Towards Passenger Intermodality in the EU. Report 1: Analysis of the Key Issues for Passenger Intermodality

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Towards Passenger Intermodality in the EU

Report 1 (Final Version)

Analysis of the Key Issues for Passenger Intermodality

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Executive Summary

The Context for Passenger Intermodality on a European Level

The study "*Towards Passenger Intermodality in the EU*" (02/04-01/05) has been commissioned by DG TREN to support the development of its policy on intermodal passenger transport. This report presents the results of the first phase of the study based on a comprehensive literature review with a focus on European research. The first phase has examined:

- current status of passenger intermodality
- key issues
- barriers to implementation

Intermodality is both a technical term for a specific type of journey including several modes of transport and a policy principle. This study is guided by the following definition: "*Passenger intermodality is a policy and planning principle that aims to provide a passenger using different modes of transport in a combined trip chain with a seamless journey*." As such it can contribute to an integrated and efficient transport system which will establish networks of interconnected modes, where transfer from one mode to another is easy and comfortable and will offer more choice options to the travelling passenger.

Intermodality has been put forward in several European policy documents. The *Transport Policy White Paper (2001)* identifies integrated ticketing, baggage handling and continuity of journeys as priority aspects for passenger transport. In the follow-up of the White Paper DG TREN has put a priority on activities in the freight sector (MARCO POLO, intermodal loading units, freight integrators). A number of EU-research projects (regarding strategy, operations and design, technology) as well as standardisation activities have been carried out in the passenger domain.

With a view to the European Union remit it has been decided that the main focus for this study is the *inter-urban/long-distance dimension of passenger travel*. This includes international travel and also smaller scale cross-border traffic. Since seamless door-to-door chains and an integrated transport system are the aim, the last (urban) mile will be analysed from the viewpoint of the long-distance traveller.

Trips over long distances (> 100 km) only have a small market share of 1-2 % of total trips but account for about 20 % of person-km. They are of significance due to their economic importance, their high ecological impact and their above average growth rate. The traffic forecast of the TEN-STAC study suggests an average growth in inter-regional passenger transport from 2000-2020 of 28 % in the current member states and 74 % in the new member states. Air travel is particularly expected to grow with 88 % and 133 % respectively (European Commission 2003, p. 17).

A larger number of long-distance trips is for private reasons (31 % holiday, 47 % other private trips), whilst the share of business trips is 22 % (EU-15). Private car use is prevailing with 65 % of all long-distance trips, followed by aeroplane 14 %,

train 12 %, bus 6 % and other modes 3 %. There is a strong asymmetry both in mobility rates and in travelling intensity. In Germany, for example, only 10 % of the persons account for nearly half of all trips. In general the data availability for specific intermodal issues is rather weak.

Intermodal passenger journeys can include a range of different mode combinations. In order to arrive at priorities for a supporting policy several principles can be applied. Assessment methods for the specific benefits of intermodal measures are widely lacking. A look at costs and benefits must include total cost including externalities. European studies of total costs of transport modes consistently show rail to carry easily the lowest external costs, significantly below car and air modes. Therefore the *long-distance rail mode* should be preferred in transport policy. Both at international and urban/regional level the integration of rail into the transport systems is still neglected and concrete measures to improve this situation still have to be taken, which is generally realised on the European level. This includes interoperability as well as the intermodal combinations of air and rail, rail and urban public transport, cycling and walking as well as car access to long-distance trains in an integrated system. Priority setting must further acknowledge the contribution to other Community objectives such as economic and social cohesion, accessibility, European competitiveness or the protection of the environment.

Quality Elements of Seamless Journeys and Barriers for Implementation

In order to offer a seamless journey the *product of "passenger intermodality"* consists of several elements which need to be strengthened and integrated:

1. *Networks and Interchanges*: Infrastructure networks must be interconnected and interoperable. Within the physical transport infrastructure especially the rail network, which is a key element of intermodal long-distance passenger transport, still presents many problems of interoperability and can in many parts be characterised by a lack of integration with other modes of transport (e.g. air-rail, rail-urban public transport). Transport services of different public and private operators need to be co-ordinated to satisfy the passengers demand for a flexible, convenient and fast transport system. Especially with regard to the competition with the private automobile public transport services need to be improved in an integrated and customer oriented way, spanning over different levels (urban, regional, national, European). As a mode transfer results in a loss of comfort and/or time or involves a higher cost, interchanges are central elements within this field. Their quality in both physical design and operational integration (including co-ordinated management of interruptions) has a very strong influence on the quality of the intermodal journey.

2. *Door-to-door Information*: Integrated and real-time door-to-door information systems (both pre-trip and on-trip) are a key tool in developing workable and attractive long-distance and European passenger intermodality. Technology is a major driver of progress in passenger information. Information is often available only separately per mode and per network hierarchy level. Much progress on integrated information systems has been made at the regional/urban level, but there is no equivalent intermodal structure that would promote integrated information at national or European level.

3. *Tariffs and Ticketing*: Organisational and technical aspects are strongly interrelated. Technical solutions to the problem of integrated tariffs and ticketing (including booking and payment) are already available and will be further devel-

oped. Advancements in card technologies make electronic payment a viable option but could be impeded by a lack of a common European smart card system. Therefore standardisation in this field has to be considered as a high priority. The main obstacle is a lack of co-operation among stakeholders, especially for long-distance and border crossing journeys.

4. *Baggage Handling*: Baggage handling is a specific burden for the elderly, travellers with children, persons with impaired mobility and those with heavy luggage. Solutions to baggage handling problems are still unsatisfactory but in the field of air-rail interesting concepts, e.g. check-in at the rail station, have successfully been implemented. It has to be further evaluated in which areas and transport chains baggage services are financially, organisationally and technically feasible.

5. *Promotion of Intermodality*: While it is essential to improve all parts of the transport chain it is also necessary to promote intermodality. Techniques of awareness raising through general campaigns and mobility management at individual and site level (e.g. through the employer for business trips) can be used to influence travel behaviour. Target group orientation is a governing principle but there is a lack of sufficient survey data for a market segmentation. For intermodal, especially long-distance and international journeys, it is not obvious who should take the initiative.

Societal and demographic developments of course play an important role when looking at the elements of a seamless travel chain. Demographic change and more concretely the ageing of the population for example are leading to different travel patterns and specific requirements with respect to intermodality. Not only elderly people but also the group of mobility impaired travellers in general needs special attention regarding baggage handling, accessibility of interchanges, user-friendliness of information systems and many other fields. Of course measures taken to facilitate easy intermodal travelling for elderly and mobility impaired people, in many cases also contribute to an easier seamless journey for other passenger groups and should therefore not be seen as only target group specific.

After having assessed the user needs and current status for the key elements of intermodal travel, the study moves on to identify *major barriers for the implementation* of intermodal solutions. These concern policy, planning and design issues, co-ordination and co-operation, legal issues, financing, technical issues and language.

Some of the relevant *obstacles* involve, among other things, a lack of:

- lobby support for intermodality (compared to single modes)
- data availability (market data, cost/benefit, evaluation)
- putting user needs regarding interchanges into practise
- network level planning of interchanges
- co-operation in a difficult multi-stakeholder and/or competitive environment
- successful business models for intermodal information systems

To improve the situation considerably a holistic approach with a strong combination of measures would be favourable. The potential technology base and also the user

needs assessment are quite well advanced. It is therefore necessary to concentrate on a number of *implementation gaps* regarding services and infrastructure, including, for example, integrated information systems (national/international, multimodal, real-time, disruptions) or user-friendly interchanges (security, accessibility, short transfers, intermodal management of disruptions etc.).

Priorities from a European Policy Perspective

Policy development has to account for large-scale trends such as demographic change, market opening for public transport services, increasing air travel volumes or the enlargement of the European Union. The current understanding of the subsidiarity principle gives the EU limited scope to systematically influence national and urban systems unless directly related to the principle of European cohesion or as a condition on financing of measures related to social policy. As the Commission can only act where a real need for Community rules and common action can be proven, it is likely that the European approach to influencing passenger intermodality should be top-down in fields with a clear European interest: reviewing the European corridor focus of transport cohesion by applying the door-to-door principle of intermodality to its logical conclusions and defining strict requirements of door-to-door European systems. This of course is a challenging task and concrete strategies and actions still will have to be defined within the further work on this study (especially in the proposals phase).

Possible *measures* on a European level include regulations, funding, standardisation activities, research or the exchange of best practice. More emphasis might be placed on regulation topics and opportunities of direct intervention. Nevertheless, the long-term impact of policy recommendations, research and standardisation support can be great, and these issues will not be sidelined.

In terms of services and infrastructure, more natural points of stronger European intervention are holistic services such as information and ticketing systems, and therefore the successful implementation of these will form a greater priority in the study than issues of interchanges. Nevertheless, interchanges as key elements for intermodal passenger transport are an important target for standardisation work. With regard to mode combinations, the air-rail combination will receive special attention as it is closest to the European remit, with a large international market.

The study will move on to the second phase, the analysis of the national level. Here studies, legislation and good practise will be collected across Europe and in Japan. The work will be guided by the key issues identified in this report.

Structure of the Report

The following report provides the results of the first phase (Analysis) of the Study "Towards Passenger Intermodality in the EU". It is structured as follows:

Chapter 1 characterises the context for passenger intermodality policy. It defines the concept, looks at the current market for long-distance travel (including some of the most important driving forces) and gives a short summary of European activities to date.

Chapter 2 considers how to define the priorities to guide an intermodal policy. The issue of costs and benefits is equally important as the contribution to other policy objectives.

In *Chapter 3* the resulting aims and the scope of the study are briefly described as well as the methods that were used in this first phase.

Chapter 4 discusses the relevant modal combinations and highlights some initial issues with respect to policy and implementation.

Chapter 5 analyses the need, current status and important implementation issues for the core product of "intermodality". This includes networks and interchanges, information, ticketing and baggage. It highlights the need for promotion to influence user behaviour.

Chapter 6 builds upon the earlier chapters by identifying several relevant barriers for the planning and implementation process.

Chapter 7 draws together the key findings and presents the conclusions.

In *Chapter 8* an introduction is given on the next phase of the study – the national inventories across Europe and in Japan.

The *Annex* contains a list of 39 key issues as well as a summary of relevant sources of information. The focus is on the European level as most of the national studies will be reported during the next stage.

1. The Context for Intermodal Passenger Transport in Europe

1.1 Intermodality: Concept and Status

Intermodality, which describes both a policy objective and a quality of the transport system, has evolved into a major focus for the European and also national transport policies, especially within the last ten years. Whereas intermodality in freight transport is being promoted with a number of concrete initiatives on a European level (e.g. MARCO POLO programme, intermodal loading units, freight integrators), *passenger intermodality* has not yet received the same attention.

For freight transport the international bodies United Nations/Economic Commission for Europe, European Commission and European Conference of Ministers of Transport have precisely defined the relevant terms of multimodal and intermodal transport (UN/ECE, ECMT, EC 2001). For passenger transport this work is missing.

The European research project SORT-IT[1] provides the following definition for intermodality, which specifies the technical dimension of the term:

> "A route of an individual passenger or goods unit consisting of a combined chain from origin to destination involving at least two different modes (excluding walk for passengers)" (SORT-IT 1999, p. 105).

But intermodality is not only a technical term for a specific type of journey. It is also a planning principle. In the following definition from the USA we find a basic understanding of intermodal transport offering a quality to the user:

> " [...] the shipment of cargo and the movement of people involving more than one mode of transportation during a single, seamless journey (Jones et al. 1999).

'Seamless journey' is a key term in this definition as it pinpoints the basic issue underlying the intermodal concept in passenger transport: a transport system which can establish networks of interconnected modes, where transfer from one mode to another is easy and comfortable. Such a system will offer more choice options to the travelling passenger.

The following new definition that will guide the work on this study combines both dimensions to offer a holistic view on passenger intermodality. It integrates the policy and the customer viewpoint:

> "Passenger intermodality is a policy and planning principle that aims to provide a passenger using different modes of transport in a combined trip chain with a seamless journey."

[1] Strategic Organisation and Regulation in Transport (SORT-IT; 1996-1999).

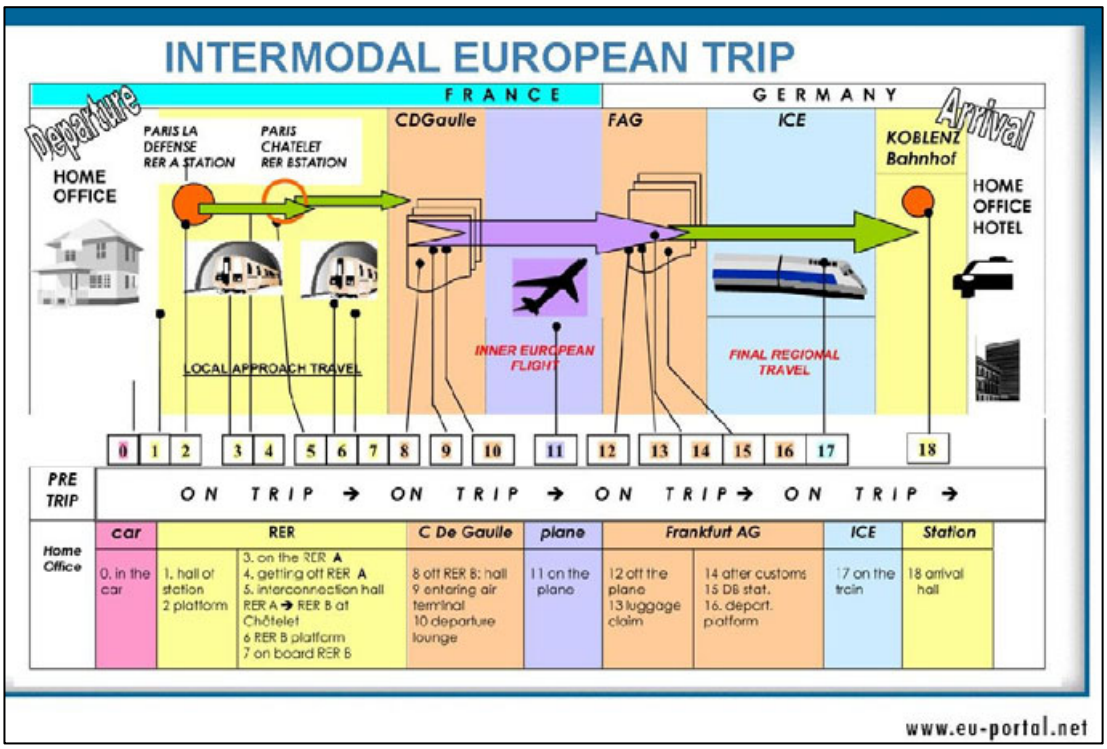

Fig. 1: Example of an intermodal European trip chain (PORTAL 2003)

By definition intermodality refers to the use of different modes on the same door-to-door journey. Public transport is generally regarded as one mode in the sense of the definition. However a journey with public transport often includes an interchange from long-distance to local train or from train to bus. Broken travel chains therefore are existing in (long-distance) public transport journeys (e.g. due to missing European interoperability in the rail system). This is generally not regarded as intermodal transport but faces similar situations and challenges.

Preconditions for true intermodality are therefore closely connected with the terms of interconnection and interoperability (SORT-IT 1999, p. 105):

> *Interconnection*: Connections between international, national, regional and local networks (for users), both within and between modes.
>
> *Interoperability*: Ability of national and geographically defined transport networks to provide efficient operations and services across national borders and across physical and technical barriers respectively.

Door-to-door trips including several modes of transport can constitute complex trip chains, which create high demands on the interfaces and operational integration of the transport system (cf. Fig. 1). If these demands can be met a higher degree of intermodality promises the following benefits:

1. Intermodality increases the chances for a *re-balancing of modes* through supporting strong linkages e.g. with the public transport system. A reduction of negative social and environmental externalities can thus be achieved in a potentially cost-effective way.

2. A well-balanced and (physically and operationally) integrated transport system offers *increased choice* to the passenger and can foster mode use according to strengths and compensate for weaknesses.

3. More seamless journeys will lead to a *higher efficiency* of individual trips but also of the system as a whole (in the sense of total socio-economic costs).

4. Increased choice and efficiency can counter existing *capacity problems* (especially in the air and road networks) of current modal and loosely connected networks.

5. Finally, a better-organised transport system contributes to the main Community objectives *competitiveness*, *employment, sustainable development* and *territorial cohesion*.

The current status of intermodal passenger transport shows that there is still a way to go in order to achieve these benefits. A *mode transfer* often results in a loss of comfort and/or time or involves a higher cost. One of the reasons for an increasing market share of the private car across most of Europe is its ability to provide (nearly) door-to-door transport – despite the problems with congestion and parking in many urban regions. The High Level Group on the TEN-T network (Van Miert group) recognises in its report that a lack of interoperability for intermodal transport systems is among the reasons for congestion in Europe (High Level Group 2003, p. 13).

The effort to improve intermodality involves many issues that will be addressed in this report. Planning and location of suitable infrastructure networks and their interconnection is only a first step. Interchanges must be developed for a smooth transfer of modes. A high quality of integrated services is needed to assist the traveller in his or her journey ranging from door-to-door information to integrated fares, ticketing and payment systems to baggage handling for the full trip chain. The implementation raises several issues from a thorough assessment of user needs, the coordination and co-operation of operators (and authorities), the diffusion of technical standards to the provision of financial resources from both public and private sources.

The political will for intermodality and consequently introducing the right policy frameworks with regard to institutions, regulations, funding and other activities is a pre-requisite for the promotion of intermodality. These framework conditions differ greatly among the European countries. The second phase of this study will therefore investigate the situation on a national level. The role of the European level in fostering intermodal passenger transport is the main focus of the study as a whole.

1.2 Intermodality and the Long-distance Passenger Transport Market

The Current Market

While intermodality generally implies the use of two or more transport modes on one trip, intermodal passenger travel includes very heterogeneous trips depending on trip length and mode use. For this study the focus will be on long-distance interurban travel including international and cross-border travel. For long-distance interur-

ban trips combinations of rail, air and road trips form the majority of the market. For specific purposes, e.g. tourist travel, additional combinations, e.g. with bicycle or ferry, come into play. International and cross-border travel have further implications with regard to international co-ordination and overcoming language barriers.

Trips over long distances only have a small market share of the total trips. The German mobility panel[2] for example, shows that only 1,3 % of all trips are longer than 100 km (Last et al. 2003, p. 267). But nonetheless they are of specific significance due to their economic importance, their high ecological impact and their above average growth rate. For the European level the long-distance inter-regional segment is a primary focus, as the European policy must be concerned with territorial cohesion, the internal market and the connectivity of the community area. Surveys conducted by Eurostat in seven member states showed that long-distance travel accounts for around 20 % of the total person-kilometres (Eurostat 1999, p. 6). The traffic forecast within the current TEN-STAC[3] study (trend scenario) suggests an average growth in inter-regional passenger transport from 2000-2020 of 28 % in the current member states and 74 % in the new member states (TEN-STAC 2003). Air travel is forecast to grow particularly strongly with 88 % and 133 % respectively. For these estimates the assumptions about economic growth have been rather conservative.

For the above-mentioned pilot studies a long-distance journey was defined as being *more than 100 km* from the origin[4]. In parallel the MEST[5] project developed a common European standard method for travel surveys and confirmed a one-way distance of 100 km as a minimum to speak of long-distance travel (cf. Axhausen et al. 2003). The DATELINE[6] project (under the 5th Framework programme) has applied the MEST-methodology and carried out surveys in all 15 member states plus Switzerland in order to create one single harmonised long-distance travel database (cf. Brög et al. 2003). The surveys were carried out in 2002/03 under a common methodology and included a net sample of nearly 87.000 persons equally spread over NUTS-1 zones. Some key results can only be briefly presented here, but give a good background to the market of long-distance travel (cf. Dateline 2003, Ch. 3):

- 57 % of the respondents have made at least one long-distance journey in the last year (51 % a holiday trip, 18 % another private trip, 5 % a business trip – multiple answers possible).This share ranged from 41 % in Portugal to 71 % in France.

[2] The German Mobility Panel (MOP) is a survey of mobility behaviour that surveys information from the participants by means of a seven-day 24-hour diary each year over a time span of three years. MOP contains data regarding all modes of transport, including also walking and cycling. Intermodal travels, defined as the use of at least two modes of transport in one journey excluding walking, were analysed as well. In 1998 only 4% of all journeys (both short and long-distance) were intermodal according to the aforementioned definition.

[3] Trans-European Network Scenarios, Traffic Forecasts and Analyses of Corridors (TEN-STAC).

[4] For a long time there has been no European standard definition for long-distance travel. Also the data availability on this travel segment has been rather poor. The above-mentioned work by Eurostat in the late 90's showed that regular surveys on short distances and daily mobility existed in many member states but few for long-distance travel. Furthermore the existing surveys were not comparable due to heterogeneity of methods (Eurostat 1999, p. 5).

[5] Methods for European Surveys of Travel Behaviour (MEST, 1996-1999).

[6] Design and Application of a Travel Survey for European Long-distance Trips based on an International Network of Expertise (DATELINE, 2000-2003).

- The average person in the EU-15 undertakes 3,2 long-distance trips per year (0,9 for holidays, 1,3 for other private reasons, 0,6 for business and 0,4 commuter journeys). The frequency ranges from 1,3 in Italy to 5,0 in France.[7]

- For the EU-15 the share of business trips is 22 % (ranging from 8-25 %), 31 % are holiday trips (ranging from 18-54 %) and 47 % are other private trips (ranging from 38-60 %). Commuting trips have been left out, as in many countries the reported number was very small.[8]

- Private car use is prevailing with 65 % of all long-distance trips, followed by aeroplane 14 %, train 12 %, bus 6 % and other modes 3 % (see Fig. 2, next page). As generally only the main mode has been analysed so that no statement can be made for intermodal trip chains. A differentiation by trip purpose shows that the car clearly dominates the other private trips, while air travel is increasingly important for holiday travel and the train is used more often for business trips than for the other purposes.

All numbers presented here are European averages. Country comparisons show considerable differences in the EU-15. The share of persons who travel long-distance and the frequency of longer distance journeys are lower in the Mediterranean countries than elsewhere. In the larger countries (e.g. United Kingdom, France, Finland, Sweden) the share of business trips of all long-distance trips is significantly higher than in some of the smaller countries (Ireland, Netherlands, Switzerland) due to the fact that economic activities are more geographically spread. For the Candidate countries the basis for comparable data is low. Transport statistics show a general development away from public transport to more private car use, which is of course an unfavourable condition for the promotion of intermodal passenger transport.

Averages hide one of the most important facts in long-distance travel: there is a strong asymmetry both in mobility rates and in travelling intensity. *Few persons travel the most kilometres.* The German project INVERMO is using longitudinal panel data and has found that 10 % of the Germans account for almost half of all long-distance trips – the most mobile percent travels ten times more often than the average (Last et al. 2003, 270). There are two main segments: persons who travel long distances for private reasons and seldom for business (71 %) and those vice versa (17 %). With regard to intermodal travel about 60 % of the long-distance travellers have a monomodal travel pattern, 75 % of these using only the car. The other 40 % travel multimodal. In general not even 25 % of all respondents have considered alternative modes before the journey. The multimodal group is highly mobile and could be the target group and motor for intermodal innovations.

[7] In the Working Group on Passenger Mobility Statistics (April 2003) this figure was debated as it seems to be lower than expected. Differences in methodology and definitions lead to higher figures in national surveys.

[8] In the USA commuter trips play a far larger role. In comparison the trip purposes are: business 16 %, holiday and other private 56 % and commuting 13 % (all trips > 80 km; U.S. Department of Transportation 2001/2002).

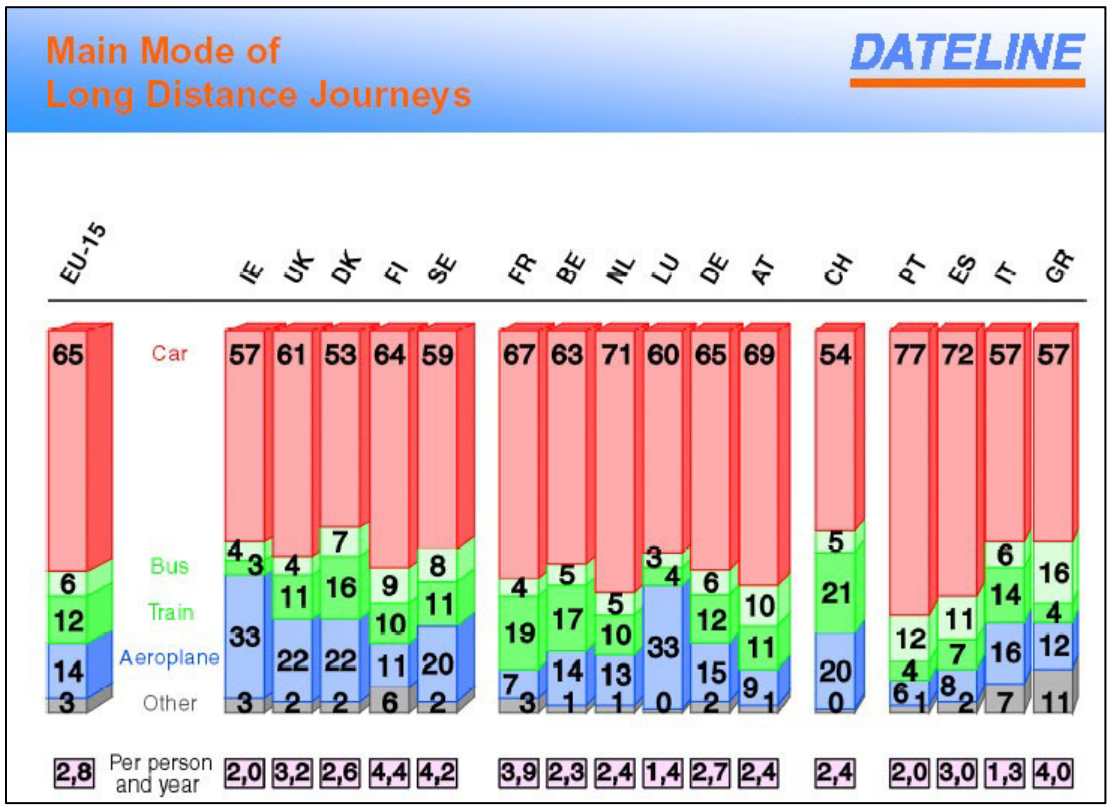

Fig. 2: Main Mode of Long-Distance Journeys (Sammer 2003, p. 21)

The study concludes that multimodal travellers are the spearhead of a changing market. To provide them with truly integrated services will be the challenge for transport professionals. On the other hand, the large group of monomodal car travellers must provide the most scope for significant modal shift to more sustainable intermodal combinations.

