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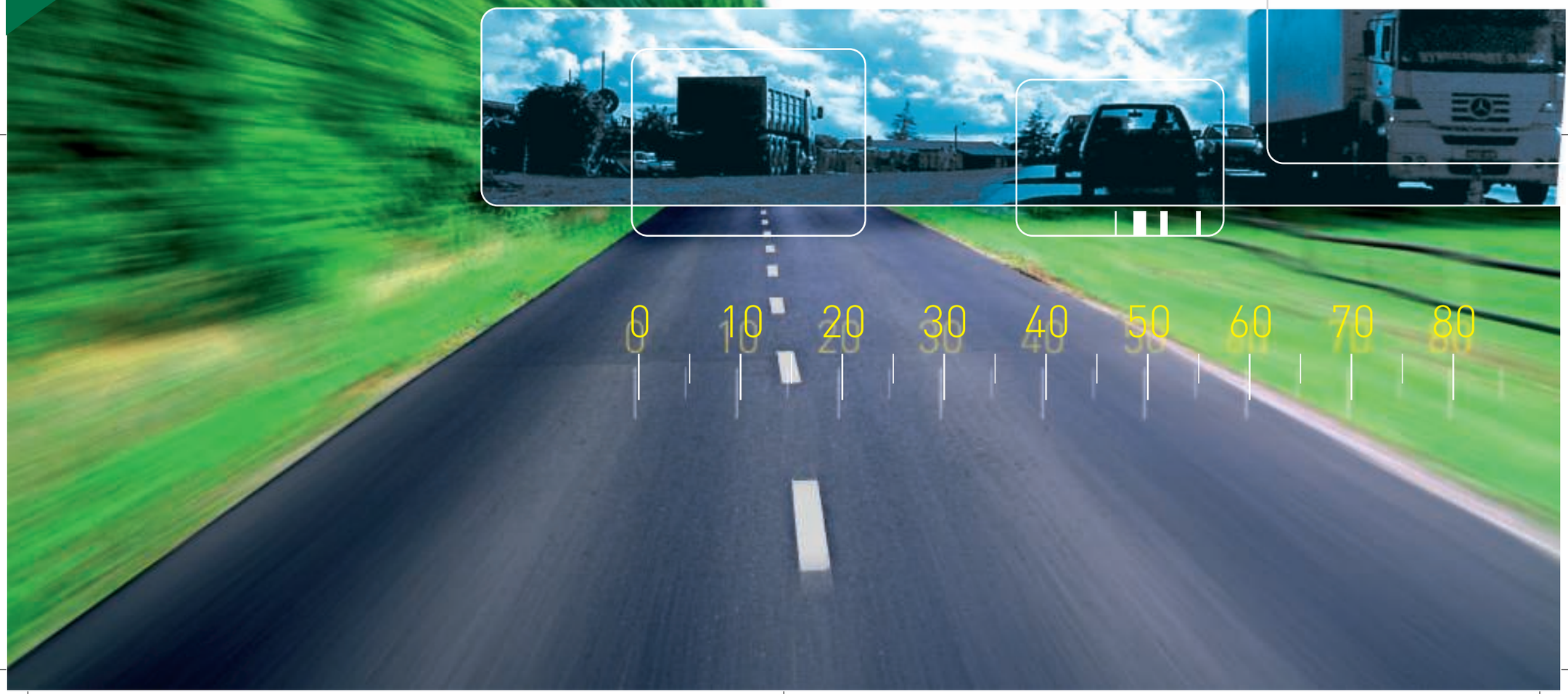

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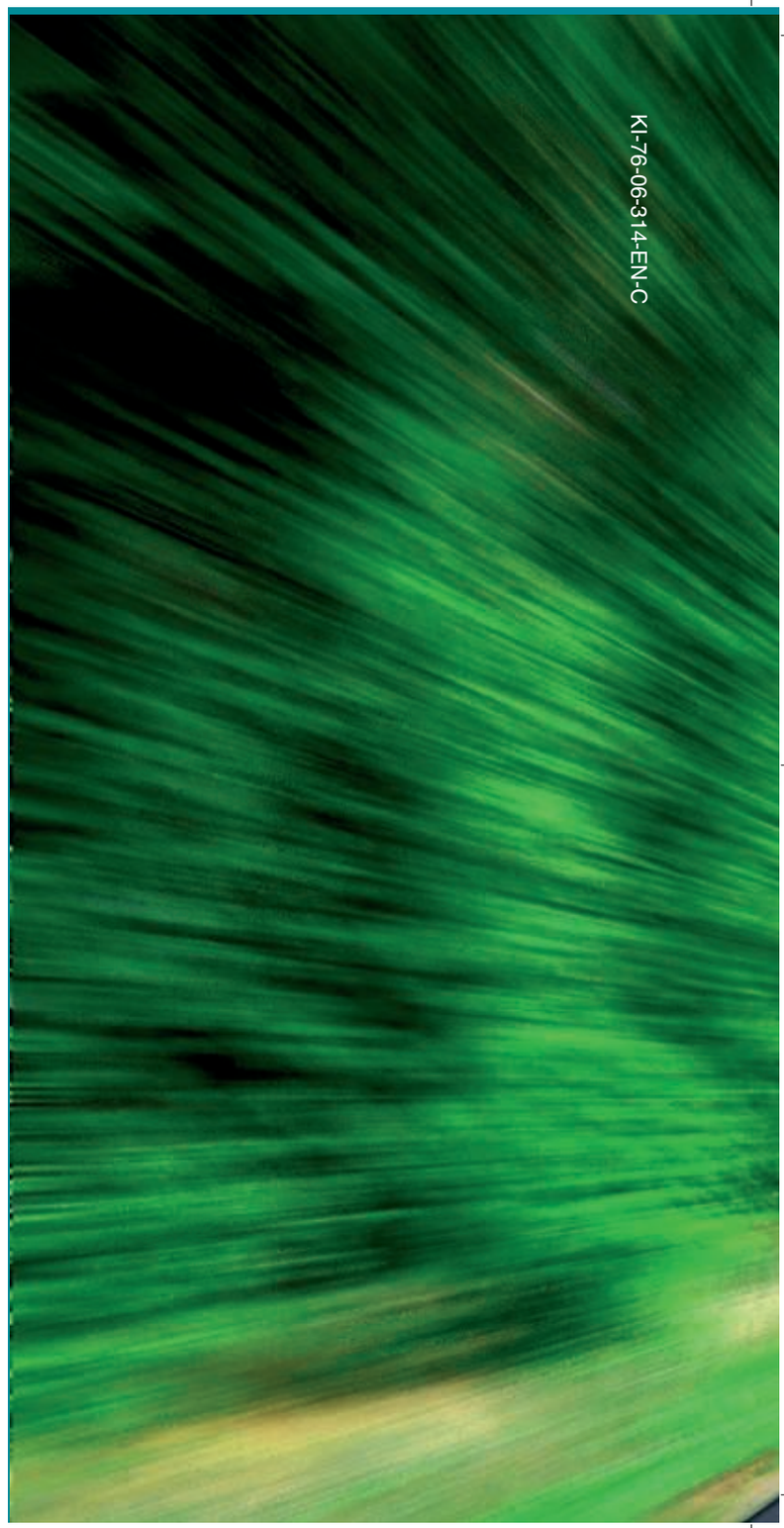

# **EU RESEARCH** IN ROAD TRANSPORT

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# > Welcome to European road research

Efficient road transport is a fundamental requirement for sustainable wealth and prosperity in Europe. Transport drives employment, economic growth and global exports. It provides European citizens, societies and economies with essential resources and means of mobility, while acting as a catalyst to knowledge acquisition, technological innovation and European integration. Road transport also drives new job creation. Indeed, it is one of the most important job-creating sectors, providing work for young men and women all over Europe. All of this makes transport a cornerstone of the European Union's Lisbon Strategy for achieving the greatest knowledge-based economy in the world.

But the increasing demand for mobility also represents a major challenge. Rising levels of road traffic and congestion are accompanied by increasing safety and health concerns. The environment can suffer due to transport activities, and transport networks require frequent maintenance and upgrading. In some cases, radical solutions are required, highlighting the essential role of research.

## Research plays a vital role

Road research moves Europe forward in a number of different ways. First, it leads directly to new products, processes and services, improving industrial efficiency and providing a competitive edge for Europe in the global transport market place. At the same time, it addresses infrastructure, mobility patterns and human factors that are specific to Europe itself, helping to improve the daily lives of ordinary citizens by making transport on our roads safer and greener.

Achieving maximum European research power requires the development of common and coherent views among stakeholders. The setting up of European 'Technology Platforms', including the European Road Transport Research Advisory Council (ERTRAC), represents a real innovation in EU research policy, bringing together all active parties in a particular transport mode.

