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COOPERATION
7FRDP Specific Programme

SURFACE AND SATELLITE TRANSPORT RESEARCH ISSUES
(PRIORITY TRANSPORT)
FIRST WORKPROGRAMMES

Detailed addendum

Approved electronically by the Assembly June 2006

REPORT ECTRI 2006-01-EN - Addendum

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This document, as dated, is aimed at the general process of preparation of the workplan of the next 7th FRDP call (s) and contains suggestions for concrete elements or research tasks of the 7FRDP.

It follows the previous ECTRI inputs for the 7FRDP (2004/2005), i.e. our comments and suggestions for the specific programmes COOPERATION, IDEA, CAPACITIES, PEOPLE and the two COOPERATION Transport and ICT related transport inputs for the 7FRDP first workplan (April 2006).

This document is detailing further, the main ideas put in the report ECTRI 2006–01–EN of ECTRI, about the COOPERATION – Transport priority first workplan. It concerns ONLY surface and satellite transport research issues.

(see page 3 of the input ECTRI 2006-01-EN - last bullet).

The material in this report is organized according to the bullets of the specific programme COOPERATION, and the ECTRI input for COOPERATION Specific Programme.

For each priority, there is a specific treatment for NoE ideas by subpriorities and big cooperative project ideas by bullets.

I Surface Transport (rail, road and waterborne) subpriority

1. NoE ideas

Mobility, Disability and Aging

The demographic changes in Europe will contribute to increased numbers of people with reduced mobility, among them older and disabled people. For this population, accessibility of transport (public as well as private cars) is a necessity for autonomy, social inclusion and sustainable development.

The EU's perspective for its disabled citizens is in accordance with the new approach to disability: moving away from seeing people with disabilities as the passive recipients of compensation, the new approach recognises their legitimate demand for equal rights and for full participation in society. The fight against discrimination and the promotion of the participation of people with disabilities and elderly people into economic activity and social participation are clear objectives of the EU policies. The charter of fundamental rights specifically protects the rights of people with disabilities, particularly under Article 26 which recognises as fundamental "the right of persons with disabilities to benefit from measures designed to ensure their independence, social and occupational integration and participation in the life of the community".

In order to meet its objectives of social participation of people with disabilities, the EU is facing a great challenge to ensure the mobility of all citizens, including those with disabilities or reduced mobility. This challenge is all the greater for some new member states or new applicant countries. These countries should be able to benefit from the practices and knowledge of "old" EU members, but it has also to be considered that some of these new member countries may have some developments or innovations that could be interesting to include and promote at a European level.

From the last 15 years, a lot of work has been done in order to improve the mobility of people with disabilities and the elderly people. However, some aspects are still unknown or under-developed and the research activity on this issue is widely disseminated in various structures of EU countries. There is a great challenge to better structure the research potential of EU on this topic in order to be able to raise the last on covered issues and to provide good partnership to new EU member countries.

The proposed network of excellence will have to cover all the research aspects related to the improvement of mobility of people with disabilities and elderly people

- Analysis of the mobility of this population including road safety accidents, national survey on mobility, best practices, regulation
- Identification and modelling of situations where disabilities appear
- Generalisation of the "design for all" approach to favour the further integration of people with disabilities and elderly people
- Design and implementation of technical solutions for helping people with disabilities and elderly people to keep or to improve their mobility in good safety conditions
- Development, harmonization and assessment of national and EU policies regarding the participation of people with disabilities and elderly people to society

- Development of training strategies for travellers

Outcome of the network of excellence

- To set-up and to run a European network of researchers and experts on the field of disability and aging with the objectives of
    - Promotion of the environmental approach of disability (disability studies)
    - Sharing and discussing best-practices and scientific knowledge
    - Identification of main research issues
    - Strengthening multidisciplinary approach to resolve research gaps
    - Incubation of joint research programmes
- To facilitate the diffusion of knowledge by European conference: actually there is only one major conference dealing with the mobility of people who are elderly or with disabilities (TRANSED), this international conference is organised every three years. The international board of this conference is thinking about creating sub committees in North America, Asia and Europe. The network of excellence could be in charge of this organisation.
- Building up of a new generation of researchers and professional of transportation and disability or aging
    - Creating an European training course : master degree
    - Supporting PhD works
- Constitution of a pool of experts that could be involved in the assessment and the improvement of European policies
- Improve the inclusion of the representative of aged people and people with disability in the research development and support to EU policies

New Kyoto round transport related research agenda

In the long term perspective the development of fuel efficient vehicles will be a necessary step towards a low emission society. According to the scenarios used by EEA the increase of CO2 emissions from the car fleet will increase in the range between 25 and 58 percent from 1990 to 2030. According to this scenario the energy demand in the EEA from transport sector will be 33 percent of the total final energy demand in 2030 and thus be a major obstacle for a sustainable transport. For this reason it is also one of the main concerns with regard to climate gas emission abatement.

The research challenge will be a three-fold one. Firstly, there is uncertainty concerning the possible technological alternatives that may be available and come of as the most prosperous in a long term perspective. Assessment of the obstacles and possibilities of low carbon technology is needed, not least to estimate the possibilities of a sustainable technology in the developing and fast growing economies. Secondly, there is a need to create a planning tool for an integrated land-use and transportation planning, which fulfils the criteria of a low carbon society. Thirdly, there is need for research on how transportation related abatement measures can be included under the Clean Development Mechanism in the post Kyoto-period in order to support the development of sustainable transport solutions in the developing countries.

Urban mobility

During the post-war era, the development many Western countries was characterised by urban sprawl, but at the beginning of the 1990s this development seemed to change direction, with the older parts of the cities witnessing a population increase. The trend seems to change from suburbanisation to *gentrification* (or reurbanisation), and with it a change in the social composition of parts of the inner cities. During the latest couple of decades, a growing number of research studies have addressed the relationship between the *physical/spatial characteristics of cities* and the inhabitants' travel behaviour. Many of these studies have concluded that the amount of transport and the proportions carried out by different means of conveyance are influenced by factors such as population density, the location of facilities, the provision of road and parking capacity, residential location relative to centre structure of the city in addition to different types of urban lifestyle.

These different perspectives on urban development are of great interest concerning urban sustainable mobility.

Low-Noise Vehicle Design

In FP6, several IPs, STREPs or CAs are funded dealing with noise abatement by passive as well active means (such as SILENCE, InMAR or CALM II). In order to ensure the continuation of the effort already spent, a NoE on Low-Noise Vehicle Design is proposed linking the different approach for different transport modes. In that way, synergies can be utilised between the projects not fully exploited in FP6.

New traffic modelling and simulation including energy

Most applications related to transportation systems planning, management or operation rely, at one step or another, on the use of transportation models. Many types of models are involved in: network models, traffic flow models, time series, economic models and others. In turn, they involve a wide range of scientific disciplines: physics, operations research, optimisation, statistics, computer science, etc… On the other hand, transportation models also present some specific common features:

- they often are complex, and their resolution involves advanced analytical or numerical computation methods,

- their development requires a good knowledge of the transportation field,

- the proper use of a model requires a deep knowledge both of the model itself and of the field.

It is thus clear that models form a focal point of transportation applications, that modelling is a complex and multi-disciplinary subject, and that scheme assessments and so real-life outcomes are materially affected by the quality of the models used.

This covers most aspects of transportation, people and freight transportations, all modes and various view points: efficiency of transportation systems, safety, local and global impacts on the environment.

The main objective of the New Traffic Modelling and Simulation Including Energy initiative consists in the promotion of a better integration of the research activities concerning the mathematical aspects of transportation applications. This initiative will:

- Ensure a better co-ordination of research programmes,
- Establilsh or enhance connections between the various disciplines involved and the various application fields (e.g. transportation planning and operation, operation and environment…),

- Constitute a common experimental basis (shared validated data sets…) which make the validation and comparison of models easier,
- Disseminate the activities of the networks.

The main achievement of the common work will be the constitution and development of a common corpus of theoretical and applied tools for transportation modelling and management. The objective of the dissemination activities associated to the initiative will be to make this corpus available for the whole European transportation community, including decision makers, consultants, software-developers and operators.

Safety and security in guided transport systems

The safety and security of public guided transport systems in Europe are of major societal concern to the stakeholders (i.e. passengers, staff, operating companies, regulators, local authorities, governments and researchers). The primary objectives of the network of excellence " Safety and security in guided transport systems [SAGES]" are:

- To establish an expertise and research network of safety and security experts in the area of guided transport systems,
- To create a critical mass of knowledge in order to conduct research, development and evaluation studies with the following objectives:
    - To facilitate convergence of safety, interoperability and security philosophies, requirements, approach and proof,
    - To increase safety and interoperability levels by understanding human-machine interactions, protection systems and adequate training systems,
    - To optimise European guided transport attractiveness, flexibility and efficiency and to make it safer both for passengers and staff and operationally more cost-effective according to the EU safety directives.

This network will aim at integrating the research activities, maintaining a minimum of coherence of European research and development, identifying the most promising results and establishing harmonised new research items related to safety, interoperability and security in guided transport systems.

It will spread excellence by facilitating collaboration and dialogue between relevant parties in order to share and to promote knowledge, experiences, results and best practices in relation with guided transport safety, interoperability and security aspects involving regulatory, authorities, operators, managers of infrastructure, standardisation bodies, notified bodies, universities and research institutes, passengers' organisations, industrial and engineering companies and associations.

The key activities of this network of excellence in the field of interoperability, safety and security will cover a wide spectrum of research activities related to eight items:

- Operational safety and security**,**
- Technical safety,
- Safety management**,**
- Passenger and staff security,
- Interoperability,
- Standardisation, legislation and assessment/certification,
- Accident/incident investigations and statistics**,**
- Maintenance

2. Cooperation projects ideas

2.1 Greening of surface Transport

Technologies and knowledge for reduced pollution

Indicators of transport sustainability

Indicators for transport sustainability should reflect the impact of transport on biodiversity and ecosystems. Important processes in this respect are landscape fragmentation and introductions of alien species. While much research has been carried out on the effects of fragmentation on certain species, communities and ecosystems, there is still a need for more basic research and synthesis in this area to develop general indicators. Biological invasions are an increasing economic and ecological problem world wide, and we know that human transport contributes to this problem. More research is needed to quantify these contributions, and to develop tools to predict the spread and impact of alien species through human transport systems.

Indicators and monitoring systems in connection to transport sustainability serve to measure and report on a range of issues from environmental quality and economic performance to progress towards transport sustainability. An important role ascribed to indicators is thus to provide policymaking support. This role is reinforced by various institutional mechanisms: standardised concepts, monitoring frameworks, reporting procedures, etc. In this way indicators also represent particular ways to conceptualise problems and solutions.

Specific indicators even have been developed focusing on the promotion of environmental policy integration in transport, thus, the so-called Transport and Environment Reporting Mechanism (TERM) maintained by the European Environment Agency.

An important question to address is how indicators function in policy making: How and to what extent are they used? Do they fulfil their stated purpose, or are they simply ignored? How do they influence policymaking? Is it even possible to suggest indicators addressing the administrative or organisational side of environmental policy integration? Research addressing these questions and dealing with issues of knowledge and politics, policy and implementation as well as institutional mechanisms is invited.

Impacts of the usage of alternative energy sources in transport

Alternative energy sources are likely to be important in the near future (5-30 years) for two reasons. Fossil fuel production is likely to peak and there is a strong wish to reduce fossil CO_2 emissions. Sustainable and alternative energy is attractive and there is a need to better understand the impacts on society and industry of replacing fossil fuels by alternative energy and alternative energy carriers. Solar energy, radiation, photosynthesis and harvest of biomass form a natural and sustainable process of energy production. Biomass and fuels with biological origin seem to be most promising concepts for the near future (5-30 years).

There are many complex implications of introducing transport fuels with biomass origin to gradually replace fossil fuels. What is needed from production? How to best transform cellulose and lignin to competitive fuels? How should a conversion to substantially increased biomass energy production be managed? What is the right time to introduce, market and substantially replace fossil energy? How can energy companies and distributors adapt and contribute to economical growth?

How society will react and can be transformed by a gradual change over to biomass production and fuels with biological origin represents opportunities and sustainable growth. Responsibility for introducing alternative energy is likely to be shared between society and industry and this

process should preferably be efficient and clear. Research and solutions are on their way but would benefit from support in the 7th Framework Programme.

In order to quantify the impact of and potential for reducing energy consumption and GHG emissions from road transport through the use of alternative energy sources, there is a need to develop proper modelling tools. Such tools should be able to reproduce the present emission situation and be sufficiently differentiated to evaluate the effect of changing fuel use in specific segments of the transport sector (for instance, biofuels for city busses).

Energy Recovery in Vehicles

Besides optimising the efficiency of ICE, or fuel cells, secondary energy sources become more and more important in vehicles to supply all electronic devices in a vehicle. Secondary energy sources such as the kinetic energy of the vehicle itself, the heat radiated by the combustion process or structural vibrations can nowadays utilised by applying advanced transducer materials or multi-functional material systems. Here, the thermo-electric or piezo-electric coupling of these transducer materials can be used to generate electricity. Concepts can range from self-powered sensor systems up to power supply for actuators, motors or audio and sound systems. In a dedicate IP, the technology of these concepts should be brought to a level where commercial applications are feasible and cost-effective. Topics to be addressed:

- Design of hybrid material systems for energy harvesting
- Development of concepts for
- Energy recovering at braking and deceleration
- Energy harvesting from heat
- Energy harvesting from vibration
- System integration (simulation, optimisation, control aspects, …)
- Manufacturing aspects, Life-cycle assessment

Intelligent noise abatement and control for the railway mode

Railways are a desirable and necessary part of the transport system because of their superior environmental performance with the exception of noise. A sustainable transport system such as railways has also to minimise the impact on the generation of noise. This project takes on this challenge and stimulates the research and development of innovative technologies for low-noise rail transport. The project will elaborate both the technical and economical aspects of noise emission by rail transport by focusing on so-called “rolling noise”, power trains and ventilation, and on passenger comfort with respect to noise and vibration disturbance. In all considered aspects, the purpose is to transfer the use of new, intelligent material systems and control techniques to the individual application.

Cleanliness of powertrains and fuels

Energy efficient driving – eco driving

Efficient driving is a simple way to reduce energy consumption. Toyota’s hybrid car Prius has a sophisticated feedback system telling the driver about fuel consumption. Is feedback and vehicle managed choice of efficient driving the best way to reduce consumption or are there other and better ways? What are the effects of advanced feed back in relation to traditional “tech how to drive”? Are programmed effective engine management systems with or without hybrid technology in the long run superior to traditional “tech how to drive” pedagogic?

Research about how to influence efficient driving style and its effects may reduce fuel consumption and lead to mandatory fuel saving management in vehicles.

Identifying and developing economic-ecological best practices and technologies to achieve positive balances in logistics processes supplying biomass from agriculture and forestry as raw materials for variants of energy utilization

Increasing transport, decreasing energy resources and CO_2-emissions are urgent and related problems to be addressed by society. Possible technical solutions are related to energy sources, energy carriers and energy conversion. There are many possible pathways to environmentally friendly energy production. However biomass from agriculture and forestry as raw materials is gathering more and more interest.

The chain from energy production by natural photosynthesis, harvesting and processes leading to attractive energy carriers need to be strengthened and weak links replaced. There is a need to identify best practices and technologies to achieve positive balances in logistics processes supplying biomass from agriculture and forestry as raw materials for variants of energetic utilization

System optimization

Introduction

The efficient operation of transport systems (e.g. full utilisation of loading capacities, avoidance of empty trips) is necessary to achieve both economically and ecologically competitive European transport systems.

To achieve this goal, along the whole planning process of transport systems, from the strategic planning of hub, depots and transhipment locations, via the planning of transport services to be offered and the disposition of the transport means to the actual route planning for each shipment, efficient planning procedures and algorithms have to be at hand, to find optimal solutions for each question within this planning process.

For future research in this context, especially the following topics deserve special attention:

Classification of Infrastructure

The development of a classification system of infrastructure, which plays an important role within the intermodal transport chain, would be a significant support for the European Commission. The focus should be on the railway system, the inland waterways and the necessary infrastructure for ports and sea transport. The outcome supports the evaluation process of the European Commission and National Authorities in choosing port locations and validation of required infrastructure for prospective funding.