Data availability on the relevant market segments is a prerequisite to knowledge of user needs. A strong orientation on user needs will enable operators, service-providers and authorities to offer quality intermodal opportunities that can compete with monomodal travel options. Regarding long-distance travel, despite the Dateline surveys there is a lack of data with sufficient quality and level of detail, especially with regard to intermodality. Knowledge about user groups and their reaction to possible policy changes and service offers is vital for the introduction of new measures.

Societal and Political Developments

The development of the market and the demand for intermodal passenger transport is influenced by several *societal and political developments*. Some of the most important driving forces to mention are:

- *Demographic change*: Ageing of the population in many European countries leads to a higher number of elderly passengers with specific requirements. Data shows that the elderly are less inclined to undertake long-distance travel; those who travel have specific requirements with regard to intermodality, e.g. baggage handling across the whole trip chain.

- *Market opening for public transport services*: currently policy makers foster competition especially for public passenger and rail transport. Increased competition will not necessarily result in closer co-operation of operators. The right framework conditions are needed to ensure intermodal integration in competitive markets.

- *Increasing air travel volumes*: Air travel, especially by low-cost carriers, is increasing, which leads to problems in airport and air space capacities in many (metropolitan) regions. There is a need to develop comparable rail solutions to replace short hops and medium distance trips. Furthermore low-cost carriers often operate from smaller peripheral airports, which are not interconnected well with the other modal networks.

- *Enlargement of the European Union and free European market*: The enlargement process leads to specific requirements for cohesion and integration also in the transport sector. Intermodal solutions are part of the picture and should figure prominently within the Trans-European Networks. New member states with different transport systems need to catch up, while facing lower buying power.

- *Public resources*: Public expenditure volumes are increasingly under pressure. This might lead to a situation where it becomes problematic to assure the funding of the necessary infrastructure and interconnections. This is a specific problem in the new member states where infrastructure needs modernisation.

- *Technological progress*: The increasing use of information and communication technology such as wireless communication, smart cards, Internet, GPS or mobile computing will aid the development of intermodal services. They will make travelling more comfortable and easy especially with regard to information availability.

1.3 European Policy and Activities

Policy and Financing

The Treaty of Maastricht has reinforced the political, institutional and budgetary foundations for the *Common Transport Policy*. Particularly in the field of long-distance and international transport the European level plays a central role. With regard to the subsidiarity principle the Commission must always demonstrate that there is a real need for Community rules and common action. In the case of transport policy the powers of the European institutions are rather far reaching though.

Intermodality, as a possibility to offer alternatives to growing road transport with its congestion problems and negative environmental and social impacts, evolved into a major policy objective during the 1990's. In the *Green Paper on the impact of transport on the environment* (COM(92)46) a better linkage of the different stages of the (urban) journeys was proposed.

The *Green Paper on the Citizen's network* (COM(95)601) was the first policy statement on public transport. The paper suggests ways of making public passenger transport more attractive and usable, putting the needs of the passenger at the centre of decision making. The requirement for integrated and intermodal services is one of the issues covered. Transport planning should include the use of intermodal

techniques (for example, interchange terminals, through-ticketing). With respect to this, research and development, a new task force on intermodality and Community co-financing from Regional Development funds are among the proposed Community activities.

The *Task Force on Transport Intermodality* (1995-1997) brought together users, transport operators and suppliers, authorities and infrastructure providers. Its aim was to contribute to the development of technologies, systems, innovative concepts and strategies that improve the intermodal transport operations in the field of passenger and freight transport. It focused on stations, ports, airports and inland terminals where freight or passengers change transport mode and on other aspects of the intermodal system such as transfer technologies and telematics tools. The main output of the *Task Force* was to form a European research road map, which was subsequently applied in the 4th and 5th framework programmes.

The Gothenburg European Council in 2001 placed a strong emphasis on *sustainable development* as a horizontal issue to be integrated in all European policies. A shift in the balance between modes of transport is at the heart of the sustainable development strategy.

In the same year the *White Paper* (COM(2001)0370) set the course for European Transport Policy until 2010. Intermodality plays an important role in the concrete proposals of the White Paper, although a larger part refers to intermodal freight transport. Regarding passenger intermodality the White Paper contains three priority aspects: integrated ticketing, baggage handling, and continuity of journeys.

In the implementation and follow-up of the White Paper DG TREN has put a priority on activities in the *freight sector*. The MARCO POLO programme (adopted in 2003 in succession of PACT; € 103 million for 2003-06) supports actions that contribute to maintain the distribution of freight between the various modes of transport at 1998 levels by helping to shift the expected aggregate increase in international road freight traffic of 12 billion tkm per year to short sea shipping, rail and inland waterways or to intermodal combinations in which road journeys are as short as possible. Recently a proposal for standardisation and harmonisation of Intermodal Loading Units has been proposed. The Commission supports the notion of freight integrators as schemes to foster intermodal transport through better information and organisation.

Developing *Trans-European Transport Networks (TEN-T)* is a prime responsibility for the Community in order to achieve goals of economic and social cohesion while contributing to sustainable development at the same time. This includes access and interconnection. Community guidelines have been amended in 2001 to include intermodal terminals (mainly freight) and achieve a truly multimodal strategy. The report by the High Level Group (Van Miert Group) in June 2003 reinforces that a rebalancing of modes needs a more vigorous promotion of intermodality: The TEN-T should not be restricted to physical infrastructure but supported by active policies on intermodality (High Level Group 2003, p. 28). Multimodal traffic management is among their main recommendations. In the current revision of the guidelines, intermodal transport and the linkage of networks, especially air and rail in the passenger sector, are among the priorities.

The main Community financing tool for developing the TEN-T is the Cohesion Fund for infrastructure investment and the TEMPO programme for co-ordinated development of transport telematics on the TEN-T corridors. Along with structural funds including the regional development funds ERDF for regional infrastructure, these

sources offer a theoretical possibility to set the basis for Community co-finance for projects containing integrative intermodal features. Transport is also a part of the Interreg Initiative (funded under the ERDF) to stimulate cross-border, transnational and interregional co-operation. Intermodality compliance can be used as a funding lever in all of these funds. In practice, though, in the 1990's the large majority of transport financing from the Cohesion and Structural Funds and the TEMPO programme was used for isolated monomodal road (and increasingly rail transport projects) at different network levels and very little for projects with any intermodal integrative concept.

Research

In the intermodal passenger sector the focus so far has been on *research* following the recommendations of the *Task Force on Transport Intermodality*. Under the 4th and 5th Framework Programme several projects were carried out dealing with intermodal passenger transport (see Annex for short summaries). One focus was on a more strategic level (e.g. EUROSIL; MINIMISE; TENASSESS; INTRAMUROS, INTERCEPT, SORT-IT, STEMM), the other on a more operational level focusing on interchanges and terminals (e.g. GUIDE; MIMIC; PIRATE; EMOLITE; HSR-COMET, SWITCH). CARISMA-Transport[9] was a concerted action which gives a good summary of the research work and further recommendations for linking long-distance transport as does the VOYAGER[10] project for the overall concept of seamless intermodal transport from the viewpoint of public transport.

For research and demonstration on technology solutions and user-needs in relation to telematics, especially electronic ticketing and information systems, valuable work was done in the IST programmes, especially the TAP-T[11] programme of the 4th Framework Programme. The IST Support Measures CODE[12] and ROSETTA[13] draw together the results and findings of these transport telematics projects. The recently completed ATLANTIC[14] project looks in detail at best practice and the issues of implementing multimodal traffic and travel information systems. At the European level, first attempts to create European intermodal information systems have arisen within EU-SPIRIT[15] and TRANS-3[16] (Trans-Basel).

Standards

The European standardisation body *CEN* has several technical committees that work on intermodal issues, e.g. TC 278 (Road transport and traffic telematics), TC 320 (Transportation logistics and services). Of specific interest is the working group CEN/BT/WG 141 “Intermodal and interoperable transport – Telematics” formed in 2002. CEN co-operates with other European standardisation bodies such as

[9] Concerted Action for the Interconnection of Networks- Transport (CARISMA-T; 1998-2000).

[10] Vehicle for Mobility Advancing Public Passenger Transport in Europe (VOYAGER; 2001-2004).

[11] Telematics Application Programme – Transport (TAP-T; 1994-1998).

[12] Co-ordinated Dissemination in Europe of Transport Telematics Achievements (CODE; 1998-2000).

[13] Real Opportunities for Exploitation of Transport Telematics Applications (ROSETTA, 1999-2002).

[14] A Thematic Long-term Approach to Networking for the Telematics and ITS Community (ATLANTIC; 2001-2003).

[15] European system for passenger services with intermodal reservation, information and ticketing (EU-SPIRIT; 1998-2001 as research project, initiative continued).

[16] Multimodal travel information service for trinational regional transport (TRANS-3; 2000-2002).

CENELEC (electro technical) and *ETSI* (telecommunications). The ICT Standards Board (ICTSB), which is an initiative of CEN, CENELEC and ETSI, has formed the Intelligent Transport Systems Steering Group (ITSSG) which co-ordinates specification activities for Intelligent Transport Systems (ITS) and aims at a well-structured and consistent set of standards in this field.

Passenger Intermodality Priorities

To aid this study it is important to identify priority issues for an intermodal passenger transport policy. For these purposes different criteria can be applied. The analysis of costs and benefits is one, the contribution to horizontal policy objectives another. The role of the EC compared to that of the national, regional and local levels will also be discussed briefly.

2.1 Costs and Benefits

The aim of this study is to create a basis for an EU work plan which will address the vast subject of intermodal passenger transport. It requires the consideration of costs and benefits of intermodality measures, which, without doubt, is a highly important aspect. *Cost-benefit analysis* can serve to back up specific policy aims and to create a priority list of possible actions.

The topic however is complex and many questions arise within this context that can not be easily answered since necessary data, methods and case studies are still unavailable for many important fields.

Among the most important cost benefit issues for intermodal passenger transport is the general question of which modes or mode combinations in an intermodal travel chain should be promoted when considering the *true costs* (inclusive external costs[17]) of transport, and on a more specific level the evaluation of concrete costs and benefits of certain intermodal investments against those of single mode infrastructure investments.

External costs of transport play an important role in the political discussion. However, in the context of the study the individually felt benefits or disadvantages (e.g. cost, time, comfort, flexibility) have to be considered as a key aspect as well. Travel time, especially over long distances, can be the key decision factor for the individual passenger for or against a certain mode of transport. This is especially the case regarding the superior average trip speeds of air over other modes over certain distances. In the context of the study it has to be kept in mind that intermodal transfers may add significantly to travel time and even more to perceived travel time. Therefore it is impossible to judge a favoured mode or intermodal combination just from the consideration of external costs. Furthermore not only the duration of trips by different modes but also the structure of the market (expensive business time or cheap leisure time) determines the total costs of transport. This clearly requires a case-by-case analysis which also includes consideration of operations and investment costs.

External Costs of Different Transport Modes

The topic of internalisation of external transportation costs has already been dealt with extensively by EU- and other institutions. The EC Green Paper “Towards fair

[17] The European Environment Agency mentions as external costs: environmental costs, urban separation, non-covered accident costs, congestion, non-covered infrastructure costs, fragmentation of landscape, land-take and ecological separation.

and efficient pricing in transport" that was adopted in 1995 for example and the Transport White Paper look at the external costs of transport in the context of pricing, taxation and infrastructure investments (European Commission 1995a and 2001).

Policy decisions in this field need as a basis a profound analysis of the true costs of transport. Within the calculation of the social cost of transport, which is the sum of the internal and external costs, the component of external costs has for a long time been uncertain. During recent years the analysis of these external costs has advanced considerably, although it has to be stressed that there is currently no unique, commonly accepted methodology for estimating external costs. The Commission is preparing guidelines for such a methodology (cf. EEA 2003).

Several studies (cf. ExternE project 1997, ECMT study 1998, Infras-IWW 2000), using different approaches, nevertheless can serve to draw some rather consistent qualitative conclusions with regard to the question of which mode or intermodal combination should be given preference in a sustainable transport system, in terms of the lowest external costs. None of these studies has focused specifically on the intermodal dimension of passenger transport[18]. However, data on the total and marginal external costs of single transport modes[19] are available and can of course be used to calculate the external costs of the different modes used in transport chains. The results of the studies show that the external costs are large in absolute terms and represent a substantial problem for the EU countries.

Road transport, representing the largest share of passenger volumes, is the largest contributor to total external costs, having, alongside air transport, a relatively higher average cost per passenger-kilometre than other modes (cf. Infras-IWW 2000*,* EEA 2003, Fig. 3 next page). Air travel is characterised by high fuel consumption with a large impact on global warming, whilst car travel has a number of negatives including congestion, accidents and environmental impact. The lowest external cost significant mode for long-distance travel appears to be rail transport.

Current studies provide a workable basis for the topic of external costs if interpreted in an appropriate manner, but it has to be stressed that the estimation of external costs on a European level scale still faces several challenges and further work in this field has to be done.

The use of available methods to calculate the true costs of transport (including internal and external costs) provides guidelines and justification for policies that aim at an optimum use of each transport mode, by drawing on all possible methods of intermodal co-operation. Investments in infrastructure and transport systems and investment support should take into account such aspects as well (cf. UIC and CCFE 2000).

[18] Freight has been considered under this aspect in the EU funded RECORDIT project (Real Cost Reduction of Door-to-Door Intermodal Transport, cf. RECORDIT 2001).

[19] Evaluations of certain unimodal transport corridors have been made in the INFRAS-IWW study for different transport modes as well.

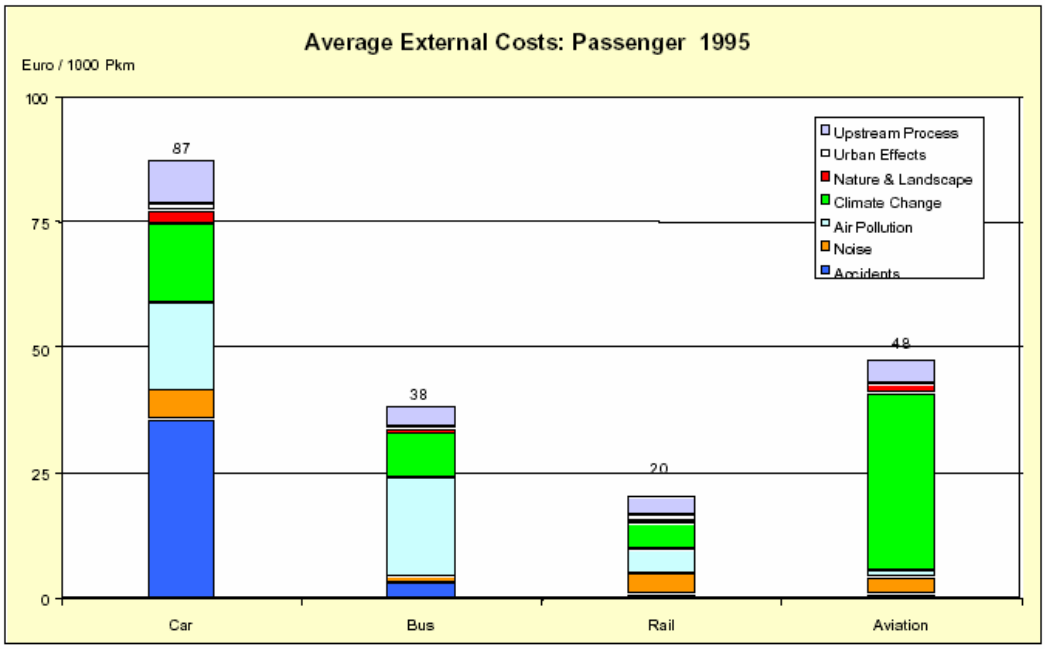

Fig. 3: Average external costs 1995 (EUR 17) by means of transport and cost category: Passenger transport (without congestion costs), (Infras-IWW 2000, p. S-4)

Costs and Benefits of Intermodality Measures

Besides the general question of external costs of certain modes or mode combinations, the specific costs and benefits of certain intermodality measures on a more concrete level have to be evaluated in comparison to the costs and benefits of unimodal measures. When considering which priorities should be set and where to invest scarce financial resources from public and private sources, there is still a strong uncertainty involved. Assessment methods for the concrete benefits of intermodal measures are widely lacking.

For example, to achieve a sustainable, cost efficient transport system, which measures have a stronger impact? Could the same amount of money invested in high-speed-rail have a greater impact on modal shift towards sustainable transport modes if it was instead invested in intermodality measures like information systems, electronic ticketing and better interchanges? What are the costs and benefits for operators that are introducing expensive intermodal information services, how should the costs be distributed and who gains what kind of benefit? How do passengers see potential benefits of new intermodal technologies and services and are they willing to pay for them?

The passenger point of view is of special importance in this context. It has to be evaluated what passengers need – from an objective perspective -, what passengers want – which of course is more subjective - and how to motivate non-customers to use intermodal products and services. This will be an important task in the third phase of this study (proposals phase). As it is difficult to assess costs and benefits in monetary terms such an analysis will probably be more of qualitative nature.

A whole range of such questions arise in the context of costs and benefits and the inclusion of many different stakeholders in intermodal services and products gives the problem a complexity not existent in unimodal transport services.

Some of the few approaches to a cost-benefit analysis applicable to intermodal products have been undertaken within the TAP-T programme[20] and the VOYAGER project.

The TAP-T programme for example looks within certain projects at payback periods, cost savings, rates of returns and other aspects of some Telematics Applications that have a high importance for intermodal transport, like passenger information systems or integrated payment technologies (cf. European Commission 2000). The programme also adopted a common assessment and evaluation framework for ITS projects.

The VOYAGER project looks in even more detail at various cost benefit issues for e-ticketing, traveller information systems, and public transport operations. Start-up-costs, capital expenditure and operating costs are discussed, particularly regarding costs and benefits from the viewpoint of operators and customers. However, quantifying the clear benefits of certain measures in financial terms is seen as a very difficult task (e.g. positive image effect related to the introduction of a smart card system for electronic ticketing).

The VOYAGER report also gives summaries of major problems, obstacles and possible solutions to cost benefit issues for the different fields mentioned. One typical problem, e.g. in the field of traveller information systems, may be that costs fall on the public transport operator and benefits fall more on the user side, which could make necessary the involvement of public authorities with a collectivist point of view. Other problems may relate to high costs of implementation and a lack of evidence of the return of investment. An interesting and important question discussed as well is, how much travellers are willing to pay for certain services like new information systems and how business models to minimise costs can be approached (cf. VOYAGER 2002b).

The aforementioned aspects show how complex the discussion of cost and benefits regarding intermodality measures is. Further research and development of assessment methods in this field and on removing current uncertainties may be key to a successful implementation of intermodal technologies and services in the future.

2.2 Contribution to Horizontal Policy Objectives

The Common Transport Policy of the EU includes several horizontal objectives that have to be considered in this study, since intermodal passenger transport, in many areas, is an important building block that is influencing them.

The Commission's Communication paper “The Common Transport Policy – Sustainable Mobility: Perspectives for the Future” (cf. European Commission 1998), which was adopted in 1998, mentions the following horizontal policy issues, which have to guide the elaboration of an EU work plan on passenger intermodality:

- *Economic and social cohesion:* Transport services may also contribute to economic and social cohesion in Europe if they are easily available, including in peripheral and less-developed regions, affordable and safe as well as providing convenient door to door service (European Commission 1998, p. 3). Intermodal

[20] Telematics Applications Programme – Transport Sector (TAP-T).

measures surely have potential in this field. However, there are certain aspects that have to be discussed as well. Intermodal measures that concentrate on long-distance transport between metropolitan areas might further strengthen economically prosperous areas, while peripheral or rural regions may be left out of such developments since some intermodal transport investments are not financially feasible in areas of low population density or of weak economic activities. This is a general problem regarding some other investments that are linked to intermodal services and technologies, like high speed rail.

- *Accessibility*: Social cohesion may only be improved by intermodal transport that is easily accessible to all population groups. Accessibility is a major issue for intermodality both in terms of physical inter-connections and information presentation. Many disabled (about 37 million EU citizens) and elderly people as well as parents and those with heavy luggage still face many problems when trying to use public transport or transport related information technologies. Therefore organisations like the European Disability Forum demand a coherent and strong approach to ensuring accessible transport to all citizens (EDF 1999, p. 24).

- The *competitiveness of Europe*, including growth and employment to which the efficiency of transport systems continues to be essential. Congestion and other high external transport costs already affect and will increasingly damage Europe's economy if growth in the transport sector will not be canalised into more sustainable transport modes like intermodal travel chains that include rail and local public transport. In an increasingly global economy efficient transport systems for passengers and freight are a key element for successful economic development and an important location factor for the EU.

- *Protection and enhancement of the environment*, both at the local and global level. Another element that is quite high on the EU's agenda is the protection of the environment. Current trends for certain transport modes (road, air) are unsustainable in relation to its environmental impact. Therefore the development of sustainable forms of transport is one of the key priorities of the Commission. Intermodality is definitely a key building block to achieve this:

  > *"The different components of the (transport) system must be better integrated to provide convenient door to door service. Developing efficient and integrated transport systems will, in turn, permit to take fully into account the need to protect and enhance the environment..."*
  > (European Commission 1998, p. 6)

2.3 Policy Levels: European, National, Regional/Urban

Passenger intermodality is clearly a topic which has to involve all levels of authorities, on the European and national as well as regional and urban level. In the context of this study the roles that the different levels could and should play in strategies to promote intermodal passenger transport has to be discussed. This will be a topic to be looked at especially in the last of the three phases of this study which will deal with proposals and recommendations for the European Commission.

The nature of travel chains, including the last urban mile, requires co-operation of stakeholders from the European to the urban level to assure seamless transportation options. However, this is influenced by a large number of factors, including for

example the political interest in intermodal passenger transport at different levels and in different countries, and the political structures (e.g. federal vs. centralised structures).

Initiatives by the European Commission may face limitations when trying to influence intermodal measures at the national, regional and urban level. The EU has to act under consideration of the subsidiarity principle, stated in Article 5 of the EC Treaty. The Commission must therefore demonstrate that there is a real need for Community rules and common action, and if the need for Community rules is demonstrated, the next question that arises concerns the intensity and the form that they should take. Intermodal passenger transport in the European and border crossing dimension indeed needs action on the European level. However, it has to be considered how far national, regional and urban elements of intermodal passenger transport can and should be influenced by actions at the European level and if this conflicts with the subsidiarity principle. Phase two of the study, that deals with national inventories of intermodal passenger transport, may give interesting insights in the political framework and legal aspects regarding intermodal transport issues for the analysed countries.

The liberalisation of the transport market that is in many areas driven by EU regulations already shows impacts on the national and regional level, which have to be taken into consideration when developing a strategy for the promotion of intermodal passenger transport on the European level. The topic of intermodality in the framework of a more and more liberalised transport market is facing challenges, as harsh competition often affects co-ordination of different transport operators and transport modes. There is a tension between liberalisation in transport markets, that includes the hope of a dynamic competition that serves the clients, and the necessary co-operation between transport operators to achieve a seamless travel chain. Currently it seems that integrative forces of the market are not sufficient to guarantee co-operation of transport operators in the field of integrative and intermodal transport services, which is a danger for sustainable transport system (Schöller and Rammler, 2003). Framework conditions set by the government to give incentives for co-operation among transport operators within a liberalised market seem to be widely missing and there is a lack of concepts in this area. The often mentioned aim to achieve a system that enables “co-ompetition” (co-operation + competition) can not be filled with many concepts yet. This aspect has to be considered in the third phase of this study as well (proposals phase).

3. Aims and Scope of the Study

Following the analysis of the context in the previous two chapters, the aims and scope of the study can be summarised as:

3.1 Aim and Expected Output

The Transport White Paper of 2001 has called for a *user perspective* in transport. Modal shift and the better organisation of intermodal passenger transport chains are envisioned for passenger transport in order to provide an efficient and more sustainable alternative to car transport. So far, however, there is no common language and no comparable work programme for intermodal passenger transport as there is for freight transport, where in the last few years activities have moved from research to more regulative and financial incentive action (cf. Ch. 1).

Work on intermodal passenger transport at the European level has remained at the level of policy, research programmes and relatively uncoordinated standardisation activities mainly in the area of transport telematics.

The aim of this study is to extend the work of the Intermodality Task Force and create the *basis for a EU work plan* which will not only address further policy and research, but will also cover issues of directive/regulatory action, financing programmes, financial levers, European co-ordination and more focused standardisation activities.

In order to facilitate this aim, the project is broken into three phases:

1. In the *analysis phase*, described in this document, existing European research and activities are described as well as some better known national frameworks and best practice. This analysis is used to define the key issues for passenger intermodality.

2. In the *inventory phase*, drawing on the key issues defined in the first phase, existing policies, frameworks and practises throughout Europe and in Japan will be analysed in order to identify promising models for action and recommendation at a European level.

3. In the *proposal phase* a set of practical action recommendations and promising proposals for further study will be identified on the basis of the first two phases by the consortium and a team of external experts.