>>>

Since its inception in 2003, ERTRAC has played a crucial role in the road transport sector, drawing together researchers and resources to develop a Strategic Research Agenda (SRA) which defines clear priorities for future research. The SRA has become a key source document for planning the next EU Framework Programme (FP7) and will continue to contribute to the development of a strong European Research Area (ERA).

In the world's most regulated sector, efficient knowledge sharing and pooling of resources is now critical. Through co-operative action, both within and outside the Union, Europe is creating a critical mass of ideas and solutions, strengthening European excellence while helping to steer the world towards a safer, cleaner and more prosperous road transport future.

## The best of European road research

In this brochure, the Commission proudly presents a cross-section of the excellent work being carried out by researchers across Europe under the Commission's Framework Programme. All of these projects will be featured at the Transport Research Arena (TRA 2006) conference in Göteborg, grouped by thematic session. Contact details are also provided, for those of you who would like further information on any of these projects.

We believe that the initiatives presented here represent the cream of European technological research and innovation in road transport and we would like to salute all of those who have been involved in this work. Of course, there are many other road research initiatives currently being undertaken, of equal stature and importance. We are sorry that we could not include all of them here, but they are all playing an important part in the creation of tomorrow's road transport system and they will continue to receive our recognition and strong support.

**Luisa Prista**

HEAD OF UNIT FOR SURFACE TRANSPORT

EUROPEAN COMMISSION

RESEARCH DIRECTORATE-GENERAL

Foreword

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# BESTUFS II

## > Best Urban Freight Solutions

**Europe's urban areas rely on the freight business to pack their stores with goods – from food to clothes, almost everything needs to be delivered, usually by truck or van. However, local authorities are introducing measures and policies to improve the quality of the urban environment that can sometimes conflict with the needs of the freight industry. Pedestrianisation schemes and restrictive parking zones may well make for cleaner, safer and more attractive cities, but they can be a headache for those delivering goods. BESTUFS II is an EU-backed research project that aims to improve the sustainability of urban freight transport. It seeks innovative solutions to the problems surrounding freight operations in Europe's busiest population centres. The BESTUFS II team aims to offer practical support to help the transport business, municipalities and other stakeholders work together.**

### Smoothing the path

The project will increase awareness of urban freight transport best practices, and foster co-operation between industry, research institutions and city administrators. The researchers hope to identify and encourage the use of City Logistic Solutions (CLS) that will make it easier to transport goods into urban areas in a more sustainable way. The BESTUFS II project will:

> Broaden the original BESTUFS project network to include more medium-sized and small urban areas;

> Produce a series of CLS best practice guides in 16 languages;

> Arrange best practice workshops, to be held around Europe that will highlight recent innovative activities and share common problems that are faced by transport operators, public bodies, retailers, etc.

### The road ahead

BESTUFS II began work in September 2004 and will run for four years. It has eight main project partners and a further 16 subcontractors, guaranteeing Europe-wide coverage. The project team will:

> Use and develop their best practice guides to disseminate the latest CLS information to stakeholders;

> Hold seminars to exchange information and experiences between the European and national/local levels;

> Quantify urban freight transport processes to help explain the role freight transport plays in Europe's towns and cities;

> Develop data models and practical modelling tools, and explore ways of harmonising approaches to managing urban freight transport issues that can be used across Europe.

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More information

#6.

# FIDEUS

## > Freight innovative delivery in European urban space

**With the demand for mobility rising at an ever-increasing rate and with city traffic creating ever more frustration, pollution and noise, the EU-funded FIDEUS project is promoting a coordinated approach to urban freight delivery, involving the automotive industry, logistics companies and city decision-makers. The aim is to make available appropriate vehicles, to ensure that delivery operations are efficient, and that cities have the necessary information and tools to be able to define and manage effective mobility policies for goods traffic.**

### Innovative approach to urban freight transport

The objective of FIDEUS is to provide a complementary set of vehicle solutions to support an innovative approach to the organisation of urban freight transport. This is in line with political strategies to safeguard the 'liveability' of cities, while being compatible with efficient logistics. Three new vehicle types are being developed and tested:

> An innovative electric freight transporter for sensitive areas such as pedestrian zones;

> An enhanced 3.5-tonne transporter;

> A 12-tonne truck, optimised for city traffic.

### New vehicles

All three of the new FIDEUS vehicle types are to be equipped with high-tech drive, loading and communication technologies. This will enable improved interactive communication with municipal traffic-directing centres. For instance, trucks would be able to register to use specific loading zones, or react promptly to a sudden disruption of access.

Faced with new and increasingly strict environmental regulations, FIDEUS' improved logistics, trans-shipment and transport processes are expected to contribute substantially to the reduction of emissions and traffic pollution in cities while assuring that, over the long term, supplies will continue to reach companies, stores and citizens in heavily populated urban areas, in an efficient and cheap way.


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More information

# HOST

## > Human Oriented Sustainable Transport

**Europe's towns and cities are getting more and more congested and consequently face a range of environmental problems caused by pollution. Planners are tackling these issues by introducing new ways of managing traffic flows and densities, such as pedestrianisation zones and restrictions on delivery times. Yet the need to use motorised transport in urban areas remains because people and goods have to be moved. Now an EU-funded research project is looking to develop a flexible and more sustainable vehicle for Europe's urban streets. HOST aims to produce a prototype modular vehicle that harnesses hybrid engine technology and that can utilise a variety of cabin configurations, each tailored to a different task.**

### Quick change artist

HOST's project team wants to develop a drive-by-wire vehicle. This will ensure that the only mechanical connection between cabin and chasis is the anchorage system that secures the two sections together. Such a set-up will allow for rapid installation and removal of different cabins which will be designed to carry passengers or goods.

> For passenger cabins, the research team will assess a range of criteria relating to safety, aesthetics and ergonomics.

> For freight cabins, the team aims to produce a system that makes it easy to carry pallets and move them quickly and easily from a HOST cabin to a warehouse, train wagon or loading unit (and vice versa).

The HOST powertrain will incorporate a thermal electric hybrid configuration. The aim is to produce a vehicle that has extremely low outputs of $CO_2$, other gases and particulates. In their bid to create a "clean" vehicle, the HOST team will use the most promising alternative fuels and the newest combustion technologies.

### User flexibility

The HOST prototype's modular nature should prove attractive to both pubic and private organisations. In particular, local authorities may find it useful as the vehicle's interchangeable cabins mean that it can be used for a wide range of tasks. That flexibility – combined with HOST's low emissions targets – could be a perfect fit for organisations that are introducing policies to improve sustainability in urban areas, but still need to move goods and people around busy places.

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More information

#8.

# NICHES

## > New and innovative concepts for helping European transport sustainability

**Over the last few years, a wide range of innovative concepts for making urban transport more efficient, competitive and sustainable has been developed in Europe. However, the full deployment and mainstreaming of those innovative concepts has not taken place. A two-year 'Coordination Action' launched under the EU's Sixth Framework Programme for R&D, NICHES is working to stimulate a wide debate on innovative urban transport and mobility between relevant stakeholders from different sectors and disciplines across Europe.**

### Overcoming transport obstacles

The NICHES consortium was launched as a way to address barriers to progress in implementing existing innovative concepts in this field. What are the barriers?

> No coordination of urban transport initiatives in different cities;

> No integration of mainstream transport policy and R&D;

> No concrete strategies for achieving the transition from R&D to common practice;

> Lack of awareness among stakeholders of needs and interests across transport modes and sectors;

> Lack of dissemination outside the transport sectors.

NICHES will promote the most promising new concepts, initiatives and projects, moving them from their current 'niche' position to a 'mainstream' urban transport policy application. Its two specific goals are:

> To facilitate the coordination of research activities in the field of innovative urban transport concepts;

> To help identify and disseminate examples of innovative transport measures.

### A full programme

The implementation of the NICHES project and its four main work steps will be organised into Work Packages (WPs):

> WP1 Inception and state of the art;

> WP2 Feasibility and transferability;

> WP3 Integrated strategies and practical guidelines;

> WP4 Roadmap and recommendations;

> WP5 Dissemination and exploitation.

The successive WPs prepare and guide the discussions in the four Working Groups (WGs):

> WG1 New seamless mobility services;

> WG2 Innovative approaches to city logistics;

> WG3 Non-polluting and energy-efficient vehicles;

> WG4 Innovative demand management strategies.

More information

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# APROSYS

## > Advanced protection systems

**Every year, more than 50 000 people are killed in the 25 EU Member States as a result of road accidents. For European transport authorities, the high number of road fatalities is the most severe problem facing Europe today, a real threat to public safety that demands immediate and drastic action.**
**APROSYS is an ambitious initiative aimed at improving passive safety for European road users.**
**The aim is to develop and introduce critical technologies relevant to all road accident types and severities.**
**At the same time, it is helping to strengthen the competitiveness of the European automotive industry.**

### Addressing needs of all road users

APROSYS identifies four categories of road users to benefit from its outcomes: car occupants; motorcyclists; truck occupants; and pedestrians and pedal cyclists. Its goal is to see a reduction in road deaths by 15 000 once the results are fully integrated. Current statistics show that about 40 000 Europeans die every year in road accidents. Specific APROSYS objectives are:

> Development of new injury criteria;

> New mathematical models of the human body;

> A worldwide, harmonised, small female crash-test dummy for side impact testing;

> Development of knowledge and tools for design, implementation and evaluation of intelligent safety systems;

> Enhanced virtual testing technologies;

> Test methods and advanced protection systems for injury reduction.

