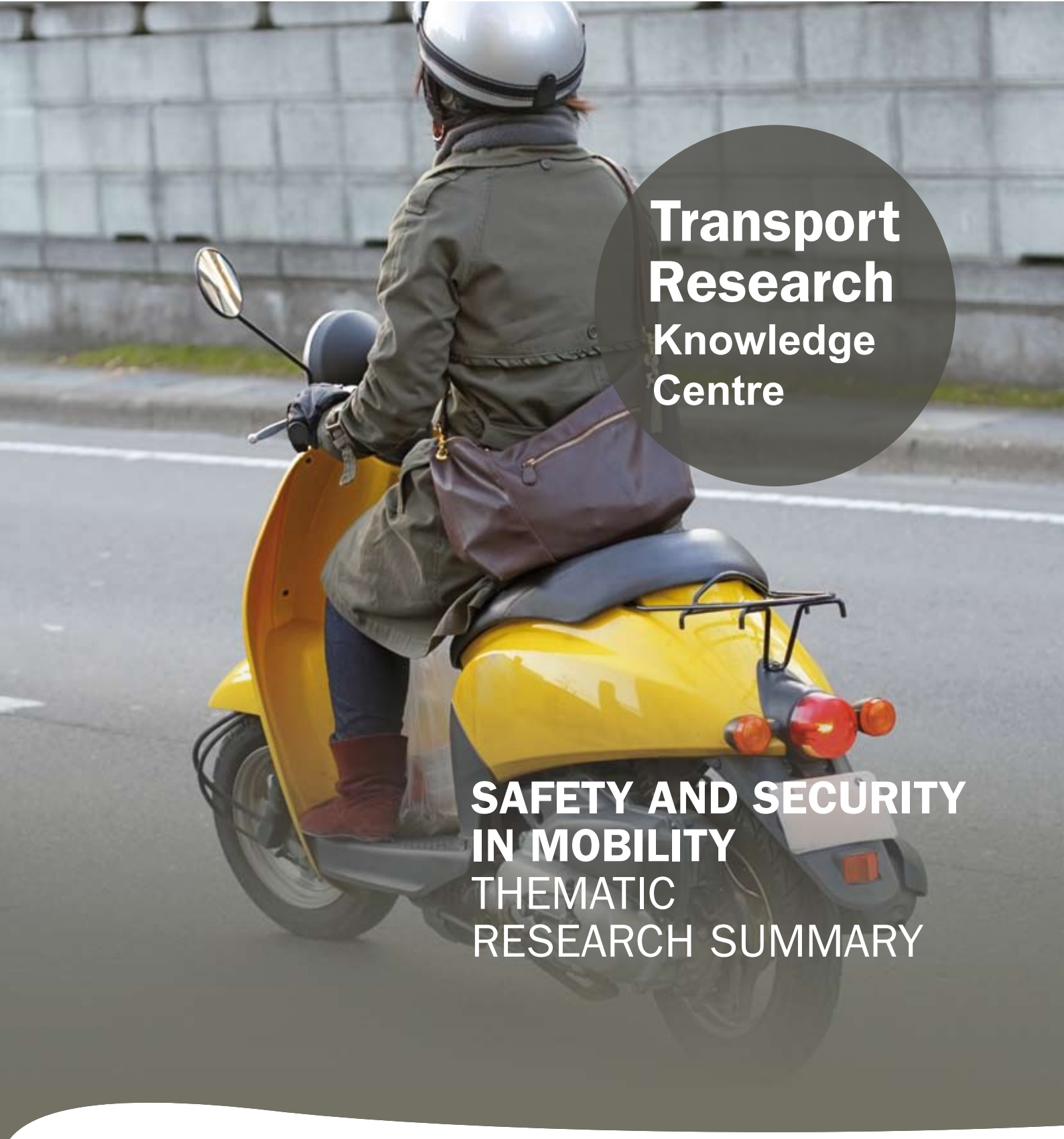

Transport Research Knowledge Centre

SAFETY AND SECURITY IN MOBILITY
THEMATIC RESEARCH SUMMARY

Directorate-General for Energy and Transport
EUROPEAN COMMISSION

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European Commission
DG Energy and Transport

Thematic Research Summary

Specific Support Action

Transport Research Knowledge Centre

Safety and Security

Prepared by Wolfgang Helmreich

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Abbreviations and acronyms used