3.2 Scope and Initial Priorities

Intermodal passenger transport is a vast subject that ranges from small-scale bike & ride schemes to international trips combining air, rail or private car transport.

To improve the opportunities for sustainable intermodality, a systematic and high quality approach to transport is needed. The study will however focus on concrete intermodal journeys and their requirements.

With a view to the European Union remit and EU possibilities for practical influence beyond policy recommendations, it has been decided that the main focus for the study is the *inter-urban/long-distance dimension of passenger travel*. This includes international travel and also smaller scale cross-border traffic. Since seamless door-to-door chains and an integrated transport system are the aim, the last (urban) mile will be analysed from the viewpoint of the long-distance traveller.

Although urban modes (including walking) form only a small proportion of the transport performance, in practice their attractiveness and efficient integration into the long-distance system is key to diverting drivers from single-mode long-distance car trips (65 % of the current market).

Sustainable transport will be the guiding principle since it is one of the overarching concepts followed by the Commission. This implies that environmental, social and economic sustainability issues define priorities and that mode combinations such as (high speed) rail / air, long-distance rail / urban public transport, cycling or walking as well as car / long-distance rail will receive most attention. The new issue of the booming low-cost air market and its isolation from sustainable feeder modes will be addressed.

User demand and the determinants for (inter-)modal choice as well as market segments and target groups will be considered since these are relevant to understanding the functioning and potential of intermodal chains.

Intermodal transport requires the physical connection of networks and suitable interchanges as well as integrated services. For integrated services, the key issues of information, ticketing, tariffs, timetables and baggage will be examined closely. For networks and interchanges, most attention will be placed on overall network design and interchange design (particularly orientation and security) and management.

Attention will also be placed on implementation issues both for specific parts of intermodality and also at a more general level. Implementation issues addressed will include political will/lobby, policy, planning/design, co-ordination/institutional, legal/regulatory, resources and technical issues including standardisation.

3.3 Work Mode in the Analysis Phase

After the kick-off meeting with DG TREN/G 3 the study was started with a *scoping* phase among the study team. This scoping served as problem identification and definition. In this first phase a large number of issues have been identified in connection with the improvement of intermodal passenger transport. This list of issues has structured the subsequent intensive *literature review*. In this review phase the focus has been on European research and European policy supplemented by additional information from selected good national policy and local/regional practise examples. The aspects addressed covered the three main elements of the study: context, products/services and implementation.

In the literature review each relevant study or project was summarised in a common format. A selection of the most relevant sources can be found in the Annex. The long list of issues has been reduced into a short list of *key issues*. These will guide and structure the further work. The list can also be found in the annex.

4. Priority Mode Combinations

This chapter summarises the state of the important mode combinations (from the perspective of socio-economic desirability and market potential) in long-distance intermodal passenger transport, as discussed in Chapter 2 (passenger intermodality priorities).

The important combinations profiled are:

1. Rail /air
2. Urban public transport / long-distance train (coach, ferry)
3. Car / long-distance train (coach, ferry)
4. Cycling / long-distance train (coach, ferry)
5. Walking / long-distance train (coach, ferry)
6. Cross-border transport

4.1 Rail / Air

The expanding offer of high speed rail (HSR) in Europe is fast enough to both expand the long-distance travel market and replace (for distances of between 100 and 800 km) both many point to point direct flights between cities and also some feeder flights from regional to hub airports. HSR has a proven potential to radically alter modal balance between air and rail, although almost never to eliminate parallel air trips entirely, where a market almost always remains[21].

Standard rail is also competitive with air travel for shorter trips up to roughly 400-500 km, although beyond this there is not a great overlap in the market for business travellers due to time costs and even for greater distances the emergence of low-cost airlines has reduced the remaining cost advantage of rail for leisure travel greatly in some countries.

It is not clear however that increase of rail use as a feeder to hub airports has a potential to directly reduce slot demand where there is scarce supply and related airport congestion. The latent demand is possibly too great and the solution of managing airport congestion may lie in both increasing attractive alternatives such as HSR and regulating the number of slots at airports at a level which puts less strain on the overall capacity of the system.

The Spanish high speed AVE opened in April 1992 and reduced the rail travelling time between Madrid and Seville from 6h30 to 2h32, making total journey time comparable with air. The available data show that the modal split between 1991 and 1994 changed substantially for public transport modes, from 16% to 51% for rail,

[21] IATA, Air/Rail Inter-modality study - Final Report (2003). This is the seminal report on the topic of Air/Rail intermodality. Together with the COST report it forms the base source of this chapter.

from 40% to 13% for air and from 10% to 5% for coach, the impact on car being moderate (from 34% to 31%), (COST 318[22] 1994).

For feeder flights to hub airports, much progress has been made in Germany where for example high speed rail has 45% (still increasing) of all Lufthansa-passengers between Cologne and Frankfurt Airport using the new AIRail service (Scherz and Fakiner 2003; Krohn 2004).

Key intermodal service aspects of rail as a feeder service to hub airport include system integration and continuous branding. This mainly means integrated baggage, ticketing and information services, schedule co-ordination, clear corporate signs of continuity for the business passenger market of standard airlines (such as separate wagons and airline type catering services) as well as insurance and reasonable waiting mechanisms in the case of delays of individual trip legs.

The AIRail-Service from Stuttgart and Cologne main railway stations to Frankfurt Airport offers a service of baggage check-in and issuing of the boarding card, which takes place in special Lufthansa check-in and check-out facilities within the railway stations.

A similar service, called Heathrow Express, is offered between London Heathrow and Paddington Station in the centre of the city, enabling full check-in services for passengers of various airlines at Paddington station

In Switzerland the Fly Rail Baggage Service enables flight passengers on their way to Zurich, Geneva and Basel airport to check in their baggage and obtain their boarding card at many railway stations. The price per baggage item, which also includes the issuing of the boarding card, is CHF 20,- for passengers travelling in economy class (cf. SBB 2004a).

The potential for high-speed rail as a feeder to hubs, however varies from case to case with factors such as the availability of an airport railway station at the hub airport and the actual travel times involved as well as pricing factors. The provision of comparably smooth intermodal connections is however of great importance to passengers used to the higher level of integrated airline services (according to the IATA Air/Rail intermodality study survey, 41 % of those questioned said that connections between air and rail need to be easier).

Specific implementation issues include securing effective co-operation of rail, flight (mainly network carriers) and airport operators, especially where there are commercial conflicts. Only if a win-win situation can be created and all partners work together, can such services be introduced (cf. Scherz and Fakiner 2003).

Air-rail services face the core question of whether the inter-modal service offered is financially desirable for all parties involved. The realisation of such services often requires a high investment in technical solutions and service facilities at railway stations and includes substantial operational costs. Regarding the AIRail service, the substitution of domestic short range flights (ones that lose money) by rail, and the re-use of the scarce slots that were occupied by those flights at Frankfurt Airport for profitable long range flights, contributes to the financial feasibility of the service. This of course is not always the case and in some cases the airport bound rail route

[22] Interactions between High Speed Rail and Air Passenger Transport (COST 318, 1994-97).

is not of comparable quality and would lead to, undesirably from the viewpoint of the affected network carrier, market shift to other hubs due to a drop in quality.

The position of operators is a clear commercial one. Where inter-modal services are cost-effective for their own business short or long-term, they will support it if they can overcome other barriers of co-operation with rivals and partners from both private and public sector.

The position of public policy on supporting rail-air might in theory (but not so often in practice) be dictated by total socio-economic cost considerations. Although the environmental external costs of air are greater mainly due to high green-house gas emissions (see section 2.1 of this report), the total cost comparison depends greatly on the trip distance and associated travel times (longer distances mean greater advantage for air) and the investment and running costs of the connecting rail system. I.e. air-rail should perhaps not to be publicly supported in terms of investment and operations subsidies in all cases but arguments instead judged on a case-by-case basis.

Getting between airports and destination urban areas by any rail types is also becoming a more and more important issue, particularly for regional airports which are expanding in a number of countries as a result of low-cost airlines, especially in the UK. Despite rapid expansion, passenger volumes are most often insufficient to economically justify the cost of constructing a light or heavy rail connection from operators own funds alone and this leads to high environmental external costs. Low cost airlines that have a successful model based on minimum cost are unlikely to contribute directly to infrastructure development. Public-private partnerships with public co-funding of investment - where justified - may be the way forward here as is the case in Edinburgh for example.

4.2 Urban Public Transport / Long-distance Train (Coach, Ferry)

This is a high potential sustainable mode combination for the majority of medium distance long-distance trips (up to 300-400 km for standard rail, up to 700 km for high speed rail).

Key long-distance intermodal service aspects include:

- service integration (national and European integration of information systems, integrated ticketing, timetables, capacity balancing, luggage storage/handling),
- safe, secure, transparent and efficient transfer from national to urban set-up with minimum walk times.

The state of the art is mixed but generally poor in most categories, with most progress in national information systems. Ticketing and timetable integration is generally restricted to urban / regional services and luggage services are generally non-existent in urban public transport with the exception of some airport lines and

urban trains. European travel services are almost non-existent although trials have been made (e.g. EU-SPIRIT[23] information system).

Specific implementation issues include:

- will for and legal possibility of co-operation of various operators and regulators involved, especially where competition is in place,
- needs of the long-distance traveller differ from urban traveller, especially international travellers,
- revenue division between rail and urban operators with integrated tariffs and different subsidy systems,
- financing of interfaces (who benefits?),
- intermodal public transport service management (especially disruptions).

4.3 Car / Long-distance Train (Coach, Ferry)

Although the urban car leg is not so sustainable from an urban point of view, a pragmatic view is that car/train (coach, ferry) combination could form a large and realistic market share if well set-up, and although not optimally sustainable is better than many long-distance trips just by car. As was seen in the section on the markets, car trips form 65 % of long-distance trips and the share of long-distance trips in urban transport is small. A relatively small shift of mono-mode long-distance car-trippers to the car/train combination, would therefore have quite a large effect on the share of rail transport, without greatly affecting urban transport.

For ideal urban sustainability park and ride and kiss and ride opportunities are perhaps best placed at out of town long-distance stations or as part of the urban public transport system. Connection to the urban public transport system – as opposed to main (long-distance) rail stations – can be a disadvantage, however, as the long-distance trip is overly complicated and extra transfer, ticketing and information complications introduced.

Key long-distance intermodal service aspects include:

- national and European integration of multimodal information systems providing combined urban car and national public transport information,
- parking/ticketing integration, luggage handling, integration of taxis and car rental at train stations,
- secure, safe and covered park and ride facilities at stations and interchanges suitable for long-distance trips, and kiss and ride facilities.

[23] European system for passenger services with intermodal reservation, information and ticketing (EU-SPIRIT, 1998-2001 as research project, initiative continued).

State of the art is mixed but generally poor. Most focus is on urban/regional one day stay park and ride, and integrated multimodal information systems are still very rare especially for this combination.

Car sharing, although a small part of the market at the moment, can also be integrated into long-distance transport (currently about 140.000 users in Europe), (VOYAGER 2002a[24]). Several public transport operators in Central Europe co-operate with Car-Sharing organisations. For long-distance travel the German rail company DB has recently started its own Car-Sharing scheme in order to provide rail passengers with a convenient and inexpensive short-term car rental at their destination.

Car rental at destination is also an option which can be attached to long-distance rail. (e.g. “Greenwheels” concept of the Dutch Railways), (VOYAGER 2002a).

Taxis form a high quality and more flexible urban option particularly suited to long-distance travellers. The main problem is cost. Taxis can be made more popular through cost-reduction and better integration into services. The “Trein-Taxi” concept of the Netherlands is a successful example of integration of taxis (VOYAGER 2002a) with tariff integration (fixed price for train users).

Specific intermodality implementation issues include:

- anti-car urban policies can in practice discourage inter-urban train support involving cars especially through restrictive parking policy near main train stations in city centres,
- will and legal possibility for co-operation of operators involved (especially public transport operators / authorities “supporting” taxi firms),
- financing of measures (who gains?) and revenue distribution with taxi operators,
- road/public transport multimodal service management (especially disruptions).

4.4 Cycling / Long-distance Train (Coach, Ferry)

Cycling is a highly sustainable mode already heavily used and supported in a few countries, particularly for urban trips of up to 5km. National modal share and therefore market potential of cycling as part of train trips varies widely from country to country (40 % to 1 % of all trips, VOYAGER 2002a). In the context of this study it is a desirable feeder mode for long-distance train and bus travel.

The intermodal uses of cycling in long-distance travel are several: parking at urban public transport station / main interchange, taking bicycles on board, hiring/borrowing bicycles at the destination.

Key long-distance intermodal service aspects include:

- safe, secure parking at stations / interchanges,

[24] Vehicle for Mobility Advancing Public Passenger Transport in Europe (VOYAGER; 2001-2004).

- specific information for cycling amenities pre and on-trip,
- possibility to take bicycle on urban and long-distance public transport (especially trams, metros, long-distance trains and coaches),
- integrated bicycle hire (booking and payment) and easy drop-off at destinations (drop off in city and walk), (e.g. “Bahn and Bike” and Call-a-Bike concept of DB),
- luggage handling, repair service at stations.

At present, integration between bicycles and public transport modes is generally poor in Europe. Facilities to promote Bike & Ride, such as supervised cycle parking and the possibility of taking bicycles onto trains or buses are not common in most European cities. In addition to this, few modern trains have dedicated space for bicycles: this implies no, or severely limited, cycle carriage.

In cycling-friendly countries like the Netherlands, Belgium, Germany, Denmark, and Austria, facilities to promote Bike & Ride, such as supervised cycle parking, bicycle service stations and the possibility of taking bicycles onto trains or buses can be found in many places.

Specific implementation issues include:

- urban policy commitment,
- hostility and indifference of national and urban public transport operators (cyclists seen as cost, nuisance and competitive burden),
- financing of cyclist measures (who benefits?).

4.5 Walking / Long-distance Train (Coach, Ferry)

Walking is another sustainable mode already heavily used for many door-to-door journey segments. In the context of this long-distance study, mainly the potential of walking from home to urban public transport stops, from interchanges to physical destinations and the aspects of walking around interchanges should be analysed.

Key intermodal service aspects include:

- specific information about walking segments of intermodal journeys pre and on-trip, information via mobile devices accessible whilst walking,
- short, secure, safe, comfortable, attractive, accessible walking in and around interchanges,
- good orientation systems in the interface between urban and long-distance transport.

State of the art of planning for walking is mixed but generally poor. Some information services are beginning to give walking advice.

Specific intermodality implementation issues include:

- policy commitment,
- indifference of interchange operators and public transport operators,
- financing of walking measures (who gains? and lack of lobby).

4.6 Cross-border Transport

Cross-border transport has both an international long-distance and a regional dimension. For regional trips the integration of different public transport providers on both sides of the border is the challenge, which includes also questions of bringing together different technical systems of any kind. For the European policy maker this trip category is relevant in the attempt to overcome borders in the internal market and between national societies.

Key long-distance intermodal service aspects include:

- service integration is even more difficult across national barriers, which are not only institutional barriers but also often language and cultural barriers (integrated transport services, information, ticketing, marketing),
- cross border public transport is often thought of as long-distance rail service. Improvements of high speed rail can have a negative impact on local cross border traffic. In some examples local border-crossing rail transport was reduced in favour of long-distance rail connections. Within such processes many smaller stations were disconnected from border-crossing rail transport and tariffs or booking procedures for long-distance trains were unattractive e.g. for border-crossing commuters as cross-border passengers on a regional connection must pay a compulsory express train supplement (although alternative train connections by local or regional trains are lacking), (CONPASS Consortium 2002).
- border regions are often low-density where traditional public transport services experience economical difficulties.

The CONPASS[25] project has delivered a comprehensive insight into the nature of existing border barriers throughout Europe. Overall, the number of urbanised border regions is quite restricted. In only a few of the analysed cases the number of cross border services approached the normal level of urban areas. The project has developed a handbook with recommendations for implementation.

Specific intermodality implementation issues include:

- regionalisation of responsibilities and funds is regarded as positive,
- integrated planning could be achieved through a cross border public transport master plan,
- cross border markets are weak and could be the loser of more market orientation and competition,

[25] Better Connections in European Passenger Transport (CONPASS).

- continuous funding, marketing and technical standards are needed.

5. Core Elements for a Seamless Travel Chain

The first part of this report has been devoted to the context for an intermodality policy and has discussed how to arrive at priorities. In this chapter the discussion moves to the *core product of "passenger intermodality"*. From a customer perspective it consists of a combination of different modal trips within a longer journey that should be linked as seamless as possible. In order to arrive at such a seamless product several building blocks are needed which touch upon a number of different issues in need of integration:

1. *Networks and Interchanges*: The most basic prerequisite for any intermodal policy is the availability of the respective modal infrastructure of a certain quality. Its degree of physical interconnection and interoperability defines the possibilities for intermodality. The integration of the different transport services, e.g. integrated timetables (mainly with regard to the different public transport provision) is a further basic requirement. Interchanges are central elements as they are breaking points and linkages at the same time. Their quality in both physical design and operational integration and management has a very strong influence on the quality of the intermodal journey.

2. *Intermodal Services*: Besides the core transport services there are further basic elements of the transport chain. A decision about an intermodal journey starts with *information* both pre-trip and later on-trip. *Integrated ticketing and tariffs* in conjunction with booking and payment can contribute to the quality of such a journey. Last but not least the *handling of baggage* needs to be managed in an effective way to attract customers.

3. *Promotion of Intermodality*: While it is essential to improve all parts of the transport chain it is also necessary to promote intermodality in a more stringent way. Techniques of awareness raising and mobility management can be used to influence travel behaviour in order to raise the share of intermodal trips.

Each part starts with a short outline of the issue from a user perspective. A discussion of the current status will lead to the main issues for implementation. Here also the perspective of operators and authorities comes into play.

5.1 Networks and Interchanges

User Needs

Trip duration, cost and comfort are the most important dimensions for modal choice. The same holds true for intermodal travel options. The status and interconnectivity of the networks are of high importance with regard to user-friendliness. Lines should be adapted to facilitate transport chains, and should represent clear structures with different hierarchical levels. In public transport, railway, light rail, trams and buses each have their optimal operating level. At each level services should be characterised either as main links or as local services. Interchanges in the public transport

system and with other modes make the different levels work together to form a coherent system. Operating these levels as a whole network makes it much more dependent on organisation and co-operation with regard to information flows within the system and to the user, telematics support and ticketing systems.

An intermodal system should optimise the use of different transport means to compete in comfort, speed and flexibility with the private car. This optimisation should not be done in isolation but should consider travel as a whole, trying to reduce any perception of breaking the trip for the passenger. Transfer between modes takes place at interchanges, being the converging point of the nodes in an integrated transport network. An interchange represents both an action and a location. The two main functions are access and transfer (GUIDE 2000, p. 2).

Most multimodal traffic models cut demand by 30-50% when introducing an extra transfer, assuming other conditions are unchanged. The MIMIC-analysis on importance of door-to door factors on people‘s intermodal choices has shown that in many cases a necessary interchange is sufficient for choice of a monomodal trip (e.g. private car) for the whole journey. This has to do with the extra transfer time, (waiting time is commonly reckoned to be perceived as being two/three times longer than in-vehicle time) but also discomfort and uncertainty about the reliability. Studies show that a person’s dislike of interchange may vary. People who rarely use public transport, those with impaired mobility or passengers making a particular journey for the first time, are likely to have a particularly strong aversion to interchange (cf. TfL 2002, p. 7). Also the trip purpose has an influence: time-sensitive business travellers are generally less inclined to transfer more often than needed whereas the same person as a leisure traveller might not object to a transfer (without heavy baggage).

The SWITCH project has categorised the user needs for intermodal trips (SWITCH 2001, p. 23). The most important ones concerning interchanges are the following:

- *logistical and operational* (timetable integration, average waiting time),
- *psychological and social* (personal security, language, cultural, physical or sensory barriers, feelings of social exclusion),
- *physical design* (accessibility and pedestrian flow, physical obstacles between modes, availability of physical amenities, lighting, ease of transfer, cleanliness, access to (system) information, ticketing systems),
- *local planning and land use* (location, surrounding land use, accessibility).

On the *level of the interchange itself*, the *physical design* is an important component that may contribute to functionality and high quality of the transfer. The PORTAL material about integrated transport chains, which summarises the results of several EU projects, provides a good source about topics that have to be considered in this context (cf. PORTAL 2003). The architecture for example should be transparent, providing visibility and brightness, and provide axis of visibility between entrances, exits, platforms and other elements of the building. Ticket vending machines and information points have to be located appropriately. Easy accessibility for all user groups, including of course disabled people, is a key requirement. Short walking distances, escalators and lifts are a important in this context. Pedestrian flows can be separated from other traffic to avoid dangerous situations. Larger interchanges often provide service and shopping areas which can contribute significantly to the quality of interchanges if well designed (cf. PORTAL 2003). The topics mentioned

show that the design of an interchange has to consider a whole organism of functions and elements. Historical interchanges are often a special challenge, when trying to adapt them to modern transport requirements.

Current Status

Considerable research on a broad range of topics regarding networks and interchanges has already been done in EU projects like CARISMA[26], GUIDE[27], MIMIC[28] and PIRATE[29], which have contributed to rise awareness of the topic. The project results show that in many aspects current transport networks and interchanges are quite often an obstacle to the realisation of seamless intermodal travel chains.

On the *network level*, issues like the interoperability of the rail systems and the state of the core rail infrastructure in different countries have to be seen as important issues. The CARISMA project is an interesting source regarding the aspect of interconnection and interoperability on the European as well as the regional and local level. It contains a state-of-the-art review of approaches to network interconnection and provides good summaries of European research work (cf. CARISMA 2000). Unfortunately network optimisation for public transport in general is still poor. Due to historical, technical (different infrastructures) and legal reasons[30], the public transport network consists of several subsystems that are seldom fully integrated at operational level. As several different operators and authorities are involved in moving people from one place to another the co-ordination of transport services is a complex task, still only poorly approached by the stakeholders. Interoperability planning needs to consider the interoperability of vehicles used, the standardisation of infrastructure, as well as options for track-sharing between different modes and between different operators.

The topic of *rail interoperability* in particular requires a strong co-ordination between Member states, and has been addressed by the European Commission. Directive 96/48/EC on the interoperability of the trans-European high-speed rail system has established the framework for drawing up technical specifications for interoperability. Directive 2001/16/EC deals with the interoperability of the conventional rail system (cf. European Commission 2003). These are important steps regarding intermodal passenger transport, as interoperability of rail systems is a pre-condition to seamless and fast travel chains.

A good example of an interoperable transport system can be found at the regional level. In Karlsruhe, Germany, urban trams can run on the same railway lines as those used for regional train services, linking the city centre with the outlying region. In this case the compatibility between heavy and light rail enables the a direct journey from surrounding areas into the city centre without the previously needed change at the main railway station that is located outside the city centre (cf. KVV 2004).

Improvements in interoperability have to be linked to a *network optimisation* containing integrated timetables and tuning different services to reduce waiting times (in-

[26] Concerted Action for the Interconnection of Networks (CARISMA).

[27] Group for Urban Interchanges Development and Evaluation (GUIDE) .

[28] Mobility and intermodality and interchanges (MIMIC).

[29] Promoting Interchange Rationale, Accessibility and Transfer Efficiency (PIRATE).

[30] In certain cases underground vehicles may not always use heavy rail tracks.

clusive incident management). Missing links in the infrastructure have to be filled and public transport on-demand should be provided where needed. Other public and private transport services (e.g. bicycles and pedestrians) should be integrated as well (UITP 2003, p. 12 ff.) Although the aforementioned demands are high and require well co-ordinated measures, there are examples which show that network optimisation can be achieved. In Switzerland for example the Rail 2000 concept contributes to very successful frequent, faster public transport services, with more direct and more comfortable services. Swiss cities are connected with transport services in a half hourly frequency, not only by rail but also by very busy regional bus lines. Good connections in the interchange stations enable shorter total travel times, as stations are served at the same minute every hour or half-hour in a hub-and-spoke system. Trains and buses arrive shortly before, either the full or half-hour, or the minutes 15 and 45, and they depart from the station shortly after (cf. SBB 2004b).

Improvements on the network level however have to go hand in hand with *enhancing the interchanges themselves*. The *location of an interchange* in the transport and territorial system is a first factor that has to be considered, as it causes land-use and urban effects. There are circumstances (e.g. consequences of urban sprawl or competition with better roads) where land-use and transport network characteristics of a city can substantially influence travellers' intermodal choices, much more than barriers at the interchange (cf. MIMIC 1999). In the case of urban sprawl, park-and-ride facilities may improve intermodal travel opportunities substantially. There are many good examples of how land-use and public transport can be integrated, especially in new developments. In Helsinki for example public transport is integrated into each new development right from the planning stage, with the public transport station built in the first phase of the development, creating options for easy public transport use (cf. City of Helsinki 2004).

Regarding the *design and layout of interchanges* a wide range of good and bad examples can be found across Europe. A good example of a successful modern interchange is the Avenida de América interchange in Madrid. It is a huge interchange station which was opened after renovation and substantial new constructions in 2000. The interchange between buses and the metro was improved and led to savings in transfer times. The design of the interchange itself was an important aspect of the renovation. A complete facelift was carried out, including a new layout which makes sure that travellers can transfer easily and comfortably as possible. The volume of passengers passing through the interchange increased by 30% in the first year after re-opening of the interchange station (UITP 2003, p. 19). Another example, worth mentioning, is the Stratford interchange in the UK. The London Borough of Newham co-operated with transport operators, the private sector and other partners to integrate public transport, traffic, urban design, and economic regeneration strategies for the town centre. A new bus station, which was the first element of the interchange that now also includes National Rail and Underground stations, set a landmark for East London and was a catalyst for the regeneration of the town centre (TfL 2001, p. 20).