### Groundbreaking initiative

APROSYS is one of the first Integrated Projects to be launched under the Union's Sixth Framework Programme (FP6), which encourages a more comprehensive and goal-oriented research approach. Work is divided into eight subprojects, with all co-ordination being carried out by the consortium itself. Subprojects include:

> Car accidents;

> Heavy vehicles;

> Pedestrian/cyclist accidents;

> Motorcycle accidents;

> Biomechanics;

> Intelligent safety systems;

> Virtual testing;

> Accident analysis, training and innovation-related activities and project management.

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More information

# CHILD

## > Child injury led design

**Every year, more than 700 children are killed or severely injured on European roads. The CHILD project, launched under the EU's Fifth Research Framework Programme, gathered and provided comprehensive data on injuries and injury mechanisms for children of different ages in road accidents.**

**Using innovative tools and methods, CHILD has contributed to revising and improving standards and to the development of more efficient child-restraint systems. The CHILD consortium comprised 13 partners, representing a full spectrum of research, industrial, regulatory and testing institutions from seven European countries. Partners carried out in-depth accident studies, experimental and virtual testing, including the development of new tools, i.e. dummies and models, for the evaluation of child passive safety and restraint systems, especially car seats.**

**CHILD investigated injury mechanisms and tolerances and has supplemented previously defined injury criteria and risk curves for frontal and lateral impacts under – the EU-funded CREST project (1996-2000).**

### State-of-the-art methodology

Work package 1 – accidentology

> Analysis of real car crashes in which restrained children are involved;
> Analysis of child-restraint system use on the road;
> Effective and efficient management of the CHILD accident database;
> Accident database analysis.

Work package 2 – experimentation and modelling

> Child crash-test dummy and sensor development;
> Virtual dummy and human modelling;
> Experimental accident reconstruction;
> Virtual crash tests.

Work package 3 – consolidation, synthesis and selection

> Selection of accidents and synthesis;
> Development of database analytical tools;
> Development of injury criteria and standards.

Work package 4 – management and coordination of the project

CHILD project results represent an invaluable source of real-world crash injury data, based on real and virtual reconstructions of such cases, child-based simulation methods and tools, and in-depth evaluation of child dummies. The project will also provide the manufacturers of restraint systems and airbags with much more accurate information which, in turn, should lead to rapid improvements in the safety of young passengers.

Three-year-old child finite element head and neck model performed at ULP

Adult vs Three-year-old child

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More information

# HUMOS2

## > Human model for safety 2

**Automobile collisions are the most lethal form of road accident, producing the highest number of deaths and injuries. They cost the EU billions of euros in economic losses each year, not to mention the human cost. Research into such collisions can help significantly reduce the carnage on Europe's roads. However, current crash-test dummies still cannot simulate perfectly accurately the impact of a crash on the human body.**
**The objective of the EC-funded HUMOS2 project was to develop a set of finite element models of the human body capable of representing a large range of the population of road users involved in any type of road accident, and allowing an accurate prediction of the injury risk. Fifteen partners from four Member States were involved in this project, which ended in February 2006.**

### Successful modelling

Starting with the outcome of a first phase, completed in 2001, methods allowing the presentation of a generic human model, including anthropometry, geometry and position, have been developed. They include a scaling tool enabling the derivation of any individual model from the original by means of control points and statistical relationships between external and internal dimensions. These were established from geometric data collected on standing and sitting volunteers with a low-dose bi-plane X-ray system, and from geometric data directly measured on bone parts.

A positioning tool has also been developed in order to adjust the model for different sitting and standing postures. The application of these tools required the redefinition of several aspects of the model.

Second, experimental work was conducted on human volunteers in order to identify the influence of muscular tensing on the response of the body to moderate impacts, and muscular tissue mechanical properties. These were also analysed through animal and cadaver testing.

### Testing and validation

Third, a set of reference postures for testing the models, including occupant and pedestrian postures, was defined. A database of laboratory biomechanical test results, appropriate for model validation, has been set up, mainly including existing cadaver test results from previous EC-funded projects and from Heidelberg University. It was completed by specific cadaver and volunteer tests performed during the HUMOS2 project. Bone and ligament material properties and failure limits were investigated, as well as injury criteria for most common injuries sustained by road victims.

These models, implemented on three different crash codes, were used to simulate a set of specific cases, in order to evaluate their performance in terms of accuracy of behaviour and injury prediction. Results show that good overall kinematics of the human body can be reproduced in various accidental situations. Body part loading can be calculated and resulting injury risk evaluated. Some improvements are still necessary to improve the robustness of the model in certain cases, and extensive testing against real accident cases should be performed in order to fully validate the models. Part of this work was being conducted under the EU-funded APROSYS Integrated Project.

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More information

# SAFETYNET



## > Building a European Road Safety Observatory

**The EU target of a 50% reduction in road fatalities by 2010 can only be achieved through the introduction of the most effective countermeasures. This, in turn, will depend on the availability of basic knowledge of crashes and their causation and of road safety data and information systems for monitoring and assessing safety performance. In its 2001 Transport White Paper and in other public documents, the European Commission has expressed the need for a 'Road Safety Observatory'.**
**SAFETYNET is a large research project co-financed by the European Commission Directorate-General for Transport and Energy. It involves 21 partners from 17 countries. The purpose of the project is to develop the framework for a European Road Safety Observatory that can be used to inform and direct road safety policy across the 25 Member States. When complete, say partners, the data resources developed within SAFETYNET will revolutionise EU approaches to road safety.**

### A revolution for EU road safety

SAFETYNET will bring together all of the most experienced European road safety players to assemble a coordinated set of data resources that together will meet all EU needs in terms of policy support. The Road Safety Observatory will enable the Commission to monitor progress towards targets, identify best practice, and ensure that new regulatory and other safety actions will result in the maximum casualty reduction. All data assembled or gathered within the project will be available over the Internet to the entire road safety community.

The main work areas will be:

> Further enhancement and exploitation of the CARE Community database on road accidents, including its extension to cover the ten new Member States under CAREPLUS 10;

> A new methodology to gather risk and exposure data and to integrate it within datasets incorporating the CAREXPO project;

> The design and implementation of a Europe-wide network for periodical measurements of safety performance indicators;

> Recommendations for independent road accident investigation;

> A new intermediate-level fatal accident database and an in-depth accident causation database;

> Creation of a new safety information system that will serve as a gateway to the complete set of information;

> Validation and analysis of the data.

More information

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# ALICE

## > Advanced lightweight graphite based composite components for low emissions combustion engine

**Pistons for internal combustion engines require specialised and highly developed materials. Due to their unique properties, carbon materials which have been specially developed for this application offer an alternative to metals and allow exceptional solutions as well as improved performance in automotive engineering.**
**The aim of the EU-funded ALICE project is to develop a new piston system for combustion engines. This entails a light metal infiltrated graphite piston, an adapted cylinder liner and graphite-based piston rings.**

### Impressive list of advantages

The use of carbon pistons in internal combustion engines, say ALICE partners, can contribute significantly to achieving important European goals, in terms of efficiency and environmental performance:

> Carbon density is 30% lower than that of aluminium. This weight advantage results in a considerably reduced engine mass, leading to higher performance and reduced vibration as well as lower fuel consumption.

> Carbon is a refractory material; while the mechanical strength of metals heavily decreases with rising temperature, the strength of carbon actually increases. Thus, even in thermally high-loaded engines, a complicated system for cooling pistons is not necessary.

> Carbon exhibits self-lubricant properties which increase the operational reliability of the engine and result in reduced lubricant (oil) consumption.

> Carbon has a low thermal expansion coefficient. This allows engine designs that feature lower cold clearances without risking piston seizure under high loading. This also implies a significant decrease in hydrocarbon (HC) emissions during cold start and reduced blow-by as well as increased operational reliability.

> Carbon shows excellent resistance to thermal shock.

### ALICE looks for real results

Compared to engines using aluminium pistons, the use of carbon in pistons will therefore allow for:

> Reduction of piston weight by up to 30%;

> Reduction of HC emissions by up to 40%;

> Increase in engine performance by up to 10%;

> Reduction of oil consumption by up to 50%;

> Reduction of fuel consumption by up to 5%;

> Reduction of blow-by by up to 50%;

> Reduction of carbon monoxide emissions by up to 55%.

Since its launch under the Fifth Framework Programme in 2001, the ALICE project has undertaken the development of a new class of materials and processes. Extensive laboratory and road testing of new piston systems has also been carried out.