Development of Key Performance Indicators for Short Sea Shipping and Intermodal Transport

The quality of a short sea shipping based intermodal transport is of growing importance. The European Commission TEN-T, port authorities, terminal operators, short sea shipping companies, freight forwarders and other parties involved in intermodal transport chains require a number of indicators to evaluate the quality of transport chains. In selecting Key Performance Indicators for the Motorways of the Sea (MoS), it is critical to limit them to those standard factors that are essential to the integrated organization reaching quality goals. It is also need to set targets for each Key Performance Indicator that everyone will understand and be able to take specific action to accomplish. Tasks are:

- Scientific survey of Balance Scorecard concepts and Key Performance Indicators (KPI) and their deflection on Short Sea Shipping based intermodal logistic chains

- Application of the developed Balances Scorecard and KPIs to define quality determinants for MoS

- Dissemination of Balances Scorecard and KPIs and development of implementation strategies

The assessed operating figures will be used to create minimum quality determinants for prospective funding projects such as “Motorways of the Sea” or “Marco Polo”. Further special Quality Labels can be assigned by the European Commission.

Optimization of single wagon load traffic

Single wagon load traffic still has a major share of the rail transport volume. However, all railway companies operating single wagon load networks are facing economic problems, in some cases leading to a reduction and reorganisation of the networks (e.g. Germany, Switzerland), in other countries even leading to the complete closing of the network (Norway).

Against this background, the European-wide expertise concerning the optimisation of single wagon load traffic has to be bundled in order to achieve a quality and productivity leap for these transport networks, which are more and more internationally oriented. Participants are seen within all major railway operating and infrastructure companies and research institutes in the field of railway and transport network optimisation.

Eco2 TRAIN: Ecologic and economic rolling stock

Development of a methodology and measurement tool to reduce the environmental and noise pollution. This includes embracing vehicles, vessels and component technologies, including overall system optimisation, all with special regard to energy savings by performance improvement, new materials and structures for mass reduction, noise and ground vibrations reduction and rules to quantify passengers' comfort.

Reduction of environmental and noise pollution (embracing vehicles, vessels and component technologies, including overall system optimisation)
- Energy savings by performance improvement
- New materials and structures for mass reduction
- Noise and ground vibrations reduction
- Rules to quantify passengers' comfort as a global concept, to balance energy cost reduction and affordable comfort.

Optimization of the utilisation of non-driven transport resources

Most transport systems are based on the utilisation of driven (e.g. vehicles) and non-driven (e.g. rail wagons, swap-bodies) transport means. As non-driven transport means tend to cause less capital cost, their optimization has not yet been in the focus of research. However, optimised planning of depot locations and round-trip-schemes can significantly reduce the number of empty trips and thus improve the environmental effects of transport systems.

Application of infrastructure or vehicle based dynamic traffic information to support optimised dynamic traffic management

For the actual operational planning of transport services usually the actual traffic situation cannot yet be taken into account. Therefore new systems have to be developed to consider actual traffic information for an optimized, dynamic route and network planning. Research initiatives should also include demonstration facilities for Traffic Management.

Improved timetable synchronization

Transfers are inevitable in public transport and one of the main drawbacks experienced by users. Improving timetable synchronization during planning and daily operation globally requires new procedures and tools and will result in increased attractiveness of public transport.

Advanced multimodal driver-vehicle interfaces

Recent developments in head-up display technologies and Augmented Reality together with eye-gaze interaction and speech technologies provide new opportunities in human-machine interaction. Such devices may be utilized to redesign the human-machine interface in vehicles to enhance traffic safety, interaction efficiency and comfort in vehicle guidance.

Forecasting methodology of the environmental pollution emission from the road transport, with respect to sustained regional development

Forecasts on how the economy and the environment are affected by demographic changes, new transport taxes, infrastructure investments within the transport sector, and regional economic growth are needed for long-term planning of transport infrastructure, regional development, environmental policy and taxes. Different kinds of planning models are useful, with a variation from economic models for regional development and interface, to models for transport behaviour and modal choice. Regional economic growth affects transport distance, modal choice, and transport volumes.

There has been a development towards specialized production, centralisation and moving of production to low cost countries in the east, with increased transport distance, higher transport volumes and corresponding pollution as results. The development is caused by decreased transport costs (in nominal value) during the last decade and the fact that transport costs represent only a marginal share of the logistics and production costs. Whether this is a wanted development, and whether it gives rise to a sustainable regional development, is a research issue, where both economic and transport planning models is needed.

Environmental Management Tools for Railway Systems

Adaption of durability and life expectancy of materials to achieve a fixed service interval. The use of recycled materials according to the boundary conditions then allows to reduce Life Cycle Costs as well as increases the environmental compatibility of the railway system.

There is a big potential to optimize. 75% of the material input given to the track system consist of gravel and sands. Other significant inputs are switches, rails and sleepers. An adaption of durability and life expectancy of all materials would result in a fixed service interval, resulting in low Life Cycle Costs (LCC)! Therefore, the use of recycled materials according to the given boundary conditions allows to reduce Life Cycle Costs as well as it increases the environmental compatibility of the railway system.
The project shall comprise exactly these aspects. It is divided into several working packages:

- WP 1: State of the Art
- WP 2: Emission potential of a railway system (Soil, Subsoil, Air, Material)
- WP 3: Analysis of Material Flow for the railway vehicle and track system
- WP 4: Creation of an Environmental Management Tool according to the standards of LCC/RAMS
- WP 5: Dissemination

Climate change and the railway environment (CLICHÉ)

The railways, together with all other transport modes will be significantly affected by the climate change. Evaluate the results of the latest generation of global climate change models and to prepare a number of possible scenarios for the European railway system and develop long term strategies for dealing with such problems. Make recommendations for future infrastructure and vehicle development etc.

The European Railways need to prepare themselves for such eventualities, and to develop strategies for dealing with these issues. The objectives of this project are thus to

- Evaluate the results of the latest generation of global climate change models and to prepare a number of possible scenarios that describe the possible effects on the European railway system.
- Evaluate the degree to which weather induced problems are of concern to European Railway operators, and to identify the major vulnerable areas for the different aspects of climate change that are presented, and identify sources of environmental data available for the railway environment.
- By applying the climate change scenarios to the European Railway system, and utilising existing data for environmental parameters such as temperatures, wind speeds, rain and snowfall data etc, evaluate the likely increase in climate induced problems throughout Europe over the next 50 years, to identify those climate effects that will be of most significance, and to identify regions of particular vulnerability
- To develop long term strategies for dealing with such problems and to make recommendations for future infrastructure and vehicle development etc.

The major innovation in the proposed project would be to integrate what is already known about climate change and environmental effects on the railways on a European wide basis. At this stage it is envisaged that this would be through the development of a GIS system on which the various climate change scenarios could be overlaid onto the European Railway network. This would allow a quantitative assessment to be made concerning the increased frequency of climate induced problems, which would give an indication of the areas that are particularly vulnerable to each effect and the research on specific phenomena that still needs to be carried out. It would also allow railway authorities to prioritise work on those issues that are of most importance to them. Taken together this would enhance the long term sustainability of the railway network as climate change occurs over the next few decades.

2.2 Encouraging modal shift and decongesting transport corridors

Developing seamless door to door transport

Combined Passenger and Freight International Trains

In the future, modern communication and navigation technologies, which allow both the detection and guidance of persons (and if necessary goods), will give trip recommendations to the traveller already before he or she leaves the front door – travelling becomes seamless when

transitions between transport modes occur. Major obstacles to intermodality will be eliminated. The novelty of the smooth transition arises from the possibility to provide travel recommendations with maximal accuracy and adjusted to current traffic conditions and other framework parameters.

Basic conditions to realise this vision are technical and organisational knowledge, but also knowledge about the travellers' mobility behaviour including individual preferences and context sensitivity at all points and steps of the travel. Knowing the traveller and the basic conditions for the intermodal use of transport modes is essential for improving orientation and way finding and will help to develop the guidance of persons through outdoor and indoor areas, as, for example, from their home to the boarding gate in the airport terminal.

The degree of realisation of seamless travel concerning both individual and public transport will mainly depend on the design of the supply side (e.g. technological sophistication and reliability, organisational implementation/accessibility) and on user acceptance. Individualisation will be possible by creating mobility services responding most suitably to travel purposes and the current traffic conditions. From the view of traffic generation and management, it will be important to learn how seamless travelling changes travel behaviour and allows a more efficient and sustainable use of transport infrastructures.

For freight traffic new technological options develop currently for the realisation of seamless transport, in particular RFID. In principle, they extend both the potential for automation and increased flexibility in supply chains. Additionally, organisational changes will become necessary or wishful, possibly connected to new requirements for infrastructures.

It is to be expected in general that the realisation of seamless travel and transport affords the adjustment of the existing infrastructures to the requirements of intermodality, for instance by the development of user-friendly connections from car to railway to airplane (P&R areas, long distance railway connections at airports) or the development of connections between ports and multimodal sea port hinterland for freight transport.

The fundamental condition for the realisation of seamless transport will be the harmonisation of data used along transport or travel chains.

Necessary research tasks concern technology, organization, use and user behaviour, legal conditions and data harmonisation. As a central setting of tasks can be regarded the following ones:

- overcoming of insufficient or missing interoperability by international harmonisation of technical, organisational and legal conditions,
- development of successful operation of comodality by demand oriented cooperation of all substantial components of transport sub-systems (like rail or road),
- reduction of obstacles for the realisation of intermodality.

Potential research topics of greater relevance are:

- accompaniment of the entire transportation chain by information technologies using uniform data structure for traffic information in private and public transport (including air traffic), for reservation and billing of tickets that have been issued for the entire travel (like postal stamps which are valuable for the transport between countries),
- user acceptance, user behaviour and user guidance for seamless travel services, behavioural change by the possibilities for seamless travel,
- harmonisation of check-in, luggage delivery, ticket acquisition and control for bus, railway and airplane, also with consideration of infrastructural requirements,

- standardisation of maintenance, supply and fuel supply of the means of transport with the objective to allow vehicle exchange between the traffic systems,
- continuous and integrated traffic control (particularly for private transport), safety control for public transport (e.g. ETCS) and improvement of control and communication systems,
- provision of intermodal connectivity by information and planning,
- accompaniment of the entire logistic chain using uniform data structure for freight transport (In contrast to what is often repeated there are still no standards for Electronic Data Interchange on the basis of Internet solutions),
- potentials for optimisation in supply chains through seamless transport,
- effects of seamless transport on production processes,
- effects of seamless transport on total goods movement,
- support of combined traffic by new technical developments,
- assessment of combined passenger and freight international trains (using distributed locos' towing powers between certain number of passenger wagons and freight flatcars in order to reduce the amount of freight required to break-even each shipment)

One of the critical barriers hindering rapid growth of rail freight in Europe in short and medium-terms is shortage of network capacity for high-frequency international shuttle-trains carrying containers, swap-bodies and/or semi-trailers. With the trans-European trade growing at 10 p.c., per year, more goods could be moved by rail if the network capacity were higher. This development increases competition between passenger and freight trains for the most attractive time slots and infrastructure along the busiest trans-European corridors. The passenger traffic in Europe stagnated over the last five years as a consequence of, among other things, considerable increase in cheap air travel. These two trends indicate that time slots and infrastructure paths allocated to passenger trains are not used optimally.

Since investments in rail infrastructure are both expensive and time-consuming, one solution is offering combined passenger-and-freight-trains at international lanes linking important urban and logistic centers in Europe. By using slots reserved for passengers, the combined passenger- and freight trains will make rail freight more flexible and attractive to shippers and consignees. Distribution of locos' towing powers between certain number of passenger wagons and freight flatcars will also reduce the amount of freight required to break-even each shipment. There is a need to assess the economies of scale, scope, density and frequency that need to be fulfilled in order to make such offerings financially feasible, as well as organizational and operational models that will make the combined trains attractive to both passengers, shippers and consignees.

Interoperability and operational optimization of transport networks

Economics of freight transport and logistics services in Europe

Conventional wisdom related to rail freight cost structure holds that up to 60 p.c. of rail operations generate fixed costs while the variable part is distance-regressive. In addition, a rule of thumb posits that rail freight operations are economically feasible on distances exceeding 500 kilometers.

Empirical evidence from small rail ventures, providing point-to-point freight transfer, challenges both of these beliefs. Rail market liberalization changed the operational conditions and the economics of production of rail service and rail logistics. Small rail operators can deliver high-

quality low-price services for short haulage. We also observe that the larger is the size of a rail company, the higher its costs/prices.

Evidently there is a need for assessing how the size of rail companies and organization of service provision in national and international markets affect the costs of service production.

In addition, new knowledge is required on how the economies of scale, scope, frequency and density affect the competitiveness of sea-rail freight operators as compared to road and combined sea-road hauliers in domestic and international markets. There is a need to appraise the roles of different business models for the cost and quality of production and supply of rail freight and rail-related logistics.

Development of planning tools for intermodal transport networks

For the integration of transport by rail and inland navigation, among another and with road transport, the development of efficient planning instruments for intermodal transport networks is necessary. With that, realistic intermodal networks can be planned that guarantee a fast and cheap supply and distribution of growing amounts of transport flows. Potential users of these planning instruments are logistic service providers and shipping companies operating intermodal networks, and also ports and terminal operators that want to refine their transport offers. These players have a high interest in planning tools for the examination of intermodal transport alternatives in a computer-based way.

An essential aspect of such a tool should be a computer-based register of all relevant transport infrastructures, e.g.. rail, road and inland waterway networks and terminals for the transhipment of the loading units.

Development of an education and training scheme of European Rail Logisticians

Whether rail will acquire a higher share of the freight transport market will depend on how easy it is for logistic service providers and shippers to employ rail as transport mode. Many freight managers are not skilled rail users, but they find themselves confronted with a complex and intransparent rail system. Especially on the international level, the education at universities of applied sciences and universities for logisticians, forwarding merchants or rail engineers are still oriented to (former state) railway companies. There is need to develop an education scheme for logistic service providers in order to enable an easier access to rail transport services.

Co-ordination in passenger inter-modality information, operation & accessibility

The automobile is currently the transport mode of choice for an increasingly large number of people, because of its convenience and high quality. The European Commission (EC) must therefore, persuade more of us to change to public transport if it is to achieve its sustainable transport policy, reduce congestion and improve safety. Modal shift is unlikely to occur, however, until public transport can offer “seamless journeys” of a high standard. The EC has recognised this and identified the need for a large scale integration and validation platform to support the realisation of the intelligent vehicle and infrastructure of the future. From the perspective of the seamless passenger journey, however, the platform will not be successful unless we first understand clearly the requirements of passengers and the complex systems that are currently in place to manage public transport. The project will be focused on understanding these issues with regard to rail transport and providing a high-level systems model that can be used to guide more detailed, future rail studies and examine the interfaces between other transport modes. The project will begin with a review of literature on this topic, followed by development of a generic system model and sets of queries to be addressed to stakeholders

including train operators, infrastructure owners, passenger lobby groups and policy makers. The queries will be used in interviews with the stakeholders and responses will be analysed and used to amend the generic system model. The expected outcome is an objective understanding of the structure of the existing system and the stakeholder requirements and constraints.

Improvement of the operational interoperability by upgrading planning and controlling in international train traffic

The main scope of the research project is to define and implement unified systems and procedures to exchange basic information for planning, monitoring and controlling of train operation on European level. It should be developed a harmonised information framework to cover the whole transport process starting from the timetable through the monitoring of the train run towards on-line solution of operational conflicts.

Further, there must be a link to customize information, like tracking and tracing solutions for wagons and/or consignment of transport units.

Railway traffic regularity monitoring unified methodologies

Railway traffic regularity monitoring unified methodologies: quantified approach to quality of passenger and freight services perceived by the customers, effects on the train dispatching decisions (e.g. train overcoming) and management of the commercial relations between IM and RU (e.g. penalties for delays)

The main scope of the research is to define universally accepted methods to quantify the quality (actual and perceived by the customers) of the railway services as a premise to unified commercial transactions between RU and IM, in particular, but not exclusively, for international traffic.