Besides the physical layout of the interchange, the *economic and administrative organisation* is an important topic as well, especially regarding larger interchanges. However, there is very little literature about how to organise and manage interchanges (cf. PORTAL 2003). There lacks a coherent management structure for most interchanges. A scarce example of a management approach can be found in Germany, where large interchanges often have an interchange manager who co-ordinates different companies within the context of the interchange (MIMIC 1999, p. 66). The economic organisation for interchanges is another quite complex field,

as agreements have to be reached among various stakeholders regarding how an interchange is financed (publicly or privately), how income and revenues are split, and how revenues can be increased.

Interchanges are an important element of intermodal transport chains, but few transport authorities have already taken the initiative to co-ordinate between different stakeholders to promote the improvement of interchanges. Improvement of interchanges and networks will involve co-operation between different actors across economic, political and geographical barriers. There is a clear need for a place where all actors can meet. A good example of such an approach is the Interchange Plan in London. Better integration is a key element of the Mayor's emerging Transport Strategy, and investment in interchanges is an important aspect. Transport for London realised that they could not deliver a comprehensive package of interchange improvements alone, but took the lead to bring together important actors. More than 600 interchange locations within London are identified and appraised in the plan. Priorities for action are identified and approached in a dialogue between the various parties involved in interchange including transport providers, users, and local authorities, guided by Transport for London (cf. Tfl 2002).

Implementation Issues

Establishing a clear user perspective is the foremost implementation issue, to avoid the risk of misunderstandings. The logic of a (public) transport operator is based on its logistic organisation (lines, timetables, rotation of rolling stock and drivers), while the logic of users is based on their needs of coupled origins and destinations, and looking for the easiest way to travel.

Interchanges are often developed with a very site-specific focus. A network approach that includes standards has not been adopted everywhere but is needed to achieve a higher quality of the intermodal system (SWITCH 2001, p. 81). The SWITCH project identified a need for a European standard to specify acceptable access levels for new intermodal measures, e.g. acceptable distances between public transport modes or access between platforms and vehicles. It further proposed to work on a set of intermodal signage standards, which may instil confidence in intermodal travellers across Europe when making intermodal journeys. The establishment of a set of minimum standards for cycle provision, based on average levels of usage and the expressed needs of cyclists should be considered.

Poor punctuality and reliability are common barriers and therefore in many projects the need for real time information in interchanges is mentioned. This issues, along with many other themes that require co-operation, is linked to the problem of competition vs. co-operation associated with the introduction of market forces to the transport sector.

Interchanges cannot only be planned element by element but should be considered in a holistic way. This is especially true for the operation and management of interchanges. As interchanges often integrate several operators and sometimes more than one owner it is essential to install some form of interchange management with clear responsibilities. This is especially important for the management of disruptions and emergencies. Organisation of staff at the interchanges (including customer care) and co-ordination of operators and services can contribute substantially to the quality of an interchange for the traveller as well.

Current economic understanding is that full deregulation and market competition only works in long distance transport, while urban public transport requires co-

ordinated planning and control. Both meet at interchanges connecting long-distance with local networks. CARISMA[31] perceives a fundamental conflict between the required co-operation between modes and operators, integrated schedules, common planning, etc. and the required competition for customers between those operators. Different operators wish to distinguish between themselves and provide individual, recognisable services. They have no interest in closely co-operating or even sharing information with competitors.

As interchanges can become focal points in people's mental maps of the city, they cannot be isolated from their surrounding areas but must be seen as part of a community with impacts outside the building itself (MIMIC 1999, p. 74). This applies not only to the mental map of inhabitants, but also with that of travellers and tourists, whose knowledge of a foreign city is mostly only schematic.

Major interchanges are themselves bound to facilitate and cause land use changes. A suitable approach harmonises the transport network layout and operational aspects with spatial planning objectives and economic stimulation. The integration of land use and transport network planning requires new approaches by planners and authorities. On the executive level co-operative approach and rational process steering is essential. Inappropriate feelings of autonomy of actors are a reason for many dysfunctions in the planning process. This is especially a problem as there are many actors in the field, with particular interests. Project partnerships should be set up and a co-ordinator with considerable competencies is an unavoidable function. A frequently mentioned barrier, not only in the MIMIC-research, but also in CARISMA, has to do with differences in objectives from the different private and public stakeholders and consequently the unwillingness to co-operate.

The integration of long-distance with urban/regional networks is a major planning task. With regard to the Trans-European Networks, the CARISMA project recommended the consideration of revising the TEN-guidelines regarding the interconnections of the regional and the local networks of the metropolitan areas with the TENs (in particular rail/public transport networks), (CARISMA 2000, p. 94f).

The improvement of interchanges and transport networks is indeed an important topic for intermodal passenger transport. However, a lot of work still has to be done to achieve a high standard throughout Europe in this field.

5.2 Intermodal and integrated passenger information

User Needs

Integrated and real-time door-to-door information systems are a key tool in developing workable and attractive long-distance and European passenger intermodality. Well promoted, accessible, timely, real-time, rich yet simply and transparently presented information is necessary to smoothly plan for and negotiate transfers, especially in the case of disruptions to service or road traffic. It is also necessary to allow rational decisions about modal choice.

[31] Concerted Action for the Interconnection of Networks (CARISMA).

The CEN/BT/WG 141[32] (2002) includes the following multimodal user information needs that might be supported by telematics:

- Information on timetables, fares, rules in different European countries, in different languages,
- Easy comprehension of messages before, within and after interchanges and capability to attract the attention of travellers,
- Easy support in planning a multimodal trip,
- Availability of information along the trip with real-time and immediate information about delays, even when the user is in modes preceding the affected mode,
- Provide location based warnings in case of emergency, natural disaster,
- Personal profile information.

The requirement of best value total trip cost calculation and comparison is an important issue certainly within the jungle of public transport options, offers and tariff systems and even more to enable comparison with road travel. In European travel, language and pictographic presentation become increasingly important.

A study by Kenyon and Lyons in 2002 suggests that information about alternative modes is rarely consulted and travellers can be unaware of viable modal alternatives for their journeys. Results suggest that presentation of a number of modal options for a journey in response to a single enquiry could challenge previous perceptions of the utility of non-car modes, overcoming habitual and psychological barriers to consideration of alternative modes.

Current Status

The reality is far from the services described in the previous section. Content is simply missing in many of these areas and if available often only separately per mode and per network hierarchy level. Content is often missing on walking and cycling times and conditions for example.

Technology is a major driver of progress in passenger information. The internet, mobile phone (and to a lesser extent PDAs) have become ubiquitous media for pre-trip and on-trip information respectively. The latest promising technology with intermodal potential is DAB (digital audio band) which is being trialled and standardised in the TPEG and DIAMOND systems. Digital audio is promising as it offers a single and potentially multi-modal method of potentially cheap long-range digital data transmission which has very wide reach, an essential characteristic for intermodal information.

For the key issue of fusion of disparate databases, more advanced data merging meta platforms are emerging, which make it easier and cheaper to combine data sources.

[32] CEN/BT/WG 141 : Working Group “Intermodal and interoperable transport – Telematics” of the European Committee for Standardization.

Mobile phones are a major driver of information systems with a workable payment model, and with the increasing quality of phones, and the addition of GPS units into phones, high quality map-based navigation applications will become merged with public transport schedules and real-time information to make feasible door-to-door trip navigation (Czech EUROTEL application 2002[33] is a precursor).

In fact the potential of technology is no longer a real barrier to high quality information systems. Automatic media are not however everything in information provision and in practice equally important are telephone and face-to-face information provision.

Regional and Urban initiatives

Much progress on integrated information systems has been made at the regional/urban level, where regional/urban public transport integrators/authorities and mobility managers/centres have played a co-ordinating and driving role in assimilating public transport data and, less frequently, cycling, walking and road transport sources. Both regional/urban public transport integrators and mobility centres are more common in Central Europe and it is here where most progress is being made in high quality telephone and face-to-face information.

Such regional/urban information services often extend to real-time information where available. One interesting system is the real-time information centre in Gothenburg[34] where real-time information on public transport vehicle disruptions is accumulated and made available over the telephone and is also transmitted live to bus stop information units.

In only a few cases is multimodal information provided which includes road information. A good example is the MATISSE[35] system in the British Midlands, which is run by an association of public transport and road transport management stakeholders.

National initiatives

There is no equivalent intermodal mobility structure or movement that would promote integrated information at national or European level, and in practice national rail operators or transport Ministries have taken most initiatives unilaterally.

Germany can be considered as a precursor in the design of long-distance door-to-door information systems. In 1996, the Federal Ministry of Transport in Germany set up the DELFIproject to achieve the goal of a German-wide, door-to-door information system on public transport. The solution chosen was to connect the existing systems by means of communication. Following this concept, itinerary information was created by compiling information from all participating systems through open interfaces and harmonised meta-information.

Today, the DB AG and the quasi totality of the Federal States use the DELFI architecture for their door-to-door information systems. It currently includes informa-

[33] Door-to-door walk and PT navigator, documented in ATLANTIC project Good Practice Cases, Deliverable 5.1 2003

[34] Described in ITS group of benchmarking project of 2001, www.eltis.org

[35] Documented in ATLANTIC project Good Practice Cases, Deliverable 5.1, 2003

tion about all of public transport, walking in access to stations and for transfers as well as taxi in case of no available public transport service. It also provides maps. Extensions are planned under the form of a new project named Netzwerk Direct. This project aims at integrating all the regional/national routers and to transfer the DELFI approach to all other modes, particularly motorised and non-motorised individual transport modes.

The highly used integrated national public transport information systems of Holland and the Czech Republic[36] are two good examples. Both involve independent information integrators/providers which require all transport operators by law to contribute quality data to the system.

The Dutch system operated by OVR works 24-hours a day, seven days a week. Since 1993, the amount of advice increased from 7 million units per year to 20 million in 2002. It is subsidised heavily by the many transport operator beneficiaries, mainly the cost of the human interface. The Czech system, however, is fully self-financing and relies more on internet and SMS service, but still is used by over 0,5 million customers per month.

In July 2000, the U.K. Government launched a programme named Transport Direct. As currently envisaged, Transport Direct[37] should involve provision of information and selection, reservation, booking and issuing of tickets (or other travel permits), which cover all aspects of a journey. Transport Direct will act as a portal, data source and co-ordinator, but no compulsory data provision is expected.

European initiatives

At the European level, first attempts to create European intermodal information systems have arisen within European Research projects, specifically within EU-SPIRIT[38] and TRANS-3 (Trans-Basel)[39].

EU-SPIRIT is a European travel information system offering the calculation of itineraries (door to door travel information) between European cities and regions with regard to public transport, including all transport modes offered by certain operators in Sweden, Denmark and part of Germany (long-distance as well as short distance). EU-SPIRIT is not a travel planner itself, but a compilation of already existing internet-based information systems integrating existing systems through an open interface standard, similar to the DELFI system. It has ambitions to become a fully European system and is a promising approach to a truly European travel planning system. However, it hasn't yet migrated beyond its trial size of 3 countries after several years of existence.

Trans-Basel is a door-to-door European intermodal cross-border information trial system including road transport which works in the Basel region in Switzerland, France and Germany. It is a research project and had 600 users per day at its peak. At least 20 % of users have changed behaviour based on information, but few are willing to pay the full production cost of such complex information. There were many difficulties of data integration due to non-standard and unavailable sources.

[36] Documented in ATLANTIC project ,Good Practice Cases, Deliverable 5.1, 2003

[37] Documented in TRANS-ITS project, State of the Art Report, 2001

[38] European system for passenger services with intermodal reservation, information and ticketing (EU-SPIRIT, 1998-2001 as research project, initiative continued).

[39] Documented in ATLANTIC project ,Good Practice Cases, Deliverable 5.1, 2003

Implementation Issues

Provision of intermodal and multimodal information is a very complex business for the reason that it covers a whole range of infrastructure and institutions, thus requiring demanding multi-stakeholder partnerships and the fusing of diverse and often incompatible data sources.

Architecture, standardisation and traveller needs

Information sources may be compiled multimodally relatively easily on a single portal, but not truly intermodally integrated (for example to compare and combine routes or costs). There is still a lack of multimodal information architecture and standards, which makes high quality intermodal information expensive and difficult to produce. Traveller user needs are, however, well documented.

The KAREN[40] European Telematics architecture framework is not yet intermodally conceived and most European and World standardisation activity until a couple of years ago was dedicated to the road sector (mainly CEN TC 278 and ISO TC 204).

In the new multi-modality workgroup of the FRAME-NET project (Final report D3.1, Oct 2002), which follows up the KAREN project examining the need and possibility of extending the Framework Architecture to cover intermodal and multimodal functions the final report concludes that a full multimodal architecture is not feasible, but that key interfaces should be developed and the relevant 'User Needs' included in the Framework Architecture.

As a response to Commission Mandate (M283) following European policy, the CEN/BT/WG 141[41] workgroup was established in 2002 to create a business plan which requests the European Standard bodies – CEN, CENELEC and ETSI – to develop a work programme for multimodal and interoperable transport (freight and travellers). The CEN/BT/WG 141 business plan has yet to be transmitted to a fruitful work-programme for intermodal information.

Traveller user needs have been well documented through a number of EU projects in the 4th framework TAP[42] research programme. INFOPOLIS2[43] defined guidelines for designers of traveller information systems, which should be the basis for standardisation (CEN TC278) including content, layout, icons etc. TELSCAN[44] defines the user needs of the market segment of persons with limited mobility in telematic applications. EUROTRACS[45] defines user needs for European intermodal travel including information requirements and baggage handling.

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[40] KAREN (Keystone Architecture Required for European Networks)/FRAME projects financed with support of EU 4th/5th framework programme funding between 1998 and 2004

[41] Working Group “Intermodal and interoperable transport – Telematics” of the European Committee for Standardization

[42] Telematics Applications Programme – Transport Sector (TAP-T) sub-programme of EU 4th framework programme from 1994-1998

[43] Infopolis 2 aimed to improve user access to electronic intermodal traveller information by developing guidelines for the presentation of information, 1998-2000. Project of EU 4th framework programme

[44] Telematic Standards and Coordination of ATT systems in relation to elderly and disabled travellers (TELSCAN), 1996-2000. Project of EU 4th framework programme

[45] European Traveller Care Services (Euro-TraCS), 1996-1999. Project of EU 4th framework programme

The project CODE[46] synthesised many of above sources to produce a structured user needs analysis for intermodal travel including a specification for the long-distance traveller.

At the technical level, the EUROSPIN[47] project has made major progress in solving data retrieval from third party databases. EU-SPIRIT developed a new architecture to communicate with existing systems providing long-distance door-to-door information and reservation systems. Both offer open architectures.

Stakeholder co-operation and private sector involvement

To have an effective door-to-door service, the system should be fully inclusive of all services of different modes and network hierarchy levels. This is problematic for a number of reasons:

- Some operators are not convinced of the added-value of providing data in standard formats at their own cost or may have worries about commercial risks.
- Long-distance intermodal information presents the added problem of invoking the specific needs of the long-distance market segment at all parts of the network hierarchy without being the priority of all stakeholders in the trip chain (e.g. urban transport providers).
- Information integration between the car and public transport modes is equally difficult because car-public transport intermodality policy is not an aim of all operators and authorities involved.
- The lack of a strong advocate for cycling and walking makes specific information on these modes scarce in information systems.
- European intermodal information presents further complications of language, the institutional difficulties of international co-operation, even more diversity of data sources and the lack of a “European” transport operator or authority.

A common public sector desire is to engage the private sector in information provision, which brings in additional problems of PPP agreements and business models (ATLANTIC 2003)[48].

- The public sector often has unrealistic expectations on the capability of the private sector to finance high quality data sources and information services.
- The private sector also has greater problems ensuring compliance when integrating data sources as public sector organisations often will not want to deliver data to them.
- Guarantees on the data quality and availability is a major barrier to private sector participation in the market relying on public data sources.

[46] Co-ordinated Dissemination in Europe of Transport Telematics Achievements (CODE), 1996-2000

[47] European Seamless Passenger Information Network (EUROSPIN), 1998-1999

[48] A thematic long-term approach to networking for the telematics and ITS community (ATLANTIC), 2001-2003

Policy and Financing

Intermodal information systems suffer from low financing success, even though they are increasingly high on the policy agenda. This is caused by a number of factors including:

- the difficulty of implementation because of the multi-stakeholder nature, the high relative cost of operations and the complex and hard to decode level and share of benefits,
- the lack of a standard method of cost-benefit assessment,
- lack of consensus on what information should be publicly funded (basic level) and what should be funded by users.

All these issues make it hard in practice to get intermodal information systems into the mainstream funding, irrespective of policy support.

5.3 Tariffs and Ticketing

User Needs

Integrated tariffs and ticketing systems are of high importance for an attractive and user friendly intermodal passenger transport system. Organisational and technical aspects of these fields are strongly interrelated and should be looked at together.

The EC highlights in its *Transport White Paper* of 2001 that integrated ticketing is one of the three priority action fields for intermodal passenger transport, as travellers encounter often highly problematic conditions when they have to order tickets for a journey that involves several transport companies or different means of transport (European Commission 2001, p. 77). It has to be stressed that integrated tariffs are an essential precondition to introduce other improvements in the intermodal travel chain. The EU research project GUIDE[49] for example stated that the reduction in barriers for the intermodal passenger had little effect unless the fare system was designed to be seamless (cf. GUIDE 2000).

Tariffs and ticketing systems should be integrated, not only for urban areas or regions but also extended to the long distance traveller who may even cross borders during his journey. Easy ticketing with simple single booking and (pre)payment, using as few interfaces as possible and including customer oriented services and standards could contribute significantly to the improvement of intermodal passenger transport.

The CEN Technical Committee (TC) 320 “Logistics and Services”, whose work includes the standardisation of quality and performance criteria for services undertaken in the transport chain, envisions as an ultimate goal for passenger intermodality a system which makes it possible to plan a European Journey on the internet and booking it at the same time, complemented by the introduction of a standardised European electronic purse and/or credit facility, to be used in ticketing machines with common European icons (cf. CEN TC 320 1999). Considering the state

[49] Group for Urban Interchanges Development & Evaluation (GUIDE).

of the art it is clear that this vision is technologically feasible but organisationally still far away.

Current Status

Organisational aspects

Considering *organisational aspects* of integrated ticketing it has to be stated that across Europe a poor co-operation to achieve integration of tariffs exists, especially for long-distance and border crossing journeys. Nevertheless, there are already many examples of how good co-operation between different stakeholders working together towards integrated tariffs can be achieved. Most of these good examples can be found at the metropolitan and regional levels. Many large metropolitan transport authorities, e.g. Madrid (since 1987), as well as regional public transport associations (e.g. Germany, Rhine-Ruhr area) have achieved considerable improvements in integrating tariff structures of different transport modes and different parts of metropolitan areas and neighbouring regions. They can achieve high acceptance among users leading to a strong increase in patronage. Some further advanced solutions for integrated tariff structures are already established covering larger geographical areas and population than the aforementioned metropolitan and regional systems.

In the Netherlands the STRIPPENKAART (consisting of “strips”) which was introduced in 1980, is valid throughout the country for buses, trams and subways. It is also valid on trains which travel within the city boundaries of Amsterdam, Rotterdam, Utrecht and The Hague/Zoetermeer. The country is divided into transportation zones with set tariffs. Travelling through the zones has to be paid with a certain amount of “strips” from the ticket. Currently the four major public transport (public transport) companies in the Netherlands are working on a pilot scale on the introduction of a common smart card system (a form of electronic ticketing), aiming to establish a seamless ticketing system, which allows the use of all public transport modes nation-wide (VOYAGER 2002a, p. 9 ff.).

Another advanced approach is the “NRW Plus Ticket” that is valid within the German federal state of North Rhine-Westphalia. It is a single ticket that enables the traveller to use all regional and national trains of Deutsche Bahn (German Rail) plus all local public transport modes at origin and destination of the journey within the federal state (cf. MVEL 2004). Currently there are discussions on the possible achievement of a stronger integration of the nine regional tariff systems in North Rhine-Westphalia. However the implementation is difficult due to the many difficult organisational questions.

Even more challenging than the co-ordination of tariff structures on regional and national level is this task in *cross-border public transport*. The project CONPASS[50] that dealt with the issue of border-crossing transport identified eight barriers on tariffs concerning the lack of tariff integration, harmonisation of tariff policies, distribution channels, ticket validity and accepted currency. However, the project provides a toolbox with sufficient examples of best practice measures which demonstrate that border-crossing tariff solutions are feasible (cf. CONPASS 2002).

For the connection of *air to rail transport* and vice versa integrated ticketing is in some countries already far developed and has achieved a high acceptance among

[50] Better Connections in European Passenger Transport (CONPASS).

customers. Examples of successful integrated ticketing solutions are codesharing between airlines and rail companies (e.g. AIRail) and availability of fly&rail tickets, that include the rail and air fare for the journey in one ticket document (e.g. Fly&Rail), (cf. Deutsche Bahn 2004a; Scherz and Fakiner 2003). Low cost carriers that expand significantly are often disconnected from such developments, which has to be recognised as a problem in the improvement of intermodal passenger transport. Another interesting approach to integrated ticketing for transportation modes with completely different characteristics is the integrated "trein-taxi-service" (train & taxi) in a single ticket in the Netherlands (European Commission 2001, p. 76-77; UITP 2003, p. 23).

Technical aspects

Technical aspects of integrated ticketing, which are often linked to organisational matters, have already been dealt with widely by a large number of initiatives.[51] Many activities of European standardisation organisations and research projects have focused on electronic ticketing, including aspects of multi-service use (e.g. CEN[52], CONCERT[53], CALYPSO[54], many projects within the TAP-Programme[55], tr@nsITS[56]). Advancements in card technologies have made electronic payment media programs a viable option for public transport services. Currently tokens and paper tickets are still widely used as a means of payment, but electronic ticketing through smart cards are an efficient tool for paying for public transport and integrating other different public transport modes. Smart cards have the potential to make the transaction process and thereby also the use of different public transport modes and the interchange between them much easier. The application of such systems is taking place in many locations, for example in Berlin, London, Paris and Rome, where large scale applications of contact-less smart cards have already been carried out.

A very ambitious project of integrated, multimodal ticketing with a contact-less smart card has been developed in Switzerland under the project title "EasyRider". The idea was to give passengers the option to pay automatically (via smart cards) while getting on and off the public transport vehicle of any regional public transport or national railway operator. However, the trial phase was halted after a short time, due to the lack of agreement between the different partner organisations on the allocation of revenues (cf. VOYAGER 2002a and 2002b).

Another interesting approach to electronic ticketing can be found in the German City of Bremen. The so-called Bremer Karte Plus enables electronic payment of public transport tickets, which are directly deducted from the multifunctional chip card, which can also be used as an electronic key for car sharing vehicles, which makes it suitable for intermodal trips. Additionally the electronic payment function of the card serves for shopping activities (cf. BSAG 2004).

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[51] Analysed in detail by the VOYAGER project, which is an excellent source on this topic.

[52] CEN/TC 278 "Road Transport and Traffic Telematics".

[53] Co-operation for novel city electronic regulation tools (CONCERT).

[54] Contact And Contactless Telematics Platform Yielding a Citizen Pass integrating urban Services and financial Operations (CALYPSO).

[55] Telematics Applications Programme – Transport Sector (TAP-T).

[56] tr@nsITS was a thematic network with the aim to define research priorities for public transport ITS within the EU.

Other issues regarding ticketing that have been dealt with extensively by standards organisations and research projects are the user interface of ticket machines and other technical details. Also, ticketing over the internet, with printing of tickets on the home printer of the user, is an already widely spread service.

Ticketing at mobility centres which often provide ticketing services for local, regional, and national operators and different transport modes is available in some European cities and can be regarded as a form of integrated ticketing at one place, although often several tickets have to be purchased for the planned travel chain.

Implementation Issues

The aforementioned aspects make clear that integrated tariffs and ticketing are possible, even in border crossing passenger transport. However, stakeholder co-operation is very difficult and integrated tariffs are not as widely established as they could and should be. The main problem for the integration of tariffs and ticketing systems is the unclear allocation of revenues of public transport operators. Revenue shares are often calculated according to travel distance. The calculations are mainly based on surveys, which can be very time- and staff consuming. Although positive long-term effects that can be gained through integrated tariff and ticketing systems are evident, individual public transport operators are often reticent to becoming part of a wider tariff and ticketing system. In this context smart cards can contribute to the calculation of revenue allocation, as the quality and reliability of information about passenger travel using these tickets (derived from the electronic capture of passenger transactions) is much higher than conventional surveying methods (cf. VOYAGER 2002a). However, this field is neither without problems nor a guarantee to solve the problem of revenue sharing (as the Swiss “Easy-Rider” project showed).

Another key problem to be mentioned in the context of electronic ticketing is that standards for smart card applications are not currently finalised, with the result of a variety of different transport smart cards with different “products” on the smart card determined by the local market needs and limited geographical transferability (VOYAGER 2002b, p.10). An immense opportunity for smart card technology to contribute to European integration of tariffs and ticketing, including long-distance passenger transport, could be impeded by a lack of a common European smart card system. Therefore standardisation in this field has to be considered as a high priority. Other questions that arise with the introduction of new tariff and ticketing structures as well as electronic ticketing technologies are the estimation of the costs-benefit ratio, the passenger acceptance (which seems to be quite high) and the problems that disabled or elderly people face when trying to use new technologies (e.g. blind people, use of internet for booking).

It should be stated that technical solutions to the problem of integrated tariffs and ticketing are already available and will be further developed. The main obstacle is currently the lack of co-operation among stakeholders and the finalisation and acceptance of common standards, which is especially the case in border crossing and long-distance travel chains. Questions of financing new technologies and tariff structures may be other obstacles for integrated ticketing.

5.4 Baggage Handling

Baggage handling is another of the three priority action fields for intermodal passenger transport mentioned in the EC's Transport *White Paper* and is clearly a key decision factor in the choice of certain travel modes or chains concerning travellers with heavy luggage, especially those with restricted mobility.