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# IDEAL

## > Integrated development routes for optimised cast aluminium components

**One important approach to help reach European $CO_2$ emission goals is to reduce the weight of vehicles, but this must be balanced by maintenance of structural integrity and durability, to ensure good safety performance. Achieving this means introducing new and innovative technologies and low-weight materials that are suited to the efficient and economical manufacture of vehicle structures.**

### The ideal approach

IDEAL is a research project, financed under the FP5 GROWTH programme, aimed at achieving the efficient integration of a variety of aluminium casting simulation tools into the design chain, optimising the entire process, from initial conception to prototype production.

The set-up of an integrated software tool and a methodology to support the concurrent engineering of cast aluminium components should reduce development time and improve product quality, leading to more reliable, efficient and optimised aluminium cast components. A horizontally integrated approach will help designers to identify the best possible uses for aluminium in automotive castings, ultimately leading to lighter car and truck components, lower fuel consumption and reduced $CO_2$ emissions.

### Time sensitive

The main scientific objective is to gain a better understanding of the evolution of aluminium structure during casting, including filling of die and solidification, and post-casting process stages, and to be in a position to supply realistic data on mechanical characteristics to designers. Interest is also focused on residual stresses in components after cooling. Efficiency of design, achieved through optimisation techniques, will lead to significant reductions in testing time, lead-time to market and costs for manufacturers.

Specific tasks include:

> Optimising the casting process;

> Predicting the metallurgical quality and the mechanical properties in the castings through the use of microstructural models;

> Exporting the results of process and properties simulation to commercial finite element codes for stress analyses;

> Demonstrating and evaluating the effect of new and conventional post-casting treatments to improve the performance of castings and thus facilitate light-weight design.

The entire IDEAL methodology has now been tested on demonstrators, including industrially significant aluminium castings intended as automotive components.


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More information

# MG-CHASSIS

## > Lightweight chassis construction through extended and sustainable use of Mg alloys

**The automotive industry is contributing to reducing carbon dioxide ($CO_2$) emissions through voluntary commitments that are spurring intensive R&D efforts across Europe. A weight loss programme for cars is one major component of this effort – and magnesium is the material of choice.**
**The main aim of the EU-funded MG-CHASSIS project, part of the MG-CLUSTER initiative, is the adaptation of casting technologies to the needs of low-cost magnesium components. Focused on magnesium alloys for chassis and wheels, the project is coordinated by the Fraunhofer Institute in Germany. Different casting techniques are being employed to produce a number of demonstrators for evaluation, such as an engine bracket, a transmission mounting and a wheel.**

### Clear priorities, clear progress

Since 1995, when car manufacturers began implementing their commitment to reduce $CO_2$ emissions, significant improvements have been achieved largely through advances in engine and transmission technology and a progressively greener product range featuring cars using alternative fuels and improved diesel models. However, it has been clear from the beginning that the longer-term 2008 target would not be met by car manufacturers acting alone, nor by any single technology initiative. For this reason there has been a sustained, co-operative R&D effort by the wider automotive industry to develop more environment-friendly and efficient technologies.

A key area of research has been weight reduction; lighter vehicles use less fuel. Modern cars contain a lot of steel, and the most significant weight reduction will only come from reducing or replacing the steel content. Aluminium alloys are much researched and are used quite widely in cars today but, magnesium, which has more attractive properties, is still less well known.

### Key advantages

Magnesium is the lightest structural metal with a greater rigidity and damping capacity than aluminium. This makes it very attractive to the aerospace and automotive industries – although a high price in the past has prevented its widespread use. However, the price of magnesium has now fallen, and price alone becomes less important when more efficient manufacturing as well as external environmental costs (life-cycle considerations) are taken into account.

MG-CHASSIS partners say a key advantage of magnesium in manufacturing is its better castability compared to iron and aluminium. This allows more extensive function integration, meaning that more complicated, shaped parts can be cast in a single piece, removing the need to machine, assemble and join several individual parts from steel, thus reducing costs.

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More information

#16.

# MG-ENGINE

## > Lightweight engine construction through extended and sustainable use of Mg alloys

**The European Commission and the European car industry have agreed to work to significantly reduce $CO_2$ emissions from new cars by 30% by 2008. One of the major factors influencing fuel performance and hence exhaust emissions is car weight; the lighter the car, the easier it is to move and the less fuel is needed.**
**The overall objective of the MG-ENGINE project, launched under the Union's Fifth Framework Programme, was to help reduce environmentally harmful pollution due to road traffic by introducing lightweight magnesium (Mg) as a primary construction material in automobile engines.**

### A high-potential material for the automotive industry

Magnesium is the third most commonly used structural metal, following steel and aluminum. It is strong and light and, in its purest form, compares favourably with aluminium. It is now used in several high-volume part manufacturing applications, including automotive and truck components. New Mg alloy development and lower costs are now expected to further the number of automotive applications. In December 2005, for the first time on record, the price of automotive grade magnesium alloy dropped below that of A380 aluminium.

The specific objectives of the MG-ENGINE project were:

> Development of Mg alloy(s) with improved high-temperature properties;

> Determination of high-temperature mechanical properties for selected Mg alloys;

> Development of generic design criteria for Mg engine blocks;

> Manufacture of Mg engine block prototypes;

> Development of an Al-bolt fastening system for Mg-engines.

### An important step forward

The MG-ENGINE consortium, comprising leading members of the European automotive and research sectors, says it expects overall weight savings of 27% and 38% compared with engines made from aluminium and cast iron, respectively. This represents a significant step in the drive towards more fuel-efficient cars and trucks and better environmental performance in terms of $CO_2$ and other emissions. The project is part of a cluster aimed at introducing more Mg into cars.

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More information about

# SLC

## > Sustainable production technologies of emission reduced lightweight car concepts

**Car manufacturers and scientists around the world are working to meet ambitious emission reduction targets for automobiles, developing new materials and processes, including some aimed at limiting vehicle weight. The EU-funded SLC project is developing new lightweight vehicle concepts, materials technologies, and design and simulation tools. Partners include former and current participants in many European Framework Programme projects who are building upon established R&D results in areas such as lightweight and noise-reducing materials, passive safety, vehicle manufacturing and assembly. The consortium also includes important players from the rail transport industry.**

### Lighter is better

Generally speaking, a heavy car is a slow car, but weight also influences the automobile's burden on the environment. The overall objective of the SLC project is to develop truly lightweight, multi-material automobile concepts, ultimately leading to the construction of vehicles up to 30-50% lighter than present-day high-volume cars. Specific goals include:

> Full exploitation of the latest lightweight materials and material combinations;

> Development of parts, modules and car bodies using optimal materials;

> Development of joining technologies needed for reliable and efficient assembly;

> Improvement of current automobile design/simulation tools and the development of new tools;

> Contribution to future sustainability through reduced material and fuel consumption.

### New tools for lightening the load

Today's design and simulation tools are not able to predict either multi-material design reliability or to assess affordability and sustainability. Through high-level collaboration between key road and rail transport research players, SLC is tackling these and other obstacles to lighter cars. Features of the project's innovative work programme include optimisation of material choice on a part-by-part basis, based on overall vehicle performance:

> The guiding principle of SLC research entails a multi-material concepts approach, putting overall vehicle requirements first and allowing these requirements to then guide development of modules, sub-modules and parts;

> Parallel development programmes are being undertaken, targeting advanced forming and joining technologies as well as design and simulation tools capable of treating multi-material concepts;

> After an initial period of two and a half to three years, technologies will be selected for use in production, and a lightweight front structure demonstrator will be built for both virtual and actual physical testing.

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More information

#18.

# HEAVYROUTE

## > Intelligent Route Guidance for Heavy Vehicles

**The volume of freight carried on Europe's roads has increased in recent times, and forecasts reveal that it will continue to grow over the next ten years. What is more, Heavy Goods Vehicles (HGV) are carrying more gross weight than ever before. These changes are now causing damage to road surfaces and bridges – as well as adding to traffic management problems. Freight transport is therefore producing a negative impact on Europe's road network in relation to capacity, safety and environmental issues. And the costs of maintaining roads in a good condition continue to rise across Europe. Meanwhile, the challenge for haulage operators is to find ways of reducing their ever-increasing fuel costs while maximising efficiency and profitability. At the same time, drivers must juggle the demands of their job while complying with stringent working hours regulations – that includes finding safe and appropriate rest areas.**

### Mapping the way

Improving the maps and route information available to hauliers and drivers could help improve traffic flows and make journeys easier to plan and execute. The HeavyRoute project intends to use the latest advances in digital mapping to link Europe's road network via an electronic system that could be used by truck operators and drivers.

HeavyRoute therefore aims to:

> Develop an advanced route guidance system for HGVs that covers the whole of Europe. The final product will allow users to pick the safest and most cost-effective routes.

> Take account of the needs of road users, vehicle operating and environmental costs, as well as maintenance costs for road owners caused by road and bridge damage.