The main tasks in this area are:

- Development of measurement methods for quality of passenger and freight services
- Elaboration of rules for commercial transactions between RU and IM regarding quality
- Comparison of international rules and guidelines to ensure good quality of operation and compilation of a catalogue with quality-ensuring methods

The research activity will proceed through the following points:

1. Review of existing methodologies for quality measurement and identification of quantitative methodologies;
2. Selection or development of suitable measurement methods for quality of passenger and freight services;
3. Review and comparison of existing rules for commercial transactions between RU and IM regarding quality;
4. Development of a framework of rules and guidelines for commercial transactions between RU and IM regarding quality in consideration of the in point 2 developed methods as monitoring and control instruments;
5. Comparison among the rules and guidelines of quality-ensuring methodologies in selected countries;
6. Compilation of a catalogue of rules and guidelines of quality-ensuring methods (“best practices”).

Towards a global rail system

We find evidence of three continental trading blocs: the Americas, Europe and Pacific Asia. We assume the realistic case where intercontinental transport costs are neither prohibitive nor zero. If transport costs are low, continental Free Trade Areas can reduce welfare.

Over the next twenty years the geo-economic situation of Europe will be affected by several global forces manifested in highly potent endogenous and exogenous drives. The fast aging European population represents a Europe-specific endogenous factor, which might reduce the continent's supply of productive workforce and, in the long-term, erode its economic and industrial base.

Concurrently, several exogenous trends shape Europe's socio-economic position and trade patterns. While the technological developments in the Americas, and particularly in the US, will continue to affect the world's economic progress, in the following focus is concentrated on the Asian Dimension.

One look at "Eastern Direction" brings to the fore the following observations. The rapid growth of China's production facilities created a world-class manufacturer capable of global supply of consumer and industrial goods, including transportation equipment. Advances in India's information technology created a global partner capable of meeting Europe's growing demand for computer software, IT support services and IT equipment with applications in European transportation industry. Russia's present export structure may over next few years (and most probably will), shift away from basically raw materials to highly processed consumer and industrial commodities destined to the European mainland. Finally, one should not forget Japan's industrial power, which after ten years of recession is back in global competition with export focus on European industrial and consumer markets.

All these developments may bring a range of positive and negative consequences for Europe's strategic, political and economic welfare. The common outcome will, however, be a considerable increase in the level and intensity of trade flows between Europe and its Asian partners.

Needs for direct transport links with industrial centres in Central and Pacific Asia can revolutionise the railway's role in inter-continental goods transfer on a scale not seen before. The expected increases in freight volumes may transfer rail into a highly viable competitor to both long distance ocean shipping and international air cargo transportation. If rail can secure speedy and un-interrupted freight movement with more direct access of production and distribution centres at both ends of inter-continental supply chains, it will increase its competitive advantage over ocean shipping, for which cargo must be handled through ports and then subjected to interior consolidation at production/shipping points. Rail would be cheaper than international air transportation and possibly access production and market sites almost as well as air transportation.

This means that the principles of rail commercial, technical and operational interoperability will have to be developed for the global rail system.

An appropriate organizational structure must be in place to permit smooth and uninterrupted flow of cargo. This will very likely involve inter-continental collaborative partnerships and working relationships between rail operators and logistics service suppliers on a scale leading possibly to development of fifth and sixth professional generation of international third party providers.

The advantages of inter-continental long-haul railways may be diminished if attention and efforts are not given to resolving the location, design, and operations issues related to efficient management of intermodal freight transfer terminals functioning on a scale without predecessors in European international logistics environment.

By 2050, the global population could reach anywhere between 12-14 billion. It seems reasonable to assume, that more nations, inter-country regions, and cities join the 'club' of free market economies making up the global society with much higher trade volumes and higher intensity of economic exchanges.

The burgeoning trade flows of the 21st Century must be facilitated in a way that is both (i) logistically rational, as determined by intense, 24-hour competition in a global "free" trade area, and (ii) ecologically sound, since passage through, and despoliation of, the trade-routes will no longer be perceived as "free".

As traffic along the inter-continental supply lanes, air corridors and highways increases to accommodate the higher freight volumes and passenger movements alike, the global transport system will expand, with a commensurate diversification of routes and modes. This diversification of traffic will expand - across the inter-continental gateways - to encompass the international rail service.

The inter-continental links, which have at some time been proposed or are already under planning, are: the Bosporus Strait (Europe-Asia); the Strait of Gibraltar (Europe-Africa); the Central American Isthmus (North-South America) the Bering Strait (North America-Asia)

Several mega-projects have been proposed and designed which will explore the supply and freight movement conditions in numerous intercontinental corridors connecting Europe with sourcing and destination centres in different parts of world.

These include: an inter-modal link with continental Australia via Port Darwin; the African corridors between Cairo-Casablanca-Cape Town; the UN's "New Silk Rail Routes" in Asia; the Japan-Russia tunnels; the Transalpine, among many others.

Central Asian governments hope the infrastructure improvements will translate into increased trade. Some envision the transport projects as a modern-day Silk Road that strengthens links between China and Western Europe. New transit links would certainly help Central Asian states find new markets in China for their commodities, including oil and gas.

A new Central Asian road-rail network would also face stiff competition from Russia’s Trans-Siberian railway. The Trans-Siberian route, which has been operating for almost a century, is relatively well developed, with dual tracks running almost the entire length of the route. Russia, with an eye on preempting competition from a Central Asian rail network, is already pushing new transit options involving India and Iran.

Despite the apparent disadvantages, research can help push forward the various road and rail projects considered. China has a considerable geopolitical interest in expanding its links with Central Asia. While China already has a sizable economic presence in Central Asia, the lack of infrastructure is hampering its ability to expand its influence. An improvement of rail access from Europe to Central Asia may ultimately help China replace Russia as the dominant economic power in the region.

Intelligent System and new vehicle Concept

Interaction between drivers in traffic and their effects of traffic safety, traffic flow and the possible changes by ADAS functions

The traffic system is comprised by individual vehicles and drivers. Interactions between these individuals are essential factors behind the prevailing traffic conditions. Knowledge of the relationship between traffic safety and flow conditions and these individual interactions are also important to allow improvement of the current situation and to account for the future traffic growth without reduced safety and level-of-service. There is a need to use and develop methods

to evaluate and analyse the relationships between driver interactions and resulting traffic conditions.

The nature of driver interactions is continuously changing. Vehicle technology improvements have, for example, resulted in changes in driver behaviour. Today, a large number of in-vehicle driver assistance and information systems are developed and introduced on the market. These systems have a great potential to improve both traffic safety and flow conditions. However, the systems may result in changes in driver behaviour and in the interactions between road users. This aspect will receive specific focus in the IP. Results from the previous European projects ADVISORS, HASTE and AIDE in the driver assistance area will consequently be important input to the IP. Another related aspect includes effects of increasingly automated vehicles in the traffic system. This development may also have substantial impact on traffic flow conditions and congestion.

To evaluate and estimate effects of driver behaviour and interactions on the traffic system, one should use and develop tools such as driving simulators and traffic simulation models. Changes in driver behaviour due to driver assistance and information systems as well as vehicle automation should be given special attention. Driving simulators in combination with traffic simulation models and models and measures for estimating safety and environmental impacts constitutes a powerful platform for evaluations of effects on the traffic system. One important focus could be on new ways of combining these kinds of tools.

Driver behaviour models and new intelligent systems design

Human modelling has been an extensive area of research in many application areas. Still, human behaviour is fairly contextual and substantially different from one person to another. There is no generally accepted model of the complete driving task. There are detailed descriptions focusing on perception and handling aspects, and reporting what drivers really do in every possible (”normal”) situation from the beginning to the end of a journey. There are also more analytical approaches focusing on driver behaviour in relation to task demands, with the purpose of trying to explain and understand the psychological mechanisms underlying human behaviour.

The most recent evaluation in driver modelling concerns the notion that driver behaviour is not necessarily static, but evolves dynamically with time. It is also context related and subject to permanent as well as temporary factors of influence, which may or may not be independent. Such factors include:

- Individual resources, namely physical, social, psychological and mental conditions of the specific driver.
- Knowledge /skills level. This refers not only to actual driver training and experience, but also to generic knowledge, as basic education greatly influences motivations and behaviour of the driver.
- Environmental factors. It includes the vehicle status, the existence of traffic hazards, the weather, road and traffic conditions.
- Driver’s workload**.**
- Driver’s risk awareness.

The variables of such a model and their relationship should be carefully studied and selected based on research data from an ample database, so as to check if such a correlation is feasible and beneficiary. The model output has also to be evaluated and modified by empirical results. Thus, short and long term experiments with drivers should be performed, so as to validate the proposed model.

ADAS-IVIS with special focus on elderly drivers

In western society the older population is increasing both in absolute and relative terms. These demographic trends alone will lead to a larger participation of older persons in traffic. But apart from that, future cohorts of older people will be different traffic participants from today's. Furthermore, with increasing age, the percentage of persons, and hence drivers, having health problems and using medical drugs is increasing, with emphasis on disabilities such as heart diseases, diabetes and various mental weaknesses. Driving is a user friendly modality for elderly people, as many of them are not able to walk the required distance or keep standing for a long time, nor do they have the overall physical endurance to use public transportation means.

Experience shows that declining performance begins in the late 50's, and visual changes usually begin much earlier.

Many models have been built to explain the problems of elderly drivers. The relevant errors may come from any of the domains below:

- Sensory and motor functions are deteriorating with age. Therefore, in case of an emergency, the reaction time to the external stimuli (seeing the other car, moving foot from gas to break pedal) is higher.
- High order visual and cognitive impairments are also related to age. These are much more difficult to recognise and evaluate. They include selective attention, visual search and analysis, divided attention, and flexibility of attention. Elderly also seem to exhibit poorer performance of synchronised tasks.
- Perception and decision making impairments
- Specific ageing related cognitive and perceptual disabilities
- Lack of communication with other drivers cohorts

It is clear that the relevant problems may only be solved by a systematic and integrated approach, involving the development of particular in-vehicle aids, to compensate for the elderly drivers' loss in conceptual and perceptual functions. To this end, the following should be undertaken:

- Creating an inventory of particular neuropsychological problems of E&D drivers and mapping of them according to the various driving subtasks.
- Design and development of particular ADAS/IVIS to match the corresponding needs of elderly drivers.
- Development an integrated in-vehicle assistant for elderly drivers with enhanced HMI.

Such an approach would reasonably and fairly exclude from driving those elderly people that are a traffic hazard, while also keeping their number at a minimum through additional aids and support.

Further development and alignment of rules for a safe operation of European railway traffic systems – Subproject: Verification of the drivers track knowledge

Creation and Implementation of Instructions for drivers of cross-border services in order to compensate existing incompabilities by profound knowledge and expertise. Additionally existing differences have to be minimised. The identification and analysis of best-practice-strategies of railway operations throughout Europe could provide a solid basis for recommendations concerning need for harmonisation and standardisation

Cross-border service of drivers currently works mainly in marked-off operating ranges (above all in high speed traffic). For the conception of "one hand" transportation offers – e.g. in rail freight traffic – a more flexible posting of staff across national borders is needed. The Technical Specifications of Interoperability (TSI) for the subsystem "Operations" are setting the frame: "Alignment of the network operating rules and the qualifications of drivers and on-board staff must be such as to ensure safe international operation". Besides the establishment of rules concerning standardised communication between operational units and documents for railway operations the acquisition and maintenance of profound knowledge of the tracks are significant issues to be solved with-in the scope of the TSIs. A more flexible employment of staff without any local restrictions on specific routes on the one hand and tendencies to reduce complexity of infrastructure on the other hand evoke modified demands towards knowledge of tracks.

Besides technical there are numerous organisational operation incompatibilities between the vari-ous railway systems of member countries. There are several applicable strategies to overcome these challenges which should thus be outlined more detailed:

1: Drivers of cross-border services have to be instructed in order to compensate existing in-compabilities by profound knowledge and expertise.

2: Supportingly existing differences have to be minimised. The identification and analysis of best-practice-strategies of railway operations throughout Europe could provide a solid basis for recommendations concerning need for harmonisation and standardisation.

Which challenges have to be faced?

- Analysis of relevant bodies of rules and regulations and definitions of track knowledge, its importance and effects of restrictive regulations whenever driving with limited knowledge is detected
- Analysis of training and further education concepts and the existing supportive devices of vehicle staff in daily operations.
- Analysis of the represented expertise and development of competences of vehicle staff as well as identification of needs for further support in daily operations.
- Definition of future requirements towards vehicle staff evoked by technological and infrastructural development tendencies.
- Development of improved concepts for the education and training under consideration of the limits and abilities of the vehicle staff.
- Identification of best-practice strategies, recommendation for harmonisation and standardisation needs.

European Architecture for Rail

European ITS (Intelligent Transport System) architecture for road transport was developed by FRAME projects in the 5th FP. This Framework Architecture has now been adopted by many Member States as a starting point for their national architectures. The success of FRAME can be extended to cover also rail transport sector which lacks similar framework planning tool. The Technical Specifications for Interoperability drafted by AEIF are a long term approach to achieve interoperability of rail systems. However, also rail sector needs a "service-oriented" approach in the master planning and design of interoperable rail systems in order to support the goals of TSIs. Especially the successful methodologies adopted by FRAME projects could be transferred to rail sector. In addition, rail architecture could be utilised in domestic development efforts of member states whereas TSIs focus on cross-border and cross-operator issues.

The end result will be a European Architecture for Rail which describes the service processes and information system components needed for interoperable rail services. The philosophy of the architecture is based on voluntary utilisation when players see the common benefits. Also the public authorities and infrastructure managers may require architecture compliant solutions.

Optimization of the use of logistics and transport infrastructures

Methods and conditions to maintain an extensive rail freight network

Maintaining railway sidings becomes more and more difficult due to cost pressure. However, the subsidiary tracks are important as they often generate a traffic volume which results in a bigger share of utilisation of main railways. Formerly, numerous branch lines played an important role as complementary long distance or side tracks. As numerous bottlenecks exist in the European rail network, side tracks can improve it by a redirection of goods flows. Therefore, methods and conditions of technical, organisational and administrative kind should be developed in order to maintain an extensive rail network under consideration of business and economics. Moreover, approaches for maintenance and finance should be considered.

Use of municipal rail networks for supply and disposal traffic

There is a need to analyse the use of municipal rail networks (light rail, subway) with a view to disburden European cities from goods traffic and improve transport connections. Despite a high degree of utilisation during peak periods, these networks have extensive reserves. In central and eastern Europe these networks are very dense. Hence, a further opportunity might be to employ the trolley bus catenary for the propulsion of trucks to reduce exhaust emissions.

Intermodal Integration

Optimization and harmonisation of Freight Transport Centres (FTC) Network

A research project in this area could be focused on measures leading to creation of optimized and harmonized FTC network in Member States, implementation of new technologies in freight transport, harmonization of transport modes, transport processes technology innovation, unification of transport units, handling and warehousing facilities, with the aim to improve the qualitative parameters of circulatory processes. It strengthens the intermodal shift from roads to rails.

- Analysis and evaluation of FTC functions
- Analysis and evaluation of FTC products
- Traffic and transport performance analysis
- Allocation of knots in volume stream network
- FTC´s network development

Knowledge for policy making

Capacity shortages and demand management

One of the most critical barriers to rapid growth in rail freight in Europe is shortage of rail infrastructure capacity. This generates needs for investments in infrastructure upgrading and extension and the new, more ingenious and economically viable methods for funding rail network development. According to EC's First Infrastructure Package, one important source of investment financing should be fees collected by the IMs for access and usage of national rail networks by rail operators. However two models for charging infrastructure fees prevail in Europe. The Nordic and the West European countries base their charges on marginal cost pricing. The resultant outcome is very low infrastructure charges and no funds for coverage of maintenance outlays or infrastructure investments. The Central European Countries like Poland,

Slovakia, and the Czech Republic recoup the wear and tear of rail infrastructure by basing their charges on long-term average variable costs and generate some, albeit low, surplus for long-term investments.

There is a need to analyze the economic and market viability of different infrastructure charging regimes in order to make infrastructure managers in position to generate long-term financial means to invest in rail infrastructure on the lines with highest level of traffic and manage infrastructure resources in line with market demands.