User Needs

A research project for the UK Department for Transport found in the context of local end-leg modal options that apart from travellers with children and elderly people, the user group with heavy luggage "finds the effort of interchange rather alarming" (MORI 2002, p.23). Similar statements are made by the *Euro-TraCS*[57] *research project* that examined user needs and quantitative market requirements for multimodal baggage transport in travel chains that include rail and air: "Baggage and its transport represent the negative dimension of travel, associated with numerous physical and mental burdens: stress, fears, uncertainty, aggressions/rage, pain, exhaustion, constraints" (EuroTraCS 1998, p. 19). The study found that travelling by rail causes most baggage problems for the user, who in consequence try to avoid interchanges and carry as little baggage as possible. During a workshop, travellers stated in a discussion about baggage handling services that they expect: safety and a guaranteed arrival for their baggage; freedom; convenience; simplicity; economies of time; flexibility; individual decision-making; confidence; and, indemnification for loss or damage of baggage. A majority of users supported a door-to-door service which should be composed of freely selectable modules (cf. EuroTraCS 1997), and was even willing to pay for such a service. Other options like check-in facilities at an earlier interface in the journey than the airport (for example at the train station) were also discussed.

Current Status

Intermodal travellers with heavy or bulky luggage encounter many barriers at interchanges and within public transport vehicles. Railway stations for example often have differing platform heights that together with excessively narrow doors on trains make it difficult to get on and off with baggage. Trolleys that are provided at interchanges are often circumstantial to handle because of the deposit system or sometimes the number of trolleys is not sufficient in peak hours. Smaller railways stations especially often lack elevators which makes it difficult to handle luggage. In the rolling stock of railway companies, travellers do not always find sufficient storage space for their baggage and in local mass transit system trains there is mostly a complete lack of storage facilities for larger baggage (cf. EuroTraCS 1998).

Solutions to baggage handling problems are still unsatisfactory but, especially in the field of the modal combination air-rail interesting concepts are evolving and have already successfully been implemented in some places. In Switzerland the Fly Rail Baggage Service enables flight passengers on their way to Zurich, Geneva and Basel airport to check in their baggage and obtain their boarding card at many railway stations. The price per baggage item, which also includes the issuing of the boarding card, is CHF 20,- for passengers travelling in economy class (cf. SBB 2004a). In Germany, Lufthansa's AIRail-Service from Stuttgart and Cologne main

[57] European Traveller Care Services (Euro-TraCS), which was one project within the TAP-Programme.

railway stations to Frankfurt Airport offers a service of baggage check-in and issuing of the boarding card, which takes place in special Lufthansa check-in and check-out facilities within the railway stations. The transport of the luggage takes place in the same train as the one that is used by the Lufthansa passengers and is already included in the combined AIRail ticket (Codeshare of Lufthansa and Deutsche Bahn), as the high-speed trains are used to substitute domestic short distance flights. The service is quite successful with 45% (still increasing) of all Lufthansa-Passengers between Cologne and Frankfurt Airport using the new AIRail service (Scherz and Fakiner 2003; Krohn 2004). The baggage check-in at the main stations can be seen as one key element of this success. A similar service, called Heathrow Express, which incurs and extra charge, is offered between London Heathrow and Paddington Station in the centre of the city, enabling full check-in services for passengers of various airlines at Paddington station and luggage free travelling to the airport (cf. Heathrow Express 2004).

For rail passengers in general the transport operator Deutsche Bahn (German Rail) is offering in co-operation with a courier service company a baggage transport service from the home of the traveller to the destination address. The service can be purchased in combination with the train ticket and is available within Germany, even to special storage rooms at some large German airports, and for some neighbouring European countries. Depending on the destination the baggage has to be picked up two to five days before the planned arrival. The prices for the service depend on the number of pieces of luggage and the destination, e.g. the first and second piece of luggage cost each 14,90 EUR for one-way transport within Germany (cf. Deutsche Bahn 2004b). This service comes closest to the user preferences of door-to-door services that were monitored in the Euro-TraCS project, although the necessary transport times for the luggage and the lack of marketing for this service may be an obstacle to its success.

Implementation Issues

The topic of baggage services, which is one of the key issues for many long-distance intermodal travellers with heavy luggage and a major motivation for long-distance car use, has not been discussed sufficiently yet. The air-rail combination is one of the few areas, where high quality baggage services that can satisfy the customer expectations are realised and promoted. Even if they are quite successful, the Swiss Fly Rail Baggage Service or Deutsche Lufthansa's AIRail face the core question of whether the service offered is financially feasible. The realisation of such services requires a high investment in technical solutions (e.g. to guarantee minimum transfer times of passengers and baggage from the train to the airplane) and service facilities at railway stations and include substantial operational costs. Regarding the AIRail service, the substitution of domestic short range flights (that lose money) by rail, and the re-use of the scarce slots that were occupied by those flights at Frankfurt Airport for profitable long range flights, contributes to the financial feasibility of the service. However, the introduction of such services depend on the co-operation of many stakeholders including the railway operators, airport operators and the airlines. Only if a win-win situation can be created and all partners work together, such services can be introduced (cf. Scherz and Fakiner 2003).

AIRail and similar services show that a high acceptance for high quality baggage handling services can be achieved and that they improve intermodal travelling considerably. The Euro-TraCS project also stated that travellers are generally willing to pay about 25 EUR for a one way door-to-door baggage handling services (cf. Euro-TraCS 1998). It has to be further evaluated in which areas and transport chains

such services are financially, organisational and technically feasible and if they can be successful implemented.

5.5 Promotion of Intermodality

User Needs

So far this chapter has shown that interconnected transport networks as well as efficient and comfortable interchanges are primary requirements for intermodal travel. The provision of one-stop information and integrated services such as ticketing or baggage handling are equally important. The necessary improvements in these domains do not automatically lead to an intermodal travel behaviour. Travel behaviour and especially modal choice are underlying strong routines and changes do not come easy. For a better utilisation of intermodal alternatives not only a good product is essential. The product also needs *marketing*.

Target group orientation is a governing principle for any promotional measure in transport. The promotion of intermodality for long-distance trips can build on one advantage: for a certain proportion of travellers, long-distance trips are rare occasions. Because of this, low frequency travel behaviour is less routine, e.g. for holiday travel but also for certain private or business trips. But this should not be over estimated. Data from the German INVERMO survey shows that only 25 % of long-distance travellers consider modal alternatives (Last et al. 2003, p. 270).

The marketing that is necessary will supplement the marketing for each single mode which belongs to the core business of each operator. The challenge lies in a holistic marketing approach to intermodality. Whose responsibility is this novel task? Which organisation can lead the integrated approach?

Mobility management is a fast growing part of transport policy which is concerned with the organisation and promotion of efficient and sustainable travel alternatives. The strategy includes such measures as information, consulting, education, awareness raising or individualised marketing. A tested approach distinguishes the following activity levels:

- *individual level*: Here the traveller is directly approached. Integrated information (see above) and personalised services will support intermodal travel behaviour. The technique of individualised marketing has so far been applied mainly to local and regional (public) transport, but might be transferable to the long-distance market.

- *site level*: In this approach the target group is reached through their place of work, school, shopping or leisure. Mobility management for companies, for example, also deals with business travel (cf. MOST 2003). Intermodal solutions – if favourable – can be promoted through mobility consulting for companies. The principle can also be applied to leisure destinations which (also) attract long-distance travellers, e.g. stadiums or concert halls.

- *general public*: Campaigns for awareness raising can be applied to the general public but have more power if the messages are targeted to a specific group. Local campaigns profit from an overarching European or national framework with consistent messages (TAPESTRY 2003b).

A central theme for any mobility management is the *integration of modes*. All work is multimodal per se and can be extended to intermodal options. Instruments and functions such as a mobility centre, a mobility consultant or a mobility manager (cf. EPOMM[58]) can be useful to support an intermodal travel behaviour.

Current Status

Mobility management is so far mainly being applied in a local and regional context. The focus has been more on the everyday mobility, especially commuting to work or to school.

Regarding the daily commute, effects of promotion range around a 10-20 % decrease in car travel (see the result of the latest EU-research project MOST[59] or the UK pilot projects in Department for Transport 2002). *Business travel* as an important part of a companies travel budget is sometimes included in the strategy but has not yet been a strong focus. In a few projects this theme has been tackled, e.g. the reduction of company cars. If mobility management in companies is further established as a standard approach, intermodality for long-distance business trips should be included. As cost is the guiding principle intermodal options cannot be more expensive or difficult to be successful in this market segment.

Mobility centres integrate multimodal information and services and serve as a one-stop shops for travellers (cf. MOST 2003, MobiService Centres 2002). These centres have been mainly developed in Central Europe (Germany, Austria, Switzerland) but often with a quite different focus. Their main task is information provision but in theory they can also take over responsibility in the organisation of multimodal or intermodal services. In practise the mobility centres operate on an urban or regional level and modal integration is still at a basic stage. A first step realised is the one-stop availability of information and tickets for local, regional and national trips.

Campaigns to raise awareness and to change and support travel behaviour are becoming more common in many European countries and prove to be successful under certain conditions. The project TAPESTRY[60] has recently analysed different transport campaigns and also individualised marketing efforts (TAPESTRY 2003b). These need to be targeted, need to operate with consistent messages and should be close to the target group on a local level. While multimodality is a common theme, intermodal and especially long-distance trips have not received specific attention.

Implementation Issues

Promotion and marketing effort can only be successful if the product is of good quality. Before intermodality can be openly promoted it has to be assured that the products and services are satisfactory to the customer and can compete with monomodal alternatives, e.g. car journeys.

[58] European Platform for Mobility Management (EPOMM), http://www.epomm.org.

[59] Mobility Management Strategies of the Next Decades (MOST)

[60] TAPESTRY is the acronym for a collaborative research project with the objective of improving the knowledge and understanding of how effective communication programmes or campaigns can be developed to support and encourage sustainable travel behaviour throughout Europe.

The transferability of measures, instruments and implementation methods that have been proven for local mobility management approaches needs to be analysed.

The responsibility for marketing and promotion for local and/or modal transport services is quite clear: it lies with the operator or authority. For intermodal and especially long-distance and international journeys it is not obvious who should take the initiative.

Campaigns on a national or European level – if not connected with local efforts - run the risk to have little effect as they are often general and there is little interaction with the target group.

For any campaign and marketing effort it is absolutely essential to have a decent understanding of the target group and their needs. To achieve this the right data must be available. For the intermodal journeys there is still a lack of sufficient survey data for a market segmentation that will be suitable to this end.

The knowledge about and experience with mobility management concepts and marketing approaches for sustainable transport is spread unevenly across Europe. A role for the European level could be to spread knowledge, specifically with an intermodal focus.

A change of behaviour needs time. Any marketing approach should therefore be implemented with a long-term vision. Resources need to be set aside accordingly.

6. Barriers in Planning and Implementation

The discussion of the central services and elements for intermodal journeys has led to some major implementation issues. Several barriers have already been identified. In this chapter the discussion on barriers is further structured. Each barrier is characterised briefly. At this point no ranking is presented with regard to the urgency or impact of any barrier.

6.1 Political Support and Policy Basis

Policy Conflicts: National and Local Level

Optimal network and interchange policy requires a balance between urban and national travel policy in order to ensure direct rail connections to city centres without disturbing urban-land use plans. This balance has not and is not always being achieved.

To improve the conditions for car use as a practical urban feeder for train or bus transport in long-distance trips is a debatable policy but possibly a pragmatic way of ensuring long-distance sustainability. At the urban level, there is no policy incentive to develop such services, which go against urban sustainability and can be seen by local public transport operators as competitive with their services.

Power of Lobby Support for Different Modes and Intermodality

A balanced approach to all sustainable modes is inhibited by the dominant strength of the public transport sector over walking and cycling, which have less advocacy outside of formal policy. As a result of this, opportunities for walking, cycling and even urban car use within intermodal systems and not as developed as they should be and are often suppressed when perceived as costly or competitive (e.g. bicycles on trains).

The concept of intermodality in itself does not have any natural seat of advocacy at any level beyond Ministries and thus is in a difficult position to gain political support and financial support. Particularly at the European level there is no strong organisational base for European intermodal co-ordination. The strong co-operative bodies at the European level are modally based (e.g. UIC, CER for rail, AEA, ATAG, ACI for air, and UITP for urban public transport) and it is no coincidence that most current strong European integration is intra-modal (integration of air-carrier services through agencies and strategic partnerships, or timetable and ticketing co-ordination of international passenger rail).

Policy on Low-cost Airlines

Low-cost airlines are leading massive increases of regional airport use mainly in recreational transport, often without rail connections. To date, there is no so far no clear policy stance on how to deal with the urban externalities caused by this new phenomenon.

Data Availability on Intermodality

Policy stances on long-distance intermodal transport are inhibited by the lack of market data collected or available, which can enable a quantitative discussion on the potential benefits of publicly investing in intermodality over other options (e.g. against expensive investment in high speed rail)

6.2 Planning and Design

User-Needs for Interchanges, Information Systems, Ticketing

At the European level numerous research projects have developed user needs for information (CODE, INFOPOLIS, EUROTRACS), interchanges (GUIDE, MIMIC, PIRATE), ticketing (EUROTRACS), luggage handling (EUROTRACS) and accessibility (TELESCAN, ECMT handbook).

Such comprehensive user-needs specifications and design guidelines have rarely been transferred consistently to national level methodology or standards (and indeed to date, not to many European standards either).

Assessment, Evaluation and Monitoring

Quantification of benefits of intermodality enhancement measures is difficult beyond measures of user satisfaction and willingness to pay for services. Benefits of measures such as information and baggage services are often qualitative and thus hard to quantify. Until now, existing standard assessment methods are unsuitable to bring intermodality measures into mainstream investment planning.

Interchange Design

Deficiencies in the design, layout and functionality of interchanges act as a serious barrier to intermodality. User needs are well known but often not accounted for properly. The connection of the different modes must permit short transfer times. Serious hurdles are put up if the interchange does not meet the standards with regard to the accessibility. But also personal security and comfort needs must be met.

Network Level Planning of Interchanges

Interchanges are often planned and designed with a very site-specific focus. A network approach to interchange planning with priority levels and common standards is still often lacking. A more strategic approach could support the functionality of the single interchange as well as of the transport system as a whole and would make modal transfers easier for the passenger. European standards with regard to signage or accessibility would improve the general usability of interchanges.

Operation of Interchanges

The mere addition of quality elements of any interchange does not automatically lead to functional transfer point. Several operators and sometimes more than one owner are involved and their services need to be co-ordinated. Clearly structured interchange management is an important task which is sometimes neglected or dif-

ficult to implement. Integrated management is especially needed for a coherent handling of disruptions and emergencies.

Promotion and Awareness Raising for Intermodality

A well-focused promotion of intermodality requires good knowledge of target groups with a high potential for change, their preferences and behaviour. Detailed data is often lacking to arrive at such a qualified market segmentation.

For each transport mode, responsibilities for marketing and awareness raising are clearly assigned. For intermodality this task is not primarily allocated to any particular operator. This issue requires good co-operation and probably increased involvement of the responsible transport authorities on the different geographic and political levels. Transferability of the proven mobility management and promotional measures, which have so far been applied to a local and regional level, to the long-distance market is considered feasible.

6.3 Co-ordination and Co-operation

Multi-stakeholder Nature of Intermodal Interfaces

This is possibly the greatest barrier to development of intermodality. There is a requirement for co-operation between all modes (e.g. road and rail), between network levels (European, national, urban) all with their own responsible single modally focused planning and regulatory institutes and operators, who all have their own priorities (long-distance travellers, who have specific needs, are not the main priority of urban public transport companies for example).

There are few long-distance intermodal organisations (partial examples might include interchange managers, urban-regional public transport organisers, some mobility centres) which means there is no strong and impartial driver and co-ordinator of long-distance intermodal development or formal co-ordination frameworks.

Data-sharing between Institutions and with the Private Sector

Fully inclusive data provision to intermodal information providers is needed for consistent and comprehensive services. Data sharing is a problem when it relies on voluntary sharing between institutions. The thinking of the operators as data owners is often proprietary and protective.

When the private sector is involved in using public data, there are difficulties with data quality, exclusivity agreements, unrealistic pricing and cultural clashes between public service and profit motivations.

Fare Setting in Integrated Systems

A major problem for the feasibility of integrated ticketing is the many environments where for example air carriers, national railways, regional and urban public transport operators all have different fare policies and models (e.g. time, zonal and distance

related) and different subsidy models, making universal tickets a difficult proposition without overcomplicating them.

Revenue (and Subsidy) Sharing in Integrated Ticketing Systems

The problem of fair division of income in integrated systems remains a major barrier to integrated ticketing systems as it is difficult to practically monitor the complete movements of passengers within integrated systems on integrated transport. When this is impossible, it is necessary to estimate which partner should receive what proportion of income from common tickets, which leads to difficulties of agreement. Even modern smart card systems cannot yet fully solve this problem without forcing the passenger to check in and check out of the system at every mode.

Common Management of Disruptions

In the case of disruptions in a multimodal system, there are acute intermodal passenger information requirements, real-time timetable management and even emergency management.

Common management of disruptions presents particular problems of communication, management hierarchy, service planning and conflicting priorities where there is only horizontal co-operation of different operators, perhaps an air carrier, national rail operator, urban public transport operator or interchange manager.

6.4 Legal and regulatory issues

Effects of Competition in Public Transport

In competitive regulatory environments with several operators, intermodality is inhibited if there is no contractual or regulatory obligation to co-operate. This applies to all aspects of integration.

A specific problem occurs for urban railways operated by national railway companies which compete with urban public transport modes and also for the co-operation of rail (especially high speed rail) and air operators where feeder trips to hubs are profitable.

The extreme case of open entry market initiative regimes (fully deregulated) in particular are not practically compatible with the ethos of intermodality as there is no scope for any authority intervention. The only option in such cases is for voluntary schemes organised by the public sector or self-organisation by operators, but practice in the UK in the early 1990s for example did not show this to occur consistently.

National railway privatisation and the separation of operations and infrastructure adds an extra institutional complication to the process of intermodal integration both for international railway integration and integration with other modes.

It seems that competition in itself is not a problem as long as there is adequate authority scope for enforcing or making fully inclusive co-operation commercially attractive in the short-term.

Anti-monopoly Laws

In a number of countries and at the EU level, anti-monopoly laws can prevent close co-operation of private sector activities, which might lead to effective “cartel” status. Without suitable legal exceptions, this can cause major problems for attempts to create seamless intermodal systems, especially integrated products.

Co-operation between Subsidised and Commercial Transport

In many cases, public transport services subsidised by public money such as urban public transport and national rail in many countries cannot in any way be allowed to “support” commercial services such taxis or air carrier. This of course suppresses intermodal development.

6.5 Financing/resources for intermodality

Joint and Mixed Financing

Intermodal products and services confer benefits in a number of areas, including social benefits for authorities and commercial benefits for transport operators. At least some of the cost of investment and operations should therefore be divided between all beneficiaries, even if interchanges or information systems are operated by the private sector.

A major problem related to this is that even when benefits of intermodal services can be assessed, it is hard to estimate what benefits accrue to which players and almost always this will lead to difficult negotiation of co-financing (e.g. if I as an urban transport authority invest in information at my interchange for long-distance travellers who do most of their travelling on an long-distance train, who gains most?)

Business Models for Information Systems

Intermodal passenger information systems, especially those combining human interface and real-time road and public transport data are not usually commercially self-financing at the current time, because of low willingness to pay and the high cost of human interfaces and merging of disparate and unstandardised data sources.

This presents a major challenge, either the public sector pays for it fully themselves, which is expensive and hard to justify, many operators pay for it as a marketing partnership which may not be feasible in the competitive climate. Otherwise, the public sector and operators enter into a cost sharing private-public arrangement with a private sector provider but this is very difficult to set-up and administer.

European, National and Local Funding Structures

Public funding structures rarely fit in practice with complicated multi-player, multi-modal projects with long preparation, uncertain time lines and no simple categorisation of measures. European funding programmes in particular have almost no compatibility with door-to-door long-distance intermodal projects. This can be illustrated by the effective segregation of the cohesion fund projects and regional development

programmes and the dedication of the TEMPO European ITS development projects within the TEN-T funds almost 100 % to road ITS projects.

Public funding structures often require clear-cut financially quantified cost-benefit arguments for funding approval. This is very difficult for intermodal projects, where benefits are generally smaller, more widely distributed and harder to measure.

Professional Capacity and Know-how

The concept of intermodality is relatively new and many experienced transport professionals are unaware of the complexities and implementation issues involved in building such systems. There is also very little capacity for solving the intermodal interface in institutions, which is a major barrier to progress.

6.6 Technical issues

European Standardisation and ITS Architectures

The EUROPEAN ITS ARCHITECTURE was not conceived as an intermodal system and focused mainly on road transport. Furthermore, only a couple national architectures in Europe are multi/intermodal.

Few countries have national standards for the design and layout of interchanges, information systems and ticketing systems and there are still only a few European standards prepared and in progress addressing these issues. Intermodality by its nature cuts across standards groups (e.g. public transport and road groups, telematics and quality groups) and requires the complex management of a high level of co-ordination.

Nevertheless the complexity of intermodal passenger transport and the need for a more integrated standardisation approach to this topic has been recognised as an important issue by the standardisation organisations. A CEN workshop about intermodal and interoperable transport in Europe (November 2001) provided a broad discussion of ongoing and potential standardisation activities in the field of intermodal passenger transport. Topics have been technical e.g. in the field of IT product standards, but also organisational concepts or regarding the standardisation of the physical design of passenger terminals.

However, standardisation activities did not keep up with the fast development of policy and technical solutions that can be applied for intermodal passenger transport. Many standards with importance for this field have been developed or are on the way, but an integrative concept still seems to be missing. Key underlying technical standards such as an intermodal traveller data dictionary and traveller data exchange, with open interfaces for intermodal data including road data, are still missing. This endangers the potential of certain solutions that could contribute substantially to the improvement of intermodal travel chains (e.g. smart cards), because many of these technologies are currently developing in different directions in different European countries and regions.

Inter-operability of Rolling Stock and Infrastructure

The compatibility of the rolling stock and infrastructure presents another barrier. Rail services are affected by the lack of compatibility between infrastructure (e.g. tunnels/platforms/tracks) and rolling stock with different standards adopted in each country. Tracks with differing gauges, differing platform or train lengths, and the position at which carriages align with the platform are all issues of inter-operability. The source and specifics of powering different types of rolling stock can be equally important together with the differences between all signalling systems, particularly between old and new systems.

6.7 Language

Apart from standardisation described above, the issue of language is still a considerable barrier to European long-distance intermodality. Few European interchanges (with the exception of airports) or information systems present information in English and/or in standard pictographic forms.

7. Key Findings and Analysis of Priority Issues

7.1 The Market

Long distance passenger trips in Europe (over 100 km) account for perhaps 1 % of trips, but maybe 20% of total person km (cf. Ch. 1.2), therefore forming a significant proportion of the transport market. Trip types are mainly holiday (31%) and other personal reasons (47%) and business trips (22%), and thus long-distance trips are essential both for the business world and the holiday industry.

Modal split in the EU-15 shows that 65% of all long-distance trips use car as the main mode, followed by 14% air, 12% rail and 6% bus. In contrast to a sufficient supply of general data on the long-distance traveller market there is generally very little data on intermodal behaviour. In Germany, which is a country with good rail and air infrastructure, 60% of long-distance travellers have a monomodal pattern and of these 75% are car-drivers. The other 40% are multimodal travellers (cf. Ch.1.2). The multimodal travel market is therefore significant, but by no means dominant.

European studies of total costs of transport modes consistently show rail to easily carry the lowest "environmental" external costs, significantly below car and air modes (cf. Ch. 2.1). Therefore the *long-distance rail mode* should be preferred in policy as is generally the case in Europe now, but subject to a case-to-case analysis which reflects other costs such as time costs, operations costs and infrastructure costs.

Two challenges for intermodality become apparent in the face of the increasingly congested European motorways and the other high externalities of car transport:

1. How to retain the significant number of multimodal travellers (many who use rail as the main mode) and likewise how to attract some of the majority monomodal car long-distance travellers with improved intermodal services and infrastructure.

2. How to improve the sustainability of long distance trips and possibly free-up congested hub-airports by achieving more use of environmentally clean rail (especially high speed rail) as a feeder to hub airports, where perceived time costs are not too much greater than for air transport. (It is unlikely that airport congestion can be managed sustainably just by mode transfer as the latent medium term demand for slots at such airports is so high. It might however produce temporary space to reduce slot numbers to better reflect airport capacity).

7.2 Policy Priorities

Mode priorities

Long-distance rail will be the central mode of attention in this study. With a 12% share of the long-distance market it often forms the lowest unit total costs of all long-distance modes at typical distances of national travel.

Due to the nature of intermodality, interfaces between rail and other modes is the effective focus of the study. Particular emphasis is placed on interchange between rail and air transport with rail acting as a feeder mode, and with rail as the main long-distance mode to accompany urban modes. For long-distance travel, local car and urban public transport modes are furthermore important, especially with regard to the luggage transport requirement.

Mix of Measures

The aim of this study is to produce the foundation for a work-plan for the EU in the whole area of passenger intermodality.

Many important issues have been identified, which illustrate how immature the development of passenger intermodality is at the long-distance level. It is desirable however, in order to guide the effort of the study, to make some ranking of their significance from the point of view of an EU action plan.

There is a powerful argument that a major impact of intermodality can only be achieved by a strong combination of many of the measures summarised in this document.

Lack of data for making priorities

A definition of issue importance is very difficult because of three factors:

- lack of market data on intermodal behaviour which identifies the significance of different mode combinations for the long-distance market,
- lack of robust cost – benefit data or methodology to distinguish the importance of different measures and the evaluation of multi-measure synergy,
- lack of studies evaluating the significance of different implementation issues.

