-Brussels-Cologne-Amsterdam-London. It should be fully operational by 2001. Besides cutting travel time between Frankfurt and Cologne by half this link also provides high quality access to the principal airports of Frankfurt and Köln-Bonn. Frankfurt airport can be easily accessed by road and public transport. It is closely linked to A5 motorway, S-Bahn and regional rail services from Frankfurt and recently to the HST network by the new AIRail terminal. It is a political objective to limit the parking capacity at the airport, to discourage air travellers from accessing it by car.

Neither the outline plan for the TEN-T nor the National Transport Network Plan propose measures for an expansion of Frankfurt Airport. Prognosis of passenger development suggests, that the airport will reach airside capacity within a few years. Frankfurt airport authorities are strongly interested in expanding the airport capacity to participate in the European competition for passengers and airfreight. Owing to its location within a dense agglomeration area, all plans for airport expansion face fierce debates among public, political and airport authorities' interests. Strong public

support for environmental arguments leave little space for a broad agreement on expansion plans.

In this context the joint effort of the airport authorities, the domestic carrier (Deutsche Lufthansa) and German Rail, to shift domestic and short-distance European air traffic to high-speed rail services offers some relief by freeing airside capacity for long distance flights. The designated high-speed rail link provides the necessary infrastructure for these plans. Frankfurt airport authorities and German Rail agreed to share the costs of the new long distance AIRail-terminal at Frankfurt airport. Up to ten HST services an hour guarantee high quality interconnection with the European high-speed rail network.

Physical transport infrastructure provided in Frankfurt RheinMain region forms dense networks of both public transport and private modes. There already are a large number of interchanges, interconnecting local public transport to long-distance services, motorway network and city roads. Deficits can be identified in the operational and institutional co-operation as well as in capacity limits of individual systems, preventing users from actually arriving at the interchanges. To promote public transport in the region, the RheinMain Public Transport Authority (Rhein-Main-Verkehrsverbund RMV) was founded in 1994 to co-ordinate 145 local public transport operators and to be responsible for homogeneous fares and marketing. Passengers can move freely in the region, using all kinds of transport modes with just a single mutual transport ticket. The backbone of local and regional public transport is the extensive S-Bahn and regional rail network, serving Frankfurt and connecting it to all major towns in the region. Bus services feed into this network and a large number of Park & Ride facilities have been built up over several years. To promote intermodal journeys it was necessary to supply intermodal mobility services. Hence routing information provided by the Mobility Service Centres are not restricted to a single transport system, but all systems are regarded and combined according to their specific advantages and available capacities.

Frankfurt RheinMain region strongly supports telematics applications to improve operation of transport systems and to promote intermodality. Traffic control centres operate an extensive range of variable message signs (VMS) on the regional motorway network and a dynamic parking guidance system. Public transport is operated with the help of a computerised operation system, also providing passengers with real time information in a dynamic public transport information system. Two major research initiatives (WAYflow, ENTERPRICE) investigate further application areas for telematics in regional traffic management, traveller information and ticketing.

Frankfurt RheinMain region has a deliberate position on the further development of the TEN-T. In large urbanised regions it is necessary to provide a sufficient number of access points to the trans-European rail network, so railway stations should be included in the TEN-T outline plan. Also in network development it is necessary to separate local and regional from national and European rail services by dedicated tracks and infrastructure. Traffic management systems should be considered in the outline plan, leading to a common European database on operational and statistical information. This requires a better standardisation of train and railway technologies, which also serves faster international train connections.

In the road sector, network development within the Frankfurt RheinMain region is almost complete, with just a few gaps to be closed in future. Limited capacity at numerous bottlenecks calls for upgrading of some of the motorways and better traffic control strategies on the overall network. To cope with the frequent overloads on specific sections a number of alternative routes should be identified for traffic diversion.

Frankfurt airport will reach airside capacity limits within the next few years. Different measures to increase capacity should be considered in the European outline plan.

To promote intermodality on the European level several aspects should be considered in the further development of the TEN-T:

- To define and develop points of interchange between different trans-European networks (e. g. the AIRail terminal at Frankfurt airport) and between the trans-European networks and regional and local networks (e. g. regional train station at Frankfurt airport or Park & Ride or Bike & Ride facilities at any regional train station).
- To ensure accessibility of the defined points of interchange, especially within the trans-European transport network, by avoiding overloads and delays on all relevant parts of the trans-European and regional networks.
- To provide integrated, accurate and up-to-date information on the available transport systems.
- To develop organisational structures to allow for co-operation of local, regional, national and European authorities.
- To define technical and organisational standards for intermodal ticketing.
- To develop standards, e. g. for intermodal luggage handling.
- To develop intermodal traffic control strategies (e. g. to ensure connection in case of delays in one mode).
- To co-ordinate responsibilities (e. g. in case of claim under guarantee).

Telematics and information services could play a major role in further supporting intermodality at a European level. It will be necessary to develop a European intermodal traffic information platform, consisting of comparable data and information from various modes and subsystems. On the basis of this platform a number of services for intermodal travel could be generated, e. g.:

- international and intermodal mobility service centres,
- internet services for integrated intermodal traffic information,
- international and intermodal ticketing and reservation services,
- international and intermodal routing services.

5.5 London

London is, in many ways, both a difficult and extremely interesting city to study. It is the largest of the 5 CARISMA Transport cities with a population of some 9 million, and in which there are some 10 million passenger trips per day. Many commuter journeys are long with distances of 40-100 km quite common and a total time of 1-1.5 hours. Almost all commuter trips involve interchanges between different modes.

Size is one aspect, which makes any study of London so interesting. The other is that London (and the UK in general) has, in recent years, changed the ownership and operation of public transport from the public sector (central government or local authority) to the private sector. This applies both for the infrastructure and the operation of the services. The increase in private ownership changes the way that decisions are made for new services and capital investment. The CARISMA Transport study for interchanges is therefore looking at the role and function of public and private authorities.

London is one of the biggest transport terminals and interchanges in the world. Transport systems have been developed over many years and indeed the world's first underground railway was opened in 1863 between Paddington in west London and the City of London. All the railway stations were constructed at a time when the private sector train companies constructed and owned their own central London terminals. Competition between companies was intense and there was no central planning to provide an impetus towards more convenient interchanges for passengers. It is only in recent times, when the motorcar has become the dominant transport mode, that public transport operator and planners have realised the need to improve multimodal public transport services and facilities.

After the nationalisation of the railways in 1948 the stations continued to serve their geographic area. One benefit from nationalisation was that through ticketing, including the use of the London underground, became possible. Relatively few journeys to London involve passengers using two or more main line railway trips. Seven out of 16 main railway stations are part of the TEN-T rail network.

The London underground provides the most widely used transport mode for Londoners. It has been constructed by separate railway companies and by the nationalised London Transport Underground authority over many years. Many sections are very overcrowded especially in the peak periods, but the system provides interchanges with other underground lines, with the rail network and with the surface bus network. But some of the interchanges require a long walk and/or steps.

The London bus services had been a division of London Transport and operated as a parallel service to the Underground. The planning of the bus network has been historic, demand driven, or linked with the underground to provide a better overall service. There are though few good examples of easy interchanges between the networks, and for many years the ticketing system was independent and non-interchangeable. When London Transport owned and ran the bus services the investment priority was always towards new buses and maintenance of existing facilities, rather than the construction of new terminals and interchanges.

In 1983 the introduction of Travelcards has reduced the need for travellers to re-book when changing between the bus, underground and rail system. This created a significant shift in bus travel patterns as passengers making longer journeys began to use bus and rail combinations more efficiently. Bus services were then redesigned to provide better frequency and reliability for local and short trips.

Since the end of 1995 the bus service is provided by private sector operators at the request of London Transport Buses, a new division of London Transport, through a system of competitive tendering and negotiated contracts. Improved waiting facilities and interchanges are now of high priority and are likely to receive added investment.

London Transport Bus has the opinion that good interchanges need to be at sites where multi-activities, such as shopping, cinema, etc. exist.

A clear statement on Park & Ride is that this is very successful in some cities, but that in London it might well encourage more car travel in the outer areas and reduce the trip length for bus trips. It is also clear that in London it is difficult to find land for Park & Ride sites.

London is served by 4 major airports, all listed in the TEN-T, and offering local, European and international flights. There is also London City Airport, which is very near the City of London and is used predominantly for short haul local and European flights with smaller aircraft.

Heathrow is the major airport for London. Some 60 million passengers make arrivals and departures per year, of whom some 40 million use surface connections and the rest are interchange travellers within the airport. About 50,000 people are employed at the airport and their travel demands need to be considered just as much as those of travellers. The airport planners are committed to providing improved public transport access and plan that in the longer term 50% of all travellers and employees will use public transport to access Heathrow.

As a result of the large number of flights many operators of long distance coach services wish to offer a service to Heathrow. It has therefore become a frequently used interchange for coach travellers, who may have no need to be at the airport itself. A new dedicated railway service, Heathrow Express, between Heathrow and Paddington station in London was opened in 1998. It will be described in detail later. Earlier an underground connection had been constructed by extending the Piccadilly line.

Gatwick and Stansted airports mostly serve charter and cheap regular services. Both of them are well connected to the highway network and main railway lines, while the fourth airport, Luton, has no direct rail link to London.

The TEN-T highway network comprises the M25 motorway ring around London and the motorway roads that radiate from the M25. None of the motorways or principal roads within the M25 is included in TEN-T. There are no formal links from the M25 to other transport modes or to interchanges. In practice few motorway travellers use an interchange to the main line rail network, but some use parking facilities inside the M25 ring near to underground stations.

The number of car parking spaces is carefully controlled and costs of parking in the central area high. Within the City of London there is very little on street parking. Parking policy and charges have been in use for many years to encourage a reduc-

tion in car journeys. Proposals are being discussed to increase demand management by a system of road user charges.

It was decided that London offered a very good opportunity to examine the issues and design of transport interchanges. In particular the project decided to concentrate on public transport interchanges since there are very good examples in London from the airport to the city, and from the existing and planned Eurostar services to London from Paris, Brussels and Lille.

It is worthwhile to look first at the most common interchange of all, the simple bus stop. London Transport Bus have the responsibility for all bus stops, and have an investment plan of £10-15 million per year to improve them and to provide additional services. Passenger surveys have indicated that the priority requirements are:

- good waiting conditions,
- security,
- signage,
- information.

Of the 17,000 stops some 10,000 have now been improved and become shelters, which have electricity supply for lighting, security and ease of reading the information panels. The shelters are provided in partnership with a commercial company. Both parties obtain revenue from the selling of the advertising at the stop. The size of the advertising panels is agreed and agreements negotiated about maintenance etc. Bringing in a commercial advertising company means that a faster programme of betterment can be adopted. On some streets there is a problem to accommodate the shelter and still provide sufficient space for other pedestrians to walk around it. Hence various designs and types of shelter are used.

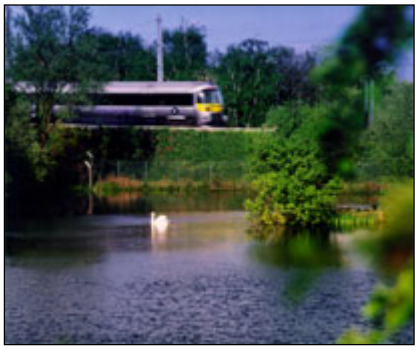
A considerable investment has been made in recent years for the improvement of the larger bus interchanges. London Transport Bus have found that the most successful sites are where the interchange is at a focus of activity, such as at a shopping complex, or where there is a close connection to an underground line. Each site requires a detailed study and any investment will need to show a financial and/or a social return in terms of more passengers carried, a reduction in private car travel, better access for elderly or disabled people, or a redevelopment of an area with improved opportunities for employment, leisure or sports facilities, etc.

As well as the negotiations between parties on the infrastructure, there needs to be discussion between the operating companies who would offer services passing through the interchange. Obvious requirements are timetabling, especially on frequency and late night running, and the acceptance of through tickets. Passengers

prefer to wait at busy sites and like facilities such as a paper shop, coffee shop and toilets.

The design and layout of interchanges for the underground are very complex. New underground lines have been constructed to increase the capacity of the crowded existing network. The space available for passenger platforms and interconnecting walkways is very constrained. The line itself has usually had to be constructed deep to avoid other lines and services. This has the added effect of requiring deep escalators, which in their turn require more space. There are existing links at all the main railway stations to the underground but some of these are difficult to use in terms of the distance that needs to be walked, or, in a few cases, steps climbed.