2.3 Ensuring sustainable urban mobility

Next generation vehicle for goods and people urban mobility

Bus system improvement

Bus system has the characteristic to be a major piece of the public transport system, whatever the size of the city it operates in. In major metropolises it has an essential feeding role for the heaviest modes such as metro and tramways. In medium and small size cities it might be the only public transport means.
Therefore it is very often the case that a heavy percentage of the population rely on this specific mode for its mobility needs. It is also the less expansive transport mode, which is not a neutral issue as everybody is aware of the financial problems encountered by all local authorities in Europe.

Now is bus really a focus for research programmes - national or European?
Yes in a way if one speak of technological issues linked to busses. Some technological pieces of busses are being worked upon (non polluting motors, low floor busses, new energies…). Also industry has developed “intermediate systems” such as trams on tyres, light guided systems etc., for which the objective is mainly to transform the vehicle bus into another type of vehicle.
But if one stick to the very bus, (the traditional one - this one mode that is normally cheaper than a heavy mode when you buy it and more costly when you operate it), the answer is no. And this is specifically true if one speak about “soft” research issues such service improvement, bus attractivity, cost/benefits analysis, comfort, design, public policies, customer needs and desires, integration in urban fabric etc…

There is therefore a real it to have some research on busses in order to see how bus services could be upgraded, how they could be optimized for the sake of the community mobility needs and each customer need.

In the approach to be developed, the customer should become the central focus and public transport should be more personalised. This request to think not only in terms of systems and modes but also on tailor-made new product or formulas, supported by a variety of new services. For example marketing (image, design, comfort, price differentiation, 'emotion' aspects…) product-innovation, financing and management are important aspects to study. Car industry is very innovative, and constantly in search of urban customers satisfaction. Meanwhile, buses and bus systems have not improved enough. Bus Rapid Transit projects, and the introduction of new design and new services on the bus system should be given a high priority.

New propulsion concept

Electrically driven vehicles for urban transport application (trams, buses, ...) have the potential of efficient and emission free operation. The vehicles can be powered by electrical energy stored on board or produced by a fuel cell. In any case a preferably predictive energy management is

necessary to operate the vehicle under conditions of very limited energy reserves. Energy storage devices and the infrastructure for loading them should be developed, along with energy management strategies. Projects should include a demonstration part for testing the new propulsion concepts in everyday life.

System Reliability of Fuel Cells and Hydrogen Storage

Topics to be addressed here include (i) leakage monitoring, (ii) structural durability, (iii) prediction of life-time, and (iv) numerical and experimental simulation of system reliability.

Modular lightweight construction of light- and heavy-duty commercial vehicles

The conflict between light weight design and passive safety requirements and a competitive selling price may be solved by the use of new flexible manufacturing processes for new advanced materials systems and complex parts. A whole set of advantages, such as low cost, high mechanical properties, and crashworthiness, emerge for example in the context of the use of innovative aluminium materials and manufacturing methods. Another important material that can be used in light and heavy duty vehicles is a new lightweight sandwich steel sheet, that has a high weight specific bending stiffness and is thus ideal for application in e.g. outer panels. Concepts of innovative modular lightweight structures need to be developed such as space frame structures with innovative cast nodes (e.g. of a bus middle section) and clad with that new lightweight sandwich steel sheet. Life cycle costs have to be evaluated carefully with regard to process engineering, manufacturing, and use. Other topics to be addressed include crashworthiness, structural durability, manufacturing processes, cost-effective design tools, design rules for modular components, as well as development and characterisation of new advanced material systems.

Advanced vehicle structures and performance by use of hybrid multifunctional materials

In many cases the design of these new light weight materials is focused only on obtaining mechanical properties (strength, ductility, stiffness). However, other aspects such as higher functionality, wear and friction behaviour or phenomena that occur at the surface of a material become more and more important which cannot as easily be met by the available material systems. Up to present, many hybrid multifunctional materials such as fibre composites with embedded electric devices are derived, characterized, and applied in lightweight structures on a laboratory scale without having an impact yet on the design rules for engineered structures or without their application in mass products. Although their potential could be demonstrated and realized to a certain extent in prototype structures, the development of these multifunctional materials applications is slowed by the lack of adequate design tools, design rules and cost effective manufacturing processes.

New mobility concepts, innovative organisational and mobility management schemes including high quality public transport

Time use and mobility

The importance of time on both the policy level and the individual level is significant in relation to transport. For example, valuation standards of time requirements for transport and time savings as a consequence of transport policies are often decisive in the acceptance or rejection of transport policies and infrastructure investment projects. Time savings usually account for about four-fifths of the non-monetary benefits of transport policy measures.

Time pressures and the scarcity of time experienced by families underlie many everyday decisions. Using the car for different purposes, regardless of travel distance and accessibility of other modes, is a good example. The perception of time pressure becomes the 'normal' social framework of daily life. Some claim that time pressure is a "contemporary myth" or a "structural story" that all agree on. Both these concepts refer to a phenomenon somehow beyond the control of the individual – "this is just the way it is" Such myths and stories are popular explanations of social relations, and simultaneously legitimate choices and actions in everyday life. It has been claimed that the subjective perception of time changes when speed in society increases. When most people in society have access to a car, the day "allows" for more activities to take place – and time "demands" more activity. Not only time but also the perception of space might change when speed increases, and distance will be seen as shorter and less burdensome. Speed, as represented by the car in daily life, changes the perception of both time and space.

Shortage of time as a sign of success, a "contemporary myth", a "structural story" or due to demands related to increased speed, are all aspects of time where the car plays an important role. The car has a central position within such a framework, and is an important part of the temporal aspect of status. The car appears as a symbol of this way of living, i.e. with a high level of activities, time pressure and the necessity to be in a hurry.

The perception of time and speed is of great importance to understand both the choice of transport mode and the acceptance of travel length.

Innovative solutions for governance of urban transport systems

These strategies should comprise new research on innovative solutions for governance of urban transport systems that focus on the regional level, as well as new forms of regional cooperation and governance in densely populated urban areas. In developing models for a sustainable land use and transportation policy there is a need to develop tools for estimating the performance of urban transport policy, taking socio-economic and spatial components of the transportation system into account.

Intermodality between public transport networks and bikes.

Some elements of the underlying context

The complementarity between bikes and PT has been little developed until now (more especially in some countries such as France and other), while it should be able to develop in several ways on various types of territories: city centers, suburbs, peri-urban and various categories of urban areas: megalopolis (Paris), agglomerations with million inhabitants (LLM), large urban areas, other urban areas.

The intermodality context

In the mind of planning engineers as among researchers sometimes, a priority often is given to the Private Vehicle/Public Transport intermodality, especially through park and ride facilities. But this solution, which was neglected in the past in France should not hide all of the others now, while its limitations can be identified beyond a given threshold (in terms of space consumption, annoyances and perverse effects on urban planning).

Moreover the work approaches on PT/bike intermodality can be richer than the approaches on PT/PV using park and ride facilities, given the multiple formulas which can be used. (see the following section).

Some works should be achieved too, concerning the traveller information, focused on the various needs of cyclists according to the type of practiced intermodality: information on

parking places and automatic boxes (location, tariffs, filling rate in real situation etc.), the routes and layouts for cyclists around stations, the accessible vehicles according to schedules, the offered services and their locations, etc.

Beyond the simple intermodality, some extensions could concern a more general reflection on the various formulas of complementarity between the bike and the PT:

- Space complementarities between bike and PT (to what extent can bike use off-load the PT on the overloaded sections in city centers on the one hand, and on the other hand increase the filling rate at line ends through an intermodality which would improve the development of PT in less crowded areas) ;
- Time complementarities: for example should the PT offer be modulated according to the year periods in order to take into account the season fluctuations as regards bike practice, as on some German networks?
- Physical complementarities: the cohabitation of bikes and PT on shared lanes, as on widened bus lanes. The assessment (to relativize) of the caused annoyance by the gaps of traditional tramway rails or new tramway rails (including tramways on tyres such as Translohr) and improvement perspectives. The compatibility with the non material guidance (type CIVIS, TEOR, PHILEAS,…) which removes the lack but makes the vehicle trajectory less precise.

Environmental ghettoes and social justice

People of low socio-economic status (SES) are often exposed to multiple adverse environmental conditions. The same neighbourhoods that are environmentally challenged by pollution often have disproportionately many people with a low SES.

This confluence of suboptimal situations might be one cause of the often found correlation between low SES and poor health.

Recent developments in mapping and visualisation of noise conflict areas ("neighbourhood soundscape mapping") are useful contributions to the study of the social distribution of noise. The visualization and mapping methodology that has been developed for mapping residential conflict areas with respect to noise, is also useful for mapping other environmental risk factors, such as air pollution, unsafe roads etc. Since social indicators of an individual can be associated with a geographical location through address registers, they may also be mapped geographically. It then becomes possible to study the correspondence between environmental and social indicators.

Urban studies reveal that there are important social processes that manifest themselves through the "ghettoization" of some city areas. However, noise is only one of the factors influencing people's choice of residential location. Future research should therefore include variables capturing the attractiveness of centrally located city areas such as connectivity measures, perceived social status, economic activity etc, in order to improve the precision of further analyses of noise experience in the community.

Studies specifically aimed at incorporating indirect effects of ethnicity, education, and other socio-economic variables will provide a broader understanding of how noise annoyance is produced, and distributed in a community through gentrification and ghettoization processes.

Real-time and personalised information for the traveller

Landscape: *Good quality information for travellers is a necessity for public transport services to be attractive.*
This information will have to be complete (multimodal and multi-operators), reliable, personalised (i.e. adapted to different kinds of travellers) and make use of all kinds of media.

Wider use of the internet and of the mobile phone within everyday life show that new technologies of information and communication are generally well accepted. As these new technologies improve and expand, so will increase the need for public transport to use these new technologies. Real time information will likely become the standard.

1. Real time information linked to real time operations
2. Disruptions and crisis situation information
3. Personalised information/Special needs

New devices, services and applications for the traveller

Landscape : *Changes in society appear in many ways within transport.*
The public transport environment should comply with these changes by developing new functions and features and location based services for the travellers on-the-fly, on board and at hot-spots, that can increase the value of travel time and make the public transport service more attractive, seamless and easy-to-use. Passengers should be guaranteed with full support in their personal travel decisions by automatic and human systems that are based on precise understanding of user needs.

1. Development of new on-board services
2. New integrated services/functions at major transport interchange points stations and hot-spots
3. Development of new devices and applications

Platform for location-based services

Previous research and development projects have resulted in different technologies (GPS, GSM tracking, WIFI spots) that can be used for determining the location of mobile devices. Each of these technologies has specific characteristics concerning reliability and accuracy, but deployment of the best possible technology in varying circumstances is hampered by the lack of a harmonised platform with standardised interfaces to support location-based services.

This motivates the need for developing architectures that hide lower-level (hardware-specific) aspects from the higher-level application layer. Such architecture should be inspired by the 7-layer ISO/OSI communication model, where each layer hides lower-level details from the next layer and where interfaces are clearly defined. Such a harmonised platform would become a plug&play component of a general ITS architecture and be used to improve existing ITS applications such as route tracking, traffic conditions reporting, real-time passenger information systems, vehicle maintenance planning, etc. With the high precision and safety information of GALILEO, a new range of innovative ITS services will be possible especially in the field of travel information and CRM in general.

Stakeholder involvement in the mobility service: what cooperation between the different actors to deliver the best service for traveller?

The public transport sector in European countries has experienced a wide range of reforms over the past 20 years. (i) division of horizontally integrated agencies and authorities into smaller single purpose organisations; (ii) transformation of former state companies into shareholder companies, and in some cases privatisation; (iii) tendering and public private partnership; as well as (iv) contracts and management by objectives and results. These reforms have been implemented under the label of New Public Management, and the main objective has been to achieve efficiency and effectiveness. The reforms, however, have been accused of contributing to a fragmented policy, planning and service delivery and of reducing political influence. Currently, we experience a reverse tendency, where international organisations as well as

national governments are starting to emphasise the need for coordination and governmental steering.

It is important to analyse how the reforms impact the performance in public transport. Do the reforms reduce political influence – or does political influence come about in new ways? Is coordination threatened - or are new ways of coordination introduced? The tendency has been to apply the same types of reforms across sectors, and it is relevant to analyse how specific reform elements appear suitable for particular transport modes and contexts.

Transforming the urban Transport Infrastructure in Europe with respect to a sustainable mobility: road maps to the future

Transport makes up a key challenge for achieving more sustainable cities and towns. Analytical and theoretical work on concepts and normative principles of sustainable urban mobility and critical analyses of actual interpretations are important as a background for studies of the practical uses of the concept and current policies for sustainable urban mobility. Basically, negative environmental impacts from transport can be reduced in three ways: by reducing the physical movement of persons and goods, by shifting from more to less environmentally harmful modes of transport, and by making each mode of transport more environmentally friendly. Different conceptualizations of sustainable urban mobility emphasize each of these three dimensions to a varying extent. In such conceptual efforts interdisciplinary research is needed. Knowledge pluralism for an integrated environmental science is demanding not least because the problems we experience today are unintended consequences of earlier over-specialisation and fragmentation in science and politics.

Analysing trends in urban development and urban mobility is important for understanding driving forces, and it is important as preconditions for societal response, because the populations expected response to the implementation of sustainability policies is of great importance. It is necessary to analyse urban trends and mobility trends in today's European cities; to explain the trends by use of theory and comparison; and to analyse possibilities for changing unsustainable trends.

The policy objectives and the knowledge regarding relevant instruments are abundant when it comes to sustainable urban mobility. What lacks is implementation – European cities experience an implementation deficit. For that reason it is important to analyse political and institutional conditions for implementing policies, instruments and measures in favour of sustainable urban mobility, and to derive possible implementation paths.

Non polluting modes, demand management, services

Impact of ICT on travel behaviour

Within the field of transport, the discussion of substitution of travel by electronic communication has been going on for more than twenty years. The energy crisis at the beginning of the 1970s was the start of it all. One of the first studies on telecommuting takes this as its point of departure. In the debate on how to combat environmental problems generated by road traffic and secure a more sustainable development, great hope has been placed on ICT bringing about reduced daily travel by car. In debates on planning policy, replacing travelling to work by telecommuting is often mentioned. E-commerce, videoconferences, tele-education and other tele-services can have impacts on location, land use and transport in urban areas, for private households as well as for industry and commerce.

In the long run, telecommuting and use of information and communication technology for organising everyday activities can have an impact on land use. For example, a reduction in the number of trips to work per week can make longer journeys to work more palatable, and people

may buy houses in more distant (and attractive) areas where prices are lower than in more central areas in towns and cities. However, this is still an open question, which is of great interest to follow.

The use of the Internet for both e-shopping and seeking information about goods and services has increased rapidly. The development of e-shopping might have an impact on travel activity patterns, but for the present different hypotheses of the effects are discussed. Results from various studies are still inconclusive, and more research is called for.

The costs of pollution due to transport system and the possible policies to manage the environmental problems

A main topic is today to define and quantify the costs relative to the pollution caused by traffic, to build a generalised cost function providing the internalisation of transport social costs. In addition, a further objective should be to define parameters of environmental sustainability and safety in cases of restraint of operating conditions of the infrastructures for internal or external causes.

A big challenge would be to build a base of data in several EU cities collecting the data already existing, containing traffic data (quantity, composition, and speed) and environmental data (noise) for different site typologies (standard sites), and to its extension to unusual operating and functional conditions, allowing for the individuation of other variables and site typologies to be investigated. This should to request further measurements and a people survey using the stated preferences technique, having different scopes:

a) the determination of an origin-destination matrix in the investigated urban contexts in normal conditions (actual, without any implementation of traffic control measures), calibrated on the territory on the base year;
b) the determination of relationships amongst the passing traffic, the perceived disturb and the social and environmental impacts (safety and health); the individuation of the people reaction to an eventual traffic control measures implementation and ecotaxes and their willingness to pay to sustain the costs produced by their trips.

A second strategic step concerns the analysis of the evaluation techniques of environmental and social impacts and, using the data collected, it would allow to individuate the significant variables in term of the quantification of the environmental and social parameters (safety and health) and of their sustainability limits.