This absence of quantitative evidence to drive intermodality is in itself a key issue for the practical implementation at the measure level, which generally requires robust socio-economic assessment to obtain financial approval.

7.3 Technology Development and User-needs Assessment

Analysis of current practice demonstrates that the potential technology base is already well advanced to support passenger intermodality. Although better services will develop with advances in media (e.g. cheap mobile phones with colour displays and GPS inserts) and broadcast technologies such as Digital Audio Broadcasting (DAB), current technical state of the art would enable very high quality intermodal real-time information systems, a European smart card ticketing system, one-stop shop ticket reservation and purchase, and door-to-door baggage systems.

User needs are also well developed and documented at the European level for most of the elements of an intermodal service, including information systems, ticketing systems and interchanges, down to the level of long-distance passengers and total needs of restricted mobility passengers in the transport system.

7.4 Services and Infrastructure for Passenger Intermodality

Special emphasis will be given to identifying practice that meets the *major implementation gaps* identified for services and infrastructure. The following items are either almost without implementation across Europe or restricted to specific countries:

Intermodal Services

- One-stop-shop information, book and pay for intermodal journeys of any kind at national level
- Fully integrated international –national- local information systems
- National real-time public transport information systems
- Integrated walking and cycling information in information systems
- Fully integrated road and public transport information systems
- Intermodal information on delays and disruptions
- Intermodal baggage management and door-to-door baggage services in air/rail and urban transport
- (Standard) smart card integrated ticketing systems at national and European levels

Networks and interchanges

- Intermodal management of disruptions and delays
- High levels of personal security in and around interchanges
- High quality of interchanges and facilities
- Interchanges designed with short walking distances
- Secure cycling and motorbicycle parking
- Park and ride for long-distance travellers at urban interchanges
- Accessible interfaces between rail and urban modes at interchanges
- Rail links to regional airports
- Quality rail infrastructure in candidate countries

7.5 Implementation Issues

Special emphasis will be made in identifying practice which overcomes the major implementation barriers identified for services and infrastructure.

Political and policy support for intermodality is getting stronger, but successful strategies for implementing the vision are less apparent. The sparseness of implementation is most caused by intransigent problems of: co-ordination and co-operation; legal and regulatory issues; financing and resources; and the practical implementation of standard solutions in design, which meet real user needs.

More specifically, the following main implementation issues have been identified. All are difficult to overcome.

Political support, policy basis :

- Policy Conflicts: National and Local Level
- Inconsistent power of lobby support for different modes and intermodality
- No policy for low-cost airlines
- Lack of data and data collection on intermodality

Planning and design:

- Acknowledging user-needs for interchanges, information systems, ticketing
- Lack of and inconsistent assessment, evaluation and monitoring methods
- Deficiencies in interchange design
- Lack of network level planning of interchanges
- Poorly co-ordinated operation of interchanges
- Lack of promotion and awareness raising for intermodality

Co-ordination and co-operation:

- Difficult multi-stakeholder nature of intermodal interfaces
- Poor data-sharing between institutions and with the private sector
- Difficulties of fare setting in integrated systems
- Difficulties of revenue (and subsidy) sharing in integrated ticketing systems
- Difficulties of common management of disruptions
- Detrimental effects of competition on public transport

Legal and regulatory issues:

- Co-operation obstruction of anti-monopoly laws
- Co-operation obstruction between subsidised and commercial transport

Financing and resources:

- Difficulties of setting-up joint and mixed financing
- Weak business models for information systems
- Rigid and monomodal European, national and local funding structures
- Lack of professional capacity and know-how

Technical issues:

- Slow progress of European standardisation and ITS architectures
- Lack of inter-operability of rolling stock and infrastructure

The Candidate countries have specific issues relating to the scarcity of public resources, quality of existing infrastructure, and the quality and rigid structure of institutions. The latter two issues are of huge importance for developing intermodality and so special attention will be paid to analysing specific requirements of the Candidate countries within the inventory phase.

The difficulties of introducing European systems are compounded by language and currency differences and even greater problems of co-ordination, legality, financing and standardisation. The European level will be analysed in greater detail in the proposal phase while national approaches and local cross-border solutions which may bring learning points for European solutions will be sought in the inventory phase.

Documentation of any successful solutions to these major implementation problems within European states will form a focus of the inventory phase.

7.6 Priorities from the Perspective of EU Influence

The current understanding of the principle of subsidiarity gives the EU limited scope to systematically influence national and urban systems unless they are directly related to the principle of European cohesion or as a condition on financing of measures related to social policy.

It is likely that the European approach to influencing passenger intermodality should therefore be top down: reviewing the European corridor view of transport cohesion by applying the door-to-door principle of intermodality to its logical conclusions and defining strict requirements of door-to-door European systems, which along the way encompass national requirements.

The scope for European influence on passenger intermodality at the European and national levels is determined by the sorts of measures that the EU can realistically impose. Ranked according to the level of intervention, the EU can for example:

1. publish a Commission communication to introduce a framework concept for passenger intermodality

2. introduce directives or regulations, especially ensuring European co-operation

3. support or finance European intermodality products and services

4. introduce and support intermodality co-ordinating organisations

5. use financing programmes to fund intermodality measures of significance for cohesion, and use financing levers on other programmes to ensure intermodality compliance,

6. finance and organise standardisation activities

7. finance research and studies, especially those which support standardisation

8. make policy recommendations

9. provide and help set up professional training programmes and exchange of best practice.

This order of impact can affect the importance attached to issues in the study i.e. more emphasis might be placed on *legislation and regulation topics, and opportunities of direct intervention*. Nevertheless, the long-term impact of policy recommendations and research and standardisation support can be considerable, and these issues will not be sidelined.

In terms of services and infrastructure, more natural areas of stronger European intervention are holistic services such as *information and ticketing systems*, and therefore the successful implementation of these will form a greater priority in the study than issues of interchanges.

As regards mode combinations, the *air-rail combination* will receive special attention as it is closest to the European remit, with an international market.

8. Approach to the Inventory Phase

In the *analysis phase* more than one hundred study reports have been collected and screened by the four consortium partners. Most of them are European studies, some are national studies. All relevant information about passenger intermodality within these reports has been assessed and summarised in specific summary sheets[61]. One of the results of this first literature analysis is a list of 39 key issues of passenger intermodality (see Annex) that should be addressed since they can favour or hinder the realisation of high quality passenger intermodality at the European level.

The 39 issues are classified under the following three domains:

- *context* or framework conditions for realising passenger intermodality,
- *products and services* linked with passenger intermodality,
- *implementation* issues.

The aim within the inventory phase is to enrich this first analysis and its sources with information and analysis on the national level. These national inventories will be carried out in 28 European countries and in Japan by the consortium partners and a network of subcontractors who can be considered as experts with respect to passenger intermodality within their country.

The *national inventories* are structured along the same key issues within the three domains as the ones defined within the analysis phase. For each issue a short description will be provided. From the inventory phase, we expect:

- information and an analysis of the situation in each country,
- a specific assessment of the relevant issues with regard to passenger intermodality; factors of success or failure, importance/relevance of each issue for the national level,
- summaries of important sources of material at the national or regional level with regard to the issue where relevant (studies/legal frameworks/good practices).

To guarantee consistency all work in this phase will follow common *guidelines* which specify:

- the overall aim and scope of the study,
- the task description for the national inventories in detail,
- the way on how to fulfil this task,
- basic principles in collecting information and analysing the national situation,
- the timing.

[61] The most relevant of these source summaries are included in the Annex.

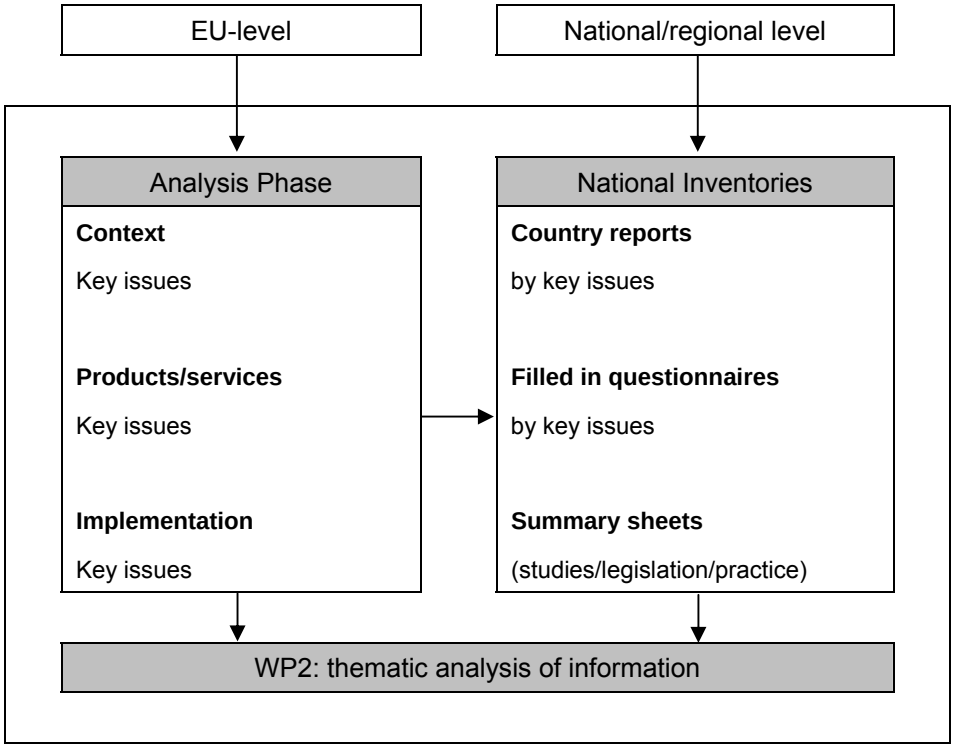
For each country a concrete output is expected:

1. a comprehensive national *report*, structured along the key issues , delivering information and analysis on the national situation

2. a completed *questionnaire***;** delivering more specific information on the expert assessment of the relevance of the issues as factors of failure and success

3. *summary sheets* of relevant national material (studies, good practices, legislation)

The following scheme summarises the information flows available for the thematic analysis within the inventory phase.



In assisting the inventory task, the guidelines specify some important principles for collecting and analysing the national situation with regard to passenger intermodality:

- The *focus should be on key national topics*. The subject of passenger intermodality is a very broad one. Although long-distance and international/cross-border transport is the common theme for the inventory, the specific situation in each country might require different focuses. The guidelines should offer a common framework for analysis while leaving enough room for a specific emphasis. The expertise of the researchers should be split between the requirements of a comprehensive treatment of the topic and necessary focus on the most important issues in each country. Resources for this work are clearly limited so that the result will not be a full state-of-the-art review but rather a concise document identifying the national situation with regard to the key issues

- A *combination of different methodologies is suggested* to provide information on the national situation based upon own expertise, analysis of available literature, analysis of other material (e.g. leaflets, presentations, unpublished documents, policy documents, legislation, etc.) to expert interviews (one-to-one telephone interviews). Strict guidelines are given on the reference methods.

- In order to facilitate the analysis of the national information across different themes or issues and by different partners**,** *templates* will be set up to structure the output.

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Towards Passenger Intermodality in the EU

Annex of Report 1 (Final Version)

Annex
Analysis of the Key Issues for Passenger Intermodality

for the
EUROPEAN COMMISSION
DG ENERGY AND TRANSPORT
Unit G 3
Motorways of the Sea and Intermodality

Dortmund, July 2004

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4	European vs. national long-distance intermodality
5	Modal Conflicts, operator priorities
6	Disaggregated ownership
7	Impact of competition models
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11	EU policy and activities
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B. Summaries of Key Sources

B.1 Programmes, Projects, Committees

Project Name	**ADONIS** Analysis and Development of a New Insight into the Substitution of Short Car Trips by Cycling and Walking
Start date – duration	May 1996 - 18 months
Funding	52% EU-funded
Project Summary	ADONIS developed the first comprehensive European catalogue of measures concerning walking and a compilation of measures to promote cycling, as a complement to existing catalogues of basic measures. These measures include both technical solutions (such as infrastructure changes) and non-technical actions (such as education and planning). Participants who used multimodal trips in the researched cities were young and more women than men. The reasons of 30% of the people using multimodal trips were either that they did not have a car at disposal or had no other available transport. ADONIS made recommendation for cities and policies to decrease the number of cars and to increase the number of bikes in a city. Walking and cycling require clear recognition within local and national transport policies and plans. This particularly requires changes with regard to walking, which enjoys little public advocacy (e.g. by lobby groups). The choice of measures is largely dependent on the local situation.
Modal focus, trip length focus	Walking and cycling Local, regional, national and European level
Main contact	Project co-ordinator Inger Marie Bernhoft Danish Council of Road Safety Research Ermelundsvej, 101 2820 Gentofte DK E-mail: imb@rft.dk
Website	http://europa.eu.int/comm/transport/extra/adonisia.html http://www.cordis.lu/transport/src/adonis.htm
Available Material	A report and a CD-ROM

Project Name	**ARCH** Alternatives to Short Distance Air Connections through Organisational Measures
Start date – duration	(?)1999 – 2 years
Funding	100% EU-funded
Project Summary	The main focus of the study was to improve marketing tools for rail, bus travel and high speed shipping as alternatives for short air connections. A number of demonstrations were established in Austria, Belgium, Czech Republic, Greece, the Netherlands and Spain. The "ARCH-Manual" was published to provide an overview of possible actions, containing a review of current practices in the demonstration countries, review the scope/barriers for the switch to non-air modes (mainly rail) for short air connections and setting out a number of recommendations relating to different elements e.g. travel agencies, ticketing, taxation and training.
Modal focus, trip length focus	Air versus rail Short/medium distance
Main contact	Jan Vanseveren (Consortium Leader) Langzaam Verkeer Minckelersstraat 43A B-3000 Leuven Belgium
Website	http://arch.fgm-amor.at/
Available Material	• Phase 1: Current Practices Report (November 2000) • The Arch Manual: Sustainable Alternatives to Short Air Trips – An Overview of Possible Actions (September 2001)

Project Name	**ATLANTIC** A Thematic Long-term Approach to Networking for the Telematics and ITS Community
Start date – duration	June 2001 – May 2003
Funding	100% EU-funded
Project Summary	Analysis of framework conditions required for the successful implementation of TTI services. Country reports across Europe, good practice reference, key player interviews, local practioners handbook and recommendations on framework conditions for deployment of TTI services in Europe. Good examples of inter-modal information services, provides basic conditions for wider implementation of TTI systems with intermodality as a key principle. Few truly intermodal services available yet and many institutional, legal and commercial barriers to this happening at all levels. The project offers a number of solutions to these problems, but is not directive in its approach.
Modal focus, trip length focus	All modes, intermodal All lengths
Main contact	Paul Riley Babtie E-mail: paul@babtie.cz
Website	http://www.atlan-tic.net
Available Material	Many reports on line

Project Name	**CARISMA Transport** Concerted Action for the Interconnection of Networks Interconnection of Trans-European Networks (Long-Distance) and Regional / Local Network of Cities and Regions (Final Report)
Start date – duration	1997-2000, Final Report: August 2000
Funding	DG TREN Transport under the 4th Framework Programme CARISMA Transport was managed in close co-operation with the DG IS project, CARISMA Telematics, of the Telematics Applications Programme-Transport.
Project Summary	The aim of CARISMA was to identify good practice in the inter-connection of transport networks and to help build a consensus on how to tackle key issues, especially by looking from a local perspective at connections with the long-distance networks. Special emphasis was given on the TEN-T networks and on the urban/inter-urban transition zone. CARISMA brought together experiences from across Europe to provide a state-of-the-art review of approaches to network inter-connection and provided good summaries of recent European research work. It provides a good summary of definitions and terminology in intermodal transport. Three priority themes were identified: ▪ planning infrastructure and interchanges ▪ operations and services of multi-/intermodal interchanges ▪ policy environment for interconnectivity
Modal focus, trip length focus	All modes Long-distance and Regional/Local (Integration)
Main contact	POLIS (Co-ordinator) Rond-Point Schuman 6, box 8 (Scotland House) B-1040 Brussels Belgium Tel.: +32 2 282 84 67 Fax: +32 2 282 84 66 E-mail: polis@polis-online.org Final Report available under: http://www.europa.eu.int/comm/transport/extra/final_reports/urban/carisma.pdf
Website	http://www.europa.eu.int/comm/transport/extra/carismaia.html http://www.cordis.lu/telematics/tap_transport/research/projects/carisma.html
Available Material	Final Report

Name	**CEN TC 278** European Committee for Standardization, Technical Committee Road Transport and Traffic Telematics
Start date – duration	Established in 1991
Funding	
Summary	The scope of CEN/ TC 278 Road Transport and Traffic Telematics focuses on standardisation in the field of telematics to be applied to road traffic and transport, including those elements that need technical harmonisation for intermodal operation in the case of other means of transport. Among the topics that relate to passenger transport are the communication between vehicles and road infrastructure, communication between vehicles, in-vehicle human machines interfacing as far as telematics is concerned, traffic and parking management, user fee collection, public transport management and user information.
Modal focus, trip length focus	The standardisation work of CEN/TC 278 is restricted to the application of telematics for Road Transport and Traffic only, it does not cover waterborne or rail transport. All trip lengths
Main contact	Chair of the TC: G.A. van Toorenburg Ministerie van Verkeer en Waterstaat Dir. Gen. for Passenger Transport P.O. Box 20901 2500 EX The Hague The Netherlands Phone: +31 70 351 72 63 Fax: +31 70 351 64 13 E-mail: ge.toorenburg@dgp.minvenw.nl You may contact the different working groups (e.g. public transport or traffic and traveller information) of the TC directly, contact information online: http://www.nen.nl/cen278/Organisation.html
Website	http://www.cenorm.be/nr/cen/doc/PDF/6259.pdf http://www.nen.nl/cen278/
Available material	You may address particular Working Groups to obtain detailed information

Name	**CEN TC 320** European Committee for Standardization, Technical Committee Logistics and Services
Start date – duration	Founded in December 1993
Funding	
Summary	The scope of TC 320 is the standardisation of quality and performance criteria for services undertaken in the transport chain. The aim of TC 320 is to develop standards that make it easy for customers to make use of any transport system, not known to them in advance. Field of work in passenger transport are for example passenger information systems, travel planner, ticketing machines, electronic ticketing and payment systems. Especially the work in the field of Public Passenger Transport (WG5) will be of interest for the EUPI study.
Modal focus, trip length focus	All modes, European perspective
Main contact	For Working Group 5: Public Passenger Transport Finn Hoegsbro Sydbus Skelbækvej 2 6200 Aabenraa Denmark Tel: 74 33 50 50 Fax:74 33 51 50 E-mail: sydbus@sydbus.dk
Website	http://www.cenorm.be/nr/cen/doc/PDF/6301.pdf
Available Material	Short document regarding market, environment and objectives of CEN/TC 320

Name	**CEN Workgroup (WG)** **CEN/BT/WG 141** **"Intermodal and interoperable transport – Telematics"**
Start date – duration	Established May 2002
Funding	
Summary	CEN/BT/WG 141 is a working group that was established with the purpose to create a business plan and to define the main standards requirements related to "Intermodal and interoperable transport – Telematics", on the basis of ongoing work in different Technical Committees (TCs) and in co-operation with the TCs. The business plan was developed in response to a Commission Mandate (M283), which requests the European Standard bodies – CEN, CENELEC and ETSI – to develop a work programme for multimodal and interoperable transport (freight and travellers). CEN/BT/WG 141 does not have the purpose to produce standards, but could propose possible allocation of the standardisation work. The Business Plan of the WG analyses the current state of the standardisation activities in the field of intermodal and interoperable transport telematics, as well as framework issues (user needs and operators involved) and makes recommendations how to approach this field in the future.
Modal focus, trip length focus	All modes, European perspective
Main contact	UNINFO Corso G. Ferraris 93 10128 Torino Italy Tel. +39 011 501027 Fax +39 011 501837
Website	http://www.ictsb.org/ITSSG/Documents/Intermodal_transport.pdf
Available material	Business Plan, March 2003

Project Name	**CONPASS** Better Conections in European Passenger Transport
Start date – duration	January 2000 to December 2002
Funding	Part funded by the European Commission, Cost sharing contract
Project Summary	Aimed at developing strategies and concepts for improvements in cross-border public transport on a local and regional level. A state-of-the-art overview (e.g. problems for passengers, operators), methodology for case study analysis and toolbox. A series of case studies reveals problems, but also innovations and solutions. A solution e.g. between the French and Belgium border was a half-hourly cross-border bus route that is operated by French and Belgium operators.
Modal focus, trip length focus	Public transport Interregional – cross border regions with 50-70 km diameter
Main contact	Ingenieurgruppe IVV Stephan Krug and Dirk Meinhard Oppenhoffallee 171 D-52066 Aachen Germany Tel.: +49-241-94691 Fax: +49-241-531622 E-mail: office@ivv-aachen.de
Website	http://www.conpass.org/ http://dbs.cordis.lu/fep-cgi/srchidadb?ACTION=D&SESSION=86102004-3-16&DOC=1&TBL=EN_PROJ&RCN=EP_DUR:30&CALLER=PROJ_GROWTH http://www.conpass.org/toolbox/about/index2.htm
Available Material	Deliverables, Conference Papers, Case Study Reports, Toolbox are online: http://www.conpass.org/download.htm Final Report: CONPASS – Better connections in Europe Passenger Transport - edit.: IVV (D) Aachen, 11/2002, 72pp.

Project Name	**COST 318** Interactions between High Speed Rail and Air Passenger Transport
Start date – duration	March 1994 – 3 years
Funding	60% EU-funded
Project Summary	COST 318 has looked into the relation of high-speed rail (HSR) and air transport (AT) and has found that travel time is the most important factor for modal choice on long-distance journeys. While for travel distances of more than 300 km the competitive edge of conventional railways is rapidly declining, for HSR this only applies for travel distances of over 600-700 km. In a future with HSR, AT will predominate on longer travel distance relations. Document includes figures on modal split, choice of transport and passenger figures for different modes.
Modal focus, trip length focus	Rail and Air Regional and national journeys
Main contact	European Commission Directorate General of Transport
Website	http://www.cordis.lu/cost-transport/src/pub-318.htm
Available material	Interim Cost 318 report: COST318.1994. *Integration between high speed rail and air passenger transport.* European Commission Directorate General of Transport (Available from: http://www.cordis.lu/cost-transport/src/pub-318.htm)

Project Name	**COST 335** Passengers' Accessibility of Heavy Rail Systems
Start date – duration	October 1996 – 3 years
Funding	100% EU-funded
Project Summary	The main objective was to provide guidance for governments and rail operators on best practice for meeting the needs of rail travellers with reduced mobility (focusing on travellers with physical disabilities and the elderly). Secondary objectives included increased awareness among train operators of the actual and potential size of the market for rail travel amongst disabled and elderly persons. 17 COST Countries participated in the research. Key elements of the research were: rolling stock design; physical access between the platform and train; station design; information; and, training. Guidance included in the themes of station design and information have most relevance to intermodality.
Modal focus, trip length focus	Rail All lengths
Main contact	Ann Frye (Chairperson) Department for Transport, Mobility Unit Great Minster House 76 Marsham Street GB-SW1P 4DR LONDON Tel: +44-207-8904461 Fax: +44-207-8906102 European Commission (Scientific Secretary) DG TREN
Website	http://www.cordis.lu/cost-transport/src/cost-335.htm
Available Material	• Proceeding of Brussels Seminar 30/31 October 1997 • Final Report (November 1999) • Stations Handbook (1999) (not available on-line)

Project Name	**COST 340** Towards a European Intermodal Transport Network: Lessons from History
Start date – duration	January 2000 – 4.5 years
Funding	100% EU-funded
Project Summary	The main objective of the project is to provide (through lessons learnt in the past) a framework of analysis to act as a decision aid in European transport policies, and develop a set of recommendations that will help establish priorities to be given to different projects involving trans-European connections and intermodal transport. It analyses successful case studies in the areas of interoperability through technical standardisation, commercial cooperation and between national networks. The project is structured into three main themes: technological, economic, legal and political framework; intermodal and trans-European infrastructure; and managing intermodality.
Modal focus, trip length focus	All modes. Trans-European journeys.
Main contact	Michèle Merger (Chairperson) French National Centre for Scientific Research 3, rue Michel-Ange 75794 PARIS cedex 16 France Tel. +33 1 44 96 40 00 Fax : +33 1 44 96 53 90 E-mail: mimerger@tin.it Mr Philippe Stalins (Scientific Secretary) DG TREN
Website	http://www.cordis.lu/cost-transport/src/cost-340.htm
Available Material	Available to members only (password protected)

Project Name	**DATELINE** Design and Application of a Travel Survey for European Long-distance Trips based on an International Network of Expertise
Start date – duration	April 2000 – June 2003
Funding	100% EU; European Commission, Brussels
Project Summary	The DATELINE project has presented concepts, methods and the potential for implementing a homogenous European travel survey of long-distance mobility in all the member States of the European Union, based upon an international network of expertise. This was in response to the need for passenger transport statistics at the European level, for which no high quality database previously existed. Firstly, it has developed a survey design for long-distance passenger travel to be applied in all Member States. Secondly, these surveys have been realised in all member states plus Switzerland. The DATELINE project created a database to provide answers to planning related issues and to provide input for future analysis. Finally, this database is integrated in both a national context and in the EUROSTAT statistical programme. The project demonstrated that many different methodologies are being applied to the collection of long-distance travel information throughout Europe. The benefit of a project such as DATELINE is that it has adopted a common methodology, albeit with local documented variations, throughout Europe, leading to greater confidence in making cross country comparisons. At the end of the project the data was incorporated in a single database, which is accessible for all interested parties and can be used for further analysis. ELMIS (European Long-distance Mobility Information System) is a comprehensive retrieval system that will be developed and used to ensure accessibility to the database. The main findings report central indicators of long-distance mobility. The information from the survey assists with decision-making in transport policy and planning at the national and European level, so that transport is more organised, economic, sustainable and corresponds to user needs.
Modal focus, trip length focus	All modes. Trans-European journeys.
Main contact	Main contractor: SOCIALDATA Institut für Verkehrs- und Infrastrukturforschung GmbH Postfach 70 16 29 D-81316 München Germany Tel: +49 89 71 08 1 Fax: +49 89 71 64 20

