ECTRI
European Conference of Transport Research Institutes

FP 7 COOPERATION - TRANSPORT

WORK PROGRAMME 2008 INPUT

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Introductive remarks

1. This document has been prepared by an ECTRI task force moderated by Jean-Pierre Médevielle from the French National Institute for Transport and Safety Research (INRETS) and Willy Diddens from the AVV Transport Research Centre, with the full support of Niels Buus Kristensen from DTF/DTU.
2. This document is a follow up to the ECTRI series of inputs for FP7 and is dated June 2007: it addresses the **WORK PROGRAMME 2008 - COOPERATION – TRANSPORT priority**.

   ECTRI envisages delivering inputs in the future (for the updating of FP7 and the future Work Programme) with inputs done by its new Thematic Working Groups and the follow up of the three Networks of Excellence it is participating in (APSN, HUMANIST and EURNEX).
3. It is addressing mainly Sustainable Surface Transport (SST) but also Galileo - including some new issues raised by the European Commission in its Communication on Galileo System - and horizontal activities (TPT). Aeronautics and Air transport (AAT) is not dealt with in the document.
4. It is organised following the format of the Work Programme 2007 taking into consideration the planned new topics for 2008.
5. It is proposing, as for the sub-priority AAT, the full use of the three FP7 funding schemes open to Cooperation Programme, i.e.
   - Collaborative Projects (CP) of level 1 or level 2,
   - Networks of Excellence (NoE),
   - Coordination and Support Actions (CSA).
6. In many cases, giving Europe an advantage in the transport field requires that the three levels of actors of the European Research (and Innovation) Area, raised by the Open Method of Coordination (OMC) around National and European systems of research and innovation are tackled:
   - Polity and policy (level 1),
   - Programme and funding agencies (level 2),
   - Operators (level 3).

   As ERANET scheme tackles with level 2, NoE tackles the fragmented landscape of level 3.
7. Although the proposals in this document are generated by ECTRI, ECTRI is aware – because of its involvement in the three European Technology Platforms (ETPs) ERTRAC, ERRAC, WATERBORNE, in the EIRAC[1] and EURFORUM[2] activities, and in the three above mentioned Networks of Excellence (NoEs), and their relationships or partnerships with other surface transport and Galileo stakeholders (industrialists, suppliers, operators, public authorities, regulators, or other academic members or trade association) that some are converging with other relevant stakeholders' proposals.
8. Part of the proposals have a full description (mainly level 1), for others (mainly level 2) only the research subject is suggested.
9. Colours are used for enhancing the clarity of the document as follows:
   - BLUE: new developments, new ideas
   - GREEN: tasks to be maintained for WP 2008
   - ORANGE: tasks not to be maintained for WP 2008

[1] EIRAC= European Intermodal Research Advisory Council;
[2] EURFORUM = European Research Forum on Urban Mobility, Coordination Action funded by FP6

Detailed proposals following the structure of the WP 2007

I. SUSTAINABLE SURFACE TRANSPORT (SST)

1. Context

1.1 Except the new challenge of transport and climate change and preparation of the follow up of Kyoto Agreement (less GHG emission and less gas oil / fuel dependence), the only question of the context part is the "International change into Cooperation". ECTRI would suggest to replace footnote 16 by the following sentence:
"ICPC[3] and industrialized countries can participate only if there is an official S&T agreement covering IPR rules and on reciprocity, and only if it is valuable for the excellence and the relevance of the activity or projects".
Statements and action plans are insufficient if not covered by an official inter-ministerial S&T agreement.

1.2 In the cross cutting activities, ECTRI suggests to add a second sub activity:
Preparing surface transport research related issues of EU S&T international agreements.
Taking into account the particular sensibility of the surface transport domain to IPR rules or competitive advantages in research and innovation activities to interface the STERA[4] in order to provide inputs to the international cooperation issues especially with industrialized countries and new industrialized countries shall be prepared.