The above objectives can be reached by the way of the analysis of the data of the mentioned survey, partially focused to understand the willingness to pay of the road network users. The utility function, obtained by the survey using the stated preferences technique, has to be strictly related with the traffic flow function and based on a generalised cost function containing also the transport cost due to the externalities. In such a way this function will contain the costs should be payed after the implementation of the traffic control policies (road pricing, etc.).

The final challenge would be to define the "evaluation model" of the traffic control policies focused to the environmental sustainability of the mobility, to define possible, reliable, flexible and articulated management urban strategies.

Tools supporting policy development and implementation including transport and land use planning

Forecasting mobility solutions, adapting to changing demand

Research subject 1;More comprehensive mode choice models

While most of the short term effects of both the transport system characteristics and personal background characteristics are fairly well understood and represented in the present mode

choice models knowledge is still lacking on effects of the new phenomena like internet and information provision and also on long-term decisions about place of residence, car ownership and especially on their interconnectivity with different stages of life. Nowadays the strong tendency towards a more sustainable transport system and saving energy affects people's attitudes and mode choice behaviour as well. It should also be noted that a person cannot always make his/her decision of the mode trip by trip but the whole daily trip chain may govern and restrict his/her free choices as well as the needs of other household members.

Task 1. Long term decisions

Most of the mode choice models are based on the generalised cost of a trip i.e. to the characteristics obtained from the transport system itself. In addition there are several personal characteristics of the traveller that affect his/her mobility needs and choices, commonly such as: gender, age, income, activity of the person (employed, child, student, housekeeping, retired etc.), driving licence ownership, car ownership (number of cars), family size and residential area. Furthermore there are some personal characteristics that more difficult to obtain or predict that presently are far less understood than the commonly used factors and thus need further research:

- *Stage of life* of the household and critical points of life cycle regarding modal choice decisions (single or couple, young or old, with or without children, youngest child under school age etc.)
- *Possibility to use car* (usually three groups: car always/sometimes/never at own disposal)
- *Personal attitudes* (attitudes towards individual modes of transport but also attitudes towards the environment, recycling, health, sports etc.)

To understand the effects properly different viewpoints should be adopted. The situation might be quite different in the densely populated areas than in the less populated, between the old EU countries and the new member states with still fast growing car ownership etc. Also cultural differences should be looked at, especially composition of the household (e.g differences in single young people living alone or with their parents or grand parents living with the family) and the school system.

Task 2.Subjective attitudes

Information provision, quality and level of service (other than frequency which is related to waiting time), security and user friendliness of the system have an effect on the generalised cost of a journey but are not generally considered as stand alone components of the generalised cost of a trip but more like reinforcement or lessening to the effect of another component. The reason for this is that it is very hard to separate one single effect from the general attitude which rather creates a feeling of satisfaction or dislike and which often is incorporated to the value of corresponding time component of the mode concerned.

However, the present fats development of the ITS, especially concerning mode choice effects of information provision, internet timetables, journey and route planners including multimodal information, real time schedule information on stops and terminals, in-vehicle navigation etc. should be incorporated in the mode choice models.

In addition to the personal attitudes on mode choice a very interesting long term research topic would be to study the effect of parents' attitudes and family mobility behaviour on their children's attitudes. Accordingly, the school's influence on children's attitudes and the effect of

traffic education in schools on the transport decisions to be made later in life raises interest as well.

Task 3. The dominant trip of the day regarding mode choice

Looking at persons' daily trip diaries we can clearly see two things that are in conflict with the principles of most of the present models. Firstly, the decision of mode necessarily isn't done trip by trip but instead there is one dominant trip during the day that rules the modes chosen for other trips as well. Secondly, the decisions on mode choice may be affected by other persons' choices in the household than the traveller him/herself. This kind of thinking is related to the activity based thinking of travelling of which there are several studies available.

Research subject 2: Impact evaluation of public transport services and public transport improvements on mobility.

Research domains

1. Development of new methodological approaches for the estimation of satisfied customers in public transport
2. Identification, validation and promotion of best practices in public transport services impact assessment
3. Advancing knowledge and techniques on innovative prediction tools and indicators in public transport

Expected outcome

The selected project should aim to deliver appropriate practical tools to be used by policy and decision makers in the public transport industry in order to assess impacts of current public transport services and mobility approaches, and to estimate future impacts on mobility, environment, the community as a whole and the citizens. These tools may have the form of best practices, sets of indicators/benchmarks, models or methodologies. Research activities will need to be coordinated between the research/academic community and stakeholders (e.g. public transport operators), while the dissemination actions should ensure the maximum visibility of the project results, employing several communication and promotion means.

Development of measurement categories for traffic and transport volume in Europe

The existing and most common measurement categories are suitable for the evaluation of the current traffic volume only to a limited extent. This leads to less significance in terms of efficiency of transportation and traffic systems.
The actual efficiency of the system depends at least on the size (granulation), the spatial appearance and the time distribution of the traffic volume. Therefore, suitable measurement categories for traffic and transport have to be developed.

Urban development and the influence of transport networks

Aims

The aim of the proposed project is to advance the integration of land-use and mobility planning in the city regions of Europe in order to improve sustainability. Here the concept of sustainability includes issues of accessibility, cultural heritage, ecology, energy, environment, equity and social inclusion, health, regional economy and safety as they affect both current and future generations. The project will include development and demonstration of methods that

will assist in the integrated planning of land use and transport in the context of all of these aspects of sustainability.

Tasks

1. *Relationships and trends*

In order to set the context for subsequent tasks, it is important to understand current knowledge on the relationship between land-use and transport, in particular the interactions between land use, traffic and public transport networks and the drivers behind urban spatial development and urban economy. The task should include a review of the state of the art and new analyses of databases such as UITP's Millenium Cities Database.

2. *Indicators of impact and outcomes*

Building on existing studies, determine which indicators suitably capture the objectives of the relevant stakeholder groups and that can be used directly in appraisal. The task should consider indicators that are outside the normal field of transport and land use, and include those relating to health, quality of life, welfare, etc.

3. *Decision-making and decision-support tools*

An assessment of the benefits of current practices is required as there is a wide range of practice in decision-making procedures across Europe, and relatively little guidance as to which models work best in different circumstances. Decision-making has also become more complex as the number of agents, and levels of government, has increased. The growing emphasis on citizen participation will introduce new opportunities and challenges. There is also a gap between the development and application of decision-support tools which suggests that current methods are not wholly fit for purpose. Renewed emphasis must be put on developing affordable and accessible predictive models and appraisal and design tools which serve the needs both of individual decision-makers and of groups

4. *Analysis of land-use and transport planning measures*

Using the methodologies derived in previous tasks, this task involves investigation of the role of consistent pricing policies in transport and land use; controls on urban sprawl; the relationship of transport to public space; intelligent transport systems; innovative public transport; integration of motorised and non-motorised modes; enhanced supply chain management; intermodality; and improved vehicle fleets. The emphasis should be on integrated approaches, enhanced understanding of the principles of integrated design, and research into the performance of integrated strategies.

The pricing of infrastructures

There are various objectives of charging transport infrastructure use: to increase welfare, to achieve full cost recovery or to reach profit maximisation under constraints. For every resulting regime it is most important to forecast how the users will react to the charges set. Therefore, the first general goal is to compile the present state of knowledge on user reactions on transport pricing into a consistent scheme to allow for reliable estimation of the main impacts of pricing. The second general goal is to extend the existing knowledge on important impact areas where we find it necessary to improve on the reliability of estimates. Starting from this general platform the main targets are:

- to define pricing schemes for typical regimes, which foster efficient use of infrastructure capacities, reduce external diseconomies, provide cost recovery and respect fairness and equity goals, all this eventually supported by other instruments;

- to identify user reactions in the small (urban/regional), in the large (country, European), as well as in the short (real time) and long run (planning horizon for the infrastructure);
- to elaborate a set of consistent cost reaction functions based on empirical and theoretical knowledge;
- to extend the present state of the art for the reactions of passenger transport by implementing a survey based on experimental games;
- to extend the present state of the art for the reactions of freight transport by selected investigations on the micro scale;
- to simulate and assess the behavioural effects of pricing regimes on regional, national and European level;
- to assess the results with regard to short-term transport effects and long-term economic/ land use effects;
- to derive recommendations for policy makers depending on the institutional settings and predominant objectives of user charging.

Soundscape, context and the experience of noise

Many European cities contain important cultural heritage sites and cultural environments that can be seen as silent witnesses of times passed. They have strong mytho-poetical qualities, and it is in the market of dreams, experiences, and identity they probably have their most significant economic potential. To attract potential tourists, investors and future inhabitants, modern cities have to provide not only good housing conditions, but compete in this market by providing rich experiential urban surroundings.

When planners, researchers and politicians direct their attention to the field of noise experience, it is almost invariably from a residential perspective. Through years of research a fairly sophisticated knowledge base has been built on how people become annoyed by noise when at home. However, there is considerable qualitative evidence emerging that people experience noise differently depending on context. Thus, it can easily be assumed that people have different demands and different thresholds for annoyance when they are experiencing the environment as users of a city, rather than as residents. There has been little research on the interaction of people and soundscapes till now. Notable exceptions are research on the perception of public places, processions and cultural events, but not on everyday experiences.

The soundscape approach for describing the perceptions of sounds depending on the subjective intents and activity context should be useful, because its main aim is the study and the possible improvement of the relationship between the "aural space" and the living environment – the "soundscape". The sonic environment is seen here as mediator between humans, their activities and the environment. Sound sources thus create "meanings" to the exposed and block or enable human activities, thoughts, feelings. By studying soundscapes we gain a larger understanding of noise experience in the context of human activity across space, time, and society. The theory about soundscape has also spawned the concept of “quiet areas” as crucial explanatory factors for predicting environmental quality in urban areas. Soundscape theory also opens for the potential of masking noises by introducing other more pleasant sounds in specific locations.

Previous research on soundscapes has borrowed much of its thematic orientation from musicology, and has focused mainly on characterising urban sound by the use of different psycho-acoustical measures. However, we lack a thorough understanding of the basic condition for describing urban sounds as noises: the degree of undesirability, their function as noise screens as backdrops and appropriateness. This is a matter of content just as much as acoustical

qualities. Future research should thus assess differential soundscapes for various groups of users of urban space, with the focus of the content of the sounds people experience. By increasing our understanding of what sounds are considered appropriate for different types of urban scenes we also gain knowledge about what type of sounds "quiet areas" are made of. This may provide an important basis for designing more efficient noise abatement measures in general and more active strategies for noise masking of ambient sounds in particular.

The impact of lifestyle changes and life stages on travel behaviour

Three phenomena deserve to be studied:

Young persons' driving licence acquisition and car use

Analyses of the national travel surveys of several Western countries indicate that young people are now less interested in obtaining a driving licence and buying a car than they were 10-20 years ago. The groups who have best access to a car live in sparsely populated areas; they are men, have paid work, live in a relationship and may have children. Those with least access are living in urban areas, are students, women, live on their own or with other grown-ups.

The research questions related to this phenomenon can be; have young people changed their attitudes toward the car, has the car lost its status as a cult object for youth or are they postponing having their driving licence?

Elderly people and transport in the future

In most European countries the share of elderly people will increase significantly over the next few decades, and a large part of them will possess a driving licence.

For many older people, better health condition, increased access to a car, more leisure time and a relatively good income make possible a greater variety of activities and travelling in the future. The older groups of tomorrow will be people who during their working career have had good access to a car and have developed habits for car use which they will not want to abandon.

In the future, a greater proportion of old age groups will be people over 80 years of age. Today, many have reduced mobility due to health problems.

These two trends will be a challenge for transport planning. How can the increased number of elderly drivers be handled? How can the transport system, both the public transport and road systems, satisfy the demand from this group?

Gender and transport

Traditionally, men have had better access to cars than women. To some extent this has changed, but there are still large gender differences in most European countries. In addition to having a higher average income than women, men also have fringe benefits which make it more convenient to use a car to the workplace. Men make more work and business trips than women. They go on more trips related to their own leisure activities than women. Women for their part do more escorting (children) and trips related to family shopping. In other words, they carry out trips that others in the household could do. The differences between men and women have not disappeared. The situation is rather the other way around, especially in the case of escorting trips. Better access to the car seems to have increased women's chauffeuring role in the family.

What are the future perspectives on gender and transport?

2.4 Improving safety and security

2.4.1 Cross cutting, multimodal and intermodal issues

Improving safety – cross-cutting issues

Towards a global rail system

We find evidence of three continental trading blocs: the Americas, Europe and Pacific Asia. We assume the realistic case where intercontinental transport costs are neither prohibitive nor zero. If transport costs are low, continental Free Trade Areas can reduce welfare.

Over the next twenty years the geo-economic situation of Europe will be affected by several global forces manifested in highly potent endogenous and exogenous drives. The fast aging European population represents a Europe-specific endogenous factor, which might reduce the continent's supply of productive workforce and, in the long-term, erode its economic and industrial base.

Concurrently, several exogenous trends shape Europe's socio-economic position and trade patterns. While the technological developments in the Americas, and particularly in the US, will continue to affect the world's economic progress, in the following focus is concentrated on the Asian Dimension.

One look at "Eastern Direction" brings to the fore the following observations. The rapid growth of China's production facilities created a world-class manufacturer capable of global supply of consumer and industrial goods, including transportation equipment. Advances in India's information technology created a global partner capable of meeting Europe's growing demand for computer software, IT support services and IT equipment with applications in European transportation industry. Russia's present export structure may over next few years (and most probably will), shift away from basically raw materials to highly processed consumer and industrial commodities destined to the European mainland. Finally, one should not forget Japan's industrial power, which after ten years of recession is back in global competition with export focus on European industrial and consumer markets.

All these developments may bring a range of positive and negative consequences for Europe's strategic, political and economic welfare. The common outcome will, however, be a considerable increase in the level and intensity of trade flows between Europe and its Asian partners.

Needs for direct transport links with industrial centres in Central and Pacific Asia can revolutionise the railway's role in inter-continental goods transfer on a scale not seen before. The expected increases in freight volumes may transfer rail into a highly viable competitor to both long distance ocean shipping and international air cargo transportation. If rail can secure speedy and un-interrupted freight movement with more direct access of production and distribution centres at both ends of inter-continental supply chains, it will increase its competitive advantage over ocean shipping, for which cargo must be handled through ports and then subjected to interior consolidation at production/shipping points. Rail would be cheaper than international air transportation and possibly access production and market sites almost as well as air transportation.

This means that the principles of rail commercial, technical and operational interoperability will have to be developed for the global rail system.

An appropriate organizational structure must be in place to permit smooth and uninterrupted flow of cargo. This will very likely involve inter-continental collaborative partnerships and working relationships between rail operators and logistics service suppliers on a scale leading

possibly to development of fifth and sixth professional generation of international third party providers.

The advantages of inter-continental long-haul railways may be diminished if attention and efforts are not given to resolving the location, design, and operations issues related to efficient management of intermodal freight transfer terminals functioning on a scale without predecessors in European international logistics environment.

By 2050, the global population could reach anywhere between 12-14 billion. It seems reasonable to assume, that more nations, inter-country regions, and cities join the 'club' of free market economies making up the global society with much higher trade volumes and higher intensity of economic exchanges.

The burgeoning trade flows of the 21st Century must be facilitated in a way that is both (i) logistically rational, as determined by intense, 24-hour competition in a global "free" trade area, and (ii) ecologically sound, since passage through, and despoliation of, the trade-routes will no longer be perceived as "free".

As traffic along the inter-continental supply lanes, air corridors and highways increases to accommodate the higher freight volumes and passenger movements alike, the global transport system will expand, with a commensurate diversification of routes and modes. This diversification of traffic will expand - across the inter-continental gateways - to encompass the international rail service.

The inter-continental links, which have at some time been proposed or are already under planning, are: the Bosporus Strait (Europe-Asia); the Strait of Gibraltar (Europe-Africa); the Central American Isthmus (North-South America) the Bering Strait (North America-Asia)

Several mega-projects have been proposed and designed which will explore the supply and freight movement conditions in numerous intercontinental corridors connecting Europe with sourcing and destination centres in different parts of world.