Heathrow is the major airport for London yet it was constructed in the 1950s with no provision for direct rail access. As traffic increased it was realised that rail access would be needed. First the Piccadilly line Underground was extended to the airport and in June 1998 a new direct rail line from the airport to Paddington station was opened. It was designed as a non-stop express service with a running speed of 160kph using the existing railway tracks owned by Railtrack Plc for two-thirds of its length, and in a new tunnel under airport land for the other third.



British Airports Authority (BAA) have funded all the construction costs and have negotiated a long lease for the track paths on the section on line that is owned by Railtrack Plc. The total investment has been £500 million including the rolling stock. The rolling stock design allows for passengers' baggage to be carried in security cleared containers on the same train as passengers and within the seating area provision is also made for luggage.

BAA collect all fares on the route and are also able to offer passengers a through ticket for the London underground, but not as yet for any onward rail journey. The Heathrow Express is marketed under the slogan, " In 15 minutes- every 15 minutes", which refers to the journey length and frequency. The present fare structure is £12 for a single ticket, which is expensive in comparison with the competing Piccadilly underground fare, but is significantly less than the market competition, which is taken to be a taxi. At present the Heathrow Express is carrying about 15,000 passengers per day, most of whom are business travellers. BAA is considering offering a stopping service as well as the direct one and it is expected that this would be popular with airport employees and a greater percentage of leisure travellers.

From the passengers' point of view there are many advantages of using this connection to the airport. First, all checking in can be carried at Paddington Station. Passengers' luggage is placed into special containers at the check-in to conform with airline security requirements. The train runs at regular intervals and the checking-in time at Paddington is only 2 hours before a flight if the passenger has baggage, and one hour without. (This is the same as recommended at Heathrow itself). The train has two stopping stations at Heathrow, one for terminals 1,2,3 and the other for ter-

minal 4. There is quite a long walk at Heathrow for passengers and unless the traveller is familiar with the terminal layout he/she might find the signing inadequate.

Possible future schemes include running the Heathrow Express around the north west of London to reach St Pancras. This would provide direct connection to the future Eurostar services at St Pancras, and to the main line stations of Kings Cross and Euston. Studies are in hand to evaluate future train services to Reading (travellers heading west), to Woking (south-west), Gatwick airport (interconnection), and a Paddington stopping service.

The Channel Tunnel Rail Link (CTRL) is being constructed in two phases. Section 1 is from the existing channel tunnel near Folkston to Fawkham Junction (74kms), where trains will join existing Railtrack lines to Waterloo in south London. This service will operate from 2003. Section 2 is from Southfleet, near Fawkham Junction and Ebbsfleet to St Pancras station in north London. Much of section 2 will be in tunnel and has the lower design speed of 160kph rather than the 300kph for Section1. London and Continental Railways (LCR), who are the owners of CTRL and Eurostar, are constructing the project. The project has a total cost of £7.6 billion of which £ 1.8 billion is the contribution from the public sector. All other funding has been through bank loans, bonds and shareholders.

At St Pancras station the new terminal will be a part of the main line St Pancras station. St Pancras is very close to Kings Cross station and within about 500 metres of Euston station. These three stations are the London terminals for travellers to the large cities of Birmingham/Manchester/Glasgow/Edinburgh/Newcastle/Leeds and York. Extensive links to the underground system already exist making use of the Piccadilly, Northern, Victoria, Circle, and Metropolitan lines. The area is also served by many bus services including the express link to Heathrow. So as a site the use of St Pancras for Eurostar is ideal. Inevitably there are quite long walks to make the interchange between some of the services, and work will be needed to provide better signing and information for travellers. This becomes even more important with a higher number of infrequent travellers who will be expected to be using the Eurostar line. There will be many parties involved in the improvement of the interchange facilities. Railtrack and London Underground will be the biggest owners of the facilities and discussions are in hand about the flow of extra passengers from the Eurostar trains. Models of passenger movements at the stations and the interchanges are already used with data from existing travellers and land-use plans.

Before any decision was made about the location of the intermediary stations, traffic demand, planning, and socio-economic studies were undertaken. Several possible sites were considered both for international and domestic services. These studies concluded that stations should be built at Stratford (north-east), at Ebbsfleet (south-east), and at Ashford where there is an existing interchange for Eurotunnel.

At Stratford the station has a transport role but there also is a need to provide an impetus to general development in the area. CTRL will interchange here with the new Jubilee line underground, with Docklands light railway (Canary wharf and London City Airport), and the Central line of the underground. London Transport Bus has recently constructed a new bus terminal in the area and so improved bus services are also to be expected. The linking of these interchanges will require coordination between the parties and passengers will need information about the range of new options that will be available to them.

The second interchange is at a new station at Ebbsfleet. Ebbsfleet is just outside the M25 ring road in the southeast and beside the A2 trunk road (both roads in the 'TEN-T' network). There are plans for substantial changes in land use around Ebbsfleet with some 40,000 houses and industrial facilities. Also nearby is the largest shopping complex in the south east of England. The new station will provide for local travellers, for park & ride for drivers to transfer, and for international travellers, who may reach the station by car, bus or local train services in eastern Kent.

The third station at Ashford is already in use as an interchange. It provides good secure parking facilities and the local bus operators have adjusted their routes to link better with the station. Ashford serves a local catchment's area for southeast England outside London, but there is some evidence that more people are using it as a park & ride to mainland Europe. Passengers are able to join the Eurostar services only in the outbound direction and alight in the inbound direction. The Eurostar service can therefore not be used for local commuting. Local trains have to be used from Ashford.

5.6 Conclusions from Case Cities

The five site visits performed during the project are not easy to compare. Situations have been found to vary with regard to size and economic power of the cities, historical situations, physical infrastructure, organisational structures, planning approaches and policy goals. As a consequence the focus of the visits and the issues covered have been adjusted individually every time. However, a small number of

relevant topics can be identified to be of common interest or experience throughout Europe.

Most important seems to be a general understanding of the benefits arising from a joint public transport authority, responsible for co-ordination and planning of all PT activities within an urban area and possibly the surrounding region. Such an organisation does not necessarily need to own and operate all PT themselves, but guide (private or public) operators to align and link their lines and services into a shared network, adjust timetables to facilitate interchanges and most importantly enable through ticketing within a joint fare system. These public transport authorities are quite common in German metropolitan areas such as the Frankfurt RheinMain region), planning and negotiations have been observed in Lille or Budapest. Current privatisation and market liberalisation in London seems to have gone beyond that point, with London Transport Organisation being split-up further into bus and underground departments. Through ticketing and interchanges are (still) available, but rather on a negotiation basis between operators than on the grounds of common planning.

All of the cities visited provide or discuss some means of IT services to travellers. This ranges from (static) line and timetable information on the internet, to dynamic displays of approaching services at bus stops, to the Frankfurt Mobility Service Centre, providing a greater range of IT based transport services. However, real time information concerning punctuality, performance and interconnection of public transport is often not available and accurate (and timely) information on system disruptions, any resulting consequences for travelling plans and possible available alternatives is still far from the norm. Current best practice in the field remains to be the provision of public address announcements within the system (or vehicle) concerned, with no information passed on to connecting services.

Public private partnerships raise hopes of an attractive alternative funding approach in times of heavy budgetary restraints in all countries. London certainly is on the vanguard here, with privatisation of public transport progressing rapidly and public subsidies being reduced annually. Size and density form a unique situation in London, naturally restricting private transport and providing a good basis for competitive mass transit. The framework is different in other European cities, so the London experience must be reflected very carefully in the respective local context.

Relevance of the TEN-T is mixed throughout the cities visited. Budapest and Trieste, poorly connected to European long distance networks, have great expectations regarding the implementation of the TEN-T. The concern is not about providing proper interchanges, but about the financing, alignment and realisation of the network links themselves. Obviously cities in CEEC and some landlocked regions of the EU hope to benefit from new infrastructure proposals, enforced and partly funded by the community. In Western European cities like Frankfurt or London the TEN-T concept has little influence on local planning. Long distance networks are more or less fully in place; any capacity bottlenecks need to be solved with or without EU support. There is no functional difference to local planners when some of the major network links belong to the TEN-T or just to the national long-distance networks. In none of the case-cities could a differentiated approach be identified, concerning the interconnection of local transport networks with TEN-T or national long-distance networks.

In some places, like Trieste or Frankfurt airport, the interconnection of uni-modal TEN-T amongst themselves appeared to be more relevant than local access to long distance travel. Again, this was not a common experience, as Lille and London experienced the opposite. Also, different opinions prevail on the necessity and effects of park and ride schemes. While Budapest was convinced that P&R could play a significant role in reducing motorised city traffic, London was rather sceptical about negative effects on bus patronage. P&R is a popular feature within the Rhein-Main-Verkehrsverbund in Frankfurt, yet the AIRRail terminal at the Frankfurt airport supposedly is not designed to provide car park facilities for HST travellers.

All the Western cities took for granted a permanent increase in transport demand. Budapest was the only exception, in that they that hope to curtail transport demand (private road traffic in particular) with regional planning tools and demand management.

6 Synopsis of Member States' Current Best Practice

The strong need for promoting concerted action between Member States arises from the Commission's difficulties in enforcing Common Transport Policy (CTP) recommendations and the slow progress of implementing the directives in some of the Member States. Therefore facilitating the dissemination of knowledge regarding best practices and state of the art technologies between Member States is vital to ensure that national and local transport solutions can develop in compliance with the CTP goals and national and local achievements can be incorporated in Community policy.

Examples of best practice regarding different aspects of interconnecting long and short distance travel in the Member states are identified and their compliance with the CTP mission statements is considered in the following.

6.1 Objectives of the Member States and European Commission

6.1.1 National Transport Policies

The European Commission, acknowledging the subsidiary principle in all areas of transport developments, is supporting initiatives and promoting measures at local and regional level by informing and enabling best practice. A concerted action of European projects in the relevant fields of transport therefore requires consideration of the national policy and infrastructure planning, institutional procedures and organisational structures, either complying with or representing barriers towards the implementation of the Common Transport Policy (CTP) goals and the further improvement of the Trans-European Transport Networks.

Table 6-1 (TEN-ASSESS, 1997; CARISMA-Transport) summarised the main policy documents related to transport across the Member states.

CARISMA-Transport is seeking to form a more thorough picture through input from the action's Management Committee meetings where representatives of the Member States are asked to contribute.

6.1.2 The Common Transport Policy

To meet the need for mobility and user's needs of ensuring safety and protecting the environment, the European Commission is promoting activities aimed at an efficient, accessible and competitive transport system. The Commission's White Paper on "The Future Development of the Common Transport Policy" (Common Transport Policy: CTP) was a first step towards defining goals and establishing the work programme to achieve them.

Overall objectives

The CTP Programme for the period of 1995-2000 (COM, 1995) consists of policies and actions under three fundamental objectives of

(1) Improving quality of the transport system

(2) Promoting more efficient and user-friendly transport services

(3) Broadening the external dimension

Country	Policy Documents	Infrastructure Master Plans
Austria	General Transport Concept Austria, 1992	Federal Infrastructure Plan, under Preparation
Belgium	Plan of mobility and Transport in Wallonia, 1994 - Walloon region	Vlanderen Spatial Structure Plan, 1995 - Flemish region
Denmark	White Paper on Transport and Traffic Plan 2005, 1993	White Paper on Transport and Traffic Plan 2005, 1993
France	LOTI – Framework Law on Physical Planning, 1995; Annual Reports on Transport CNT PDU (Plan de developpement urbaine)	National Infrastructure Master plans (6 modal plans)
Germany	Federal Transport Investment Plan, 1992	Federal Transport Investment Plan, (BVWP, 1992)
Great Britain	Green Paper, transport – the way forward, 1996 White Paper, 1998	NOT EXISTING
Greece	NON EXISTING	NOT EXISTING
Italy	(General Plan for Transport 1986)	NOT EXISTING
Luxembourg	NON EXISTING	NOT EXISTING
Netherlands	4th Policy Document on Physical Planning; Annual Report on Transport	2nd Structure Scheme for Traffic and Transport
Spain	NON EXISTING	Infrastructure Guideline Plan 1993-2007, 1993
Sweden	Ten-year plan on Swedish Transport Policy, 1988	

Table 6-1: Main National Transport Policy and Infrastructure Documents

Table 6-2 summarises the main CTP objectives and corresponding actions in the transport field as identified by the European Commission. Those principles and measures that are to be considered in the interconnection of long distance and local/regional transport and will therefore be highlighted in the course of the concerted action programme within CARISMA-Transport are marked with (>) in Table 6-2.