1.3 On the funding scheme, regarding the Networks of Excellence, ECTRI is proposing to open topics with this instrument in the WP 2008 and to change the related sentence on NoE as follows:
Networks of Excellence: some topics are opened in the 2008 Work Programme to NoEs in sub activities where a fragmentation of European research landscape is too critical, or where sufficient work needs to be structured by research operators to feed "focused research" with "frontier research results" to be useful to STERA stakeholders.

2. Content of Call for 2008

Activity 7.2.1 – The greening of surface transport

Considerations

For level 1, ECTRI is supporting the idea developed by the ERTRAC chairman in his paper dated 20 March 2007 around:
- Hybrid gasoline and electric vehicles
- ICE and HCCI breath system
- Hybrid diesel.

If clearly it is critical for automotive industry, it is also critical for rail industry in the same range of power, and both rail industry and shipbuilding industry for a range of power more important.

[3] ICPC = International Cooperation Programme Countries
[4] STERA = Surface Transport European Research Area

Therefore, ECTRI is supporting the following priorities, the first four already being listed in the Work Programme 2007:

- Clean and energy efficient gasoline and diesel powertrains
  - Future efficient, clean and competitive propulsion systems for passenger cars, heavy duty vehicles and rail applications, with regard to 2nd generation biofuels.(level 2, 2 large scale projects)
  - Cooperative system to support engine/drivetrain management with map-related and off-board sourced data (level 1, small scale)
- Efficient urban bus and freight delivery systems
  - Next generation hybrid technology vehicles (level 2, large scale)
  - New vehicle and mobility concepts for the delivery of goods(level 1, small/medium scale)
- Advanced and cost-effective infrastructure construction and monitoring (level 2, small/medium scale)
- Intelligent highways and roads (level 1, large scale)
- Improved tyre/road interaction (level 2, small scale)
- Eco-driving support systems
- Better personal CO2 impact information to all users.

Proposed activities

AREA: 7.2.1.1 The greening of products and operations

1. Energy efficient driving – eco driving (level 1)

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

2. Eco2 TRAIN: Ecologic and economic rolling stock (level 1)

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.

3. Environmental Management Tools for Railway Systems (level 1)

Adaptation 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 reducing Life Cycle Costs as well as increasing the environmental compatibility of the railway system.

There is a big potential to optimize. 75% of the material inputs 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

4. Climate change and the railway environment (level 1)

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 utilizing 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.

5. Advanced multimodal driver-vehicle interfaces (level 1)

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.

6. Optimization of the utilisation of non-driven transport resources (level 2)

7. Application of infrastructure or vehicle based dynamic traffic information to support optimised dynamic traffic management (level 2)

AREA: 7.2.1.2 Environment-friendly and efficient industrial processes

8. Low-Noise Vehicle Design (NoE)

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.

9. Energy Recovery in Vehicles (level 1)

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

10. Intelligent noise abatement and control for the railway mode (level 2)

AREA: 7.2.1.3. Socio-economic issues

11. New Kyoto round transport related research agenda (NoE)

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 reasons 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 could 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.

12. New traffic modelling and simulation including energy (NoE)

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,
- Establish 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.

13. Forecasting methodology of the environmental pollution emission from the road transport, with respect to sustained regional development (level 1)

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.

14. Classification of Infrastructure (level 1)

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.

15. Indicators of transport sustainability (level 2)

16. Impacts of the usage of alternative energy sources in transport (level 2)

17. Development of Key Performance Indicators for Short Sea Shipping and Intermodal Transport (level 2)

Activity 7.2.2 – Encouraging modal shift and decongesting transport corridors

AREA: 7.2.2.1 Logistics and intermodal transport

1. Optimization and harmonisation of Freight Transport Centres (FTC) Network (level 1)

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

2. Economics of freight transport and logistics services in Europe (level 2)

3. Development of planning tools for intermodal transport networks (level 2)

AREA: 7.2.2.2 Maritime and inland waterways transport

AREA: 7.2.2.3 Enhancement of the Knowledge Base of the Rail Sector

4. Development of an education and training scheme of European Rail Logisticians (level 2)

5. Improved timetable synchronization (level 2)

AREA: 7.2.2. 4 Quality of Rail Services

6. Combined Passenger and Freight International Trains (level 1)

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 passengers, shippers and consignees.