### Broad partnership

HeavyRoute will build its system using available technologies that are being used in areas such as: fleet management and logistics; guidance and rerouting; traffic monitoring and management; and dynamic map updating. The project will also harness relevant research into Intelligent Transport Systems and Services (ITS).

Project partners include the Forum of European National Highway Research Laboratories (FEHRL) and ERTICO, the European body that supports research into and the development of ITS. Both these organisations and other project partners provide valuable links to the transport industry, and those authorities charged with looking after Europe's roads.

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# INTRO

## > Intelligent roads

**The EU-funded INTRO ('Intelligent roads') project aims to address the dual problems of road safety and increasing road capacity, bringing together information from the latest sensing and real-time networking technologies. The aim is to provide rapid warning of emerging problems to both maintenance authorities and road users.**
**INTRO calls for increased co-operation between road authorities, national road research institutes, private engineering companies and the road industry. In particular, co-operation between car manufacturers and public bodies will be strategic for the development of tools to benefit industry and the community at large.**

### Ambitious goals

Specific INTRO aims include:

> Assessing current road safety and road capacity technologies, strategies and knowledge;

> Data fusion, bringing together *in situ* sensor data and vehicle sensor data within common data bases;

> Evaluation of *in situ* and vehicle-based sensors, and development of 'smarter' roads and intelligent vehicles for monitoring road surfaces conditions;

> Development and validation of novel concepts and systems for monitoring and predicting road friction and skid resistance;

> Development of other new and improved methods for traffic and safety monitoring;

> Structured clustering activities with other FEHRL projects and targeted activities to disseminate project results.

### A comprehensive programme

Rather than developing completely new technologies, INTRO will first focus on better use of existing ones. Thus, its first task will be to review existing practice in the form of previous and ongoing studies and deployments. INTRO will develop systems to provide real-time information on skid resistance and pavment conditions; methods will be identified for combining data from *in situ* measurements and from standard and probe vehicles; relevant traffic performance and safety indicators will be identified; and new methods for monitoring traffic conditions will be developed.

Data sources are to include loop detectors, cameras and floating cars, using traffic simulation, driving simulators and analytical methods. The outcome will be improved prediction of traffic conditions and evaluation of traffic safety.

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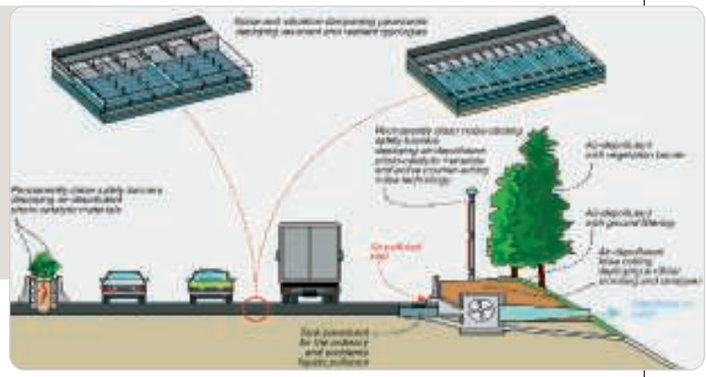
# NR2C

## > New road construction concepts

**European roads represent a tremendous heritage, but road-building techniques have developed slowly, due to limited significant technical breakthroughs, poor coordination among stakeholders and a largely short-term focus. The objective of the EU-funded NR2C project is to create a global vision for the road of the future, confronting both technological and societal problems within a single research process. Based on a large survey among road stakeholders, NR2C will identify safe and environmentally friendly infrastructure construction and maintenance concepts.**



### Building on a strong tradition

European countries encompass a large amount of existing surface transport infrastructure, and its adaptation to new societal demands remains a major challenge. The enlargement of the European Union has heightened the acute need for a sustainable integrated European surface transport network. Unfortunately, road-related budgets have been steadily decreasing while user expectations become more demanding and contradictory: increased transit capacities, higher safety levels, pollution mitigation (noise and air), aesthetic and integration.

NR2C aims to address these issues by identifying and developing new concepts for the roads of the future. Targeted innovations for different social and geographical environments will be selected and developed to achieve pilot applications in support of a long-term perspective.

### Identifying problems and solutions

A number of surveys are being carried out on the state of the art, expectations, trends and needs regarding social and economic developments, technological innovations for urban roadway systems, interurban infrastructure and civil engineering structures. The results of these surveys will be collected in one report and presented in a dedicated workshop.

Innovative concepts will be ranked and the most promising developed for further studies aimed at establishing feasibility, clarifying unsolved problems and laying out a path towards their progressive implementation. The development of specific innovations will be addressed in separate work packages:

> (WP1) Urban and suburban infrastructure;

> (WP2) Interurban infrastructure;

> (WP3) Civil engineering structures.

NR2C will consider urban and interurban areas as well as needs specific to Western and Central Europe. Bridges, considered as single network nodes, will be studied separately.

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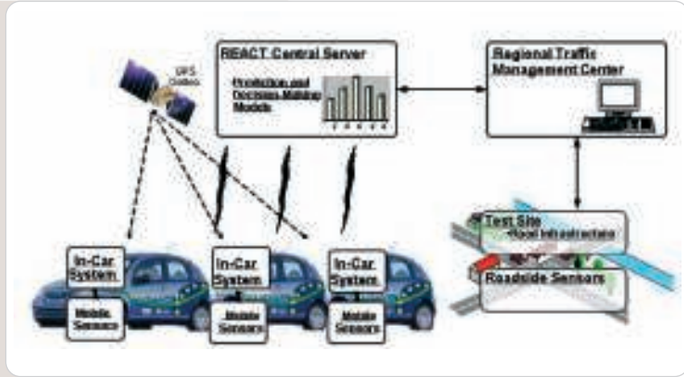
# REACT

## > Realising enhanced safety and efficiency in road transport

**Road transport is by far the most dangerous and costly of all transport modes, in terms of human lives. More than 50 000 people die every year on European Union roads. That is more than five people per hour, every hour, every day. Despite a decrease in road accidents in recent years, the figures for those killed and injured are still unacceptable and require the special attention of all road experts.**
**Meanwhile, the rate of increase of European car and truck use compared to road infrastructure development – nearly always insufficient and inadequate – together with increasing demand for passenger and freight mobility, result in a complex traffic congestion problem, which is magnified in high population areas. The loss of efficiency due to road transportation congestion represents 11 billion hours of delays for European Union passengers. The EU-funded REACT project represents a major step towards significantly reducing traffic deaths while improving transport infrastructure efficiency.**




### The future is real-time

Based on a long-term vision for road transport, REACT will sense natural and infrastructure conditions within and near specially equipped vehicles. Real-time sensory data will be transmitted to a central server to be analysed by a set of sophisticated prediction and decision-making models, and will generate:

> Safety alerts, speed and route recommendations to be communicated to vehicle drivers;

> Relevant information for road and law enforcement authorities.

Using mobile vehicles sensors, REACT will ultimately cover all roads, and not just interurban routes where existing traffic management systems tend to be located. Capable of detecting both road conditions and driver behaviour, REACT could have a strong and favourable impact on road safety. A warning of potential danger from the REACT system will raise driver vigilance and reduce the risk of an accident. In areas with existing traffic management systems, REACT will share data and results with the current system and would operate in close coordination with the regional road authority.

### Widespread road safety coverage

Initial sensors will include road friction, visibility, and traffic indicators. Wireless technology will transmit data from sensors to an in-car computer, and between individual vehicles and a central server. The in-car computer will be able to generate some recommendations to the driver based only on in-car data.

Field tests of the prototype system, using several sensor-equipped vehicles, will be carried out in stages in Munich. There, the system will be demonstrated in conjunction with the local traffic management system.

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# AUTOBRANE



## > Automotive high temperature fuel cell membranes

**Hydrogen is now seen as a major potential solution to the problem of reducing $CO_2$ emissions and replacing fossil fuels. The American space agency, NASA, has been using liquid hydrogen since the 1970s to propel the space shuttle and other rockets into orbit, but its potential use in fuel and energy applications also includes the powering of environmentally friendly surface-based vehicles. The current focus is on the use of hydrogen in fuel cells. A fuel cell works like a battery but does not run down or need recharging. Instead, fuel cells make electricity as they go.**

### The next generation

Proton exchange membrane fuel cells are a new type of power source being developed for transport applications as well as for stationary and portable applications. Their distinguishing features include lower temperature and pressure ranges and a special polymer electrolyte membrane (PEM).

PEM fuel cells still face some particular problems in automotive applications:

> Relatively low operating temperatures, limiting heat rejection;

> Too narrow an operating temperature range;

> High humidification needs.

### Highly knowledge-based approach

Partners in the EU-funded AUTOBRANE project say new types of electrolyte membranes and catalysts could offer a solution. The systematic development and testing of such membranes is the main focus of their effort. They are also carrying out research with monoethanolamine (MEA), an organic chemical compound that can be used to used to remove carbon dioxide ($CO_2$) from exhaust gas. In addition to their work on MEA, entire cells and small-scale stacks will be developed and validated at a representative level of power.