These include: an inter-modal link with continental Australia via Port Darwin; the African corridors between Cairo-Casablanca-Cape Town; the UN's "New Silk Rail Routes" in Asia; the Japan-Russia tunnels; the Transalpine, among many others.

Central Asian governments hope the infrastructure improvements will translate into increased trade. Some envision the transport projects as a modern-day Silk Road that strengthens links between China and Western Europe. New transit links would certainly help Central Asian states find new markets in China for their commodities, including oil and gas.

A new Central Asian road-rail network would also face stiff competition from Russia’s Trans-Siberian railway. The Trans-Siberian route, which has been operating for almost a century, is relatively well developed, with dual tracks running almost the entire length of the route. Russia, with an eye on preempting competition from a Central Asian rail network, is already pushing new transit options involving India and Iran.

Despite the apparent disadvantages, research can help push forward the various road and rail projects considered. China has a considerable geopolitical interest in expanding its links with Central Asia. While China already has a sizable economic presence in Central Asia, the lack of infrastructure is hampering its ability to expand its influence. An improvement of rail access from Europe to Central Asia may ultimately help China replace Russia as the dominant economic power in the region.

2.4.2 Road safety research

Protect vulnerable persons - roads

Effective Vulnerable Road User (VRU) protection

There is a need to assess the most appropriate methods and technologies to improve the safety level of Vulnerable Road User (pedestrians, cyclists and motorcyclists), a road user group which accounts for approximately 25% of the EU's road fatalities, a priority area with respect to national and EC casualty reduction targets. This will include both active and passive vehicle-based solutions (integrated safety), infrastructure design and technological solutions. The objective is to provide an assessment of the injury benefits, cost benefit, and feasibility of solutions to address the currently high level of VRU casualties on Europe's roads and to provide strategic guidance on the "value" of the range of potential options. This is especially important as the development of vehicle (and roadside) technologies progresses to monitor and ensure effectiveness of implemented and future solutions.

The analysis could consist of a review of accident data using research conducted in other European projects (for example PReVENT, APALACHI, APROSYS) as a basis, and building on this data to provide an up to date view. It should include an analysis and comparison of the risk and of preventive measures applied internationally. Accidentology would focus on accident configurations, types, environmental factors, and accident location. The recent data may provide information on the effectiveness of recent VRU safety measures, for example the trends over the last 1, 3 or 5 years. Assessment of the improved passive protection resulting from changes to EC Directives may be assessed. A "state of the art" review is required to understand the current (and future) technologies; again this area links to recent and ongoing European projects and should be updated to include recent developments, emerging technologies and other potential solutions. These would provide details on the types of VRU accidents and injuries which occur in Europe, the injury severity and the available and future accident mitigation or avoidance solutions. Sensor technologies should be reviewed in relation to the required specification. The required data fusion should also be assessed and the system response time (sensor detection response time plus decision-making time) and be compared to VRU accidentology to estimate the benefits of the available and emerging technologies. Requirements for technological systems should be developed and a feasibility assessment made which cover issues relating to the effective implementation of vehicle and roadside technologies. Other areas which should be considered are accidents at night and road type (urban/rural) and the range of potential solutions which could be applied such as improved detection and conspicuity issues. An assessment of the effect of emerging demographic shift in the driving population and the implications for technology and other solutions should be considered. Human factors research should focus on the implications of older drivers involved in VRU accidents and consideration of the effectiveness of a broad range of solutions, including vehicle technology (accident avoidance and mitigation, driver assistance systems), roadway design, intelligent roadside furniture and driver behaviour training and awareness.

Driving and older people

The factors that can modify the crash involvement rates of elderly drivers are not well understood. There is a need to develop a firm knowledge base for implementing effective measures to improve the possibility of their safe mobility. This is especially important considering the rapid increase in the older driver population in future, which will occur due to the higher share of elderly persons in the general population, and to the increased share of licence holders among the elderly. A special challenge is to obtain good data regarding temporal

and spatial distributions of exposure among elderly drivers as compared to the driving population in general.

It has been repeatedly demonstrated that elderly drivers have an increased injury and fatality risk compared to middle-aged drivers. It is clear that this is explainable at least partly by the fact that elderly people are more fragile, and consequently will be more seriously affected by the physical impact of a collision. A possible additional explanation could be that elderly drivers are more likely also to be involved in an accident in the first place, i.e. have an increased accident involvement risk, possibly due to a gradual impairment of dexterity and of sensory and cognitive skills with increasing age. There is evidence that drivers above the age of about 75 years are over-represented in certain types of accidents, especially those occurring at intersections and complex driving environments. If crash involvement risk increases with old age, older drivers may constitute a hazard both to themselves and other road users. On the other hand, there is also evidence that some older drivers compensate for their limited capacities, so it is uncertain to what extent older drivers have an increased aggregate risk. There is also evidence that older persons drive less, a fact that by itself can explain a higher crash involvement per distance driven, since it is a well established fact that crash involvements per distance driven tends to decrease with increasing annual driving distance for drivers in general. A further important question is to what extent older drivers maintain a relatively lower risk when driving in familiar road and traffic environments, compared to less familiar roads.

Impairment due to disease is more likely among elderly persons, which implies that there may be certain groups of elderly drivers with a particularly high risk. Cognitive impairment like dementia is one example, and in some cases the drivers have impairments of which they are not aware, and therefore are less likely to compensate for. There is a need for more knowledge about the health-related risk factors among elderly drivers and for the development of efficient methods to identify drivers at high risk.

Dynamic response of vehicle occupants

In vehicle crashes resulting in soft tissue neck injuries, so-called whiplash injuries, females are constantly reported as more vulnerable than males given similar crash circumstances. In addition, whiplash injuries are costly, and most common in rear-end impacts. The biomechanical research establishing the dynamic response of females has not yet been conducted in the same way as that of the males and crash testing is currently performed with a dummy representing an average male. There is a need for research in this area. The aim would be to establish the dynamic response of females.

The risk of whiplash injuries for females is nearly twice that of males. From the earliest crash investigations women have been found to have higher whiplash rates than men, with results from the US being similar to those in European studies. Some studies found only a slightly greater risk in women, while others found 40–50% higher rates, and even others more than double the rate. In the literature, even more and later studies can be found that show the higher risk for females compared to males. Whiplash injuries are common and costly and have increased during the last decades. In Sweden, for example, the estimated cost of these injuries has been shown to be in the order of 430 million Euro in 2004, for a country of 9 million inhabitants. For low severity rear impact the majority of the tests that have been conducted to establish the dynamic response, have been performed with male volunteers. However, a small number of tests conducted with females indicate that there could be characteristic differences between the dynamic response between males and females.

Vulnerable road users' protection

Vulnerable road users, i.e. pedestrians, cyclists, children, elderly and handicapped persons are particularly accident prone due to not being protected by the vehicle weight, seatbelts, airbags and other security enhancing devices.

A number of international campaigns have been conducted with the aim of drawing attention to the vulnerable road user issue. The development of motorization in the 20th century was pursued with the motorized road users in mind. Constant upgrading of the vehicle was accompanied by development of the road network. The contemporary vehicle has been equipped with a number of devices guaranteeing safety both to the driver and the passenger. Those include: seatbelts, headrests and airbags. Vulnerable road users however still miss relevant provisions, engineer devices and rules providing for their safety. Research should focus on various areas of activity, e. g. construction of roads and road facilities, passive safety measures (vehicle equipment, e.g. outer airbags for pedestrian protection as well as personal protection measures – such as helmets, fluorescents elements), legal provisions – road traffic regulations, obligatory equipment (international conventions, directives, national law), police supervision, children and parents education programs, driver training schemes, campaigns, co-operation with local communities.

Advanced analysis systems and risk analysis – roads

European Road Safety Observatory

Creation of European Road Safety Observatory and on this basis in European countries the national road safety observatories should be created, they will provide accident and exposure data, good practice recommendations, road safety analyses, road safety programs etc. to European Road Safety Observatory, creation of the rules for European Road Safety Observatory.

Aim of the project**:**
The project is aimed at decreasing the number of road accidents with the participation of vulnerable road users, enhancing their security by indicating necessary preventive measures and gathering good practice in this respect.

Justification of the project:
Vulnerable road users, i.e. pedestrians, cyclists, children, elderly and handicapped persons are particularly accident prone due to not being protected by the vehicle weight, seatbelts, airbags and other security enhancing devices.
A number of international campaigns were conducted with the aim of drawing attention to the vulnerable road users issue. The development of motorization in the 20th century was pursued with the motorized road users in mind. Constant upgrading of the vehicle was accompanied by development of the road network. The contemporary vehicle has been equipped with a number of devices guaranteeing safety both to the driver and the passenger. Those include: seatbelts, headrests and airbags. Vulnerable road users however still miss relevant provisions, engineer devices and rules providing for their safety.

National and regional data and models

Data on traffic, behaviour, exposure, and accidents are required for many applications, such as international comparisons, identification of trends or new risks, evaluation of public policies, and above all understanding of the phenomena in order to tackle the problems at the right level. But collecting data is an expensive and long-term process, which has to be cost-effective, especially for new applicants in the European Union. It is not independent of the models used,

and must take into account road-users often neglected and for whom we lack data and knowledge, such as two-wheelers and pedestrians. A sub-title of this task could be “What data for what model”.

Attitudes, opinions, reported behaviour

An interesting approach to the study of interrelated attitudes, opinions and behaviour is represented by the concept of “social representations”. Others behave according to their beliefs, and those beliefs are representations that may or may not reflect reality. This idea is confronted to road risk, either as opinions, or judgments, or reported behaviour. The objective remains to understand better what are the underlying factors of road practice for target populations and to infer recommendations that may be taken into account in the frame of road safety.

In consideration of the relative lack of information about motorized two-wheelers, specifically when the vehicles have no plate, the 'building of facts', by means of an extensive survey, is very important, as it was the case for car drivers. Characteristics of motorized two-wheelers, either young users of vehicles less than 125 CC, or professional users mostly in big cities, or older users with engine size over 125 CC, as well as their respective 'philosophy' of mobility and risk, plead for a research action distinct from the car drivers' perspective. This does not exclude comparisons between the two populations via common questions.

Mobility, exposure, accidents

The development of DRAG-type models in a number of countries or regions (California, France, Germany, Norway, Stockholm-County, Quebec), presented in a book[1], established the usefulness of two dimensions in the explanation of the number of road accident victims:

- **Formulation**: the importance of explaining *Exposure* (Road Use, i.e. Vehicle-km), *Accident frequency* (by severity category), *Accident Severity* (Numbers of killed and injured victims by accident) separately, rather than merely relating the number of Victims to various explanatory factors;
- **Estimation**: the usefulness of allowing the data to determine the mathematical form of relationships rather than assuming a particular form (say, linear or logarithmic), because the size, sign and significance of statistical causality in multivariate analyses depends critically upon the mathematical form of the relationship.

It is expected that these issues arise independently from the level of aggregation of road safety data (individual, or aggregate) or from the type of statistical estimation method used (discrete probabilistic, classical or state-space regression) in the explanation of road safety levels.

It is therefore expected that four sub-themes will be addressed by road safety modellers:

- The link between *sampling method and estimation method**:*** for instance, if a Logit model is used, choice-based sampling is an option which reduces sampling costs. Also, if a Stated Preference survey is carried out, one would expect the questionnaires to be designed in such a way as to obtain variables that are orthogonally distributed (uncorrelated) in the proper form of the variables: for instance, if the utility functions are logarithmic, the variable should be orthogonal in that space, not in the linear dimension used to ask the questions.

[1] Gaudry, M. and S. Lassarre, eds, Structural Road Accident Models: The International DRAG Family, Elsevier Science Publishers, Oxford, 2000. www.elsevier.com/locate/isbn/0080430619.

- As one moves away from classical regression and adopts co-integration, unit root and state-space methods, issues of *optimal functional form* arise in new ways. For instance, how is a unit root problem defined if the optimal form is square root of the variables? Do the correlations change?
- What is the optimal *search strategy* if the optimal form is not known with certainty? Clearly, Monte-Carlo methods can be used to help define search strategies that reduce estimation costs when functional forms of variables have to be estimated.
- Are *simulation methods* affected by modifications in optimal forms?

Structural road safety models at regional, national and European levels

Road accidents represent tremendous losses to society in general and to the individuals most directly affected in particular. Enhanced knowledge of the accident generating mechanisms operating at the societal level might help improve the effectiveness of the fight against these losses.

While in most western industrialised countries the road accident fatality rate has been declining since its historical peak around 1970, the situation in certain eastern European countries, as well as in Asia, Africa and Latin America, is more worrisome. It may appear that strong economic growth and the release of market economic forces are closely linked with an increase in motorised travel and in the accident toll. What societal and economic laws are at the root of such an association? Is it possible to learn from the experience in highly developed economies how to break the association between growth and accident toll, so as to enter sooner into the phase of declining risk?

In certain western European countries, notably in France, a very impressive reduction in accident risk has been achieved in recent years. More generally, the cross-section of western industrialised countries differs widely in terms of fatality risk per vehicle kilometre travelled. These differences arise for a reason. It would appear that a systematic comparison between countries and a rigorous, country-by-country analysis of past experience, in which one estimates the separate effect of each factor, could provide valuable insights into the potential for safety enhancement.

In such an effort one could be greatly helped by the use of structural econometric road safety models. In many countries or regions, notably France, Germany, Norway, Sweden and Spain, such models already exist or are being developed. There are large synergy benefits to be gained from an extended network of comparable models and from the continuous updating and improvement of existing ones.

Road accidents occur as a result of a potentially very large number of (causal) factors exerting their influence at the same location and time. First, accident numbers depend on a number of truly *autonomous factors, determined outside the (national) social system*, such as the weather, the natural resources, the state of technology, etc – in short, factors that can hardly be influenced (except perhaps in the very long term) by any (single) government, no matter how strong the political commitment. Second, they depend on a number of *general socio-economic conditions*, some of which are, in practice or in principle, subject to political intervention, although rarely with the primary purpose of promoting road safety, nor – more generally – as an intended part of transportation policy (industrial development, (un)employment, disposable income, consumption, taxation, inflation, public education, etc). At a third level, however, the size and structure of the *transportation sector*, and the policy directed towards it, obviously have a bearing on accident counts, although usually not intended as an element of road safety policy (transport infrastructure, public transportation level-of-service and fares, overall travel demand, modal choice, fuel and vehicle tax rates, size and structure of vehicle pool, driver's license

penetration rates, etc). Most importantly, many of these factors are strongly associated with aggregate *exposure*, i.e. with the total volume of activities exposing the members of society to road accident risk. Fourth, the accident statistics depend, of course, on the system of *data collection*. Accident underreporting is the rule rather than the exception. Changes in the reporting routines are liable to produce fictitious changes in the accident counts. Fifth, accidents counts, much like the throws of a die, are strongly influenced by sheer *randomness*, producing literally unexplainable variation. Finally, accident counts are susceptible to influence – and, indeed, influenced – by *accident countermeasures*, i e measures intended to reduce the risk of being involved or injured in a road accident, as reckoned per unit of exposure.

Although generally at the centre of attention among policy-makers and practitioners in the field of accident prevention, this last source of influence is far from being the only one, and may not even be the most important. To effectively combat road casualties at the societal level, it appears necessary to broaden the perspective on accident prevention. To distinguish the effect of one factor from another, structural multivariate modelling is needed, in which one takes into account the entire spectrum of variables susceptible to influence the aggregate road accident toll.

Structural accident models are useful in estimating a variety of policy relevant parameters, including the elasticity of casualty counts with respect to exposure, the marginal external accident cost, the effect of accident countermeasures, and the importance of behavioral response (risk compensation).

Accidents are – with few exceptions – unwanted events, frequently even very traumatizing ones. To a large extent, this fact serves to preclude the use of perfectly controlled experiments as a means of gaining insights into the causal relationships governing the accident generating process. There is, however, an abundance of non-experimental data available, in the form of road accident statistics, as well as other social and economic indicators having been observed over a long period of time and for a large number of different geographic units. To extract policy relevant knowledge from this vast array of data, structural econometric modelling may well be the most efficient tool.