7. Improvement of the operational interoperability by upgrading planning and controlling in international train traffic (level 2)

8. Methods and conditions to maintain an extensive rail freight network (level 2)

9. Use of municipal rail networks for supply and disposal traffic (level 2)

10. Optimization of single wagonload traffic (level 2)

AREA: 7.2.2.5 Interoperability and Safety

11. Railway traffic regularity monitoring unified methodologies (level 1)

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:
- Review of existing methodologies for quality measurement and identification of quantitative methodologies;
- Selection or development of suitable measurement methods for quality of passenger and freight services;
- Review and comparison of existing rules for commercial transactions between RU and IM regarding quality;
- 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;
- Comparison among the rules and guidelines of quality-ensuring methodologies in selected countries;
- Compilation of a catalogue of rules and guidelines of quality-ensuring methods (“best practices”).

12. Towards a global rail system (level 1)

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.

13. Further development and alignment of rules for a safe operation of European railway traffic systems – Subproject: Verification of the drivers track knowledge (level 1)

Creation and Implementation of Instructions for drivers of cross-border services in order to compensate existing incompatibilities 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 various 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 incompatibilities 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 harmonization and standardization needs.

14. ADAS-IVIS with special focus on elderly drivers (level 1)

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 of 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.

15. Interaction between drivers in traffic and their effects of traffic safety, traffic flow and the possible changes by ADAS functions (level 2)

16. Driver behaviour models and new intelligent systems design (level 2)

AREA: 7.2.2.6 Traffic and information management

17. European Architecture for Rail (level 1)

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.

18. Co-ordination in passenger inter-modality information, operation & accessibility (level 2)

AREA: 7.2.2.7 Policy support

19. New Kyoto round transport related research agenda (NoE)

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

20. New traffic modelling and simulation including energy (NoE)

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,
- Establish 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

21. Capacity shortages and demand management (level 2)

Activity 7.2.3 – Ensuring sustainable urban mobility

AREA: 7.2.3.1 New transport and mobility concepts

1. Mobility, Disability and Aging (NoE)

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

2. Mobility concepts, systems for travellers ensuring accessibility for all (level 1, small scale)

3. Developing effective city-wide Information Communication Technology systems and services (level 1, small scale)

4. Systematic approach to urban mobility (level 1, small scale)

5. Traveller service & information network and e-market place (level 1, small scale)

6. New devices, services and applications for the traveller (level 2)

AREA: 7.2.3.2 High quality public transport

7. Innovative solutions for governance of urban transport systems (level 1)

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.

8. Platform for location-based services (level 1)

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.

AREA: 7.2.3.3 Demand management

9. Forecasting mobility solutions, adapting to changing demand (NoE)

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

- Development of new methodological approaches for the estimation of satisfied customers in public transport
- Identification, validation and promotion of best practices in public transport services impact assessment
- 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.

10. Real-time and personalised information for the traveller (level 2)

11. Impact of ICT on travel behaviour (level 2)

AREA: 7.2.3.4 Innovative strategies for clean urban transport (To be also covered by Energy Work Programme (ENERGY.2007.8.6)

12. Modular lightweight construction of light- and heavy-duty commercial vehicles (level 1)

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.

13. Urban Bus system improvement (level 2)

14. New propulsion concepts for urban vehicles (level 2)

15. System Reliability of Fuel Cells and Hydrogen Storage (level 2)

16. Advanced vehicle structures and performance by use of hybrid multifunctional materials (level 2)

17. Next generation hybrid technology vehicles (level 2, large scale)

AREA: 7.2.3.5 Policy support

18. Stakeholder involvement in the mobility service: what cooperation between the different actors to deliver the best service for traveller? (level 1)

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.

19. Transforming the urban Transport Infrastructure in Europe with respect to a sustainable mobility: road maps to the future (level 1)

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.

20. The costs of pollution due to transport system and the possible policies to manage the environmental problems (level 1)

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:

- 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;
- 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 paid 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.