The project brings together a range of European expertise in the field of advanced polymer membranes in a well-focused cluster/network aimed at including a number of institutes from non-EU Member States, in particular China, Russia and India.

A steering group includes representatives of seven major European car manufacturers, working together to guide developers and to assess the results.

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# HYICE

## > Optimisation of hydrogen powered internal combustion engines

**Now widely expected to usher in a new era in global energy production, hydrogen is the third most abundant element on Earth and it can be produced using any kind of solar or geothermal power. As a renewable and carbon-free energy carrier, hydrogen produces no $CO_2$ emissions during combustion. Today, scientists around the world are seeking to advance new hydrogen and fuel cell technologies, and European researchers are providing leadership in the production and marketing of corresponding systems and components. HYICE is a three-year European Integrated Project aimed at contributing to the development of a clean and economical hydrogen-fuelled automobile engine.**

### Aiming for higher ground

The goal of HYICE is to work out an engine concept that has the potential to beat both gasoline and diesel engines with respect to power density and efficiency at reasonable costs. In the range of high-power vehicles, where hydrogen internal combustion engines can deliver even higher efficiency, HYICE technologies may present not just an intermediate, but also a long-term solution.

Principle strategic objectives include:

> Answering customer demand regarding both engine performance and fuel efficiency;

> Developing a product that can be sold at a reasonable price;

> Direct conversion of chemical-bound energy, in the form of hydrogen, to mechanical propulsion energy, using the well-established internal combustion engine (ICE);

> Rapid integration of HYICE technologies into mass market vehicles.

### Advancement without disruption

By taking the combustion engine as its starting point, the HYICE project is applying a well-developed technology to the requirements of the future without demanding profound changes in the organisational structures of automotive manufactures. At the same time, it aims to offer customers a product with similar characteristics to those of conventional automobiles. Specific tasks required to adapt the internal combustion engine to the use of hydrogen include:

> Bringing together representatives of the automobile industry and researchers from Europe and beyond;

> Developing components capable of handling the new fuel, with its specific characteristics;

> Development of suitable concepts for mixture formation and combustion;

> Ensuring the dissemination and exchange of important and valuable know-how.


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# HYTRAN



## > Hydrogen and fuel cell technologies for road transport

**The European transport sector is growing rapidly, with far-reaching implications for citizens and the environment. Transport activities are a major contributor to environmental pollution and have an important impact on climate change, accounting for more than 25% of all $CO_2$ emissions.**
**Hydrogen represents a clean and storable energy that can be produced from a variety of primary sources. Hydrogen fuel cells are intrinsically clean, very efficient, and offer great potential to address the problems of energy supply and to mitigate the effects of climate change. HYTRAN is an EU-funded Integrated Project that is applying hydrogen fuel cell technologies in the development of power systems for passenger cars and heavy vehicles.**

### Bringing fuel cell technologies to market

The overall objectives of HYTRAN are to develop commercially viable fuel cell technologies for motor vehicle applications, including the development of advanced components and systems, and their integration into two innovative power sources. Specific objectives include:

> 'POWERTRAIN' – development of a system for traction power via an 80 kW direct hydrogen fuel cell system installed in a passenger car;

> 'APU' – development of 5 kW 'Auxiliary Power Unit' for both light-duty and heavy-duty vehicles, including a micro-structured diesel oil steam reformer, clean-up reactors, an innovative reformate hydrogen stack and balance of plant components;

> The APU system will include a fuel processor to convert diesel fuel to hydrogen, and a fuel clean-up system to purify the hydrogen;

> The system will employ advanced thermal and flow technology similar to the emission control systems.

### A comprehensive approach to a complex problem

Components and subsystems are major bottlenecks for the commercialisation of fuel-cell-based powertrains. Factors include: cost, durability, weight, volume, and efficiency. HYTRAN is therefore focusing largely on the development of necessary components and sub systems. Specific targets will be achieved via a system approach leading to high 'well-to-wheel' efficiency (low fuel consumption), easy and optimised packaging and on-board integration. Specific tasks include the development of:

> Highly efficient, clean and compact micro-structured diesel steam reformer and gas purification unit providing at least 2 000h durability;

> Innovative humidification/dehumidification apparatus;

> Heat exchanger and radiator customised for the different applications;

> Humidity and CO sensors tailored to automotive application.

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# STORHY

## > Hydrogen storage system for automotive applications

**STORHY is an Integrated Project funded under the EU's Sixth Framework Programme and coordinated by Magna Steyr Fahrzeugtechnik AG & Co KG. The consortium will carry out concrete R&D work covering the whole spectrum of hydrogen storage technologies, including compressed gas, cryogenic liquid and solid materials, with a focus on automotive applications, an issue of utmost importance for the future of the European industry as a whole.**

### Driving European collaboration

Hydrogen storage is a key enabling technology for the extensive use of $H_2$ as an energy carrier. As none of the current technologies satisfies all of the $H_2$ storage attributes sought by manufacturers and end-users, the state of the art calls for efforts that should focus on improving existing commercial technologies (compressed gas and liquid hydrogen) and exploring the higher-risk technologies involving advanced solid materials. Providing economically and environmentally attractive solutions for these three storage options for transport applications and reinforcing the competitiveness of the European car industry are indeed the main objectives of STORHY.

The Integrated Project STORHY is a European initiative on automobile $H_2$ storage driven by major European car manufacturers, and covers the full spectrum of currently qualified technologies. Although the primary target of STORHY is the automotive industry, the preparation of spin-offs for stationary systems is also considered. In order to STORHY resources, such activities will be coupled to other related EC projects.

### Strong partnership

A large-scale R&D effort with the strong participation of the European car industry, suppliers, as well as research and testing organisations is necessary to develop sustainable on-board storage solutions. Thus the STORHY consortium includes:

> European automotive industrial companies;
> Leading European hydrogen supplier;
> European S&T excellence (including research institutes and universities);
> European standardisation and certification bodies.

The project is structured along three vertical subprojects (SPs) which correspond to the three major storage technologies. In addition, three horizontal SPs cut across the vertical activities by addressing:

Issues of dissemination/exploitation/training – users, which consist of the car manufacturing companies participating in the STORHY project, define the requirements for the different hydrogen storage systems, including $CH_2$, $LH_2$ and solid materials, as well as their safety properties.

Safety assessment and requirements – the proposed hydrogen storage systems have to be particularly safe. STORHY will address safety issues in coordination with other European projects focusing on hydrogen safety, such as HYSAFE. The long-term goal is the development of a quantitative risk assessment tool and a detailed study of several special safety aspects of the new hydrogen storage technology.

Multi-criteria evaluation – STORHY will assess the different technologies that result from the project in a harmonised way, based on common tools and assessment strategies that could be useful for decision-makers and stakeholders in the hydrogen field.


Prototypes of plastic liners


Finished 700 bar Type IV pressure vessel

Design of a thermoplastic-based modular multi-cylinder vessel

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#26.

# CLEVER

## > Compact Low Emission Vehicle for Urban Transport

**Europe's towns and cities already suffer enormously from traffic congestion and the problem is likely to get worse as car use continues to rise. One solution is to provide people with smaller, less-polluting vehicles that retain the practicality demanded by today's busy urban lifestyles. An impossible combination? The EU-funded CLEVER project aimed to create a vehicle that addresses all of these issues. The project partners have designed and built a prototype three-wheeled vehicle that can carry two people. At three metres long and one metre wide, the CLEVER vehicle offers the comfort of a car and the flexibility of a motorcycle: it is able to tilt around corners, and passengers are enclosed in a sleek all-weather cabin.**

© CLEVER.

### Better, by design

Because the CLEVER vehicle is small and light its fuel consumption is low – certainly compared to a car. It will therefore produce much lower emissions of harmful greenhouse gases than its four-wheeled cousin. CLEVER carries a 213cc single cylinder, 15hp natural gas-powered engine. It is capable of accelerating from 0 to 60kph in less than seven seconds, emitting less than 60g/km of $CO_2$.

The project team addressed other key issues to ensure their vehicle will appeal to the European consumer:

> Safety – CLEVER will come with a two-chamber driver air bag and specially designed safety-belt system. Its aluminium cabin protects against weather and can withstand normal accidents – the aim is to obtain a three-star rating under EuroNCAP tests.

> Tilting mechanism – CLEVER's tilting chassis is truly innovative. It uses hydraulics to tilt around corners in much the same way as a motorcycle, but with a lot more stability.

> Design – The project team has been mindful of the less than glorious history of three-wheeled vehicles. The way they look can put people off. CLEVER's design is sleek and modern and takes inspiration from the aerospace industry, nature and science fiction to produce a vehicle that has the "wow factor".