1. Improving quality of the transport system
'Developing integrated transport systems based on advanced technologies that contribute to environmental safety and economic objectives '
System development > Better integration of transport modes, including better use of those modes offering unused or potential capacity Co-ordinated approach to transport- related research including new transport technologies Co-ordinated planning of investments in trans-European Transport Network (TEN-Transport) measures including financial support from the Community, the promotion of public-private partnerships and technical convergence > Promotion of Public passenger transport to an attractive alternative to the car > Establishment of a Citizens' Network for the development of high quality collective transport of all kinds Safeguard interests of transport users by safeguarding competitive environment and creating the Single Market
Environment Reconcile increased demand for mobility and significantly enhanced sensitivity to the environmental impact of transport > Improve modal balance and technical standards in order to improve transport's environmental impact
Safety Improved systems for analysing the causes of accidents and evaluating the costs and benefits of alternative responses Improved technical standards for vehicles and their enforcement Improvements in infrastructure
2. Promoting more efficient and user-friendly transport services
'Improving the functioning of the single market'
Market Access and Structure Supervision of the implementation of the rules creating the Single Market in transport services and firm enforcement of the general competition rules Accompanying measures at a national level for the transition from a national regulatory system to a Single Market Community action to assist in the elimination of structural over capacity (e.g. inland waterway sector)
Costs, charges & pricing: Green Paper 'Towards fair and efficient pricing in transport' > Overcome differences in the charging systems of different Member States Optimal modal balance > Steps towards further convergence in the charging regimes applicable to the different modes > Reduce unacceptable divergences between modes and favour intermodal operations that will reduce pressures on more congested parts of the transport system
Social Dimension > Attention will be given as a matter of priority to the development of regimes on working time adapted to the particular needs of the different transport activities concerned
3. Broadening the external dimension
'Improving transport links with third countries and fostering the access of EU operators to other transport markets'
Rapid conclusion of the Council deliberations on mandates in relation to road and air transport relations with the countries of Eastern and Central Europe Negotiations with the United States on aviation in relation to the United States Strengthening the EU role in international organisations dealing with transport matters

Table 6-2: Common Transport Policy objectives and corresponding actions (COM, 1995)

Main activity areas

The mission statements of the EU in the main activity areas are:

- *Trans-European Network Policy*

To develop efficient, integrated and interconnected transport systems across the internal frontiers of the Union, covering all its regions and reaching out to neighbouring countries, through co-ordinated planning of investments, the promotion of public-private-partnerships and technical convergence.

In consideration of the Union's future enlargement and the way in which transport links should develop, the Commission has highlighted five themes of action:

(1) Fixing the Pan-European Corridors and Areas, complete the corridors and launch new investments in the Mediterranean Area.

(2) Extension of the TEN-Transport to the applicant countries as part of the pre-accession process.

(3) Common European approach to transport technology throughout the pan-European Network.

(4) Encouragement of intelligent transport technologies throughout the network.

(5) Closer co-operation on research and technology

- Public Passenger Transport

In order to ameliorate the balance of modes in the transport system, public transport must provide transport users with attractive alternatives to the private car. The European Commission Green Paper "The Citizens' Network" (COM (95) 601) and the follow-up Communication on "Developing the Citizens Network" (COM (98) 431) have proposed a list of assessment objectives setting the standards for best practice of passenger transport systems. In order to make public transport more accessible and attractive to the public, the following key issues are addressed:

- better infrastructure and physical inter-connections
- planning between different modes of transport through ticketing and provision of reliable and up-to-date information.

The sites selected in CARISMA-Transport as examples of best practice for the various fields of transport fit particularly well with regard to a number of the indicators listed in Table 6-3.

Main Measures

To achieve sustainability in transport the Commission thrives towards positive measures to encourage environmentally friendly and user-friendly modes of transport. Positive measures can be investment in public transport, improvement of services and vehicles, better information to travellers and improvement of technical standards. In several directives the Commission has established principles and main objectives for the four sectors of transport, see Table 6-2.

As a measure across all sectors, setting up public-private partnerships (PPPs) is considered a priority for accelerating the completion of the TEN-Transport infrastructure. The Brenner Tunnel and parts of the TGV Sud in France are two projects of the initial set of candidates proposed for PPP by the Commission.

Road	- Improve the monitoring and analysing the causes of accidents - Set out technical standards and their enforcement - Improve the infrastructure
Air	- Consumer choice - Lower fares - Easy fare structures - Links with peripheral areas - Liberalise ground handling facilities to make reservations more open and transparent and rationalise slot allocation
Rail	- Management independence of the railways - Separation between infrastructure management and transport operations - Improvement of the financial situation of national railways - Improvement of access to rail infrastructure
Water	- Liberalisation of the sector - Reduce structural over capacity - Encourage investment in inland terminals

Table 6-3: Transport sectors and main areas of interest (COM(95) 199/ 302/ 318/ 601/ 691)

6.2 Transport Demand and Transport Modes in Europe

Between 1970 and 1993 passenger transport in the 15 European Union countries grew at an annual rate of 3.2 %, whereas the average growth rate of the GDP (in real terms) was 2.4% (COM(95) 601). The average distance travelled every day increased from 16.5 km to 31.5 km per European citizen in the same period.

The increase of transport demand has been met largely by increased use of private cars (Fig. 6-1), which in 1994 accounted for approximately 80% of person kilometres travelled (Fig. 6-2). On the other hand railway, although largely acknowledged as the most environmentally friendly mode of transport besides walking and cycling, accounted for only 5 % of the passenger kilometres travelled in 1990 with a decreasing trend (Fig. 6-2).

Ownership of cars in the EU has increased between 1975 and 1995 from 232 per 1,000 people to 435 per 1,000. Car mileage in the EU is expected to increase by a further 25% between 1990 and 2010 (EC DGXII, 1996). Road haulage is expected to increase by 42% in the same period, compared to only 33% increase in rail freight.

Despite large-scale investments in the public transport sector most cities in Europe have experienced continuous decline of public transport use over the last decades. This shows that other measures such as improving service, comfort, accessibility, image and safety of public transport have to be emphasised.

In general quality of public transport is substantially determined by design and operational aspects as well as services provided to the users.

6.3 Trans-European Transport Networks and Local / Regional Networks

Until recently, transport networks have tended to be developed from a national perspective, with the emphasis being placed upon individual modal networks rather than on integrated transport systems.

The European Community has recognised the need for a network approach to transport infrastructure planning and has consequently adopted the Guidelines for trans-European Transport Networks (TEN-Transport).

In the process of elaborating the Maastricht Treaty a network of corridors was specified forming the Trans-European Transport Networks (TEN-Transport). At the second Pan-European Transport Conference in Crete in December 1994, nine transport corridors in central and Eastern Europe were identified for action. Master plans and guidelines for building the Trans European Transport Networks for rail, road and waterways were prepared by the Directorate General for Transport (DG VII) and specified in the Commission's "Trans-European Transport Network Outline Plan" (COM(94)106).

Community action aims to promote the interconnection and interoperability of national networks, as well as access to such networks, paying particular attention to the need to link island, landlocked and peripheral regions with the rest of the Community.

The **TEN-Transport for roads** mainly consists of motorways and is therefore classified by operational categories rather than infrastructural ones:

- **Links**: Links of strategic importance for international traffic. Road operation is based on provision of Information and driver assistance. As incidents rarely occur, emphasis in operation is put on event management in case of rare major incidents.
- **Corridors**: Parallel alternative routes loaded with a mix of local and regional traffic. As incidents often occur the main operational task is to optimise traffic allocation in a system optimal way taking into account all links of the corridor.
- **Networks**: Within networks different routes exist for each destination. If an alternative exists for each segment of the network, the network consists of a combination of corridors. Networks are mainly operated in conurbation areas, regional traffic constituting the lesser portion of traffic. Major congestion and incidents occurring in networks require real-time traffic monitoring and management, the required complexity of the system depending on the network scale.

The Commission's main focus regarding the TEN-Transport is to improve safety, efficiency and comfort, organise the co-operation between different road operators, ensure competitiveness of the European industries, minimise adverse environmental impacts and in general facilitate sustainable mobility.

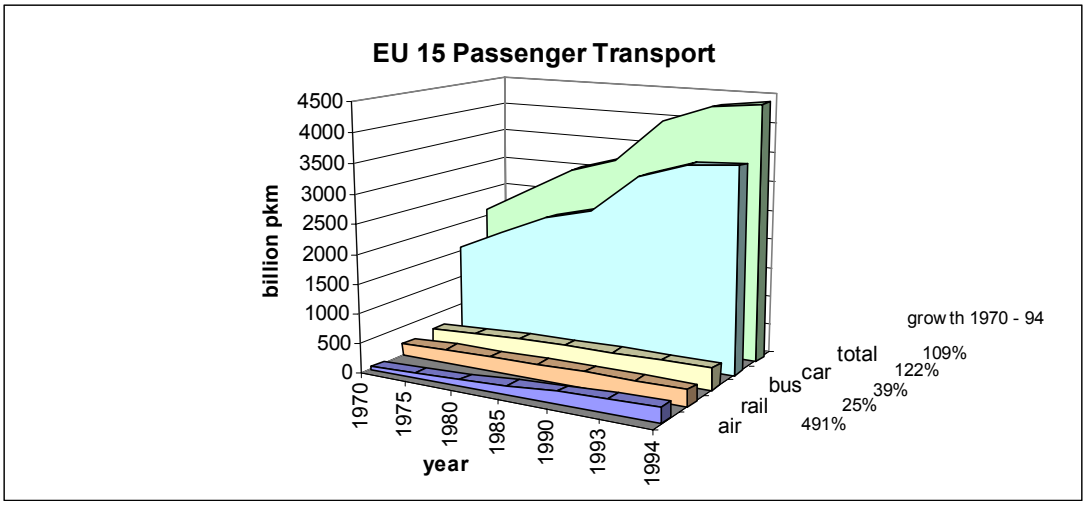


Fig. 6-1: Growth in Passenger Transport by Modes (following COM(95) 601)

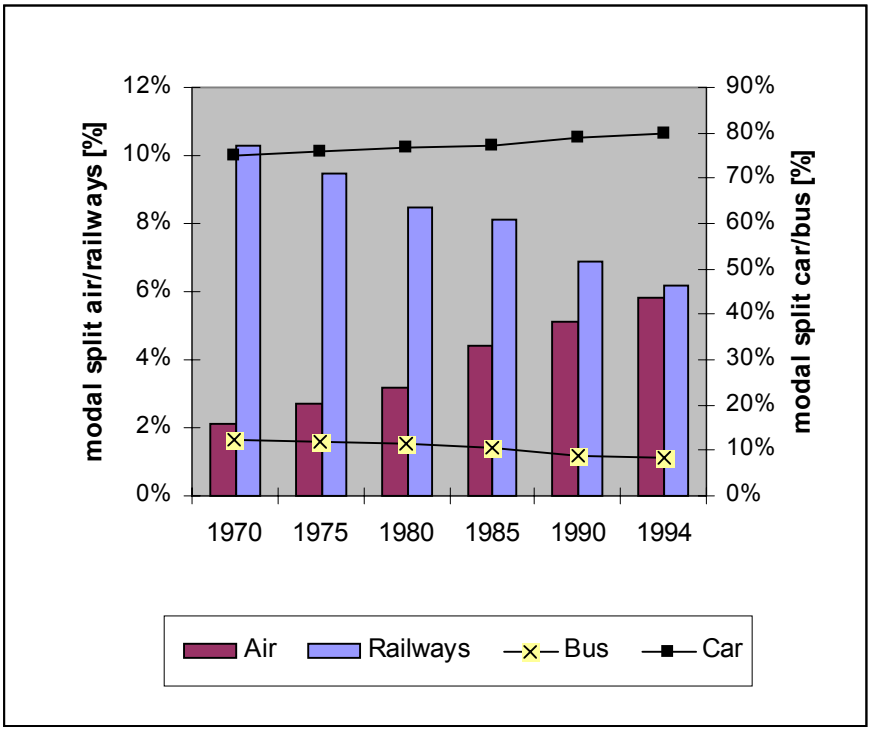


Fig. 6-2: Modal Split based on Pkm in EU (1993) (EU 15, 1993)

Mode / Year	1970	1980	1985	1990
Car	76,1	77,8	77,5	79,0
Rail	10,0	8,0	7,7	6,6
Bus	11,7	10,6	10,0	8,9
Air	2,2	3,5	4,9	5,6

Table 6-4: Changes (%) of Modal Split of European Passenger Transport in EU 1970-1990

In trying to achieve these goals it was envisaged to complement the infrastructural concept of the TEN-Transport by operational aspects. For this the MAGIC Working Group was established to develop common definitions and a framework for Traffic Management on the TEN-Transport (MAGIC, 1994). In addition ERTICO was commissioned to propose a telematics' architecture and launched the TELTEN project, which worked closely together with the MAGIC action group. The methodology developed by TELTEN is based on three main concepts (TELTEN, 1994):

- operator tasks by network classes
- "Level-of-Service"-concept
- framework for a telematics architecture in traffic management

Based on the TELTEN concept five - 'Euro-Regional' projects (CORVETTE, SERTI, CENTRICO, VIKING, ARTS) were funded by DG TREN to support the integration and standardisation of TEN-Transport.