	E-mail: dateline@socialdata.de www: http://www.socialdata.de/
Website	http://cgi.fg.uni-mb.si/elmis/ http://www.ncl.ac.uk/dateline/
Available material	Several reports downloadable as deliverables, available via websites

Project Name	**EMOLITE** Evaluation Model for the Optimal Location of Intermodal Terminals in Europe
Start date – duration	1997-1998
Funding	DG VII under 4th Framework Programme
Project Summary	EMOLITE has developed and tested the prototype of a decision support system that allows an integrated evaluation of potential terminal locations according to general and terminal-specific criteria, while simultaneously taking into account the dynamic transportation market. The access-based EMOLITE system incorporates a user weighting in terms of cost, flexibility and reliability. The application of the decision support tool has been in the freight sector but the model is seen to be applicable to passenger terminals as well, if a database with relevant information on passenger travel is created.
Modal focus, trip length focus	Freight, long-distance/international
Main contact	University of Antwerp – RUCA Department of Transport Prof. Dr. A. Verbeke Project co-ordinator Tel: +32 3 218 07 32 Fax: +32 3 218 07 46
Website	http://www.europa.eu.int/comm/transport/extra/emoliteia.html
Available Material	Final Report under: http://www.europa.eu.int/comm/transport/extra/final_reports/strategic/EMOLITE.pdf

Name	**ERTICO** Co-operative company
Start date – duration	Since 1991
Funding	Financed by annual fees from its partners and by project funding from others, including the European Commission
Summary	ERTICO is a Europe-wide, not-for-profit public/private partnership for the implementation of Intelligent Transport Systems and Services (ITS). The mission of ERTICO is to promote and to support the implementation of ITS in Europe, ensuring sustainable mobility, travel satisfaction and high economic returns. ERTICO works closely with several European institutions. It is monitoring and trying to influence strategic developments at the European and global level. Fields of work of ERTICO are co-development work on key ITS platforms, standards, services and market roll-out support. Many of ERTICOS activities may be of interest in the context of intermodal passenger transport (e.g. in the field of traffic, travel and tourist information services; service interoperability; e-payment systems)
Modal focus, trip length focus	All modes, European perspective
Main contact	ERTICO - ITS Europe Blue Tower Avenue Louise 326 B-1050 Brussels Tel: +32 2 4000 700 Fax: +32 2 4000 701 E-mail: info@mail.ertico.com
Website	http://www.ertico.com
Available material	Website only

Project Name	**EUROSIL** European Strategic Intermodal Links
Start date – duration	1997-1999, Final Report: January 2000
Funding	DG VII Transport under the 4th Framework Programme
Project Summary	EUROSIL has developed comprehensive guidelines to support decision making processes with respect to the impacts of multi-modality, intermodality and interoperability on area development in the context of the Trans-European and Pan-European Networks. Through 12 cases studies good practice in appraising the benefits of multi-modal transport investment was identified. In 1997, the projects had not taken into account the concept of intermodality, which was relatively new at that time. The project concluded that interconnection, intermodality and interoperability need to be addressed much more. Also the impact on area development needs more study. The guidelines consist of recommendations on the identification, measurement and evaluation of these impacts. Concrete software has been provided for these tasks.
Modal focus, trip length focus	All modes Long-distance (TEN-T)
Main contact	Project co-ordinator Prof Maria Giaoutzi National Technical University of Athens Irron Polytechniou 9 Zographou Campus 15780 Athens Greece E-mail: giaoutsi@central.ntua.gr
Website	http://www.europa.eu.int/comm/transport/extra/eurosilia.html
Available Material	Final Report available under: http://www.europa.eu.int/comm/transport/extra/final_reports/strategic/EUROSIL.pdf

Project Name	**EU-Spirit** European System for Passenger Services with Intermodal Reservation, Information and Ticketing (note: reservation and ticketing are not included yet)
Start date – duration	1998, still running; after completion of the EU research project EU-Spirit (duration 28 months) the participants decided to continue the work
Funding	EU funding and financial contributions of project partners
Project Summary	EU-Spirit is a European travel information system offering the calculation of itineraries (door-to-door travel information) between European cities and regions with regard to public transport, including all transport modes offered by certain operators in Sweden, Denmark and Germany (long-distance as well as short distance). EU-Spirit is not a travel planner itself, but a compilation of already existing internet-based information systems. It is planned to extend the EU-Spirit system in the future spatially and in its functions. It is a promising approach to a truly European travel planning system.
Modal focus, trip length focus	Public transport, all lengths, with a focus on the European dimension
Main contact	EU-Spirit Management Office c/o VBB Verkehrsverbund Berlin-Brandenburg GmbH Mr. Jürgen Ross Hardenbergplatz 2 10623 Berlin Germany Tel. +49-30-254 14 260 Fax +49 30 254 14 315 E-mail: ross@vbbonline.de
Website	www.eu-spirit.com The travel planner can be checked under: http://www.vbb-fahrinfo.de/fahrinfo/bin/eu/query.exe/dn?L=vs_intermodal
Available Material	Webpage with newsletters and information brochures for download, detailed technical information

Project Name	**GUIDE** Group for Urban Interchanges Development & Evaluation
Start date – duration	January 1998 to August 1999
Funding	52% European Commission
Project Summary	GUIDE operated through surveys and case studies drawn from a number of major European cities. The objectives were to assess best practice in the functional specification and design of Interchanges by means of a peer group review of selected case studies. For the network-wide level and individual location level. Collection of information about how many passengers use interchanges in 20 European cities. Tests on public transport network models showed benefits could be gained if barriers to interchange were eliminated.
Modal focus, trip length focus	Public transport Urban
Main contact	The MVA Consultancy Dr. George Terzis MVA House Victoria Way GB - GU2 1DD Woking, Surrey Tel.: 0044-1483-728051 Fax: 0044-1483-755207 E-mail: gterzis@mva.co.uk
Website	http://www.interchanges.co/uk (not online anymore) http://www.cordis.lu/transport/src/guide.htm http://europa.eu.int/comm/transport/extra/guideia.html
Available Material	Detailed report online (http://europa.eu.int/comm/transport/extra/final_reports/urban/GUIDE.pdf)

Project Name	**HSR – COMET** Interconnection of the High Speed Rail Network with other Transport Modes: Connection in Metropolitan Areas of HSR Terminals
Start date – duration	1.1.1996 – 31.3.1997 15 months
Funding	50% EU-funded
Project Summary	High Speed Rail (HSR) can offer high transport capacities on medium distance trips and provides easy access to urban centers. The efficiency of HSR, which will generate massive arrivals of passengers at fixed intervals, is conditioned by the possibility of providing passengers with a complementary mass transit system, which should be as efficient as HSR. The HSR COMET project has led to major advancements and has resulted in proposals for improved intermodal connections to HSR terminals. The HSR-COMET project aims at providing public and private bodies with guidelines to prepare a HSR development policy based on the characteristics of interconnecting urban transit systems. To fulfill this aim, some cases have been studied in the three countries involved – Roma Termini, Frankfurt am Main, Paris Nord, Roissy Charles de Gaulle and Marseilles St. Charles. A software program entitled Systerminal was developed as a part of this project, in order to simulate the HSR demand for intermodal connections and to resolve the issue of intermodality.
Modal focus, trip length focus	High Speed Rail (HSR) terminals Urban transit systems
Main contact	Dr. Antonio Savini Nicci Treno Alta Velocita S.p.A. Via Mantova, 24 I-00198 Roma Italy Fax: +39-6-85258400
Website	http://europa.eu.int/comm/transport/extra/final_reports/urban/hsrcomet.html http://www.tav.it
Available Material	Project Report available on website http://www.tav.it/hsr/home1.htm

Project Name	**IATA Air/Rail Intermodality study**
Start date – duration	2003
Funding	EU, ACI, ATAG, CER, UIC
Project Summary	Seminal document on air-rail intermodality analyses in depth the issues for development and promotion of high speed rail and intermodality where there is competition with air services. The project addresses: - the customer/market perspective including a new survey on segmented customer needs with emphasises the importance of a good intermodal connection (40% of those questioned) from all aspects and summaries of impact of high speed rail as a point-to-point service and feeder service. In any case it seems that there will always be a market for air-air connections through hubs whatever the HSR alternative. High speed rail can gain a large market as a point-to-point service but has less consistent impact as a feeder to hub airports (here the issue of connection quality is more important). Amongst business passengers there is concern about quality of baggage transfer and connection guarantees and consistency. - the society perspective addressing the issue of total costs of alternatives and emphasising that perhaps rail travel should not be preferred absolutely by public investment unless it offers a total cost advantage (i.e. up to a certain distance). - the operator perspective including all the practical barriers to intermodal rail feeder to air services in a competitive internal market of network air operators and rail companies with network and regional carriers. An interesting point is that network air carriers not only require a rail feeder service to be better than the equivalent air feeder service, the total trip must be better than competitive air-air trips through competing hub airports. The project suggests that the slot deficiencies at hub airports may not be solved by HSR feeder services, a) the market potential isn't strong enough and b) the slots will be absorbed by latent demand
Modal focus, trip length focus	Air/Rail
Main contact	Clémence Routaboul Business Analyst routaboulc@iata.org 6373 Central House, Lampton Road Hounslow, TW3 1HY United Kingdom Tel +44 (0)20 8607 6223 Fax +44 (0)20 8607

Website	http://europa.eu.int/comm/transport/rail/research/doc/air-rail.pdf http://www1.iata.org/Whip/Public/frmMain_Public.aspx?WgId=213#2
Available material	Final report, see web reference above IATA Air Transport Consultancy Services, 2003, *Air/Rail Intermodality Study: Final Report*. Available from : http://europa.eu.int/comm/transport/rail/research/doc/air-rail.pdf [Accessed May 2004].

Project Name	**IDIOMA** Innovative Distribution with Intermodal Freight Operation in Metropolitan Areas
Start date – duration	December 1998 - 27 months
Funding	45% EU-funded
Project Summary	The success of intermodal transport depends strongly on the managerial and organisational performance of the pre- and end-haulage of the intermodal transport leg. IDIOMA wants to demonstrate different concepts aimed to improve the distribution of goods within urban areas and between intermodal terminals/freight centres and urban areas. The combination of freight with passenger transport was examined as well. There were innovative solutions that showed a reduction of emission levels but the economic performance was unsatisfactory. Regional or local bundling projects were only partially successful and were found difficult to implement in the current transport business environment. While in some cases computer-based network optimisation helped achieve environmental benefits, savings of distribution costs could not be proved. The in-time provision of traffic information proved effective in eliminating a substantial part of the delays at the intermodal centres. Integrated transport of passenger and freight has the advantage of fast access to city centres but showed limitations in the feasible sizes of the cargoes as well as organisational difficulties for their transhipments.
Modal focus, trip length focus	All modes Regional and local, focus on freight transport,
Main contact	PTV Planung Transport Verkehr AG Dr. Dieter Wild Marcel Huschebeck Stumpfstrasse 1 D-76131 Karlsruhe Germany +49-721-9651-177 +49-721-9651-696 E-mail: Marcel.huschebeck@ptv.de
Website	http://www.idioma.gr/ (not available) http://europa.eu.int/comm/transport/extra/idioma.html http://www.cordis.lu/transport/src/48343.htm
Available Material	Best practice handbook, Final summary ftp://ftp.cordis.lu/pub/transport/docs/summaries/integrated_idioma_report.pdf

Project Name	**INFRAS-IWW – External Costs of Transport**
Start date – duration	Results published in 2000
Funding	
Project Summary	This project is an update and extension of a former study of external effects. It aims to improve the empirical basis of external costs of transport based on the actual state of the art of cost estimation methodologies. The report examines accident and environmental costs in 1995 and projects these forward to 2010. It also considers congestion related costs as well as focusing on four transport corridors within Europe: Paris-Brussels, Paris-Vienna, Cologne-Milan and Rotterdam-Basle.
Modal focus, trip length focus	All modes and all trip lengths considered.
Main contact	Markus Maibach Gerechtigkeitsgasse 20 Postfach CH-8039 Zurich Switzerland Tel. +41 1 205 95 95 Fax +41 1 205 95 99
Website	
Available Material	INFRAS-IWW, 2000. *External costs of transport (accidents, environmental and congestion costs) in Western Europe*. Zurich/Karlsruhe: Infras Zurich, IWW, University of Karlsruhe

Name	**Intelligent Transport Systems Steering Group (ITSSG) of the ICT Standards Board (ICTSB)**
Start date – duration	
Funding	
Key Words	European level standardisation, Intelligent Transport Systems
Project Summary	The ICT Standards Board (ICTSB), which is an initiative from the three European standards organizations CEN, CENELEC and ETSI, has formed the Intelligent Transport Systems Steering Group (ITSSG) which co-ordinates specification activities for Intelligent Transport Systems (ITS) and aims at a well-structured and consistent set of standards in this field. It shall focus on strategic co-ordination of standardisation programmes, taking into account the need for longer-term planning of standard issues. These include multi- and intermodal requirements for ITS for road, rail, water, and air.
Modal focus, trip length focus	All modes, European perspective.
Main contact	Chairperson: Cathy Jenkins Transport Technology & Telematics Division Department for Transport 76 Marsham Street, Great Minster House UK- SW1P 4DR London Tel: +44 20 7944 4851 Fax: +44 20 7944 2196 E-mail: cathy.jenkins@dft.gsi.gov.uk Secretary: Mr. Gerd Ochel ETSI Secretariat 650, Route des Lucioles F-06921 Sophia Antipolis Tel: +33 4 92 94 42 47 Fax: +33 4 92 38 52 47 E-mail: gerd.ochel@etsi.org
Website	http://www.ictsb.org/ITSSG_ToRs.htm
Available Material	Website

Project Name	**INTERCEPT** Intermodal Concepts in European Passenger Transport (EU TAP-T-programme)
Start date – duration	December 1998 - 24 months
Funding	EU-funded, amount not mentioned
Project Summary	INTERCEPT realized demonstrations in four cities (Barcelona, Bristol, Alkmaar and Bremen) having a good geographical distribution across Europe. There are 9 basic applications that have been developed and integrated into the INTERCEPT "tool-box". The main project aim was to develop, integrate and demonstrate in three sites (Barcelona, Bremen and Bristol) a series of measures based on integrated transport telematics applications to support strategies for promoting passenger intermodality in urban areas. The results showed that there were reductions of up to 10% in car use. The results in Bristol showed that also ride sharing and walking mode were promoted and that the reduction in car usage achieved for the trip planner sub-sample (less 5% car) was improved when this “carrot” is combined with the “stick” of road pricing (less 12.8% car). The respondents stating that the trip planner has helped them use a better public transport service ranged between 8% and 10% in Bremen and Bristol and new public transport trips were found as a result of new trip planner up to 7% of the participants (in the same cities). The internet-based public transport trip planner, developed to a common specification in the three sites, showed high levels of acceptance with those stating that they would either definitely or probably use this application in the future ranging between 70% and 90%. The bookings of the car sharing in Bremen handled by the internet accounted for 10% of total and the taxi dispatching system in Bremen based on GPS location and smart cards recording taxi information showed significant improvements in the efficiency of fleet management.
Modal focus, trip length focus	Regional and local
Main contact	DSD Design Systems Development Simon Hayes Centreservei Zona Franca, Carrer 60, Núm. 25-27, Sector A Spain - 08040 Barcelona Tel: 34 93 431 4650 Fax: 34 93 4314163 E-mail: shayes@dsd.es
Website	http://www.btsa.es/intercept http://europa.eu.int/comm/transport/extra/intercept.html http://www.cordis.lu/transport/src/48345.htm
Available Material	Report on Users’ Needs, Report on State-of-the-Art Overview & INTERCEPT developments, Validation Plan, Concepts / Systems Architecture, Verification Report, Implemented demonstrators including Transfer Studies, Final Validation Report, Exploitation Plan

Project Name	**Interchange and Travel Choice**
Start date – duration	**1997 – 1999**
Funding	Scottish Executive
Project Summary	In order to improve understanding of the role and effect of interchange on the travel behaviour of bus, train and car users, this piece of research was commissioned by the Scottish Executive. Focus groups and interviews were undertaken to discuss experiences and attitudes towards interchange. The study found that an interchange penalty was found at 4.5 minutes, but a guaranteed connection could reduce this to 0.9 minutes.
Modal focus, trip length focus	Bus, rail and car Local trip length, mainly commuting.
Main contact	2J Victoria Quay EDINBURGH EH6 6QQ Tel: 0131-244 7560, or E-mail: cru.admin@scotland.gov.uk
Website	http://www.scotland.gov.uk/cru
Available material	SCOTTISH EXECUTIVE CENTRAL RESEARCH UNIT (Authors: Wardman, M., Hine, J. And Stradling, S.), 2001. *Interchange and Travel Choice*. Volume 1

Name	**International Organization for Standardization Technical Committee 204 ISO/ TC 204 – Intelligent Transport Systems**
Start date – duration	
Funding	
Summary	ISO/TC 204 creates international standards in the field of Intelligent Transport Systems. The work of ISO/ TC 204 encompasses standardisation of information, communication and control systems in the field of urban and rural surface transportation, including intermodal and multimodal aspects thereof, traveller information, traffic management, public transport, commercial transport, emergency services and commercial services. In the sector of intercity rail transport ISO/ TC 204 covers, besides freight aspects, the intermodal movement of passengers, and the development of passenger information systems. The work of ISO/TC 204 is linked to standardisation activities on the European level (e.g. CEN 278, CEN 320) through the Vienna Agreement (agreement on technical co-operation between ISO and CEN).
Modal focus, trip length focus	All modes, all trip lengths
Main contact	ISO/TC 204 – Secretariat ITS America 1100 17th Street, NW, Suite 1200 Washington, DC 20036-4639 USA Tel +1 202 484 48 47 Fax +1 202 721 42 05 Secretariat direct Secretary: Paul B. Najarian Tel +1 202 721 42 25 Fax +1 202 484 34 83 E-mail najarian@itsa.org
Website	http://www.iso.ch/iso/en/stdsdevelopment/tc/tclist/TechnicalCommitteeDetailPage.TechnicalCommitteeDetail?COMMID=4559
Available material	Business plan of ISO/ TC 204 online

Project Name	**INTRAMUROS** Integrated Urban Transport Concepts and Market Orientated Urban Transport Systems/On-Demand Urban Transport Systems
Start date – duration	1997-1998
Funding	DG VII Transport under the 4th Framework Programme
Project Summary	INTRAMUROS elaborated a methodology to help the different actors involved in urban transport to assess and improve their level of integration and co-ordination. The project has produced a multi-criteria decision support tool, which helps urban transport organisations identify areas where greater co-operation is possible. The INTRAMUROS decision support tool provides city and regional traffic planners with a means of comparing quantitatively the relative benefits of different local strategies for improving the co-ordination and integration of the urban transport system. The project concludes that there is no single organisational, financial and legal structure that will best encourage transport integration for all the different types and sizes of urban areas in Europe. An activity-based organisation, where actors have powers extending over different transport modes and across wide geographic areas, may be regarded as the most likely to induce better transport integration. However, such a structure cannot be imposed abruptly, and this major transition may not be as sensible as lesser modifications to existing structures.
Modal focus, trip length focus	All modes Urban
Main contact	ETRA, S.A. Vicente Sebastián New Technologies Department Tel.- +34 96 313 4082 Fax.- +34 96 350 3234 E-mail.- vsebastian.etra-id@etra.es Final report only as hardcopy, contact sylvie.puissant@cec.eu.int
Website	http://www.europa.eu.int/comm/transport/extra/intramurosia.html http://www.cordis.lu/transport/src/intramur.htm
Available Material	Final Report

Project Name	**MEST** Methods for European Surveys of Travel Behaviour
Start date – duration	1996 – 1999
Funding	European Union
Project Summary	This project reviews the existing practice of long distance travel surveys in Europe. The project analyses a summary of a sample of European long distance travel surveys and comments on the collected surveys. Also the general quality criteria for long distance travel surveys and those criteria considered to be used in the project are discussed. As a general base for further recommendations the project describes the options for the design of the long-distance travel diaries to be tested in the first wave of MEST-pilots and then second the options selected for further testing. The qualitative and quantitative results of the three waves of MEST pilots were conducted to address a number of methodological issues raised by the definition of an European benchmark survey of long-distance travel. Thereby the project discusses the object of measurement: The long-distance journey and the various levels of abstractions possible. The possible themes for the surveys of concept and question understanding are presented, while the various survey format options are presented as well. One deliverable deals with the state of the art and the current practice of long distance travel surveys methodology in Europe. Starting point is the question, of how to improve their “cost efficiency” by optimising sample schemes. The importance of “over-sampling” the highly mobile persons and the way to implement is discuss additional. Regarding incomplete data two main categories of methods were used to cope with the variety of non-responses to the questionnaire: weighting and imputation. After a presentation of the main useful concepts in this field, these two methods were considered, both theoretically and practically, with examples drawn from a methodological survey (VATS) and from the French National Personal Transportation Survey (NPTS). The original methodologies developed for the MEST project and the synthesis of many papers, which are either presented in the appendices or mentioned in the references are summarised in a final report as well as suggested administration and evaluation methods for travel diaries are in a special manual. Two final workshops had the task to present the results of the projects in their final draft form for discussion and critique.
Modal focus, trip length focus	All modes. Trans-European journeys.
Main contact	Univ.-Prof. Dr.-Ing. Kay W. Axhausen (now at ETH Zürich) Dipl. Kauffrau Maria Youssefzadeh Institut für Straßenbau und Verkehrsplanung Fakultät für Bauingenieurwesen und Architektur Leopold-Franzens-Universität Innsbruck

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Website	http://www.uibk.ac.at/c/c8/mest/
Available Material	Several reports downloadable as deliverables, available via website

Project Name	**MIMIC** Mobility and Intermodality and Interchanges
Start date – duration	January 1998 – 18 months
Funding	Part funded by the European Commission: 64%
Project Summary	The project goal is to 'break down the barriers to intermodality' at passenger interchanges. The research plan has been developed according to four study areas, which help structure and identify project results. 6 cities were field test of MIMIC tools. Questionnaires on intermodality and its barriers on passengers. The MIMIC research has shown that travellers give great importance to the interchange when they choose whether to make intermodal trips. Removing barriers is a necessary condition for a successful interchange, but not a sufficient one.
Modal focus, trip length focus	Intermodality, public transport, Urban and regional
Main contact	Regione Lazio Enzo Coccia Via Capitan Bavastro, 108 PO Box Cedex Lazio IT-00154 Roma Iltaly Tel.: +39-6-51686528 Fax: +39-6-51686067
Website	http://cordis.lu/transport/scr/mimic.htm http://europa.eu.int/comm/transport/extra/final_reports/urban/MIMIC.pdf
Available Material	Final Report online and a CD-ROM

Project Name	**MINIMISE** Managing Interoperability by Improvements in Transport System Organisation in Europe
Start date – duration	1996-1999
Funding	DG VII Transport under the 4th Framework Programme
Project Summary	MINIMISE has identified measures to improve interoperability in different transport sectors. Specific emphasis was given to (intermodal) freight markets, but also passenger rail and local public transport were covered. Main focus have been economic and organisational measures. Several concrete recommendations are given, for many of whom positive benefit-cost ratios have been calculated, e.g. P&R, door-to-door-transport (bookable taxis), low-floor-vehicles, dual light rail. MINIMISE supports trough ticketing, smart cards, harmonisation of fares and real-time information and proposes common EU public transport accessibility standards. Also, guidelines for European transport infrastructure should define a minimum level of interconnectivity.
Modal focus, trip length focus	Intermodal focus mainly on freight; passenger rail and regional/urban public transport were covered but not under an intermodal perspective All trips
Main contact	HEUSCH/BOESEFELDT GMBH Dr.-Ing. Hartmut Schaefer Liebigstrasse, 20 52070 Aachen Germany Tel: +49-241-1680557 Fax: +49-241-1680555
Website	http://www.europa.eu.int/comm/transport/extra/minimiseia.html http://www.cordis.lu/transport/src/minimise.htm
Available Material	Summary

Project Name	**MobiService Centres Project**
Start date – duration	September 2000 – 18 month
Funding	Partially funded by the European Commission's Information Society Technologies Programme (Project Number IST-1999-20794), Total cost: 714,090 Euro, EC Contribution: 425,673 Euro
Project Summary	MobiService is a project within the IST programme of the European Commission (action line "Intelligent transport infrastructure and mobility management"). It examines a wide range of organisational and technological aspects as well as methods regarding the MobiService Centers. Aim of the project is to analyse the multi-modal systems and services provided by the leading Mobility Management and Service Centres in Europe, and to identify requirements for improving the services provided by them to achieve a standardisation on a high level. The projects also examines the transferability of the component systems and services and developed guidelines and recommendations for their transfer. Leading MobiService Centers in Europe are involved in the project and provide examples for a user group of followers.
Modal focus, trip length focus	All modes, all trip length
Main contact	WS Atkins Consultants Ltd Peter Leach Woodcote Grove, Ashley Road KT 18 5BW Epsom United Kingdom Tel: +44 - 1372 – 726140 Fax: +44 – 1372 – 740055 E-mail: paleach@wsatkins.co.uk
Website	www.mobiservice.org.uk
Available Material	Website , Proceedings of Workshop on Best Practice in MobiService Centres (2001), Handbook (transfer of best practice)

Project Name	**MRO1 – End Legs and Interchanges**
Start date – duration	Mid-March to Mid-May, 2002
Funding	UK Department for Transport
Project Summary	MORI was commissioned by DTLR (UK Department of Transport, Local Government and Regions) to conduct research amongst the general public to investigate: the extent to which access/egress are perceived as barriers to considering public transport as a modal option, particularly the need to walk to/from services. The report also investigates the value of information about these modes in engendering confidence and perceived convenience of public transport overall. The report was undertaken with 12 interviews and seven focus groups.
Modal focus, trip length focus	Variety of local end-leg modal options, such as bus, taxis, walking/cycling and car.
Main contact	Enquiry Service Department for Transport Great Minster House 76 Marsham Street London SW1P 4DR
Website	http://www.dft.gov.uk/stellent/groups/dft_transstrat/documents/page/dft_transstrat_022665-01.hcsp#TopOfPage
Available material	On-line report, available in Microsoft Word or pdf format. MORI, 2002. *Transport Direct. MRO1 – End Legs and Interchanges. Final Report*. Research conducted for DTLR

Project Name	**PEPTRAN** (dg IST) Pedestrian and Public Transport Navigator
Start date – duration	01/01/2001 - 36 months
Funding	2.600.000 € Cost sharing contracts: 50% EU
Project Summary	PEPTRAN developed software to guide a user from point to point within a city, walking and using public transport in the most efficient manner. The software will be implemented on two platforms: a hand-held device, and an existing car navigation system. In the second case, the software will guide the car driver to the best place to park and change to public transport, on the assumption that the user wishes to avoid driving in the city centre. Those who made use of the system here decreased their journey times by between five and ten per cent, compared to those who tried to work out their own routes in the traditional way. Over one in ten (two per cent said "definitely" and nine per cent said "probably") of the UK testers said they would be encouraged to use local public transport more often if they had this service on their own mobile phones. The project concluded that the system would likely be more useful for those not familiar with travel routes in a city, such as tourists and professional drivers. Car-sharing and rental services might benefit too.
Modal focus, trip length focus	Public transport, walking Within cities
Main contact	British Marine Technology Limited Dr. Rory Doyle, Orlande House Waldegrave Road 1 TW11 8LZ Teddington – Middlesex U.K. Tel: +44-208-9435544 Fax:+44-208-9779304
Website	http://www.bmtech.co.uk/Peptran (currently unavailable)
Available Material	http://www.crfproject-eu.org/menu.asp?ind=peptranfolder&nome=PEPTRAN http://dbs.cordis.lu/fep-cgi/srchidadb?ACTION=D&CALLER=PROJ_IST&QM_EP_RCN_A=56912

Project Name	**PIRATE** Promoting Interchange Rationale, Accessibility and Transfer Efficiency
Start date – duration	January 1998 – 18 months
Funding	60 % EU-funded
Project Summary	PIRATE is a Research and Technical Development project that tested a new research methodology to improve transport Interchanges. Therefore, more people will use public transport. It emphasizes on the needs and requirements of the people using the public transport. The perceiving of interchanges and the reason for non-users of public transport was analysed. The findings of users and non-users on the one hand, and the vision of decision makers and experts, and of people who manage, work in, or provide services in, to or from the analysed interchanges on the other hand were confronted. There were two approaches used within the project termed “Evaluation Approach” and “Planning Approach”.
Modal focus, trip length focus	Public transport Regional and local
Main contact	South Yorkshire Passenger Transport Executive Victoria J Butterell Exchange Street PO Box 801 GB-S2 5YT Sheffield Tel.: 0044-114-2677575 Fax: 0044-114-2759908
Website	http://www.interchanges.co.uk (not online anymore) http://www.cordis.lu/transport/src/pirate.htm
Available Material	PIRATE has produced a handbook in hard copy and a CD-ROM format detailing the planning methods and the case study results.