### Automobile alternatives

CLEVER is currently a prototype and is the result of more than six years of research endeavour by ten partners from across Europe. The team believes that further refinements can be made to improve their vehicle's safety, energy performance and handling. While no concrete plans exist for production, the project shows what can now be achieved in terms of finding practical, less-polluting alternatives to the car.

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# HI-CEPS

## > Highly Integrated Combustion Electronic Propulsion

**Hybrid vehicles, which use a combination of electric and combustion engines, are now appearing on the market. They are an attractive proposition for ethically minded motorists because they offer the chance to cut emissions of green house gases and save on petrol consumption. The technology is still in relative infancy and a lot more research needs to be done to find the optimum combination of hybrid technology that can provide improved environmental benefits and a performance that will attract more motorists. The EU-funded HI-CEPS project aims to carry out research on a range of innovative and cost-competitive thermal-electric configurations that are likely to become available to Europe's drivers from around 2010.**

### Assessing hybrid solutions

The HI-CEPS consortium contains 24 partners from 11 European countries, and includes four major car manufacturers and a range of automotive product suppliers, engineering companies and research bodies. They will use their expertise to examine three potential hybrid solutions which are each paired with a different engine powered by gasoline, diesel and natural gas.

HI-CEPS aims to fulfil a number of social needs as it explores the different hybrids, including:

> Lower fuel consumption: researchers seek a 35% reduction in consumption compared to today's most efficient conventional vehicles; and a 10% reduction compared to existing best-in-class hybrids;

> A reduction in emissions that offers a negligible impact on air quality, and reduction in engine noise.

As for meeting customer demands, the team hope to enhance performance, improve driveability, and make it cost-effective for more people to buy and use a hybrid.

### Rigorous testing

The HI-CEPS team will carry out a range of tests on hybrid electromechanical and electromagnetic powertrains using two different hybrid vehicle platforms. The results will be used to make technical and cost comparisons of the three selected hybrid solutions.

The project – which starts in the middle of 2006 – is divided into five technical sub-projects. Each of the three hybrid architectures will have its own sub-project. The remaining two will look at the following issues:

> Integration of thermal auxiliaries (electrical regeneration; thermal storage systems and air-conditioning) and energy management to reduce fuel consumption and emissions while maintaining high thermal comfort in the hybrid powertrains; and

> Comparing the performance and costs of the hybrid systems – the assessment will take account of vehicle safety issues and powertrain integration needs.

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# HYSYS

## > Hybrid system component development

**Hybrid vehicles uses multiple propulsion systems to provide motive power. The objective of the EU-funded HYSYS project is research on low-cost components for fuel cell (FC) systems and electric drive systems that could be used in both future hybridised FC vehicles (medium-term objective) and internal combustion engine (ICE) vehicles.**

Newly developed components will be analysed and tested within two FC platforms representing different vehicle concepts. The focus of the project is on new components that have a high potential for significant cost reduction. This could be achieved by decreasing complexity and/or other innovative approaches that would facilitate mass production.

In the field of FC systems, key concepts being investigated include:

> Innovative air supply based on electrical turbochargers;

> Novel humidification subsystems;

> New hydrogen sensors;

> Innovative hydrogen injection system components.

In the area of electric drive systems, HYSYS partners are focusing on highly integrated drive trains, including converters, inverters and electrical motors, and on high-energy-density battery systems, based on innovative Li-Ion technology developed by EU-funded projects EV-LIFT and LIONHEART.

Running in parallel to the component research, a separate sub-project is looking at:

> Vehicle requirements;

> Subsystems and components;

> Standardisation of components;

> Identification of potential synergies between FC and ICE hybrid components;

> Safety aspects;

> Comparative investigation of different electrical storage systems, i.e. battery/supercap, and respective e-storage management.

In addition, optimised vehicle control and energy-management strategies will be developed, as well as modular system control software. The improved system components and subsystems could be used as a basis for future FC and ICE vehicles expected to be deployed by the HYCOM initiative and the LIGHTHOUSE project.

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# > Green heavy duty engine

**The heavy-duty engine sector has seen rapid changes in recent years, with new technologies resulting in important improvements in response to increased demand for fuel efficiency, lower emissions and cost competitiveness.**

HD (heavy-duty) engines operate under constraints much more severe than those for passenger cars, such as:

> Higher durability (> 600 000 km) of the engine and related after-treatment;

> Higher mechanical and thermal stress (heavier load factor);

> Higher pressure on reliability (uptime), investment and fuel economy.

## Multiple transport applications

These constraints are common to all HD engines, not just those that power trucks and urban vehicles but also those used for rail traction and inland waterway vessels.

New technologies that could help meet tough future emission and fuel consumption targets include:

> A new combustion process based on variable components;

> New control strategies;

> Holistic, 'one-system' view of engine and exhaust after-treatment;

> Sustainable fuels.

## Groundbreaking approach

The EU-funded GREEN project will perform research leading to new and better subsystems for heavy-duty engines. These systems will adhere to strict boundary conditions, in terms of:

> A competitive cost base;

> Highest possible diesel cycle fuel conversion efficiency, to achieve near-zero, real-world, including off-cycle, pollutant emissions, and significant reduction of $CO_2$ and other greenhouse gases.

Project partners say the emphasis is on diesel engines for trucks and rail applications and on natural gas engines for city transport. Innovation and durability are important priorities.

Research targets have been selected to deliver performance satisfying all current legislation, and partners say further improvements in terms of near-zero real-world emissions can be envisaged beyond 2010. For diesel, this means NOx 0.5 g/kWh, PM 0.002 g/kWh, ETC Cycle BSFC = 204 g/kWh. Corresponding targets have also been set for natural gas.

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# NICE

## > New integrated combustion system for future passenger car engines

**Europe's love affair with the automobile shows no signs of abating. However, both consumers and car manufacturers are keenly aware of the need to find ways of reducing the environmental pollution caused by the internal combustion engine. The NICE project aims to develop a new integrated combustion system that can use any type of fuel and achieve fuel conversion efficiency equal to the most environmentally friendly diesel engines. The project team hopes to achieve very high fuel conversion efficiency using new biofuels and/or alternative fuels and gas.**

### Reducing emissions

Reducing the emission of greenhouse gases produced by transport is now an important political, social and environmental objective for the EU and its Member States. NICE is helping the automotive industry respond by developing a fuel-neutral integrated combustion system that offers a zero-impact emission level.

The specific research objectives include:

> Producing a measurable increase of Homogeneous Charge Compression Ignition (HCCI);

> Developing new bio-fuel specifications that complement the NICE combustion system;

> Using different electronic control units to define new advanced systems, including real-time models and software, hardware testing and validation; and,

> Developing a predictive and affordable numerical tool to describe the project's new low-emission but highly efficient combustion processes.

### Pooling resources

NICE is a four-year, EU-backed Integrated Project that is due to complete its work at the end of 2007. Europe's automotive industry is well represented in the project, which brings together the expertise of no less than 26 partners. The work programme comprises four principal areas:

> Enlarged HCCI-diesel/CAI-Otto combustion process under transient operations;

> Compressed/spark-ignited variable engine; based on gasoline or diesel engines, combining the advantages of a new combustion system, with high EGR, supercharged and adapted to bio-fuels;

> Future gas internal combustion engines with diesel equivalent fuel consumptions;

> Improved CFD tools and modelling.

Components of the VVA cylinder head for a multi cylinder

First multi cylinder engine for an enlarged HCCI diesel combustion concept

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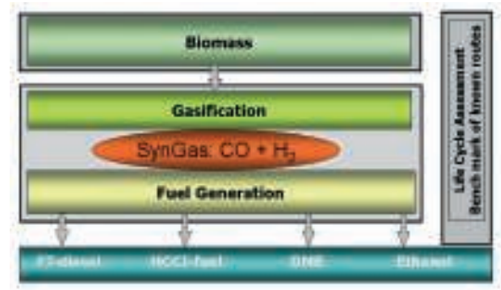
# > Renewable fuels for advanced powertrains

**Biofuel derived from biomass – recently living organisms or their metabolic by-products, such as manure from cows – is a renewable energy source, unlike other natural resources such as petroleum, coal and nuclear fuels. The production of biofuels to replace oil and natural gas is in active development, focusing on the use of cheap organic matter (usually cellulose, agricultural and sewage waste) in the efficient production of liquid and gas biofuels which yield high net energy gain. The carbon in biofuels was recently extracted from atmospheric carbon dioxide by growing plants, so burning it does not result in a net increase of carbon dioxide in the Earth's atmosphere. As a result, biofuels are seen by many as a way to reduce the amount of carbon dioxide released into the atmosphere by using them to replace non-renewable sources of energy. It is noticeable that the quality of timber or grassy biomass does not have a direct impact on its value as an energy source.**




BTL production pathways

## Looking forward with biomass

The EU-funded RENEW Integrated Project brings together 33 European partners, including automotive manufacturers, members of the mineral oil industry, plant builders and R&D institutes. They will co-operate in a four-year project aimed at assessing technical, economic and environmental aspects of production routes for renewable biomass-to-liquid (BTL) fuels.