21. Time use and mobility (level 2)

22. Intermodality between public transport networks and bikes (level 2)

23. Environmental ghettoes and social justice (level 2)

24. Development of measurement categories for traffic and transport volume in Europe (level 2)

25. Urban development and the influence of transport networks (level 2)

26. The pricing of infrastructures (level 2)

27. Soundscape, context and the experience of noise (level 2)

28. The impact of lifestyle changes and life stages on travel behaviour (level 2)

Activity 7.2.4 – Improving safety and security

AREA: 7.2.4.1 Integrated safety and security for surface transport systems

ECTRI is supporting the idea of a specific NoE aimed at the needs of the European Rail Agency and National Rail Safety Agency in this field, even in presence of EURNEX NoE:

1. Safety and security in guided transport systems (NoE)

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

ECTRI, in relationship with its three NoEs (APSN, EURNEX, HUMANIST) has the vision that European competitive advantage for both our industries and better regulations requires continuing to open for level 1 issues all the eight SST.2007.4.1.1 subtopics with the same funding schemes.

ECTRI thinks that the international cooperation suggested for mathematical modelling, crash and safety simulation has to be opened not only to USA, Japan and India but also to Australia and Canada and suggests to open the additional following subtopics to level 1:

2. Effective vulnerable area protection (level 1)

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.

3. Robust design for safety (level 1)

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.

4. Enhanced passive safety with multifunctional materials (level 1)

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.

5. Crashworthy structures for a safe, environment-friendly lightweight vehicle (level 1)

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.

6. New data options for determining crash severity (level 1)

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.

7. Intelligent sensor systems for public transport (level 1)

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.

ECTRI is convinced that European competitive advantage for both our industries and better regulations requires: to continue to open for level 1 issues all the three SST.2007.4.1.2 subtopics with the same funding schemes,
and to open new subtopics with same funding schemes than this SST.2007.4.1.2 topic:

8. Driving and older people (level 1)

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.

9. Dynamic response of vehicle occupants (level 1)

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 Euros in 2004, for a country of 9 million inhabitants. For low severity rear impacts 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.

10. Vulnerable road user's protection (level 1)

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.

11. Effect of ITS on behaviour and accidents (level 1)

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.

12. Interaction between drivers in traffic and their effects on traffic safety, traffic flow and the possible changes by ADAS functions (level 1)

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.

13. Road users' competence - analysis for road design (level 1)

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

ECTRI has the vision that the European competitiveness for better regulations requires to continue to open the SST.2007.4.1.4 topic.

For level 2 topics, the SST.2007.4.1.7 issue has to be kept in 2009.

AREA: 7.2.4.2 Policy support

ECTRI suggests that the policy support area has to be opened in 2008 and proposes the following level 1 Collaborative Projects topics:

14. European Road Safety Observatory (level 1)

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.

15. Attitudes, opinions, reported behaviour (level 1)

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.

16. Mobility, exposure, accidents (level 1)

The development of DRAG-type models in a number of countries or regions (California, France, Germany, Norway, Stockholm-County, Quebec), presented in a book[5], 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.

[5] 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.

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.
- 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?

17. Speed and heterogeneous traffic/road safety impact (level 1)

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

18. State-of-the art of transport security (level 1)

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

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 reflect 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)

19. Rail Safety assessment of operating rules (level 1)

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.

20. Rail safety Verification of the drivers track knowledge (level 1)

Creation and Implementation of Instructions for drivers of cross-border services in order to compensate existing incompatibilities 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 various 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 incompatibilities 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 harmonization and standardization needs.

21. Creation of new tools and efficient methods for virtual and physical tests to decrease costs and improve services (level 1)

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 standardization.
- The Life Cycle Cost of railway products and delivery will be reduced [Activity 5] with the application of the techniques developed.

Project parts:

1 Virtual Test and Product Qualification Laboratory
2 New Technologies for Measurements of Vehicle-Track Forces for Vehicle Acceptance
3 A Systematic Method 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

22. European Harmonization of rail safety standards and procedures: missing testing an assessment methods for new technologies (level 1)

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

23. Towards a global rail system (level 1)

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.