The MAGIC group's final report (MAGIC, 1994) included guidelines for measures and strategies for the realisation of traffic management and telematics applications on the Trans-European Transport Networks. As the MAGIC Action report constitutes the starting point for common European action in the field of traffic management, some of the main results and conclusions are summarised in the following:

- Interoperability, homogeneity and continuity are set as minimum requirements for services to road users
- A bottom-up approach is suggested for the optimisation of national traffic management systems.

The main requirements for TEN-Transport operators regarding co-operation and standardisation are in the fields of:

- data collection and monitoring
- traffic control and safety
- traffic and travel information
- demand management (e.g. road pricing)

The "Level of Service"- concept is proposed for classifying the TEN-Transport with respect to operational conditions. Three operating scenarios are defined:

	Responsibility	**Finance**	**Operation**
Scenario A	public domain	public domain	public domain
Scenario D	public domain	private	Private
Scenario P	Private	private	Private

Table 6-4:

Further efforts are required in technical standardisation and development of an organisational framework to facilitate the interconnection of national and regional TICs (Traffic Information Centres).

It should be the responsibility of the public domain to finance the basic traffic management infrastructure.

The MAGIC group makes the following recommendations:

- Improving political co-operation to ensure financing and efficient decision making
- Improving international co-operation
- Harmonisation of selected traffic management services on the Trans-European Transport Network
- Action plan for implementing those services.

Due to their considerably higher speed compared to regular train services, high-speed trains (**HST**) provide a convenient alternative to air and car travel. Having started the building of dedicated lines in the early 1980's with the French TGV the development of the TEN-Transport for High Speed Trains (HST) has since become a high priority in European transport policies. The trend towards Pan European high-speed rail networks is gaining momentum in the Community through the construction of new intra-state links. The most recent examples are the Eurostar connecting London and Paris and London and Brussels.

So far the TEN-Transport corridors have mainly covered road and rail and to a limited extent, waterways. To encompass a broader range of transport options including shipping and aviation, the Commission adopted a new concept of the Pan-European transport areas. So far the Council of Transport Ministers has approved master plans for high-speed rail and for inland waterways. New master plans to include conventional rail, airports, seaports, and road networks as well as traffic management are under preparation.

The first general revision of the 1996 TEN-Transport guidelines, envisaged for 1999, will reinforce the intermodal design of the TEN-Transport. The European Commission has therefore set up a **Multimodal Working Group** with experts from the Member States. This group will develop an inter-modal outline plan for all modes of transport and will propose criteria for locating interconnections and terminals. The work will take account of the results of ongoing research projects related to inter-modal policy and transport concepts. Examples include the EMOLITE (Evaluation Model for the Optimal Location of Intermodal Terminals in Europe), IQ (Quality Improvement of Intermodal Networks and Terminals) and IMPULSE (Technological Improvements in Intermodal Networks and Terminals) projects.

In order to strengthen efforts on improving the role of **waterborne transport** in the TEN-Transport framework, the EC launched a Green Paper on seaports and maritime transport in 1997. Ports are considered to be vital to trade and transport in the EU. Cost-efficient transport and port systems are seen as a major prerequisite for sustaining the Community's global competitiveness. Various ways are envisaged for integrating ports into the multimodal transport system increasing their efficiency and improving port and maritime infrastructure in general. A proposal for better integration of ports into the Trans - European Transport Network provides for 300 ports to be included into the TEN-Transport.

The TEN-ASSESS project provided an overview of policy measures taken so far in establishing the TEN-Transport (TEN-ASSESS, 1997). The project's overall objectives have been presented in Section 4.1.

Regarding the Trans-European Transport Networks and the Corridors towards Eastern Europe, the European Union's **priorities** were summarised by TEN-ASSESS as

shown in Table 5-5 and 5-6 respectively. It is concluded that the current TEN-Transport corridors are mostly only bimodal (i.e. road and rail), and thus do not yet meet the requirements of an efficient multimodal network. Moreover the corridors are considered mainly as efficient links between two or more activity zones of European interest (link approach). The combined link-node approach i.e. significant nodes including ports, airports, hubs, passenger interfaces is not seriously considered.

The project findings emphasise the importance of the work being carried out by the aforementioned Multimodal Working Group.

The Measures MINIMISE (MINIMISE, 1999) recommended for the improvement of the interconnection between the EU and CEE transport networks are:

- Simplification of customs procedures particularly for road and rail freight transport.
- Building of new network interconnections between East and West European transport network projects within the TEN.
- Improve the quality of the transport infrastructure in Eastern Europe.

The main issues to date in many Member States which remain to be appropriately solved and should therefore be subject to **interactive discussion** between the responsible national and local / regional decision makers are:

- Distribution of administrative and financial responsibility and competencies for traffic management and information
- Integrative quality of national transport policy guidelines (planning framework)
- Flexibility of transport planning policies to harmonise with the Common Transport Policy objectives (to what degree do master plans and guidelines comply with the CTP or create an impediment to harmonisation with the CTP)
- Distribution of competencies among the different territorial authorities (role assigned to regions)
- Shared public and private financing of the transport systems (PPP)
- Competition between private transport systems' operators
- Promotion of harmonised system architectures and technical standardisation
- Marketing aspects of information and services (Can revenues be higher than the cost?)

These issues can be discussed from different viewpoints that could either be socio-economic, political, financial or legal or from the specific viewpoint of relevant actors and organisations.

EUROPEAN UNION PRIORITIES	
PROJECT	**INFLUENCED AREAS**
High-Speed Train / Combined Transport North-South	Berlin-Nürnberg / München-Verona
High-Speed Train PBKAL	Paris-Bruxelles / Brussel-Koeln-Amsterdam-London
High-Speed Train South	Madrid-Barcelona-Montpellier / Madrid-Vitoria-Dax
High-Speed Train East	Paris-Eastern France/Luxembourg-Southwest Germany
Conventional Rail / Combined Transport: Betuwe Line	Rotterdam-Dutch / German Border (Rhine / Main)
High-Speed Train / Combined Transport France-Italy	Lyon-Torino-Milano-Venezia-Trieste
Greek Motorways	Greece
Motorway Lisboa-Valladolid	Portugal-Spain
Conventional Rail Link Cork-Stranraer	Cork-Dublin-Belfast-Larne-Stranraer
Milano-Malpensa Airport	Italy
Fixed Rail / Road Link Denmark-Sweden	Oresund Fixed Link: Kobenhavn-Malmo
Nordic Triangle Multimodal Corridor	Stockholm-Swedish / Norwegian Border, Stockholm-Malmo, Malmo-Göteborg-Swedish / Norwegian Border, Stockholm-Turku-Helsinki-Finnish / Russian Border
Ireland / United Kingdom / Benelux Road Project	Ireland-United Kingdom
West Coast Main Line (Rail)	United Kingdom

Table 6-5 : European Union Priorities for TEN-Transport

Corridors Towards The East	
PROJECT	**INFLUENCED AREAS**
Rail / Road Link Helsinki-Warszawa	Helsinki-Tallinn-Riga-Kaunas-Warszawa with Branch Riga-Kaliningrad-Gdansk
Rail / Road Link Berlin-Moskva	Berlin-Warszawa-Minsk-Moskva
Rail / Road Link Berlin-Kiev	Berlin / Dresden-Wroclaw-Katowice / Krakow-Lvov-Kiev
Rail / Road Link Dresden-Istanbul	Dresden-Nurnberg-Praha-Wien / Bratislava-Gyor-Budapest-Arad-Constanta / Craiova-Sofia-Thessaloniki / Plovdiv-Istanbul
Rail / Road Link Trieste-Lvov	Trieste-Ljubljana-Budapest-Lvov / Bratislava-Lvov
Rail / Road Link Gdansk-Zilina	Gdansk-Katowice-Zilina
River Link on the Danube	Germany-Austria-Slovakia-Hungary-Romania-Bulgaria-Moldava
Rail / Road Link Durres-Varna	Durres-Tirene-Skopje-Sofia-Plovdiv-Burgas-Varna
Rail / Road Link Helsinki-Alexandroupoli	Helsinki-St.Petersburg-Moscow / Pskov-Kiev-Ljubasevka-Chisinau-Bucharest-Dimitrovgrad-Alexandroupoli with Branches Ljubasevka-Odessa and Kiev-Minsk-Vilnius-Kaunas-Klaipeda / Kaliningrad

Table 6-6: Corridors towards the East including in TEN-Transport

6.4 Member State Reports on Network Interconnection Actions

A multitude of different institutions and actors participated in the CARISMA-Transport Management Committee meetings and the Forum discussing and elaborating on the

interconnection of long distance and regional / local networks. Relevant findings and conclusions from these discussions are summarised under three themes:

- Planning network interconnection and interchanges;
- Transport operations, management and services; and
- Policy Environments.

6.4.1 Planning of Network Interconnection and Interchanges

The common guidelines for building a Trans-European Network (COM1692/96/EC) provide a framework also for

- the integration of national networks and stepwise inclusion of intermodality and transport telematics systems;
- the development of a planning framework also for private financing, e. g. through financing models to build transport infrastructure projects; and
- the description of the networks of all modes including the interchanges, also seaports and airports, and modern management systems.

Basic elements of infrastructure planning are transport policies and transport demand. Due to increasing delays on the transport networks on the supply side, a basic policy is to promote intermodality between the networks. However first the design and operation of the individual transport system, be it rail or road, must be right before intermodality can become a reality. . (Don't people prefer unimodal journeys?). A truly seamless journey is one where there is no need to change the mode, as long as travel time and cost are competitive. The issue of planning is not to enable transport mobility, but to provide accessibility. (Shouldn't interchange points coincide with shopping, office centres, where people actually want to travel to rather than go through - i.e. be more like terminals than interchanges!).

The interconnection of networks is therefore interdependent with transport policies and transport demand as well as social, environmental, and technical framework conditions.

Contributions to the **planning of network interconnection** and modal or intermodal **interchanges** were provided and discussed in the Management Committee meetings by representatives of the following Member states: Austria, Finland, France, Germany, Italy, Netherlands, Spain and the United Kingdom[1].

The contributions from **Austria** referred to the intermodality initiatives of the Austrian Railways and an example from the main railway station in the city of Linz.

There are several activities in Austria which breathe life into the concept of intermodality, in particular from the Austrian Railways (Österreichische Bundesbahnen, ÖBB). ÖBB is undertaking a major redesign of all major stations (Bahnhofsinitiative). An analysis of the needs of the local population and the travellers showed that 30% of the growth rate in passenger transport is due to extended services (services within and in front of stations) and not more than 70% of the revenues are generated from

[1] Contributors: M Waldhoer - At, Mrs Wolf - At, Ms Piirainen - FN, M Abaille - Fr, M Coccia, M Lemessi - IT, M Lensink - NL, M Schoenharting - DE, M Leighton - UK, M Aldecoa , M Bustinduy - ES and M John Preston as CARISMA-Transport Rapporteur

the train services from origin to destination. The message for transport operators is therefore intermodality is considered to be a **revenue-creating user need** and not just a political mission statement.

Austrian Railways considers intermodality on **three levels**:

First, intermodality with respect to the **physical link** of different modes, where the major benefits for the customers are shorter distances to (?) interchanges and quicker transfer times.

This is a particular challenge for long distance railway operators, since on the one hand they have to link their systems to local transport systems and on the other hand they want to maximise synergies from network operation.

Examples of physical integration are the Park and Ride facilities of the ÖBB. There are 38,000 parking spaces already available at the ÖBB stations and 32,000 more are planned.

The newly designed railway stations in Vienna are offering the following benefits for the interconnection with Vienna's underground system, which can also be defined as common design recommendations:

- Short walking distances;
- Sheltered interchanges;
- As much daylight as possible;
- Accessible platforms;
- Additional services such as cafes, kiosks, grocery stores to support customers' needs; and
- Clear, ubiquitous sign posting.

Second, intermodality is the **co-ordination of timetables** between different modes.

This is already considered to be an advanced approach to intermodality where timetables are combined in such a way that seamless door-to-door travel without unnecessary waiting is offered to the customers. This requires close co-operation between the different transport companies.