The whole chain, from biomass production through to fuel application in today's and future combustion engines, will be investigated. The common interface is a synthesis gas ($H_2$+CO) that is produced from lingo-cellulosic biomass (wood, straw and energy plants) via gasification. Fisher-Tropsch-diesel, HCCI-fuel, DME and ethanol will be produced synthesised.

## Concrete results

After 30 months, production of BTL fuels has been completed and engine tests have proved the suitability of such motor fuels. Activities are now focused on further optimisation of processes and fuel specifications. Investigations of the biomass potential in the EU revealed a considerable potential for substituting fossil fuels. The methodology for an environmental, technological and economic assessment of BTL production routes has been defined and agreed among the consortium. Data acquisition has been completed and evaluation of results has started.

Outcomes of the RENEW project are to include:

> A comprehensive knowledge base on different BTL production pathways, open to relevant stakeholders in the EU;

> Commonly agreed strategic recommendations on future technology options.

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More information

# INMAR

## > Noise reduction by intelligent materials

**Noise is a serious form of environmental pollution, believed to affect the lives of some 100 million European citizens. The cost of the associated damage is estimated at more than €10 billion per year. Today, reduced noise radiation and emission is increasingly becoming a specific design aspect, and advanced intelligent material systems are playing a greater part in this, with potential applications in noise and vibration reduction in many industrial fields.**

Within this context, the EU-funded INMAR Integrated Project is aiming to reduce interior and exterior noise levels associated with road and rail transport, and with associated infrastructure such as bridges. INMAR will bring together top research institutes and universities, OEMs from the automotive and railway sectors, component producers, and eight SMEs that specialise in smart structures and materials.

### Obstacles to overcome

A number of different approaches will be explored, one of which involves the use of intelligent materials that create opposing vibrations to counter or cancel those created by the noise source. Presently, many intelligent materials systems such as fibre composites with embedded piezo-ceramics or shape memory alloys, are derived, characterised, and applied in smart structures on a laboratory scale, but they have not yet had an impact on the design rules for engineered structures or in mass products.

Until now, the performance of intelligent material systems has been insufficient for large-scale noise reduction. They require an unacceptable level of electronic periphery, and data on their durability and reliability is lacking. INMAR will focus on addressing these issues. The overall objective of INMAR is the research and realisation of intelligent, high-performance, adaptive material systems with integrated electronics for different individual applications. Aside from the development of the materials or material systems themselves, research also includes their characterisation, development of simulation tools for the design process, handling and manufacturing techniques, and assessment of the reliability of the selected systems.

### A comprehensive approach

As the requirements for intelligent material systems – in contrast to those for conventional lightweight materials – greatly depend on the intended application and operating conditions, such systems can only be developed through a concurrent approach that simultaneously considers the application. Reducing noise linked to land-based traffic and related infrastructure, such as buildings, bridges and tunnels, has been chosen for INMAR from among many possible applications.

The intelligent material systems developed by INMAR will encompass active noise-reduction concepts based on active structural acoustic control (ASAC) or active noise control (ANC) for sound quality design.

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# QCITY

## > Quiet city transport

**Noise is one of the most prevalent environmental pollutants, and causes immense frustration and annoyance to people living in urban areas. Transport is a major culprit – noise from road and rail vehicles and infrastructure can seriously affect quality of life in Europe's towns and cities. The EU-funded QCITY project aims to develop technologies that can control and reduce road and rail ambient noise. Researchers will tackle the problem at its source by finding ways to reduce noise from both vehicles and related infrastructure. QCITY will produce new components and technologies specifically designed for noise abatement. Research also hope to provide municipalities with a broad range technical solutions and tools so they can reduce noise and its harmful effects.**

### Turning down the volume

QCITY's objectives complement European noise reduction policy, as outlined in the EU's Noise Directive of 2002. The four-year project began work in December 2005, and has the following specific objectives:

> Developing city-specific maps, showing noise levels and hot-spots, and the production of action plans for noise alleviation;

> Producing new noise-reduction technologies and retrofitting to vehicles and infrastructure, in line with the EU's Quieter Surface Transport Policy;

> Devising new measures that can be applied to all vehicles and components rather than to specific products.

### Building and testing

QCITY's 27 partners hail from all corners of Europe and include automotive and rail industry manufacturers. The project began work with an initial 18-month assessment period to look at a range of noise-reduction measures. From that work, specific measure will be selected for further development, including design, prototype building, testing and validation. The project has a number of activity areas:

> Noise maps and modelling;

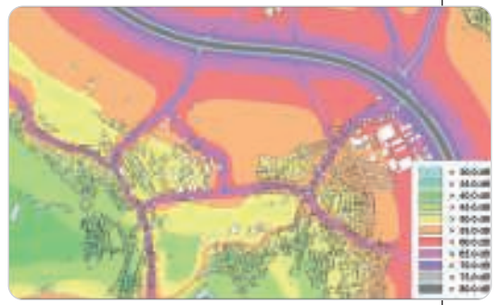
> Vehicle noise sources;

> Noise and the vehicle/infrastructure interface;

> Propagation and receiver parameters;

> Design and installation of noise-reducing solutions at validation sites;

> Dissemination of results.



Noise map showing calculated Lden – levels in dB(A) for a part of Stuttgart-Fildern (calculated with aid of Software CadnaA by Accon GmbH in Griefenberg, Germany)

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More information

# SILENCE



## > Quieter surface transport in urban areas

**Urban areas could not function properly without effective surface transport systems. People rely on cars, buses, trains and urban transit systems as they go about their business. However, noise pollution is one price the European urban dweller has to pay for this flexibility, especially in built-up areas. In response to this problem, an EU-funded research project called SILENCE aims to develop integrated methodologies and technologies to improve control of surface transport noise in urban areas. Researchers will examine ways to tackle noise at the source, how noise is propagated and emitted, and people's reaction to noise.**

### Silence could be golden

SILENCE brings together a broad range of partners including municipalities, public transport operators, bodies in charge of road and rail infrastructure, as well as transport industry associations and manufacturers. Their goal is to produce:

> Innovative technologies that will improve the control of surface transport noise;

> Fresh strategies and action plans for urban transport noise abatement, along with practical tools for their implementation;

> A reduction in the amount of noise people have to cope with in the urban environment.

### Useful tools

SILENCE runs for three years until the end of January 2008, and will examine noise from both vehicles and transport infrastructures. The project seeks to deliver:

> An integrated approach that involves an eclectic mix of experts, including planners, noise researchers, and stakeholders from the road and rail industry;

> Scenarios that assess noise levels and people's perception of noise and how it affects them;

> Work tailored to the urban area, by producing urban noise scenarios and action plans that will set out ways to reduce future noise levels;

> Global modelling tools that can be used to assess both road and rail noise emissions.

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# SILVIA

## > Sustainable road surfaces for traffic noise control

**The overall aim of the SILVIA project was to provide decision-makers with a tool allowing them to rationally plan traffic noise control measures, including low-noise road surfaces. The final output of the project is a new 'Guidance manual for the implementation of low-noise road surfaces'. It represents a comprehensive compilation of key research and findings from the entirety of the component work packages carried out within the project.**

### A new tool for EU road policy

The manual is divided into six parts:

> **Part 1** summarises the basic facts about noise in general, and vehicle and tyre/road noise in particular, providing readers with necessary background on the topic.

> **Part 2** comprises an overview of different low-noise solutions for road surfaces, including well-established surface types and relatively new or emerging technologies, some of which have been tested within the SILVIA project. It also reviews construction and maintenance techniques for low-noise surfaces and addresses the possibilities of improving their acoustic performance and durability.

> **Part 3** summarises the different measurement methods that are available for the evaluation of the acoustic performance of a road surface, particularly for labelling and conformity-of-production (COP) assessment. The essential chapter within Part 3 comprises a presentation of the 'noise classification procedure' developed to provide the most accurate and reproducible characterisation of the acoustic performance of a specific road surface, suitable for use specification and procurement.

> **Part 4** deals with economic aspects of low-noise road surfaces. This includes consideration of both safety and sustainability issues. A cost/benefit analysis tool, developed as part of this project, is also presented.

> **Part 5** considers interactions that have an impact, positive or negative, on the effectiveness of low-noise surfaces.

> **Part 6** presents advice and recommendations on how to make the best use of the low-noise solutions for road road surfaces. Here, SILVIA addresses decision-makers, road authorities, contractors and road engineers, as well as policy-makers at national and European levels.

### Informing road transport

In addition, a CD-ROM comes with the guidance manual and includes all the main SILVIA deliverables as well as the intermediate technical reports produced by the different work packages, and other related documents. The CD-ROM includes a wealth of technical details and the research results behind the development of the different chapters of the guidance manual. Both the manual and CD-ROM are also free to download via the SILVIA website.

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