Effect of ITS on behaviour and accidents

The development of ITS has opened up new windows of opportunities regarding road traffic safety of. However, the various IT-systems appear with a different degree of maturity. Some systems have been around for some 20 years or so, as ABS and Variable Message Signs (VMS), while car manufacturers and researchers still struggle with the elaboration of reliable systems for detecting and warning drivers of falling asleep at the wheel. Further, all drivers have to adapt, and will adapt, to whatever system is integrated in the car and in the road environment infrastructure. Behavioural adaptation is a key ability of the human organism, but some 20 years of traffic safety research has also revealed that driver adaptation may not always be for the benefit of safety.

This new era of ITS then calls for new and better driver behaviour models, which must comprise characteristics of human behaviour as the appear in automotive systems, issues as manual vs automatic control of the vehicle, human error in automotive systems, risk compensation, etc. Such aspects represent new challenges to the car industry and experiences from aviation, cockpit design, air pilot behaviour and situational awareness may be dimensions that would benefit the necessary elaboration of a driver behaviour model in automotive systems. Behavioural adaptation is a very complex and also a key issue, as seen by antagonistic and counterintuitive effects of ABS, which in turn raise the question of comprehension and understanding of integrated systems of the car. With the continuing sophistication of new ITS finding their way to the markets in new car models, the issue of knowledge is of general importance, especially since driving a car is “democratic”, meaning that almost everyone might obtain a driving licence, in

road traffic there is no such elaborate, professional selection of "pilots, i.e. drivers, as in aviation.

Objectives for a project in this area could be to

- Identify ITS-related driver behaviour which may pose a threat to traffic safety, in terms of adverse behavioural adaptation, risk compensation, workload, task difficulty, and/or accidents
- Propose and map methods with potentials to identify adverse driver behaviour in early stages of ITS-developments in order to correct and feed back knowledge of effects to car manufacturers
- Propose and implement evaluation methods in order to assess the effects on accidents of specific ITS used in real traffic
- Describe a state-of-the-art, as updated as possible by systematic reviews of the literature, on the association between ITS/ADAS and road traffic accidents
- Propose and develop a model of driver behaviour which incorporates new aspects of automation, automotive environments/ITS, especially on issues addressing manual vs automatic control of the vehicle, acceptance, experience and knowledge of systems
- Predict effects of ITS on behaviour and accidents on the basis of a driver behaviour model especially developed for an automotive driving environment

The work plan must include the development of standard scenarios and standard parameters to test and describe the effect of ITS/ADAS on driving with regard to different driving manoeuvres, relevant situational characteristics and driver abilities. For validating the effects, standardised scenarios and parameters may be developed for application in driving simulators, instrumented cars, as well as standard car models in real traffic. Standard scenarios and parameters must be developed by taking into account the variation in driver needs and driver abilities as they appear in different driver population subgroups, especially by considering the needs of novice or elderly drivers.

Barriers to implementation of road safety measures

The already existing project SafetyNet is working towards the establishing of a European Road Safety Observatory (ESRO).

When fully established, the ESRO will provide European, national and local decision makers with correct and updated information concerning road accidents.

However, the lack of knowledge and rational arguments is only one of several barriers to the implementation of effective road accident countermeasures and thus to the reduction of road fatalities and injuries.

Other barriers are less well known, such as lack of cooperation between bodies working for road safety, higher priorities for conflicting interests, and lack of commitment. There is a need for knowledge on how to overcome these barriers. Systematic research in this neglected topic would also improve that chances of faster and more efficient implementation and thus of the reduction of fatalities and injuries. Topics to be studied include:

1. What are the main barriers to the implementation of road accident countermeasures?

2. What is the potential for overcoming the barriers and for the implementation of effective countermeasures?

3. Why are some effective countermeasures implemented in some countries but not in others?

4. Could criteria for implementation of effective countermeasures be established?

Research on the implementation of effective road accident countermeasures has started, but it is far less advanced than other road safety research, such as research concerning the effects of road accident countermeasures, road user behaviour or accident analysis.

Even if the barriers and the potentials for road safety action may be different in different countries, some barriers may be the same in all countries. The theories and methods for implementation research will be the same in all countries. Systematic research in the field of implementation may also be useful for other topics within transportation research, such as environmental issues or public transport.

Traffic safety potentials - identifying road sections where safety measures have the best effect

An "injury severity density" (ISD) index measures the number of injured road users on a section of a road, weighted by the societal costs of the injuries. In using such an index one is implicitly putting more weight on the fatal and serious injuries than on the light injuries.

A "traffic safety potential" (TSP) index can be defined as the difference between an existing injury severity density or existing injury cost and a "best practice injury cost".

Such an index may be useful in optimising road safety investments and maintenance. To develop such an index one needs a system for calculating **the best practice injury cost** for a road section with a specified standard/condition.

New data options for determining crash severity

Retrospective estimations of severity of a crash from vehicle deformations and other clues have major limitations when attempting to understand what happened during the crash and what caused the injuries. There are currently techniques available that measure the crash pulse during the crash and thus can provide a more accurate measurement of the severity of the crash than any retrospective estimation can provide. Therefore, data that are collected in the event of a crash should be made available to researchers and engineers to assist in their attempts to design safer systems offering better occupant protection.

Mass databases are based upon police crash reports as a primary data source for investigating crash aspects. At best, these mass databases provide only a limited insight into crash issues, particularly into the actual crash phase itself. In-depth crash analyses can make retrospective estimations of crash severity in terms of velocity changes based on remaining deformation. However, current available data recorded by the Event Data Recorder (EDR) can provide the true crash severity both in terms of change of velocity and of the duration of the acceleration pulse and levels of acceleration. With further road safety gains proving increasingly difficult to achieve, it is important that the best available technology be used in the collection and analysis of crash data.

Crash data can be used at least for the following purposes: (i) to describe the extent and seriousness of the problem, (ii) to identify possible countermeasures for reducing crashes or crash severity, and (iii) to evaluate the effectiveness of implemented countermeasures in reducing crashes or crash severity.

Mass databases based upon police crash reports are a primary data source in achieving these three purposes. At the same time, however, it is accepted that police crash data necessarily suffer from a number of deficiencies. Apart from issues of data ascertainment, arguably the greatest limitation relates to detailed knowledge of the actual crash phase itself: in providing information about what produced the particular crash outcome. Retrospective assessments of crash circumstances and particularly the impact severity will inevitable have major limitations.

A detailed understanding of the loading in the crash as it interacts with the occupants, the vehicle and the road environment is critical in developing countermeasures aimed at the protection of vehicle occupants.

Integrative approaches - roads

Interaction between drivers in traffic and their effects on traffic safety, traffic flow and the possible changes by ADAS functions

The traffic system is comprised by individual vehicles and drivers. Interactions between these individuals are essential factors behind the prevailing traffic conditions. Knowledge of the relationship between traffic safety and flow conditions and these individual interactions are also important to allow improvement of the current situation and to account for the future traffic growth without reduced safety and level-of-service. There is a need to develop methods to evaluate and analyse the relationships between driver interactions and resulting traffic conditions.

The nature of driver interactions is continuously changing. Vehicle technology improvements have, for example, resulted in changes in driver behaviour. Today, a large number of in-vehicle driver assistance and information systems are developed and introduced on the market. These systems have a great potential to improve both traffic safety and flow conditions. However, the systems may result in changes in driver behaviour and in the interactions between road users. This aspect should receive special attention. Results from the previous European projects ADVISORS, HASTE and AIDE in the driver assistance area could be important input. Another related aspect includes effects of increasingly automated vehicles in the traffic system. This development may also have substantial impact on traffic flow conditions and congestion.

Road users' competence - analysis for road design

Although most car accidents can be ascribed to some human action, the driver actions "causing" an accident (often referred to as "human error") always occur in the *context* of a vehicle, a road system and other road users. It is therefore of utmost importance to have a correct understanding of how this context affects the perceptions, decisions and actions of the road users. In-depth accident investigations have shown that a large share of accidents happen because information from the traffic system or other road users is not perceived, or is misinterpreted by the involved driver(s).

Much work is already being done to develop human factors guidelines for designing roads in a way that takes into account the variation in limitations and capacities among road users, and good progress has been achieved. There is, however, much basic knowledge about human perception, decision making and behaviour that has not yet been translated into usable guidelines for designing better roads. The following needs for further research and development can be identified in this field:

- systematisation of existing knowledge about human capacities and limitations related to car driving, with special focus on high-risk groups like novice and elderly drivers
- using data from in-depth accident investigations to achieve a better understanding of the behavioural factors related to perception of critical road and traffic information during the pre-crash phase of accidents.
- development of better tools for analysing road systems, based on appropriate theoretical underpinnings regarding the drivers' behavioural characteristics, including:
    - establishing good criteria for identifying factors of the road design that are likely to result in *false expectations* among drivers

- procedures for easy applications in *safety audits* of new road projects, and during *safety inspections* of existing roads.
- testing of the effects of different road designs on road user behaviour, by different methodological approaches:
- naturalistic observation, possibly in combination with interviews and questionnaires
- using test persons in instrumented vehicles, enabling the recording of additional indicators of drivers workload and information processing
- observing driver behaviour in simulated road environments

Safety component of transport system – roads

Introduction

Providing a safe and reliable road transport system is a priority throughout the member states of the European Union. Ensuring that the primary network provides the necessary capacity to meet the traffic demand at levels of service acceptable to road users is essential. Integral to this is that road designs and traffic operations afford the road user the highest levels of safety throughout the lifecycle of a road.

Road design standards in especially western Europe have resulted in the implementation of a relatively well developed primary road network with high geometric standards. Advanced traffic management systems have further increased safety standards with the result that these roads are comparatively safer than other roads in the network. However, further gains in road safety can be made provided countries in Europe adopt measures such as those proposed in various initiatives by the EU (RISER, EuroRap etc), CEDR, ECTRi etc. and including such as the road safety audit, road safety inspections, road safety impact assessment and network safety management. Such measures will have a significant impact in countries with less developed road infrastructures but will also ensure that the standards of countries with well-developed infrastructure remain at a consistently high safety standard. Furthermore, initiatives in the field of ITS, specifically developments in the area of in-car technology hold potential benefit for safety in Europe and also here there are various initiatives that need to be co-ordinated to prevent duplication. These include programmes such as Prevent, CVIS, Prosper etc.

Highway furniture road safety level and criteria assessment

In many European countries, single vehicle accidents involving fixed obstacles contribute to upward of 10% of all traffic fatalities. Consequently many road authorities are attempting to develop procedures and best practices to reduce roadside hazards and/or methods to apply treatments to these that protect erring road users from serious injuries in the event of collisions. Many road directorates rate the concept of forgiving roadsides as potentially one of the most promising traffic safety measures for road infrastructure. Based on a status quo evaluation of current practice, an evaluation based on safety risk needs to be developed and a manual for applying remedial measures to ensure forgiving roadsides on all main European roads needs to be developed.

Speed and heterogeneous traffic/road safety impact

The Final report of the ESCAPE consortium (April 2003) “Traffic enforcement in Europe: effects, measures, needs and future” identified important issues of traffic law enforcement in the EU. The ESCAPE project summarised that traffic enforcement must be understood as an integral part of road safety policy.

Speed cameras have proven very effective in reducing speeding, and by lowering high speeds they also reduce accidents most of all those with most serious consequences.

After the ESCAPE project was finished several countries have started or at least widened their Safety Camera (SC) programs as important measure of the traffic safety policy. Large programs are working in England, the Netherlands and France. Sweden is starting a big programme on urban roads in 2006, and in cities in 2007.

There are three different camera types: Fixed, Mobile and Speed-over-distance cameras. Fixed cameras are the most common. One of the most important problems in using speed cameras is the legal question of "owner responsibility". The development in various countries has been so fast that a European study is needed to collect experience and knowledge. The study should collect international data to answer the following questions: What kind of Safety Camera programs and policy are there in European countries? What kind of technology is used, how many road kms are covered, what is the tolerance used, etc.? What kind of legislation is connected to Safety Cameras? What are the lawful sanctions? How is the question of owner responsibility solved?

Such a study may lead to more effective use of safety cameras and help many countries start their own SC programs. The programmes already running may become even more effective. One of the goals is to harmonize European legislation related to the use of safety cameras. The ultimate goal is, of course, to reduce the number of fatalities and injuries on European roads.

The use of speed cameras remains controversial in many countries, despite the fact that evidence of their effectiveness in reducing speeding and accidents is accumulating. There is thus also a need to review the experience gathered in Europe with a view to establish best current practices, i.e. what practices are most cost-effective. This has several aspects. Cost-effective practices include, for example, procedures resulting in a high proportion of solved cases, a high degree of public acceptance, and the choice of locations where cameras yield the largest benefits.

The following aspects might be subject to investigation:

A) Criteria for the choice of locations for using speed cameras

B) Who has formal authority to decide the use of speed cameras

C) Equipment used (means of detection, camera, blitz, data transmission, etc)

D) Software (for analysis of data collected)

E) Responsibility for installing and operating system

F) What the picture includes (license plate, driver, passenger, etc)

G) Image processing (manual, scanning)

H) Sanction applied (fixed penalty, demerit point, imprisonment, etc)

I) Reaction level (speed at which camera is set)

J) Spot measurement or section measurement (spot speed or speed over a distance of road)

K) Privacy issues (legal protection of privacy)

L) Technical innovation (who is responsible)

M) Evaluation studies reported (speed, accidents, or both)

N) Costs (investments and operating costs)

O) Responsibility for analysis of pictures (locally, centrally, by whom)

P) Use of revenues from tickets (earmarked to cameras, for road safety in general, or state revenue)

Q) Market structure (firms selling equipment and their market shares)

R) Synthesis of current practices – identification of best practices

Evaluation of safety interventions

A perennial and extremely troublesome problem for road safety is that of evaluating safety interventions. It is usually difficult or impossible to apply an experimental intervention to enough drivers to permit meaningful evaluation of the effect on accidents, and problems of sample bias and other research design issues need to be overcome. Research to develop evaluation methods might develop indirect indices of safety based on validated relationships between (say) driver behaviour and accidents, perhaps linked to automatic detection and recording of traffic conflict events.

Road safety impact of EuroNcap

The introduction of EuroNcap is thought to bring about significant gains in vehicle safety and thereby reduce severity of accidents resulting from traffic accidents. The extent of this impact on short, medium and long-term road safety targets in the EU is not yet fully known. Furthermore, a better understanding of the testing procedures and their relevance to the real traffic situation needs to be developed to ensure that manufacturers do not merely adapt vehicle designs to meet crash testing criteria in order to gain improved star ratings.

There is a need to scientifically assess the impact that the introduction of EuroNcap has had on road traffic accidents, and more specifically on the severity of injuries resulting from accidents. Specifically there is a need to determine the direct effect that EuroNcap has had on injury accident trends in member states. Current road accident data do not allow for such specific analyses and a methodology needs to be developed to measure or accurately estimate the effect that the EuroNcap rating has had on injury severity. The analyses must reflect the situation before the EuroNcap programme was introduced and the situation following the introduction of the programme. The analyses must take account of market penetrations and isolate the effects that the EuroNcap programme has had on accident and severity. The end product must give a statistically sound evaluation of these effects.

Robust design for safety

Development of new approaches for modelling the impact of variations in production processes (like variation of thicknesses of parts) on the crash safety properties of ***automobiles***, ships and railway systems. Functional properties (e.g. crash behaviour of a car), design, and costs determine the competitiveness of a product. Less than 5 stars in the EURO-NCAP test is a big disadvantage for the competitiveness of a new car model. The evaluation of such criteria during most of the design phase is based on simulation using a virtual prototype.

However, a specific virtual model is only an ideal representation of the reality whenever this model is due to:

- variations in the production processes for each part,
- material variations, as well as
- variations in the assembly and bonding procedures.

Due to the non-linear behaviour of the underlying processes small variations might have a huge impact of the prediction of the functional properties. In contrast to current industrial practice the

variations have to be taken into account and their impact on the functional properties has to be simulated.