Additionally, ECTRI is proposing the following level 2 topics:

24. National and regional data and models

25. Structural road safety models

26. Barriers to implementation of road safety measures

27. Identification of road sections where safety measures have the best effect

28. Highway furniture road safety level and criteria assessment

29. Evaluation of safety interventions

30. Road safety impact of EuroNcap

31. Intelligent video surveillance technologies for on-board trains' passenger security

32. Man and automation in railway transport

33. Accident and incident database for rail safety

Activity 7.2.5 – Strengthening competitiveness

ECTRI thinks that there is a need to keep open the level 1 topics of the call 2007,

but not to retain level 2 topics of the call 2007.

Activity 7.2.6 – Cross-cutting activities for implementation of the sub-theme programme

ECTRI thinks that there is no more need to keep the level 1 and level 2 topics open in the call 2007.

ECTRI thinks that for surface transport research area, there is a strong need to re-elaborate the international cooperation aspects of this sub-programme, with the aim to answer to the following remarks previously made by ECTRI in points 1.1 and 1.2 of "Context" chapter of the present document:

"ICPC and industrialized countries can participate only if there is an official S&T agreement covering IPR rules and on reciprocity, and only if it is valuable for the excellence and the relevance of the activity or projects".

Preparing surface transport research related issues of EU S&T international agreements. Taking into account the particular sensibility of the surface transport domain to IPR rules or competitive advantages in research and innovation activities to interface the STERA in order to provide inputs to the international cooperation issues especially with industrialized countries and new industrialized countries shall be prepared.

Consequently, ECTRI makes the following proposals for level 1 topics:

A. Preparing surface transport research related issues of EU S&T international agreements with countries using same approaches of IPR rules

1. Cooperation with the USA (Federal and States) EU – US transport research issues and priorities

The scope of the work is to discuss the current themes and priorities in transport research on both sides of the Atlantic, and to suggest synergies, opportunities for cooperation, and best practice analysis for both sides.

The main objectives of the work will be (indicative):

- To discuss and establish existing priorities, strengths and weaknesses, as well as gaps and diversions vis-à-vis transport research on both sides of the Atlantic.
- To discuss and determine common characteristics and needs for transport research on the basis of: the transport policies - emphases and priorities that exist today in both regions, and the expected future needs and priorities.
- To consider and discuss issues of research management in both regions.
- To assess the benefits or added values, and prospective synergies from closer cooperation, and finally.
- To investigate ways and procedures for effecting such closer cooperation.

The work is expected to come up with a report on future transport research needs, issues, and priorities, as well as recommendations concerning the contents, methods, and procedures for a closer future cooperation in transport research between the US and the European sides. Specific dissemination and coordination actions will also be welcome.

2. Cooperation with Australia (Federal and States) EU – AUS transport research issues and priorities

The scope of the work is to discuss the current themes and priorities in transport research, and to suggest synergies, opportunities for cooperation, and best practice analysis.

The main objectives of the work will be (indicative):

- To discuss and establish existing priorities, strengths and weaknesses, as well as gaps and diversions vis-à-vis transport research.
- To discuss and determine common characteristics and needs for transport research on the basis of: the transport policies - emphases and priorities that exist today in both regions, and the expected future needs and priorities.
- To consider and discuss issues of research management in both regions.
- To assess the benefits or added values, and prospective synergies from closer cooperation, and finally.
- To investigate ways and procedures for effecting such closer cooperation.

The work is expected to come up with a report on future transport research needs, issues, and priorities, as well as recommendations concerning the contents, methods, and procedures for a closer future cooperation in transport research between Australia and the European sides. Specific dissemination and coordination actions will also be welcome.

In the coming years, the cooperation with Japan and the cooperation with Canada (Federal and Provinces) could be opened, but in an ad hoc made manner.
Regarding South Africa and Brazil, this cooperation could be reopened if there is a need at the end of existing projects.