Third, intermodality is an **integrated, intermodal information policy** where customers can draw pieces of information for different modes from one single medium.

Estimations suggest that this does not only make existing travellers happier, but attracts new customers due to reduced access barriers (up to a 1% increase is estimated).

The consideration of intermodality in the design of transport facilities is considered a prerequisite for gaining public transport users and in the long run for ensuring sustainable intermodality in Europe.

An example of efforts to integrate design and implement a regional and local public traffic network was presented for the new **main station in Linz**. The approach taken is an intermodal design for the interchanges of travellers between railways, trams, and buses within the main railway station.

Due to

- this integrated design approach
- a user oriented digital public transport information system
- new infrastructures for commuters such as super markets, shops, and offices
- modern security standards, and
- a state of the art design

benefits of the new integrated interchange at the main railway station are expected in terms of reduced travel times (-10 min.) and a reduced number of transfers for more then 20,000 travellers per day.

In **Finland** the Finnish National Road Administration has published national policy guidelines for a Transport System Plan as well as for Planning of Transport Systems in Urban Regions. Both guidelines refer to integrated planning of land use and transport as well as to intermodal transport planning.

This is expressed in the objectives and expected results of these plans:

- Fluent traffic chains by improving co-operation between modes of transport
- Synchronic planning of all modes of transport makes the system more efficient
- Interchanging places.

The **Helsinki** Metropolitan Area Council published the Helsinki Metropolitan Area Transport System Plan in 1999. Intermodal elements and network interconnections within the plan are

- Connecting the main railway line from the city to the airport
- Public transport terminals and transfer points
- Park and Ride facilities
- Road connections to the airport
- Rings roads connecting long distance and regional road networks
- Linking pedestrian town and public transport town areas.

Both national and metropolitan transport planning are focussed on the interconnection of long distance and metropolitan transport networks and the objective of striving to achieve intermodality.

In **France** several national studies are underway in the area of planning interconnection of Regional, Departmental and Urban transport networks.

The focus of the PREDIT project is the intermodal interchange and interface between transport networks. It provides detailed information on user needs such as household intermodal behaviour including actual experience and expectations from users at interchange areas.

There is a Working Group on **'Urban strategies around interchange areas'** carrying out case studies and forecasts in cities such as Toulouse, Nantes, and Strasbourg. Partners are the Ministry of transport and relevant research institutions.

A **guide** is under development for conception, achievement and operation of **Park & Ride** facilities in the Ile de France region. Criteria are

- Integration into transport policy
- Instructions about signs and markings
- Building
- Financial arrangements
- Legal arrangements.

26 case studies will be conducted in France on intermodality policies including experiments of co-operation, intermodal pricing policies, interchange areas, multimodal information as well as bike and public transport as complementary modes to road transport.

In **Germany** it can be observed that the state's influence on the interconnection of long distance and regional networks is decreasing, while private involvement is increasing. Examples were highlighted such as the airport in Düsseldorf, stations of the German railways (Deutsche Bahn AG), sections of the road network and harbours. Private-public partnerships are emerging.

A **framework for planning integrated transport networks** (Richtlinie für die Integration von Netzen, RIN) is under development. It provides a methodology for deriving a hierarchical network structure and includes all modes of passenger and goods transport as well as the interconnection of local, regional and / or long distance networks. The key content areas are:

- Systematic classification of interconnection points
- Methodology for developing interconnected networks
- Criteria describing qualities
- Recommended level of service
- Examples of best practice.

The RIN-framework will be published in the year 2000.

In **Italy** the regions are – within the National General Transport plan - the main actors for transport and mobility matters.

Management of the local mobility system in Italy is subdivided into three levels with different competencies:

Region:	responsible for all transport modes at local level
Authority:	responsible for control of system management
Company:	responsible for production of services.

Municipalities are responsible for **Urban Mobility Plans** including parking programmes. Parking projects in urban areas are funded by national law (No. 122/89). There is however no specific national law to improve interchanges. A national law

(122/89) fosters the building of parking areas targeted on the interchange with public transport and pedestrian areas.

Some regions have developed local laws, based on national law (122/89), but funded by their own budget, aimed at improving public transport services and infrastructures. Some of these regional laws aim at improving intermodality, including parking and interchanges. There are also regional laws on public transport, e.g. in Liguria, Umbria and Piemonte. Major efforts are focussed on the provision of **parking spaces** in Italy.

The transport policy in the **Lazio Region** and the Municipality of **Rome** aims at shifting a significant number of trips by car and motorcycle towards railway transport, in particular within the city of Rome. Car traffic has to be reduced, because of increasing congestion on the road network, limited capacity, lack of space available for parking areas, high cost for the construction of multi-level underground parking areas near the historical centre, and archaeological discoveries, which often cause severe delays in construction.

There is a specific programme called **'Rail Treatment'** which aims at improving rail services in the Lazio Region. This includes improvements in public transport infrastructures and services, but also fare systems for parking areas and building of new interchanges to **foster P+R** in the Region.

The programme for the construction and improvement of interchanges in the Lazio Region aims at the improvement of existing interchanges to increase intermodality and accessibility to rail transport. The programme covers 41 **railway stations interchanging with cars and buses**.

Two projects were presented with intermodal concepts:

- 'Formula', the aim of which is **fare integration** in Turin. On buses, trains and tramways in the Turin metropolitan area a special multi-modal travel card can be used.
- 'Movicentro', the objective of this project being to **improve passenger transfer facilities** in Piemonte and to foster public transport services in the region. Suitable plans for interchanges ('Movicentri') have been studied and identified. Developments of cycling parking areas as well as comfortable walkways have been analysed. Movicentri are also provided within commercial and cultural centres.

Concepts for intermodality in the **Netherlands** were presented which refer to

- Public transport modes (train, bus services, dial-a-bus services, taxis)
- Public transport and car
- Public transport and bicycle.

Tasks for the interconnection of the Main port Schiphol and high-speed rail were classified to

- Feeder functions of public transport including the HSR-network
- Transfer from air – air to air – rail

with the per-requisites: travel time, interchanges, luggage handling and ticketing.

The Madrid Regional Transport Consortium (Consorcio Regional de Transports de Madrid) in **Spain** provides one example of a public transport authority in Europe that interconnects in terms of planning and tariffs for all public transport in a metropolitan area. The strategy of the Consortium is based on three fundamental features:

- Administrative integration of all institutions and organisations connected with public transport
- Tariff integration, enabling travellers to use different transport modes (buses, underground, trains) with a single ticket
- Modal integration, enabling travellers to cover the different stages of their journey with maximum convenience.

One of the most important steps taken in recent years has been the planning of new infrastructures, resulting in the opening of an additional 38 km of underground railway with 34 new stations.

One example of a new intermodal station is the **Avenida de America interchange,** which is underground in order to create an extensive pedestrian area at street level. The interchange handles 113 million passengers a year using different Metro lines, metropolitan buses, and long distance coach services. The multi-level facility provides bays for the buses, access to the metro, shopping areas and 270 short stay and 400 long tem car parking spaces.

An innovationis the bus / high occupancy vehicle (HOV) lane in the Northwest motorway access to Madrid which promotes both public transport as well as increased car occupancy, to achieve environmental objectives through integrated infrastructure management. The performance of the facility is very satisfactory and led to an increase of car occupancy and bus use. A key element of the system has been the interchange in Moncloa, located at the fringe of the city. This interchange, with two metro lines and urban buses, serves the bus service of the corridor and has also improved information and connection between modes.

In the **United Kingdom** 'A New Deal for Transport' was issued in 1998, which sets out a new UK wide policy for integrated transport. Complementary documents are issued for Wales, Scotland and Northern Ireland with local priorities such as improved transport, interchange and ticketing, and financial incentives.

The New Deal for Transport refers to a framework of change, to improve transport choice, public transport, road networks, cycle ways, information and integration as well as reliable interchange for public transport, safe and secure transport systems, and improved environment.

Factors affecting interchange policies are considered such as:

- Easy, clean and convenient interchange essential for integrated transport network
- Importance of smooth interchange proportional to journey use and dispersion
- Within the UK interchange theory and practice is underdeveloped
- There are 3500 major interchanges in the UK.

Criteria for good practice were presented such as

- Reliability of service
- High frequency service
- Good interconnections between services
- High capacity services
- Car parking
- Through ticketing

as well as bad practice such as:

- long walking distance
- absence of car park
- lack of security
- poor infrastructure
- lack of weather protection
- poor connections.

There are a great number of project activities in the UK which consider the interconnection of different types of networks: Park and Ride, bus lanes, tram and bus interconnection, multimodal studies, integrated car park, bus and rail station. The Department of Transport (DETR) funds activities for: a Passenger Interchanges Working Party, a Project into Public Transport Interchange and a Methodology for Multimodal Studies.

In **conclusion** it can be stated that some Member states have formalised procedures for network planning such as the national **master plans** or those for metropolitan areas which also include the location of intersections within the networks. Specific intermodal design guidelines were not presented, but best practice examples demonstrate the necessary criteria for modal interconnection of networks and intermodal interchanges.

Typical intermodal interchanges or interconnections of long distance and regional / local networks are Park-and Ride facilities, city terminals where regional buses are interconnected to mass transit networks, central railway stations being interlinked with local buses, local public transport lines and Park-and-Ride.

With respect to the planning of interchanges concern was expressed that before the **optimal location** of interchanges is determined it should first be decided what the optimal number of interchanges actually is.

Caution was advised in considering the examples presented, as they are not necessarily representative. It was also highlighted that the **interchange is just part** of the transport problem and transport is just one part of the 'liveability' problem.

6.4.2 Telematics in Transport Operations, Management and Services

Representatives from Germany, France, Italy, Ireland and the Netherlands discussed the role of telematics in the interconnection of transport operations management and services[2].

In **Germany** the Ministry of Education and Research launched five key projects with a total budget of approximately 125 million Euro, with the objective of demonstrating the potential of telematics technologies to contribute to sustainable mobility in metropolitan areas by measures to unlink transport and economic growth. Field trials and telematics implementations have been organised to meet this objective in Cologne, Dresden, Frankfurt, Munich and Stuttgart. These projects are based on achievements from European RTD activities in these cities and their focus is on the implementation and organisational integration of transport management into the transport infrastructure development.

Prominent examples of interconnection of TENs are for example,the airports in Frankfurt and Dusseldorf with links to high-speed rail and regional public transport networks.

Interesting to note is the privatisation of transport facilities such as German Rail stations as well as airports. The potential for interconnection of transport and shopping is visible in this context. A need for benchmarking is recognised to define criteria and scales for measurement of the effects these new activity centres, which are in competition with urban CBDs. Expressions of interest were received, in order to learn from the experience in other Member states.

In **France** a range of telematics applications are active to promote interoperability and interconnection of networks. These include:

- Pre-trip information such as Le Pilote in Marseille;
- On Trip information at stops and at terminals including at La Defense in Paris;
- Integrated pre-trip and on trip information using pagers and GPS, like those being tried at Neuilly;
- Contact less electronic ticketing as in Francile (Paris), Valenciennes and Valence;

[2] Contributors: M. ABEILLE - FR, M COCCIA - IT, M SCHOENHARTING J - DE, M Muffat - FR, M Bootsma G - NL , M Van der Kamp - UK (1999) and M JOHN PRESTON as CARISMA-Transport Rapporteur.

- Electronic wallets as in Lyon;
- The development of hybrid cards which have both contacts and contact less functions, but these were five times more expensive suggesting an interoperability problem currently exists;
- Self- Service electric vehicles including the Praxitelle scheme in St. Quentin and LISELLE scheme in La Rochelle;
- Experiments with ramp metering and electronic tolling; and
- The PREDIT project on intermodality.

The work is documented in the Ministry of Public Works, Transport and Housing's Brochure on 'Intelligent Transport'.

In **Italy** the new National Transport plan for the year 2000 has focussed on the integration of the transport modes. One prominent example is the high-speed link between Rome and Naples, now with a travel time of less than one hour.

There is a need for the design of guidelines to ensure a national and probably a European reference architecture for telematics, for examplethe interoperability between contact and contact less electronic ticketing.

Italian research studies have identified the need to consider the relevance of different telematics measures at different levels of planning. This refers to the application of information, control, pricing and enforcement to the different levels and scale of a journey . Starting from the journeys origin via the regional network, interchange, and urban network, to the destination with a possible extension to Trans-European and international networks.

Enforcement was considered important particularly for pricing, but also for information, to ensure that operators up-date their information systems as well as for control, to ensure that road users follow the instructions they are given.