Project Name	**QUATTRO** Quality Approach in Tendering Urban Public Transport Operations
Start date – duration	December 1996 -18 months
Funding	EU: 52%
Project Summary	Together with experts from the European Committee for Standardisation (CEN TC 320 WG5), QUATTRO developed a standardised set of quality indicators for UPT (Urban Public Transport). It is important to consider quality management as a continuous search for better service and organisation, rather than the pursuit of a rigid and specific level of quality. The thinking has to be customer-oriented. The benchmarking has to be against others, within the transport sector or with other sectors.
Modal focus, trip length focus	Urban Public Transport Urban and regional trips
Main contact	OGM Project co-ordinator Yves Mathieu 92, Oudergemlaan B-1040 Brussels Belgium Tel: +32-2-737 96 80 Fax: +32-2-737 96 99 E-mail: yves.mathieu@ogm.be
Website	http://europa.eu.int/comm/transport/extra/quattroia.html http://www.cordis.lu/transport/src/quattro.htm
Available Material	Quattro, final report, synthesis and recommendations; Quattro, practitioner's handbook

Project Name	**ROSETTA** Real Opportunities for Exploitation of Transport Telematics Applications
Start date – duration	Start date January 2000 till April 2003
Funding	DG INFSO, Support Measure which will draw together the results and findings of the 4th and 5th Framework transport telematics and IST projects
Project Summary	The ROSETTA project aims to support an effective application of transport telematics in Europe through the documentation of existing research and the assessment of further developments and implementation needs. Information and related technologies are essential for all aspects of travel. Intermodality is a key vision. The project presents a valuable assessment of the present situation and future developments. For multi-modal passenger transport real-time integrated information, through ticketing and value-added services are most important. Intermodality can only be found in dense metropolitan areas so far. Not only technical standardisation is needed, but also administrative and legal barriers to be overcome, especially in a increasingly competitive environment. Most new services will be device-independent. Interfaces need to be harmonised. New forms of "travel agents" will emerge (value added service providers, transport information brokers).
Modal focus, trip length focus	No specific focus (all modes, all trips, passenger and freight)
Main contact	Transportation Research Group School of Civil Engineering and the Environment University of Southampton Dr. Richard Hall Tel: +44 (0)23 8059 2174 Fax: +44 (0)23 8059 3152 E-mail: R.D.Hall@soton.ac.uk
Website	http://www.trg.soton.ac.uk/rosetta/index.htm
Available Material	Work Area Progress Reports D 4, mainly 1) Passenger Transport Services and 4) Personal Travel Services

Project Name	**SORT-IT** Strategic Organisation and Regulation in Transport
Start date – duration	1996-1999
Funding	DG VII Transport under the 4th Framework Programme
Project Summary	SORT-IT's aim has been to determine regulatory and organisational structures for the European transport system that promote efficiency (both production and consumption). A special focus has been on the concepts of interoperability, interconnection and intermodality. A literature review, 152 interviews and the use of various models have been the methods. Recommendations covered both the organisation of the European transport system and measures to promote the interconnection. Recommendations for interconnection include: ▪ continued development of high speed rail system linking key airport hubs ▪ reducing organisational barriers in international rail which are believed to be more important than technical barriers ▪ introduction of information systems which combine static and dynamic data for various modes (advanced traffic information systems and trip planning systems) As a conclusion first the strategic organisation of the market has to be completed and then interconnection and interoperability will become the main focus, which is the case already for air (and road freight).
Modal focus, trip length focus	All modes, Passenger and Freight All Trips
Main contact	Project co-ordinator Dr. Susan Grant-Muller University of Leeds, Institute of Transport Studies (ITS) Woodhouse Lane LS2 9JT Leeds UK E-mail: s.m.grant-muller@its.leeds.ac.uk
Website	http://www.europa.eu.int/comm/transport/extra/sortitia.html http://www.cordis.lu/transport/src/sort-it.htm
Available Material	Final report available under: http://www.europa.eu.int/comm/transport/extra/final_reports/strategic/sortit.pdf

Project Name	**STEMM** Strategic European Multi-Modal Modelling
Start date – duration	1996-1999
Funding	DG VII Transport under the 4th Framework Programme
Project Summary	For the improvement of intermodal journeys (both passenger and freight), STEMM worked on the determinants of mode and route choice and on policy actions to influence these. STEMM developed, calibrated and tested models to simulate mode and route choice. Also the political and social acceptance of transport measures has been assessed. For passenger transport the following policy conclusions have been reached: ▪ internalisation of external costs through pricing measures; ▪ harmonisation of fiscal conditions for transport across Europe; ▪ stimulating investment in the infrastructure of modal interchanges; ▪ improving information systems, especially on the overall transport chain; ▪ encouraging transport operators to supply services based on chains (e.g. by forming partnerships to co-ordinate flows) - by making sure that enough incentives arise in the market place.
Modal focus, trip length focus	Road, Air, Rail; Passenger and Freight Long-distance, European
Main contact	Baxter Eadie Limited Bill Eadie 60 George Street Richmond Surrey TW9 1HE, UK E-mail: wte@belwwhq.demon.co.uk Final report only as hardcopy, contact sylvie.puissant@cec.eu.int
Website	http://www.europa.eu.int/comm/transport/extra/intramurosia.html http://www.cordis.lu/transport/src/intramur.htm
Available Material	Final Report (hard copy only)

Project Name	**SWITCH** Sustainable, Workable Intermodal Transport Choices
Start date – duration	January 1999 - 24 months
Funding	EU: 41%, 59% by project partners
Project Summary	Interchange design should take account of identified user needs. Intermodality needs to be planned and managed from a network rather than a site-specific perspective, with co-operation between organisations. Both pre-trip and real-time information should be provided, and signage should be standardised. Access issues must be foremost when designing interchanges, with high quality Park and Ride car parks, Kiss and Ride spaces, and full integration of taxi services with public transport.
Modal focus, trip length focus	Land, air and water based travel Regional and urban
Main contact	Project co-ordinator B. Garner Nexus House St. James Boulevard Newcastle upon Tyne NE1 2DA UK E-mail: b.garner@nexus.org.uk
Website	http://europa.eu.int/comm/transport/extra/switchia.html http://www.cordis.lu/transport/src/48349.htm
Available Material	Final Report, Deliverable 8, SWITCH, June 2001, 65pp.

Project Name	**TAPESTRY** Evaluation Model for the Optimal Location of Intermodal Terminals in Europe
Start date – duration	2000-2003
Funding	DG TREN under 5th Framework Programme
Project Summary	TAPESTRY has analysed the role of campaigns and communication at a local and regional level in order to change travel behaviour towards an increased use of sustainable modes of transport. The case studies included a range of initiatives including school-based programmes, competitions, displays, individualised marketing. As a result, campaigns can have an influence on awareness, attitudes and behaviour, but need to be targeted, operate with consistent messages and under a strong supporting framework. TAPESTRY has developed a model "seven stages of change".
Modal focus, trip length focus	All modes, local and regional level
Main contact	Transport & Travel Research Ltd Norman James 36 Regent Street Nottingham NG1 5BT UK Tel.: +44 115 941 1141 Fax: +44 115 941 1331 E-mail: norman.james@ttr-ltd.com
Website	http://www.eu-tapestry.org
Available material	Final Report, State-of-the-Art, Best Practise Guidelines, Case Study Reports

Project Name	**TAP-PROGRAMME**
Start date – duration	1994 - 1998
Funding	various % EU-funded
Project Summary	Programme covering all aspects of telematics development, concentrating on technical verification, standardisation and cost-benefit analysis of telematics systems including e-ticketing and traveller information systems using newer technologies. Provided a basis for European standardisation and trial of these products. 20+ projects looking at travel information and integrated payment technology. Specific areas on fixed and mobile multi/inter-modal travel information systems and integrated payment. Projects showed high acceptance of information and integrated payment products and provided basis for standardisation. Benefits are less quantified, but showed willingness to change mode based on pre-trip information. Within the TAP-Programme, the project EUROTRACS also looks at user-needs for baggage handling **Multi-modal travel information:** - projects PROMISE, INFOTEN and HANNIBAL implemented traveller information services on mobile devices, mainly WAP or PTA, including real-time information. - results showed frequent benefits in changing mode (40-50 % changed mode at some time), 10-30 % expected to save time. Willingness to pay around 3-10 EUR per month in two cases. Personalisation identified as a key issue. **Fixed Multi-Modal Travel Info.** - Internet information has been implemented in CONCERT, ENTERPRICE, EUROSCOPE, HANNIBAL, QUARTET+ and TABASCO. INTOURISME clustered large numbers of diffuse small and medium sized enterprises information sources. - Pre-trip information can affect mode choice. 10 % of users may chance mode on the basis of internet information (AUSIS). - Public transport real-time information (delay + P+R advice) on road VMS signs can have an effect on travellers (2 % reduction in traffic in Munich (TABASCO). **Integrated payment** - CALYPSO developed a contactless and contact smart-card standard in Paris, Venice, Lisbon and Konstanz. Based around PT payment but with intelligent folder and payment for non-transport services. - ADEPT developed a citizens card in Finland with over 500 000 cards for multi-payment options. Was very successful - DISTINCT trialled a concept of identification data of the card-

	holder, including users needs and preference and interoperable extra services. In the four cities it was trialled in, it proved very popular (70+ % satisfaction rating) **Standard, architectures and user-needs** - INFOPOLIS2 defined guidelines for designers of traveller info. systems, basis for standardisation (CEN TC278). Content, icons, layout, icons etc. - TELESCAN defined the user needs of the low mobility sector in telematics applications - EUROSPIN project made major progress in solving data retrieval from third party databases. EU-SPIRIT developed a new architecture to communicate with existing systems providing long-distance door-to-door info. + reservation systems. Both offer open architectures - KAREN did not address intermodal issues. A global system architecture for intermodality is still open. - EUROTRACS defines user needs for European inter-modal travel including information requirements and multi-modal baggage management - CODE produced a structured user needs analysis for intermodal travel including spec. for long-distance traveller, synthesising many of above sources **Future priorities :** - Simple query and personalisation - Integration of travel and destination products, links to booking, reservation and payment services - Cost minimisation through efficiency + viable business models
Modal focus, trip length focus	No main focus, all telematics areas, but more frequently urban/regional tranpsort
Main contact	Babtie Paul Riley E-mail: paul@babtie.cz
Website	http://www.cordis.lu/telematics/tap_transport/
Available material	Many reports for individual projects

Name	**Task Force Transport Intermodality**
Start date – duration	1995 – 1997
Funding	
Summary	The Task Force Transport Intermodality has been created in 1995 with a view to developing a consistent intermodal RTD effort at a European level. Its core mandate is to add value through the improved co-ordination of existing and planned research activities. In addition, it is to highlight priorities for future research needs and to promote high-profile demonstration projects. In a broader sense, the Task Force is to reflect on how to move from a modal thinking about transport to thinking of transport as an integrated door-to-door operation. The Task Force is to provide a focal point for the wide range of stakeholders who have an interest in intermodal transport.
Modal focus, trip length focus	All modes All lengths
Main contact	**Mr. Patrick Mercier-Handisyde -** Task Force Administrator European Commission - DGVII-E 200, rue de la Loi 1049 Brussels Office: Rue De Mot 28, 7/92 1040 Brussels Tel: +32 2 296 83 29 Fax: +32 2 265 43 49 E-mail: patrick.mercier-handisyde@cec.eu.int
Website	http://www.cordis.lu/transport/src/taskforce/home.html
Available Material	Task Force Brochure, Update, Reports, Projects and Related Documents available on website: Cordis.1995. *Task Force Transport Intermodality* (Available from: http://www.cordis.lu/transport/src/taskforce/home.html)

Project Name	**TENASSESS**
Start date – duration	1996-1999
Funding	DG VII Transport under the 4th Framework Programme
Project Summary	The development of transport policy at a European level raises new issues for the evaluation and decision processes. First, the addition of another policy level places a premium on overcoming the conflicts inherent in the policy-making process. Second, it requires an integrated evaluation that goes beyond localised project and infrastructure investment appraisal. Third, it requires a transport policy to be linked with other European policy objectives. TENASSESS has accomplished two tasks: • to characterise policy processes and identify implications for decision-making on the Trans-European Transport Networks (TEN-T) and the Common Transport Policy (CTP); • to develop and test decision support tools. Intermodal issues have not been at the forefront of the analysis but play a role in any integrated policy concept.
Modal focus, trip length focus	All modes Long-distance (TEN)
Main contact	Co-ordinator: Dr. Liana GIORGI ICCR - Interdisciplinary Centre for Comparative Research in Social Sciences Hamburgerstrasse, 14/20 1050 Wien, Austria Tel: +43-1-587397316 Fax: +43-1-587397310 E-mail: l.giorgi@iccr.co.at
Website	http://www.europa.eu.int/comm/transport/extra/tenassessia.html http://www.cordis.lu/transport/src/tenasse.htm
Available material	Final report available under: http://www.europa.eu.int/comm/transport/extra/final_reports/strategic/tenassess.pdf

Project Name	**TRANS-ITS**
Start date – duration	2001-2003
Funding	100 % EU-funded
Project Summary	Trans-ITS is a thematic network project with the aim to define research priorities for PT ITS within the EU. It contains a description of state of the art and trends in PT ITS including both information systems and e-ticketing and a good description of the Dutch, German and UK national info. system initiatives. Important research priorities include commitment to exception management and information, network co-ordinated safety and security, European travel information systems and more sophisticated dynamic information at interchanges. A lot of the information here is relevant for intermodality.
Modal focus, trip length focus	Public Transport ITS
Main contact	UITP Transits@uitp.com
Website	http://www.uitp.com/Project/index28.htm
Available material	State of the art report, future trends report and research recommendations report

Name	**Transport Visions: Long Distance Travel** Transportation Research Group
Start date – duration	Published February 2003.
Funding	The Transportation Research Group at the University of Southampton was awarded funds from the Engineering and Physical Sciences Research Council (EPSRC), the Rees Jeffreys Road Fund and the UK Department for Transport, to establish and coordinate a Network of Young Professionals.
Project Summary	This report presents the views of the Transport Visions Network on the future of long distance travel. It considers current policy approaches and context for long distance travel, including statistics on trips, modes and destinations, before introducing the Network's own views and solutions to long distance travel. These are presented under four subject headings: Domestic Business Travel, Domestic Leisure Travel, International Business Travel and International Leisure Travel.
Modal focus, trip length focus	Car, train, rail, coach and air. Various trip lengths, mainly from a UK perspective.
Main contact	Mark Beecroft Transportation Research Group School of Civil Engineering and the Environment University of Southampton Highfield SO17 1BJ SOUTHAMPTON UK Tel: +44 (0) 23 8059 2192 Fax: +44 (0) 23 8059 3152
Website	http://www.trg.soton.ac.uk/research/TVNetwork/reports/report6.pdf http://www.trg.soton.ac.uk/research/TVNetwork/index.htm
Available Material	BEERCROFT, M. et al., 2003. *Transport Visions: Long Distance Travel*. London: Landor Publishing Limited The Transport Visions Network have produced a series of eight papers, each focusing on a different topic within transport related issues. These are available for download at the URL link.

Project Name	**VOYAGER**
Start date – duration	2001 - 2004
Funding	100 % EU-funded
Project Summary	Thematic network project for local and regional public transport development covers two important workgroups for intermodality : seamless inter-modal networks and services and the PT ITS group. Also WG 3 - Roles and structures of public transport (PT) actors looks at impact on intermodality of various operating models. Contains a large amount of information including state of the art reports, detailed best practice studies, challenges report and finally policy recommendations for the healthy development of the PT sector. A little bit operator orientated. Does not focus on inter-city transport but is very relevant to the sustainable urban interface, covering for example Integrated PT networks: 2.2 Integrated tariff and ticketing systems 2.3 Intermodal mobility services as feeder modes for the PT network 2.4 Intermodal, customer focussed traveller information services 2.5 Planning and management of interchange zones
Modal focus, trip length focus	Public Transport Future
Main contact	UITP andrea.soehnchen@uitp.com
Website	http://www.voyager-network.org
Available Material	State of the art report, best practice case studies, challenges and recommendations reports

Project Name	**WALCYNG** How to enhance Walking and Cycling instead of shorter car trips and to make these modes safer
Start date – duration	March 1996 - 18 months
Funding	60% European Commission
Project Summary	The purpose of WALCYNG is to sort out conditions and measures that may contribute in replacing short car trips. For that, it applies a marketing model. The aim is to show how short car trips should be replaced by walking and cycling with the help of marketing instruments. The project has produced an evaluation tool available in the form of interactive software. This is intended for use by city authorities in assessing the preconditions for walking and cycling in a certain area, and as a support when developing measures.
Modal focus, trip length focus	Local – urban Short trips, though trips could be a part of a longer chain
Main contact	Project co-ordinator Prof. Christer Hyden University of Lund PO Box 117 S-22100 Lund Sweden Tel: +46-46-2229130 Fax: +46-46-123272 E-mail: christer.hyden@tft.lth.se
Website	http://europa.eu.int/comm/transport/extra/walcyngia.html http://www.cordis.lu/transport/src/walcyng.htm
Available Material	Final Summary Report (http://www.cordis.lu/transport/src/walcyngrep.htm)

B.2 Articles, Conference Papers etc.

Type of reference & Topic	Conference proceedings **Transport Chains and Disabled Persons**
Reference	**ECMT**, 1999. Strengthening the Transport Chain, Conclusions and Recommendations. *European Conference of Ministers of Transport, 27-28 September 1999, Göteborg*
Abstract	The note outlines how the transport chain can be strengthened to improve public transport mobility for travellers with disabilities. It highlights the key elements as the individual transport modes, the interchanges between them, the pedestrian environment, and information provision both before and during the journey. It establishes underlying principles for those responsible for developing accessible transport chains and makes a number of recommendations including: closer cooperation of the institutions and organisations; more appropriate public transport provision; better integration of booking and control systems; training and disability awareness; and, improved coordination of social, health and education transport with other services.
Modal focus, trip length focus	Public transport (and community transport) Focus on local journeys

Type of reference & Topic	Round table proceedings **Airports as Multimodal Interchange Nodes**
Reference	**ECMT**, 2003. Airports as Multimodal Interchange Nodes, Conclusions of Round Table 126, *European Conference of Ministers of Transport, 20-21 March 2003, Paris.*
Abstract	The note discusses the factors limiting the role of airports as multimodal interchange nodes, emphasising the emergence of many different types of airport with different limits and opportunities. Many of the factors relate to recent liberalisation of air transport regulation, and include issues related to: planning and funding of surface access infrastructure; segmentation and fragmentation of planning and management; emergence of a hub-and-spoke air network; increase in low-cost carriers; cost-cutting in a more competitive market, and, strong alliances between airports and airlines.
Modal focus, trip length focus	Air Medium-distance and intra/inter-regional journeys

Type of reference & Topic	**Airline and Railway Co-operation, a new approach to intermodality – a research perspective**
Reference	**GIOVONI, M.** (Unfinished). *Airline and Railway Co-operation, a new approach to intermodality – a research perspective*. Thesis (PhD). The Barlett School of Planning, University College London.
Abstract	This paper argues that with the rapidly increasing demand in air travel and increasing congestion and capacity problems faced by many hub airports, there is a growing potential of co-operation, rather than competition between rail and air modes if their operation is to be integrated into one journey. The paper outlines the various advantages to such operation; including operator cost savings, shorter travel times, fewer delays and reduced environmental impact of the air transport industry. The purpose of this thesis will be to empirically test and measure the above assumptions and establish whether such intermodality would deliver the anticipated benefits.
Modal focus, trip length focus	Modal focus high speed train (HST) and Air Trip length focus mainly inter-city (mainly national).

Type of reference & Topic	**The value of integrated multimodal traveller information and its potential contribution to modal change**
Reference	**KENYON, S. and LYONS, G.**, 2003. *The value of integrated multimodal traveller information and its potential contribution to modal change*. Transportation Research Part F: Traffic Psychology and Behaviour, ISSN: 1369-8478, 6 (1), March, pp 1-21, (Access only to abstract, $30 to purchase full research document via internet – http://www.sciencedirect.com/)
Abstract	This paper reports on research that introduced the concept of integrated multimodal traveller information to mixed mode and mixed socio-demographic groups of travellers. Travellers were shown information about travel by car, coach and train for a journey with which they were familiar. Different levels of information were shown at different times, ranging from simple financial cost and journey duration information to information incorporating comfort and convenience factors. The research illustrates that the majority of travellers do not consider their modal choice for the majority of journeys. Rather, this choice is automatic and habitual, based upon subconscious perceptions of the viability and desirability of travel by modes other than the dominant mode. Thus, information about alternative modes is rarely consulted and travellers can be unaware of viable modal alternatives for their journeys. Results suggest that presentation of a number of modal options for a journey in response to a single enquiry could challenge previous perceptions of the utility of non-car modes, overcoming habitual and psychological barriers to consideration of alternative modes. Where the information presented incorporates comfort and convenience factors, in addition to cost and duration, it may challenge travellers' concerns about alternative modes and could persuade a modal change.
Modal focus, trip length focus	Information, choice of mode

Type of reference & Topic	**Unselected mode alternatives: What drives modal choice in long-distance passenger transport?** Conference Paper
Reference	**LAST, J. AND MANZ, W.** 2003. *Unselected mode alternatives: What drives modal choice in long-distance passenger transport?* Paper presented at the 10th International Conference on Travel Behaviour Research, Lucerne, 10-15.
Abstract	Understanding the process of modal choice is a key objective of the INVERMO project. This paper presents the initial results of the extensive survey data collected, as well as the research methodology used.
Modal focus, trip length focus	Modal focus mainly rail, air, car and coach. Long-distance trip length focus.

Type of reference & Topic	**Notions of Intermodality in Inter-city Passenger Transport**
Reference	**MANZ, W. and LAST, J.** 2002. *Notions of Intermodality in Inter-city Passenger Transport*. IfV – Report Nr. 02-2: Networks for Mobility, proceedings of the International FOVUS symposium.
Abstract	Intermodality has different notions, including the transport policy idea, the suppliers' motivation and customer based view. This paper provides a synopsis of these often opposing understandings, as well as presenting early results from a long-distance travel behaviour research project.
Modal focus, trip length focus	Air, rail, car. Various trip lengths.

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