Intelligent sensor systems for public transport

An environment-friendly and cost-efficient urban traffic requires novel public transport systems equipped with modern propulsion, information, communication, and sensor technology as well as the opportunity for automatic vehicle guidance. To assist the vehicle driver, sensor systems like lane keeping assistant, curve assistant, automatic cruise control, or night vision systems arise. Such systems are also required for a future automatic guided vehicle. But the current development is focused on systems for highway conditions with a supervising driver and an application in luxury cars or trucks. There is a need to develop and validate intelligent sensor systems for public transport vehicles like buses or trams suitable for automatic vehicle guidance.

Enhanced passive safety with multifunctional materials – Smart Safety

Today's passive safety devices are a compromise in that they are optimised for standard crash scenarios and only consider the most important crash characteristics. Intelligent safety systems (ISS) may resolve this shortcoming by adapting its characteristics to currently detected crash parameters like occupants' weight and position, vehicle compatibility, impact angle and speed, etc. and by minimising the injury potential by active control of loading on critical body parts during the crash event. The systems actuator should be based on smart materials that combine the required short response times with good controllability and sufficiently high mechanical potential. Specifically, research will be needed (a) on the strongly non-linear interaction between actuator loads and occupant injury signals to provide required insight for the development of real time control strategies, (b) on smart materials/structures technology for controllable high energy release and dissipation under one stroke action, and (c) on the optimised system integration of sensors and actuators.

Crashworthy structures for a safe, environment-friendly lightweight vehicle

The conflict between light weight design and passive safety requirements and a competitive selling price may conceivably be solved by the use of new flexible manufacturing processes for new advanced materials systems and complex parts. A whole set of advantages, such as low cost, high mechanical properties, and crashworthiness, emerge for example in the context of the use of innovative aluminium materials and manufacturing methods. Another important material that can be used in light and heavy duty vehicles is a new lightweight sandwich steel sheet, that has a high weight specific bending stiffness and is thus ideal for application in for e.g. outer panels. Concepts of innovative modular lightweight structures adapted to railway requirements need to be developed.

2.4.3 Security

State-of-the art of transport security

As security issues concerned with transport rather suddenly have been placed high on the agenda because of recent terror attacks in the transport system (New York, London, Madrid), there is reason to believe that quite different strategies and countermeasures have been adopted both between transport modes, between countries and between similar transport modes in different countries.

There is probably a very well developed and sophisticated cooperation between European countries with regard to intelligence and tracking of potential terrorists, but obviously less when it comes to security management of different transport modes.

In order to secure the different transport systems, there is need for knowledge of the state-of-the art and the best practices in order to

- identify vital security issues within specific transport modes
- identify best practices of how to organise cooperation between transport management, the police and relevant governmental bodies
- identify possible "missing links" of security management of trans-national transports

Security in railway system
The integration of European Rail Transport Security demands knowledge of the different Technologies and Security strategies within the European Regions. Regulations of the different regions reflects the national habits of the population and the awareness of security in life. The great challenge is to make the open system "rail" secure. Security – in terms of "counter terrorism" – is a new challenge for the rail system, it is therefore an area, which will increasingly demand for scientific contributions.

Security objectives in (here: surface/railway) transport are compatible with safety objectives. By making the transport infrastructure ("critical infrastructure") and vehicles safer and ensuring optimal levels of network capacity, passenger and freight mobility, it is possible to create a more robust system that would survive disruptions and security attacks. Therefore the strong link to safety has always to be considered while research and develop measures to enhance security.

This study should provide a survey about security strategies, operations and technologies applied in different European countries/regions, including the corresponding planning for the next years. Based on the survey, two to three scenarios should be derived fulfilling the fundamental requirements:

- enhance security in terms of counter measures towards potentials threats, while
- maintaining the important features of the rail system (e.g. open access, performance for mass transportation)

Intelligent video surveillance technologies for on-board trains passenger security

Crime and anti-social behaviour have a significant cost for society.

The main aim of IVST project is to provide automatic detection of dangerous situations onboard trains. Thanks to conventional sensors like video, audio, we will be able to detect in real time situations like : fights, aggressions, thefts, special events. After a discussion with operators, 8 different scenarios describing abnormal events occurring often in trains have been identified. Here are these events :

- Physical aggression
- Fights
- Thefts with violence
- Thefts without violence
- Vandalism against windows
- Alarm signal activation

Solicitations of beggars incivilities

Innovations of the IVST project :·

- Development of a new generation of intelligent cameras. ·
- The intelligent camera will be able to process the images and communicate with a control room.·
- A bi-directional link will be developed to have a continuous communication between control room and moving train : for instance, in case of incident, the operator will be able to send audio and video informations towards the train. In the other hand, control room could be warned by the moving train concerning the situation.·
- A continuous surveillance between moving trains and the stations (a guilty person must not escape by entering or leaving the train).·
- A development of a tool of communication between trains and stations for informations exchanges. The result of the project is a train equipped with onboard video and audio sensors. The output will be the demonstration on a suburban line of the feasibility of the functionalities proposed in the scenarios : detection, accuracy, reliability, integrity of data transmission, etc…

2.4.4 Rail safety research

Advanced analysis system

Safety assessment of operating rules

The European Railway Network is on its way to interoperability. With ERTMS/ETCS a solution for technical interoperability is specified. The work done in the European projects related to ERTMS/ ETCS will provide an approach to operational interoperability. The new CENELEC standards 5012X are giving high level requirements for the assessment of these systems. However the national rules and operations are still differing in the aspect of operational safety. The rules for the allocation of safety related to railways are different in the European countries. The aspects of technical safety have been focused by ACRUDA, SAMRAIL and SAMNET projects and will be used here as an input as well as the results of the projects HUSARE and HEROE, which have been focused on the influence of the human factors and made a step towards a harmonized operational rules. This project is a continuation of the work done in the mentioned projects. After defining the influences of technology as well as human factors defining the basis for the harmonized operational rules the next step to analyze and harmonize the operational safety is needed. In relation to the European standards an approach for the common understanding, specification and assessment of operational safety will be reached. The allocation of the safety in the different subsystems will be analyzed as well as the operation rules for the staff and the operators in the case of disturbances. E.g. the rules for overriding a disturbed level crossing, i.e. not correctly closed, are different in France and Germany. Complex systems and operational cases can not be handled by experience only. Therefore the use and the application of formal technologies is a specific aspect to be addressed in this project. A common mean of description and a common method including suitable tools and formats for the exchange of information are needed to ensure a consistent level of quality all over Europe. The resulting set of rules needs an adaptation for ERTMS to ensure that not only the current situation is covered but also the new system ensures safety.

Expected result of the project is the definition of the common understanding of safety in the domain of railways. Furthermore a set of rules for the assessment will be defined.

Accident and incident database

The ERA “European railway Agency” will need to obtain rapidly a clear and comprehensive view on the various safety aspects affecting railways in Europe. In particular it will have to set up some database in order to collect and record safety relevant data.

There are at the moment a great variety of definitions and concepts regarding the notion of risks, which should be harmonised and agreed upon for the ERA to carry out its work. It would be in this respect of great benefit to the ERA to dispose of some kind of *multi-layered database*, including a structured list of generic hazards and their underlying causes, a structured list of railway functions (e.g. based on AEIF architecture) as well as a structured list of railway infrastructure and systems in Europe to provide a format for capturing data (e.g. for CSI) for Good System Performance
A harmonised set of indicators for good performance of a risk control system is needed to develop a common approach to system performance monitoring, incident & accident reporting and analysis to achieve learning is helpful. A clear definitions and categorisations are important to easy harmonise the system safety performance evaluation. Method for assessing learning (e.g. cost-benefit analysis) can be used for assessing the current data collection, analysis and learning systems of specific companies in the railway system in order to assess their effectiveness and to uncover gaps in their performance and drive improvements.

Integrative approaches - rail

Man and automation in railway transport

Increased automation like ATC has obviously contributed significantly to increased safety in railway transport. At the same time the tasks of the engine driver has gradually changed from primarily active control to passive monitoring. And despite advanced automation, safe and efficient operation is still crucially dependent on actions by the engine driver, especially under conditions of abnormal operation such as failure of automatic systems, etc.

It is important to assure that the monitoring tasks of the engine driver do not conflict with the demand for maintaining alertness to other tasks and for handling emergency situations. At the same time the information systems that the driver must attend to, should be designed so as not to impose unnecessarily high workload during monitoring.

There is a need of knowledge about how advanced automation has affected the working situation of engine drivers. In-depth analysis of incidents and near-miss events would be an important source of information. (Data from accidents are of course also relevant, but the fortunate fact that rail accidents are rare implies that they do not provide enough data for drawing general conclusions about risk factors.)

Knowledge in this field is important for rail accident prevention in general, and it should also be considered in relation to the particular 7th Framework Programme topic on “Accident prevention of hazardous freight train activity”.

Further development and alignment of rules for a safe operation of European railway traffic systems – Subproject: Verification of the drivers track knowledge
Creation and Implementation of Instructions for drivers of cross-border services in order to compensate existing incompabilities by profound knowledge and expertise. Additionally existing differences have to be minimised. The identification and analysis of best-practice-strategies of railway operations throughout Europe could provide a solid basis for recommendations concerning need for harmonisation and standardisation

Cross-border service of drivers currently works mainly in marked-off operating ranges (above all in high speed traffic). For the conception of “one hand” transportation offers – e.g. in rail freight traffic – a more flexible posting of staff across national borders is needed. The Technical Specifications of Interoperability (TSI) for the subsystem “Operations” are setting the frame: “Alignment of the network operating rules and the qualifications of drivers and on-board staff

must be such as to ensure safe international operation". Besides the establishment of rules concerning standardised communication between operational units and documents for railway operations the acquisition and maintenance of profound knowledge of the tracks are significant issues to be solved with-in the scope of the TSIs. A more flexible employment of staff without any local restrictions on specific routes on the one hand and tendencies to reduce complexity of infrastructure on the other hand evoke modified demands towards knowledge of tracks.

Besides technical there are numerous organisational operation incompatibilities between the vari-ous railway systems of member countries. There are several applicable strategies to overcome these challenges which should thus be outlined more detailed:

1: Drivers of cross-border services have to be instructed in order to compensate existing in-compabilities by profound knowledge and expertise.

2: Supportingly existing differences have to be minimised. The identification and analysis of best-practice-strategies of railway operations throughout Europe could provide a solid basis for recommendations concerning need for harmonisation and standardisation.

Which challenges have to be faced?

- Analysis of relevant bodies of rules and regulations and definitions of track knowledge, its importance and effects of restrictive regulations whenever driving with limited knowledge is detected
- Analysis of training and further education concepts and the existing supportive devices of vehicle staff in daily operations.
- Analysis of the represented expertise and development of competences of vehicle staff as well as identification of needs for further support in daily operations.
- Definition of future requirements towards vehicle staff evoked by technological and infrastructural development tendencies.
- Development of improved concepts for the education and training under consideration of the limits and abilities of the vehicle staff.
- Identification of best-practice strategies, recommendation for harmonisation and standardisation needs.

Creation of new tools and efficient methods for virtual and physical tests to decrease costs and improve services

Creation of new tools and more efficient methods for virtual and physical tests, directed to reduce the complexity and the overall costs of the product homologation process and to improve services for industry and regulatory authorities. provides a common shell to contain and interrelate all those test and simulation procedures, and undertakes the development of simpler and more cost-effective methodologies based on the latest technologies under this common framework.

The project is aimed at the creation of new tools and more efficient methods for virtual and physical tests, directed to reduce the complexity and the overall costs of the product homologation process and to improve services for industry and regulatory authorities.

Currently different test and computer simulation procedures coexist in different countries throughout Europe. There are no test methods and validation models that meet the requirements of all European countries, and procedures employed in one country cannot be combined/coordinated with methods from another country. This leads to a regrettable level of inefficiency in the Homologation process of rolling stock throughout Europe.

The proposed work provides a common shell to contain and interrelate all those test and simulation procedures, and undertakes the development of simpler and more cost-effective methodologies based on the latest technologies under this common framework. With many

relevant institutions from different countries in Europe researching together towards this common aim, the homogenisation of the testing and simulation techniques used in product qualification is automatically achieved as an additional outcome.

The development of simpler and cheaper technologies for testing at European level proposed here relates to a number of FP7 strategic topics:

- The promotion of interoperability [Activity 2] is assured with the participation of key test laboratories from different countries. The new methods developed are thus automatically spread to different countries, leading to a natural standardisation.
- - The Life Cycle Cost of railway products and delivery will be reduced [Activity 5] with the application of the techniques developed.
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Project parts:

1 Virtual Test and Product Qualification Laboratory

2 New Technologies for Measurements of Vehicle-Track Forces for Vehicle Acceptance

3 A Systematic Metod of Establishing Track Stiffness for Use in Vehicle Acceptance

4 Development, Verification and Standardisation of a New Traction and Energy Consumption Performance Measuring Methods

5. Verification of Testing Methods of Evaluation of Thermal Influence of Railway Wheel Trend during Braking and Adhesion Processes

6 Developing New Test Methods for Increasing the Reliability of Rail Vehicles under All Weather Conditions

7 Complex Tests and Methods of Product Qualification for Railway Transportation Systems in Interaction with Environment – Transportation Infrastructure Development and Traffic Optimization on Transportation Networks

8 Aerodyrodynamics and Thermodynamics of Railway Vehicles

Harmonization of (national) standards to achieve Europe-wide cross acceptance of tools and procedures. Summarization of missing testing and assessment methods for new technologies

Creation of recommendations for the harmonization of (national) standards to achieve Europe-wide cross acceptance of tools and procedures. Therefore a summarisation of missing testing and assessment methods for new technologies has to be made also.

- Europe-wide Interoperability Testing Platform
- Product qualification methods for transport telematics, safety and reliability in railway transportation

Tools for Managing Environmental Impacts Related to Development of European Railway Systems

One of the most important objectives of the Common Transport Policy is that by 2020 the rail freight transport shall move forty percent more commodities in Europe. This brings to the fore the issue of *rail transport sustainability*. Attainment of these objectives will require much more land to be assigned and used for new rail terminals and shunting yards, and also building new roads connecting new rail infrastructure with distribution facilities.

One type of public concerns arises from needs to strike political and socio-environmental balance between the aims of the European Transport Policy to reduce negative socio-environmental externalities associated with motorized conveyance and the requirements to

minimize harmful impacts on the welfare of local communities' produced by growth in rail transport infrastructure and operations. This issue is particularly relevant for the new Member States where the rail transport exceeds twenty percent of freight movement, but which at same time experience urgent needs for upgrading, extension and modernization of domestic rail transport systems.

There is a need for a pan-European survey of rail extension projects and environmental challenges, such as habitat intrusion and fragmentation, disturbance of eco-balances arising from land seizure, increases in noise level, vibration and air pollution connected to more rail line-haul and terminal traffic, and their impacts on the quality of human and ecological neighborhoods. The impacts attributed to rail development could be uploaded into GIS tools to map their local distribution and identify the most important conflict areas that need to be dealt with at a European scale. Based on the above, both the re-examination of domestic natural environment protection legislations and the rail expansion plans could be performed to identify and manage possible conflicts between the demands for new transport infrastructure and the public rights to prevent new socio-environmental damage.

II Support to the European global satellite navigation system subpriority

1. Galileo application related issues ideas of NOEs

Protection of privacy in Galileo applications

Galileo will enable a broad scope of applications, which will lead to an expanded collection and use of personal data. This will require the enforced development of data protection technologies and applications. This development will force the development of common standards of data and privacy protection, technology development and assessment, and an evaluation of society's demands for privacy protection in various GALILEO applications.

Automatic vehicle guidance based on satellite navigation

Research and development of an automatic vehicle guidance system for articulated busses with an arbitrary count of segments based on satellite navigation. Research and development of an automatic vehicle guidance system for platoons of arbitrary vehicles based on satellite navigation

Track specific positioning for industrial railways

A track specific positioning of wagons of an industrial railway avoids the extensive manual management and tracking of the right sequence of the wagons on the track. As a result, the current state is always available. Operational processes become more efficient and reliable.

Voucherless Delivery Night Express

By means of a more precise positioning of the deliverer (e.g. Night express services), the proof of delivery of the shipment can be ensured even in case of a voucherless delivery.

Yard Management

Positioning and automated management of containers / boxes on yards in order to avoid additional local procedures for positioning and extensive manual management of the container storing positions.

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