With respect to the **Netherlands** the need was stressed to provide a synthesis for policy and research developments for information, electronic tolling and chip cards.

Examples of important intermodal interchanges of the population in the Netherlands are:

Stations	HAST-East and -South
Airport	Schiphol
Transferia (P+R)	Amsterdam / Leiden
Harbour	Rotterdam / Harlingen.

The philosophy for these interchanges promoted is: 'You should not notice it in time and effort, but if you have to notice it: Make it a convenient and very good experience'.

Telematics applications in **Ireland** tend to be limited to the internal operation of a particular mode of transport. As a result there are no network applications in place or planned. Dynamic displays for passenger information exist at the central bus station in Dublin. EDI, GIS and GPS and intelligent vehicle systems are used in freight transport, but still at low level.

In conclusion the general concern was expressed that the focus of the Member State reports was on mobility rather than on **accessibility**, i.e. the ease of reaching a destination. In order to learn from past experience the following points should be observed:

- Information must be accurate;
- Information must be perceived to be accurate, i.e. it must be believed; and
- People must be able to act on this information.

This implies that if nothing is being done to improve public transport, the main responses of car drivers will be to change the route and/or the time of travel, leading again to congestion now spreading over time and space. A modal shift can only be achieved if public transport is improved including interconnections and intermodality.

To conclude, the role of telematics in the interconnection of transport operations management and services from the Member state reports, which coincides with the findings of the RTD projects EUROSIL, MINIMIZE and SORT-IT, it was stated that the priorities of telematics implementation should be in the following order:

1. Get the transport system right, including prices;
2. Get the infrastructure investment right ; and only then
3. Get the telematics right .

All this should be done simultaneously, because the tasks are inter-related and package approaches have some synergistic benefits. One has to bear in mind that time-scales for implementing telematics solutions can often be shorter than time-scales for implementing organisational and infrastructure investment solutions and tend to be more in tune with the political cycle. There are risks in over-investing in telematics as well as the current obvious risk of under-investment. A comparative analysis of Member states' experience at either end of the investment spectrum would be informative.

Telematics are potentially important in improving the interconnection of transport operations, management and services, but they should not be seen as solutions in their own right. They need to be seen as a tool in gettingtransport, and in particular public transport organisation, services and prices more in line with user requirements.

6.4.3 Policy Environments

Policy issues of planning, design, the operation of the interconnection of networks and the respective interchanges were presented and discussed by representatives

from Austria, France, Germany, Hungary, Italy, Netherlands, Spain, and United Kingdom[3].

In **Austria** a comprehensive planning process is institutionalised to produce the National Master Plan for Transport. In this plan the TENs are an integral part as well as intermodal terminals such as the new railway station at Linz. About 100 designated road and rail infrastructure projects have been identified on the national level.

Great efforts are being made to develop the transport system in Austria via new special government owned companies, to facilitate the implementation of these systems, for example, improving the national railway infrastructure ('Schieneninfrastukturgesellschaft') or the high speed rail network ('Hochleistungsstrecken AG').

A new laweffective since January 1, 2000 established the new public transport authorities in charge of infrastructure planning and tariff organisation.

In **France** it has to be differentiated between the Paris region, Ile de France, and the rest of France with respect to institutional issues. Outside the Ile de France there are not yet any institutions particularly in charge of the interconnection of networks. Local authorities manage mobility. In several places there are local associations, which assume responsibility for public transport in a metropolitan area, including interchanges. In the Ile de France, STP is the co-ordination body for the interconnection of long distance and regional / local networks.

A new law is being formulated to join authorities and operators on a regional level in a **'mixte syndicat'**. It will be responsible for public transport in and beyond an urban agglomeration, in particular for the **intermodal interchanges** and integrating land use and transport for different modes.

France favours a franchising system for public transport operation as opposed to full scale privatisation.

In **Germany** the design of the National Master Plan for Transport and the comprehensive planning process, is coordinated by the Ministry of Transport. This plan is multimodal and includes the planning of intermodal interchanges.

The major links between the long distance road, water, and rail networks as well as the major airports in this plan are part of the TENs.

Examples for multimodal interchanges that are planned include the new railway stations at Frankfurt'21 and Stuttgart'21 and also the Berlin main railway station which is presently under construction. The privatisation of the German railway infrastructure is well under way. This leaves limited resources for improvement or expansion of infrastructure.

A major activity for interconnecting different urban and regional public transport networks are the increasing number and size of public transport authorities.

In **Hungary** infrastructure planning is centralised at the national government level, with limited power and budgets distributed to the seven new regions introduced re-

[3] Contributors: M WALDHOER - AT, M ABAILLE - FR, M BRUCKMANN - DE, M MONIGL – HU, M VAN DER KAMP - IRE, M DE ROBERTIS –IT, M BOOTSMA - NL, M BUSTINDUY - ES, AND M JAMES - UK

cently. On the local level, mostly in Budapest, different agencies and offices are involved in transport planning, with no dedicated responsibility for interchanges.

Fig. 6-3 shows a visual example of all the different parties involved in planning a local Budapest interchange. The diagram shows thedifferent levels of planningand wide ranging agencies involved, from national rail operators and highway authorities to different municipal authorities and public transport operators that all would have to agree on the layout of the new station.

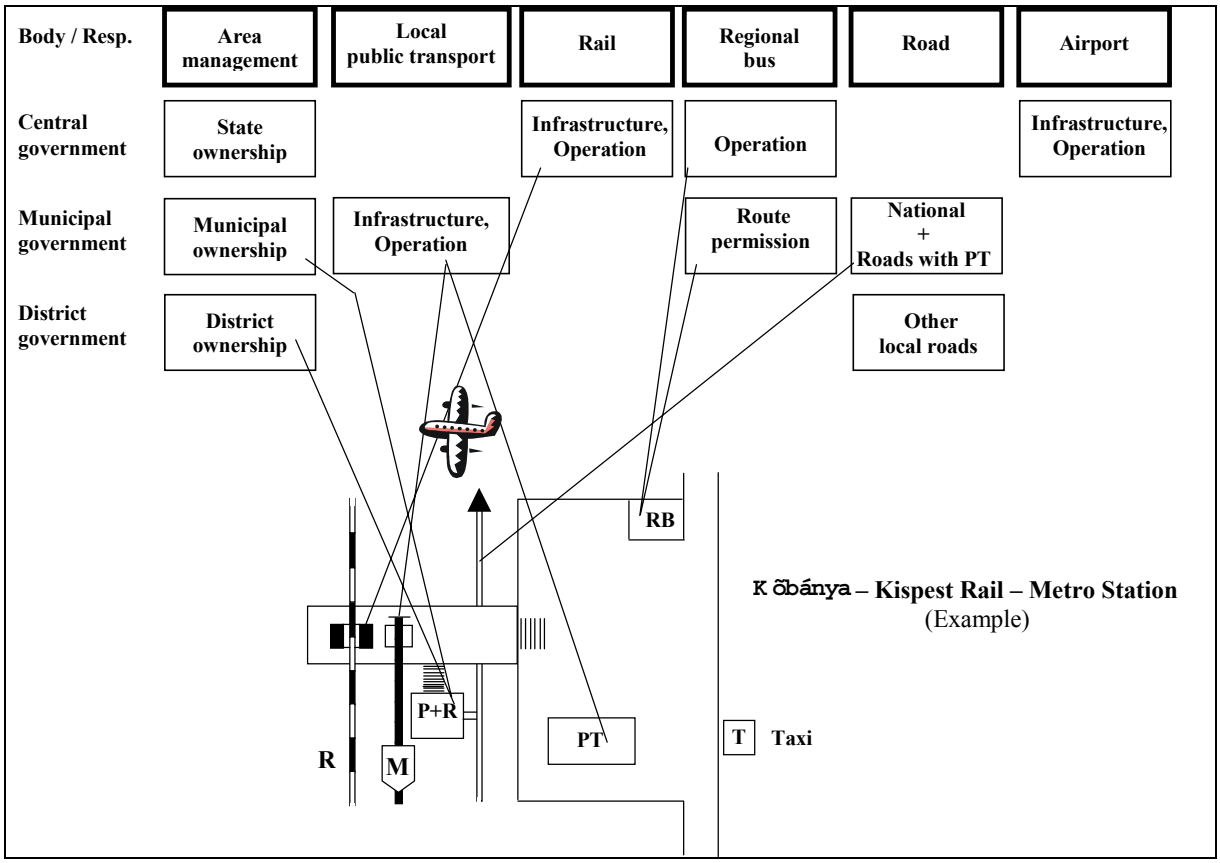


Fig. 6-3: Example for the number of parties responsible to interchange planning

A top down approach was proposed and requested for intermodal interchange design.

Despite the well known **institutional changes** in Hungary, privatisation of metropolitan transport infrastructure is not a major topic. However there are some thoughts on privatisation in regional transport, and the preparation for subcontracting of certain bus lines is under way. No opportunities are seen in the privatisation of rail infrastructure .

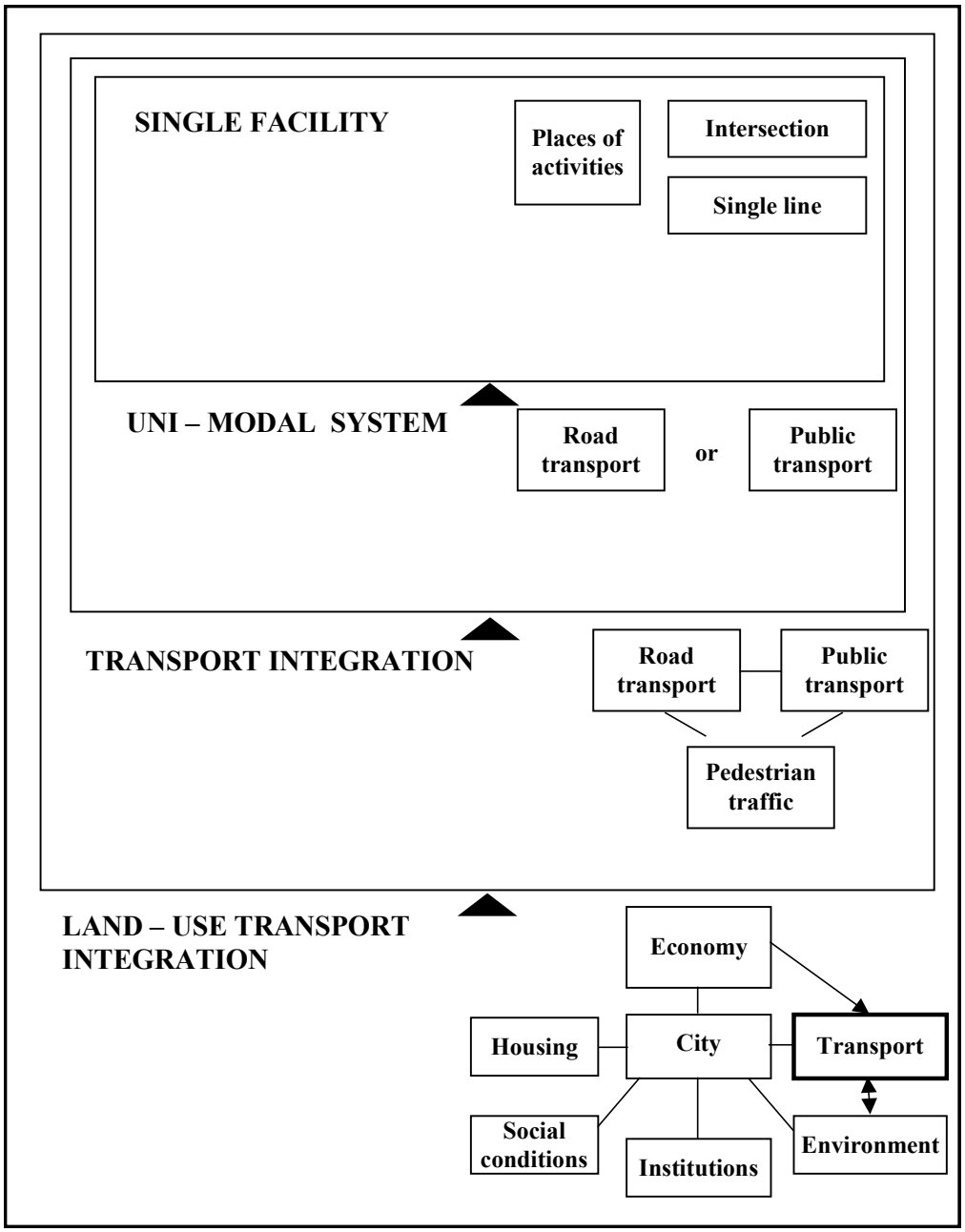


Fig. 6-4: Ideal Top down approach for intermodal planning

In **Ireland,** with just 3.5 million inhabitants and no through traffic of European scale, traffic problems are rather small when compared to other countries. First motorways have been introduced to the green island only in the eighties. Planning of transport infrastructure is rather centralised and sectoral. A national land use plan is also the tool for implementation of transport infrastructures in Ireland, while Northern Ireland has a transport plan. There is highly travelled link between Dublin and Belfast. Local levels of government are not so much involved, which leads to limited integration of transport infrastructure with local planning.