B. Preparing surface transport research related issues of EU S&T international agreements with countries raising IPR rules concern

The priority shall be India in any case.
Regarding Russia, NIS and China, the cooperation could be opened after existing projects results evaluation.

C. Preparing surface transport research related issues of EU S&T international agreements for other ICPC part (WBC are considered as belonging to ERA)

The first priority could be Mediterranean cooperation.

II. HORIZONTAL ACTIVITIES FOR IMPLEMENTATION OF THE TRANSPORT PROGRAMME (TPT)

ECTRI thinks that taking into account the results of the call 2007, some of the topics of TPT.2007 have to be kept in 2008, especially TPT.2007.1, TPT.2007.2, TPT.2007.4, TPT.2007.5 and TPT.2007.8.

Regarding the TPT.2007.6 and TPT.2007.7, ECTRI thinks that these topics have to be reopened. However, ECTRI suggests that these topics should be rephrased by taking into account: the first results of the consultation on the 2007 Green paper on European Research Area and the CREST Open Method of Coordination report which defines the three levels of actors of the European research and innovation strategy (see § 6 of "Introductive remarks"). But ECTRI would suggest grouping the two first levels as follows:

- Polity policy of transport research and FP5–FP6 thematic programmes and funding agencies of the Transport European Research Area
- Operators of the Transport European Research Area

The funding scheme has to be kept.

The TPT 2007.9 should not be reopened.

In any case, a big TPT topic is to be opened on Transport and Energy dependence and climate change issues, through a Coordination and Support Action (CSA) funding scheme to make a preparatory action in order to prepare the updating of FP7. This idea of CSA could also be linked to the idea of a NoE but the two funding schemes should be dealt with in parallels without waiting the results of one another.

III. GALILEO

ECTRI thinks that the EC new approach to deploy Galileo satellites constellation reinforces the need in setting up of the Galileo research programme to separate fully the three levels of research and innovation actors (polity – policy, programme and projects, research operators).
This approach shall also tackle separately the need of research:

- for the constellation itself and the operators of the constellation on one hand
- and the boosting development of applications research and innovation on the other hand, after a good benchmark of what has been done internationally.

While ECTRI members could be involved in "both hands", this paper focuses on the second hand, and not to loose more time on this second hand side, the innovative applications and customer side.

And as there is a need to tackle with the research operator fragmentation European landscape, ECTRI is pushing the idea of various NoEs funding scheme.

1. Satellite Communication and positioning application to guided transportation (NoE)

2. Satellite and terrestrial communication and navigation system hybridation (CNS) (NoE)

The CNS objective is to become the European focal network where the spatial expertise hold by some major academic and industrial partners meets, exchanges, works and trains each other with the land transportation expertise hold by, for the time being, different academic experts as well as, to a large extent, different industrial partners and stakeholders.

By working on an integrated approach of Communication, Navigation and Surveillance, dedicated to land transportation systems, representatives from eight Member States propose to create a seamless European, spatial to land transport high level of expertise able to imagine, prototype, evaluate and transfer components, subsystems and transport services for the European citizens. Participants to this NoE include academic partners who have developed a high level of expertise into spatial research and land transport research, applications and services. Major industrial partners from the spatial industry and from the car and railway industry as well as operators have also joined the NoE in order to work together and create this seamless European high-level research group.

Some of the road and rail transport services which are considered in this NoE are the following one:

- Demand management, Traffic enforcement, Parking management, Road pricing, Pre-trip information, On-trip information, Passenger security, Floating car data, Road guidance, Car navigation...
- Train Control and Command, Train Supervision, Energy Optimised Driving Style Manager, Fleet Management, Track Survey, Passenger Information Service...

3. Protection of privacy in Galileo applications (NoE)

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.

4. Automatic vehicle guidance based on satellite navigation (NoE)

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

5. Track specific positioning for industrial railways (NoE)

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.

6. Yard Management (NoE)

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.

7. Voucherless Delivery Night Express (NoE)

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.

Some of these NoEs, aimed at the structuration of the research operators, could be usefully duplicated also with collaborative projects aimed at producing concrete research results.