Dublin had an integrated public transport operator, that has been broken up recently, leading to competition amongst **rivalling transport (bus) operators**. As a result of EU infrastructure funding (out of the European cohesion funds) integrated, multi-annual planning was introduced, which is seen as an improvement. Work on completely new planning legislation is in progress at the moment.

In **Italy** deregulation and privatisation is under way, leading to competition in local public transport. Yet there is some scepticism of the results, i. e. will the cost savings really serve the customer needs?. National rail services are possibly to be divided into four companies responsible for operation, marketing, network and planning. The structure is not yet final.

In the **Netherlands** railway privatisation did not work out either. Initiatives and funding of interchanges come from the national level, but there are plans underway to strengthen the regional level.

There is no direct or formal responsibility in **Spain** for interchanges, even though current intermodal interchanges are more developed than 15 years ago. For example the current planning approach at the Barcelona airport extension reports where six different modes of transport are interlinked. But generally all transport infrastructure follows at present a 'first road, then rail' approach.

There are several very big interchanges planned in Madrid and Barcelona, involving the realignment of an underground line and even of a new HST line, which will eventually be connected to the local network at three stations in Barcelona. A joint project of regions and municipalities is underway with financing shared by state and municipality.

In the **United Kingdom** the Transport White Paper sets the scene for the national transport policy. The responsibility for interchanges is on the regional level. Local transport plans put down the requirements.

In **conclusion** it was observed that apparently there are close links between transport / interchange planning and land use effects, which should be considered very carefully. Transport planners should to seek assistance on the matter from urban planners, economists and ecologists to attain sustainable development in transport and mobility fields.

In all of Europe **regionalisation** is on the way, shifting responsibilities from national and sometimes local level to the regions. In some Member states regions are still in development, but the direction is clearly visible. By contrast, the responsibility for interchanges, in particular for intermodal interchanges is not defined in most countries, which probably is one of the biggest problems to be overcome in the progression towards seamless travel throughout all networks. This leads to the issueof whether Member states need EU assistance in tackling this challenge.

7 Project Conclusions and Recommendations

Interchanges between different modes or lines of transport are necessary from the supply side (operators' view) only. The traveller would most certainly prefer not to interchange at all on his journeys. From the individual user's egocentric perspective a direct means of transportation from his front yard to his final destination would be a perfect solution: this could be a HST station in front of the house on one day and an airport runway across the street on another. Limitations of available space and resources forbid point-to-point connections from every origin to every destination. Networks collect, bundle and distribute individual transport demand so that it can be met with limited internal and external costs. Interchanges are necessarysince different networks account for collection, bundling and distribution of traffic.

The best interchanges from the users point of view pass by unnoticed. Road network interchanges come closest to 'seamless travel', with drivers passing from local collector roads to main roads, from main arterials to motorways or country roads without changing vehicles, without delay, without actually noticing that they use different networks, maintained and operated by different owners. Interoperability of the system is rather advanced, with a wide range of vehicles (motorcars, trucks, coaches, bicycles, motorbikes,) equipped to use most of the road networks. Successful integration of road networks, enabling journeys closely resembling point-to-point connections to the traveller, certainly contributes to the overwhelming success of private road transport.

Integration of public transport networks is less favourable. Moving from one network into a different one always includes a change of vehicles. In most cases the traveller is required to interrupt any activity he is involved in, collect his belongings and luggage and walk himself to a different platform, vehicle or check-in counter. Since larger vehicles are more efficient (from the operator's view) than small vessels, frequency is far from continuous for most public modes of transport. Even with the best intentions on integrated schedules delays occur for the user when interchanging between modes. Public transport networks often do not stretch out to individual homes or final destinations, requiring private road transport or foot walks to access or exit the entire system. Last but not least, orientation in public transport networks (maps, schedules, signage) is more confusing than in comparative road networks. Most operators provide restricted information on their individual services, heterogeneous in device, format, design and depth of information.

While some public transport sub-systems (especially long distance HST and air transport) outperform the competing road networks on speed and comfort, public transport as a whole suffers from the imminent lack of vehicle interoperability. There is little hope that public transport can provide door-to-door transport without change of vehicles, even when some improvements can be expected in the rail sector. Specialisation of public transport modes on individual tasks requires vehicles operating on road surfaces, rail tracks (even water) or in the air. For this reason interchanges will always be more noticeable in public transport than in individual road transport. But even then there is enormous room for improvement on these interchanges, concerning all aspects from location and financing to design and operation.

Few suggestions can be made for road-to-road interchanges. The following thoughts hence concentrate on internal public transport and – to some extent – road-to-public transport interchanges. Focus of the CARISMA Transport project was on that type of interchanges.**Location** of major interchanges (especially long-distance/TEN to local/regional networks) has tremendous influence on all land-use close to the site. Aspects of alignment and transport system operation are important, but land-use changes, rising property values, development chances and employment opportunities should be considered very carefully. In that sense transport planners should closely co-operate with regional planners on the issue. The location of major interchanges is wholly a political process with far reaching long-term consequences. Transfer of best practice is very difficult due to vastly different political frameworks and constraints in each case.

Design of major interchanges is more of a technical problem. Many RTD projects provide valuable suggestions about users' needs, priorities and reasonable solutions. Transport planners, architects, civil engineers and designers should co-operate on the layout and design of interchange facilities. Copying best practice could be very valuable in some cases, but often it could prove more valuable to have a consistent system within one city/region at an acceptable level, than a melange of state-of-the art facilities not blending well.

Operation of major interchanges involves both operation of transport services and operation of extra conveniences. To provide seamless travel to the customer, it is necessary to have strong regulation (legislation), forcing all transport operators to closely cooperate. Important issues would be time tabling and shared information on high priority service disruptions.

Financing of interchanges seems to be the cardinal question. Standard interchanges (bus stops, simple underground stations) are not very interesting for private investors in most cases. Public operators have to cater for these themselves, whereas private operators will calculate very carefully the expected return of investment for every facility. Quite often a private operator will only provide such infrastructure on demand of the responsible public authority (that also finances it). In both cases revenues could be raised by advertisement or small scale retail, to reduce costs. Having a public authority owning all the infrastructure (including interchanges) and private operators paying for their use may be a worthwhile solution in urban areas. This leaves more flexibility for changing operators' contracts and more control on the quality of the infrastructure to the public authority.

More interesting (in the CARISMA context) are the larger interchanges, connecting TEN-T to local networks. Some economies of scale seem to suggest that it should be possible to operate major interchanges at a profit level. Immediate revenues should be raised from operators, retail and attached services. An interesting challenge is to regain revenues from rising land prices and economic growth stimulated by a major interchange. Very strong legislation and enforcement is necessary to involve land owners and/or developers in the transport infrastructure costs close to their properties.

At the interchanges relevant to CARISMA different financing strategies meet. Long-distance services usually operate at a profit level. Alignment and location of access points follow transport demand. Very often these services do not pay (to a full extent) for their external costs of access, like station facilities, parking spaces or local public

transport for employees and customers. The other transport partner at the interchange is local public transport, that is often strictly regulated (alignment, times of service, fares, access points) and highly subsidised. Last but not least the general public has vested interests in the quality of the interchange to encourage economic activities and public welfare in general. It is not reasonable that sheer market forces will generate the best solution in this situation.

This leads to the point of **Policies** and legislation. Since private economic goals and public welfare usually do not coincide regarding the organisation of transport. Political will defines the rules of the game. In the past this has left little for private entrepreneurs to gain, leading to heavily subsidised transport infrastructure, little competition, low efficiency and private operators covering little of their external costs. Paradigm shifts (and severe financial constraints of all public authorities) gave birth to the policy goal to reintroduce market forces to the transport sector throughout Europe. While this seems fairly reasonable for long distance and freight transport, a different situation prevails in local public transport (mainly in urban areas), where aspects of public welfare and subsistence dominate over the assignment of true costs to all transport services.

CARISMA interchanges connect two systems that are usually in the responsibility of different public authorities: competitive long distance transport, controlled to a certain extent by market forces[4]; and local public transport, regulated (and subsidised) by local political bodies. In just about every European country the respective authorities believe that the complementary system is responsible for the interchange. Local transport companies think that interchanges could well be financed by the profits gained from long distance services, while profitable private operators argue that interchanges serve the city and not their business. First of all, an agreement is required concerning the proper political level responsible for administrating the interchanges mentioned. Secondly, policy must formulate a compromise solution, that resolves private operators responsibility for interchanges without discouraging investors from operating transport services at all.

Some of the contradictions inherent in current transport supply policy become quite obvious at interchanges from long distance to regional and local services. Policy wants all public transport to appear like a monolithic system, providing smooth interchanges and seamless travel. This requires close co-operation between modes and operators, integrated schedules, common planning, marketing, ticketing and revenue sharing. At the same time policy requires private operators to compete for customers, in order to increase efficiency and reduce subsidy. To do so private operators need the flexibility to adjust supply to actual demand. They need to distinguish between themselves and provide individual, recognizable services. They have no immediate interest to closely cooperate (or even share information on performance) with competitors.

Current economic understanding is that full deregulation and market competition only works in long distance transport, while urban public transport requires coordinated planning and control, with tendering for line concessions possible. Both approaches touch at interchanges connecting long-distance with local networks. This leads to economic faults, that must be straightened by (tedious) negotiations between op-

[4] even though the framework of market competition in the transport sector is rather artificial and strongly depends on political preferences.

erators and local regulators. Profitable private long-distance operators are – naturally – reluctant, to invest into their own feeder systems, as long as they have to compete against subsidised local public transport. Conversely this raises the question as to why public money should be spent on e.g. parking facilities, (station) infrastructure or even local public transport supply, actually subsidising individual transport enterprises operating from the interchange.

There is no ready solution to the question of financing the interchanges discussed here. It may be more reasonable to have an airport providing parking facilities and public transport access at own costs than a railway company operating from a town-centre main station. As a general rule, public money will be required for any additional comfort or design elements above the minimum standard required for reasonable operation of the interchange. Even then it may be difficult finding investors willing to participate in the financing of interchanges at a substantial level.

Following the above eclectic flow of thoughts a more structured approach will elaborate on five areas of interest, for which specific recommendations can be formulated. The recommendations are organised in the following way:

- **Revision of TEN-T Guidelines:** this topic touches policy issues at the European level; and is separated from the Policy Environments section for that reason.
- **Transport Network Planning and Location of Interchanges:** one important result from the project was the understanding, that location and alignment decisions are strongly interrelated with land use effects and regional planning. As a consequence they are discussed separately from design and operation issues.
- **Interchange Requirements for Seamless Travel:** the most important results from RTD projects and current best practice on design and operation of interchanges as well as information about public transport supply are discussed here.
- **Policy Environments:** Recommendations concerning national policy environments belong to three major areas of concern: administrative responsibility for interchanges between long distance, regional and local services, financial responsibility for them and frameworks for successful, co-operative, multimodal operation of public transport.
- **Further Research and Technical Development:** this section gives some advice on further research activities required to promote even better long distance to regional and local interchanges.

7.1 Revision of TEN-T Guidelines

The TEN-T guidelines provide a framework for the development and extension of the transport infrastructure as common projects in the EU for the year 2010. The TEN-T are long distance networks connected to the regional and local networks within the Member states. The guidelines refer to the interconnection of national networks, the interoperability of national networks (ITS, trains, management), links between islands and centres (Channel tunnel), and the access to the network.

From the results of CARISMA Transport, recommendations can be derived which should be considered in the next revision of the TEN- guidelines. These refer to the

- Interconnection of the regional and local networks of the metropolitan areas with the TENs and in particular to rail and public transport networks

The requirements of the metropolitan areas in Europe, the origins and destinations of the passenger and goods flows on the TENs address transport policies, co-ordination and funding of access and terminals within and around theses areas. Focus for future transport development are the

- Location of inter-/multi-modal transfer points and interchanges (railway stations, airports, highway-interchanges, orbital motorways) within the TENs including the definition of access and their interconnection to the metropolitan areas. There appears to be a lack of formal procedures to achieve optimal interconnection considering the different objectives of the different private and public stakeholders. There is a need for tools for the assessment of the location of intermodal interchanges as well as for procedures to quantify the capacity of major transfer facilities for the optimal interconnection of the respective transport networks from a European scale.

Greater emphasis from the viewpoint of the cities has still to be given to the

- Interoperability between the networks, vehicles and technical infrastructures and the services for the traveller being information and payment systems

which asks for co-operation between the Member states.

There appears to be a need for increased public awareness-raising for the Trans-European Networks. The importance and significance of these networks for Europe and its' metropolitan areas needs to be further developed and promoted among EU cities. On the other hand there are high expectations of the associated states in the middle and eastern part of Europe that infrastructures in the defined corridors will be developed in due time.

7.2 Transport Network Planning and Location of Interchanges

Over and above meeting user requirements, the basic intention of any research in the improvement of long distance to regional and local networks interchanges is to improve competitiveness and market shares of public transport systems. However, there is serious danger, that in European reality any improvements in that field will be quickly counterbalanced by even greater investment in the competing road networks. Regional projects have tended, in the past, to be predominantly roads-orientated and often reflect, and reinforce, the process of counter urbanisation. The traffic generation and longer-term land-use effects of peri-urban projects may create significant transport problems - congestion, environmental pollution, the decline of public transport etc. - over a wide region surrounding the central city. In the absence of planning controls the spatial impact of such projects, in terms of development of the rural-urban fringe, may be substantial. Two recommendations can be extracted from these findings:

- There is a need to improve accessibility of Metropolitan Areas and promote regional traffic by building orbital roads and constrain construction of inner roads;
- The building of new road infrastructure should be limited to those cases where a reduction of traffic loads on sensible areas can be obtained, e.g. orbital roads around conurbations.

Land use changes have major impacts on transport demand and modal split. This should be highly regarded in all regional planning. Analysed RTD projects in particular provide a series of suggestions on how to avoid excessive negative impacts on transport networks:

- Multimodality, intermodality and interoperability are to be taken into account in regional and local plans as they largely affect future spatial development and increase of road transport.
- Application of strict development control measures to concentrate land use changes within existing city areas or within clearly defined new development areas such as new towns.
- Greater restrictions on developments inaccessible by attractive public transport in combination with more investments in rail infrastructure and rolling stock and investigations into demand management strategies.

On the opposite, major interchanges, especially long distance to regional and local networks interchanges, are themselves bound to facilitate and cause land use changes. While the networks' layouts and properties are largely designed according to transport demand, land use effects should be considered very carefully for the actual location of access points and interchanges. This is highlighted in the following recommendation:

- Location of major interchanges requires careful consideration of land use changes and rising property values instigated by the transport infrastructure. A capable solution harmonises the transport network layout and operational aspects with spatial planning objectives and economic stimulation.

Even perfect interchanges cannot compensate for flaws in the connected mono-modal transport networks. The order of importance calls for improvement of long-distance networks initially, followed by the upgrading of local and regional networks and consequently for the planning and design of the proper number of interchanges in the best possible location. The objective and subjective qualities of the interface should always be considered along with the quality of the transport facilities. The transport chain is only as strong as the weakest link; this could mean the quality of an interchange or the quality of any transport link involved. The focus of strategic network planning should be on (door to door) accessibility, rather than on mobility.

While some Member states have formalised procedures for network planning such as the national **master plans** or those for metropolitan areas which also include the location of intersections within the networks, there is a deficit in formal assignment of responsibility and formulated criteria for the location of long distance to regional and local networks interchanges.

7.3 Interchange Requirements for Seamless Travel

Interchange requirements for seamless travel have been described in great length in the analysed RTD projects. They can be roughly organised into recommendations regarding physical design, operation of transport services, additional services and provision of information. Only key points will be highlighted here, with more details in the relevant chapters available previously.

The most important issues on physical design are:

- Walking distances should be as short as possible when changing vehicles.
- When a change of levels is required, escalators and elevators should be provided for comfort and speed.
- Visibility axis between main destinations (platforms, entrances and exits) within the stations improve orientation and safety.
- Protection from rain, snow and wind.
- Disabled and elderly passengers have special needs concerning accessibility and freedom to move throughout interchanges.
- Natural and artificial light and cleanliness improve the feeling of safety and comfort.
- Generous space on platforms and in aisles makes passengers feel comfortable.

Smooth and integrated operation of transport services are just as important (perhaps more so) than proper physical design and layout. The RTD projects provide strong evidence that short transfer and waiting times are crucial for passenger satisfaction with an interchange. Some of the most important recommendations on successful operation of connecting transport services are as follows:

- Harmonised schedules of all modes available at the interchange to provide for short transfer and waiting times.
- Through ticketing in multimodal networks, including long-distance and local/regional services, is an essential to seamless travel.
- Proper access to and from the complete system is required to provide door-to-door travel.
- Flexible, multimodal handling of any system interruptions, consisting of information, substitute services, additional individual support and reimbursement.
- Telematics are likely to be important in improving the interconnection of transport operations, management and services, but they should not be seen as solutions in their own right. They need to be seen as a tool in assisting in getting transport, in particular public transport organisation, services and prices, more in line with user requirements.

Interchanges should be enhanced with additional services, especially when some time lag while changing modes is inevitable (airports, HST terminals). From the operators' view, retail and services provide additional revenues to the operation of the interchange.

- Linked schedules and short waiting times are more important to travellers than generous services and shopping facilities.
- Commercial activities inside the interchange can spread out to ignite or regenerate economic progress around the site.

When a public transport system is set up, it is vital that passengers and the general public are informed about the opportunities available. However, ubiquitous information cannot compensate for poor operation or the insufficient design of public transport and interchanges in particular. As a conclusion on the role of telematics in the interconnection of transport operations management and services from the Member state reports, which coincides with the findings of the RTD projects EUROSIL,

MINIMIZE and SORT-IT, it was stated that the priorities of telematics implementation should be in the following order:

1. Get the transport system right, including prices;
2. Get the infrastructure investment right; and only then
3. Get the telematics right.

New information technologies can greatly assist in spreading the information. Reliability is the key word to success:

- Information must be accurate;
- Information must be perceived to be accurate, i.e. it must be believed; and
- People must be able to act on this information.

There are further recommendations on information strategies:

- Multilingual information must be available both outside and inside vehicles and interchanges. Clear orientation within interchanges is essential.
- Information may not be limited to individual modes or operators. Real-time information systems are recommended to help in journey planning and improving connections at interchange points.
- Information systems are required that combine static and dynamic data on public and private modes (trip planning systems).
- Public Transport management systems that can assist in co-ordinating services and promoting interchanges.

7.4 Policy Environments

Recommendations concerning the policy environments suitable for better interconnection of long-distance to local and regional networks belong to three major areas of concern: Administrative responsibility for long distance to regional and local networks interchanges, financial responsibility and frameworks for successful, cooperative, multimodal operation of public transport.

Most Member states have a process of developing a national **master plan for transport**. There are a methodologies to design such plans and there are procedures to reach a consensus on the contents with the respective stakeholders involved. The **TEN-T** and their interconnection with regional networks as well as multimodal interchanges are part of these plans. The interconnections of long distance with regional and local networks are carried out in interaction with the cities and local planning agencies. **Intermodality** still appears to be in need and to be a certain gap between the co-operation of the relevant planning agencies. Major actors for intermodality are the mostly private authorities of airports and city terminals interlinking air with rail and road transport or high speed public transport with buses and trams as well as Park and Ride. Recommendations have be formulated to improve the administrative structures responsible for the Interconnection of intermodal hierarchical networks:

- Definition of the hierarchical level responsible for the interconnection of long distance, regional and local networks. This should be seen in the light of regionalisation, delegating planning and financial responsibility to the most appropriate administrative level.
- Harmonisation of organisational structures within member countries and the EU.

- Harmonisation of the regulatory framework within member countries and the EU.
- Strengthening of public involvement in planning procedures.
- *Stimulation of telematics use*

The question of financial responsibility for interchanges connecting networks of different modes and hierarchical levels is closely related. Administrative levels from the EU (in the case of the TEN-T) to local communities as well as private operators may be in involved in planning and regulation of long distance to regional and local networks interchanges. Other than network links there is no fixed or formal procedure available in the member states about sharing the financial burden of the interchanges.

- Financial responsibility for Interchanges needs to be defined in parallel to administrative responsibility. Administrative units responsible for proficient interconnection must be endowed with appropriate budgets.

The third complex is an improved framework for close co-operation of authorities and public transport operators on local and regional levels. Public Transport Associations seem to be the most efficient means to closely coordinate lines, schedules and fares of several or all operators in the same region. However, joint planning will become more difficult with privatisation and competition on the way throughout European transport markets:

- Deregulation will not facilitate smooth and seamless travel in urban areas. On the contrary, strong legislative and planning frameworks are necessary to provide an inter-operable, user-friendly, coordinated public transport system operated by a multitude of competing private operators.
- Local and regional public transport can benefit from privatisation, when the responsible authorities provide a strong and reliable framework of the services and standards required by the community. Current research suggests that tendering contracts for specific services would be the appropriate way of privatisation in local and regional transport.
- Special attentionmust be given to the co-operation of long-distance and local/regional operators, especially in the context of their interchanges. Legislative framework should guarantee a minimum level of co-operation concerning co-ordinated time schedules and fares. Joint handling of interruptions should be catered for.
- Provide legislative grounds for successful public private partnerships.
- Improve the interconnectivity and interoperability of transport networks.

As a general finding it was proposed by Member states that transport is a horizontal task for Europe. Transport problems are also cultural problems, so that within the objective of sustainable development, transport and in particular intermodal interchanges of transport networks should be developed in the context of the economic, ecological and social issues and not just of transport. It is in this way the recommendation for a close co-operation between the respective DG's with DG TREN.

7.5 Further Research and Technical Development

The main achievement of CARISMA transport has been a broad overview on current research, best practice and relevant obstacles in the field of European long distance to regional and local network interchanges. Dissemination of project findings also was a major goal of the project, which has been performed in two ways:

- The national appointees to the CARISMA Transport project have been immediately informed about the findings of the project on the occasion of four management committee meetings and two high level forums.
- Three thematic brochures, each covering relevant topics within the field of interconnection of long distance to regional and local networks, have been produced for further dissemination with all interested cities, regions and member states.

At the end of the project work it is necessary to emphasise the effective dissemination of the achieved project results. A need was seen by the Member states to be better informed of the results of the RTD projects sponsored by EC and to get easier access to the research reports. For the improvement of seamless intermodal travel throughout Europe it is necessary that those obstacles identified by the CARISMA transport project are eventually overcome; possibly by implementation of the best practice case studies portrayed in this report. Two conclusions can be derived from this:

- Thorough and lasting dissemination of RTD results and best practice identified in CARISMA transport.
- Enforced implementation of CARISMA transport results.

While the project provides a valuable overview of all the topics relevant to the interconnection of networks, there was little time and resources to provide systematic research and classification of interchanges. Visits have been paid to five selected sites only and best practice has been identified according to expert opinion. In future it will be necessary to follow a more systematic approach. This means, that different types of interchanges need to be analysed in all member countries, allowing comparisons on the basis of common quality criteria, and to define common standards necessary for the provision of seamless multimodal journeys:

- Definition of quality criteria for interchanges.
- Classification and assessment of European interchanges.
- Agreement on common standards for interchanges.

Resources are always scarce for any transport infrastructure investment. Decision-makers need solid arguments on the expected impact of any improvement discussed. In the context of CARISMA transport this means, that improvements in intermodal demand modelling and modal shift modelling are necessary, to provide a framework for optimal allocation of resources to the improvement of interchanges. A common European intermodal demand model, applicable to all Member states, would be preferable, to provide an answer on the optimum allocation of European and national funds:

- Improvement of intermodal demand modelling and modal shift modelling.

CARISMA transport has identified further research demand in some specific fields:

- For the moment static information on services and schedules is best practice in public transport. Real time information on system performance was identified as most valuable resource for travellers. Further research is required to provide this kind of information to customers and service providers.
- Privatisation and deregulation may have adverse effects on co-operation and integration of public transport services. Further research should be deployed to find out about the effects of different contracting schemes on the quality of seamless travel. Suitable forms of privatisation should be promoted as a result.
- Location of important long distance to regional and local interchanges may have immense influence on land prices and economic activities of a site. Further research should deliver a better planning framework of these effects as advice to policy makers. Also it may prove worthwhile exploring the possibilities of involving property owners in the financing of major transport infrastructure that is positively influencing property values (profit charging).

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