ASC	Adaptive Speed Control
ADAS	Advanced Driver Assistance Systems
CEC	Commission of the European Communities
CO_2	Carbon dioxide
ERA	European Research Area
EU	European Union
DGTREN	Directorate General Transport and Energy
EATMS	European Air Traffic Management System
ERTMS	European Rail Traffic Management System
EXTR@Web	Exploitation of Transport Research via the Web (EU FP5 dissemination project, predecessor to TRKC)
FLR	Forward Looking Radar
FP4	Fourth Framework Programme (1994-1998)
FP5	Fifth Framework Programme (1998-2002)
FP6	Sixth Framework Programme (2002-2006)
FP7	Seventh Framework Programme (2007-2013)
GSM	Global System for Mobile telecommunications
GPS	Global Positioning System
ICT	Information and Communication Technologies
ISA	Intelligent Speed Adaptation
ITS	Intelligent Transport Systems
MANPAD	Man-Portable Air Defence system (shoulder-launched guided missile)
NO_X	Nitrogen oxide
RTD	Research and Technological Development
TEN	Trans-European transport Network
TRKC	Transport Research Knowledge Centre
TRS	Thematic Research Summary
UNECE	United Nations Economic Council for Europe

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Foreword

This paper has been produced as part of the TRKC (Transport Research Knowledge Centre) project of the Sixth Framework Programme, priority thematic area "Sustainable Development, Global Change and Ecosystems".

TRKC, as its predecessor project EXTR@Web, aims at collecting, structuring, analysing and disseminating transport research results. It covers EU-supported research as well as research financed nationally in the European Research Area (ERA) and selected global RTD programmes. The main dissemination tool used by TRKC is the web portal at www.transport-research.info

The approach to dissemination of results of research projects adopted by the TRKC team includes the following three levels of analysis:

- Project Analysis, which provides, project by project, information on research background, objectives, results, technical and policy implications;
- Thematic Analysis, which pools findings of research projects according to a classification scheme based on thirty themes, fixed for the project life time; the product of this analysis activity is the set of **Thematic Research Summaries (TRS)**; the present document belongs to this set;
- Policy Analysis, which pools findings of research projects according to combinations of themes, based on ad-hoc policy priorities which are agreed with DGTREN of the European Commission and a representative group of research users.

The present Thematic Research Summary deals with safety and security in transport. The aim is to provide the reader with a synthesis of completed EU-funded projects which have dealt with the theme. The paper is intended for policy makers at the European, national and local levels, as well as any interested reader from other stakeholders and from the academic and research communities.

Disclaimer

The TRKC team is fully responsible for the content of this paper. The content of this paper does not represent the official viewpoint of the European Commission and has not been approved by the coordinators of the research projects reviewed.

This TRS paper was externally reviewed by Dr Dietmar Wurzel of ECTRI.

Executive Summary

This paper has been produced as part of the TRKC (Transport Research Knowledge Centre) project of the Sixth Framework Programme. The role of TRKC, as its predecessor project EXTR@Web, is to collect, structure, analyse and disseminate transport research results. It provides comprehensive coverage of transport research in EU programmes as well as key research activities at national level within the European Research Area and selected global programmes.

The paper is one of the thematic research summaries (TRS). The TRSs aim at providing a synthesis of research results and policy implications from completed projects. Each TRS deals with a theme according to the classification which the TRKC project has adopted. The theme of this TRS is “safety and security”.

The first part of the paper includes a brief analysis of the scope of the theme, and a policy review where the main policy developments at EU level are summarised.

The theme “safety and security” deals with (a) the level of danger that is socially acceptable in a real-life situation, taking into account other factors such as efficiency, cost, liberty and comfort, and (b) systems, rules and procedures aimed at preventing, discouraging and detecting negligent, irresponsible or malicious human acts which threaten safety.

Key policy developments at EU level draw on legal means to establish a framework and introduce measures in the field of road safety, provided by the Maastricht Treaty. In addition to ongoing long-term activities in the railway and aviation sectors, the Transport Advisory Group in its FP7 work programme "Safety and security in Transport" proposed research on specific aspects of safety and security in transport.

The second part includes a synthesis of the main findings and policy implications from research projects and is concluded with an overview of the implications for further research. The research projects synthesised are EU-funded projects, from the Fifth and the Sixth Framework Programmes that have results publicly available. Projects that had been reviewed in the related paper produced within the predecessor project EXTR@Web are briefly summarised.

Eight sub-themes are considered in the synthesis. The following are the main achievements for six of the sub-themes where project results have been available:

In the sub-theme concerning reporting and common guidance:

- Road sector research has identified the requirements of all stakeholders towards online services helping to reduce casualties, defined an overall framework architecture for open telematics, and came up with a common validation plan; and
- research has focused on the replacement of current VHF technology through introduction of a broadband VHF channel model, and a simulation framework.

In the sub-theme concerning assessments:

- Research on the options for deciding on the best ways for implementing safety measures has stressed the criteria of correct safety evaluation, implementation costs of safety measures, the use of systematic "ex-ante" studies, the inclusion of typical scenarios for usual evaluation practice, the categorisation of cases for cost-benefit analyses, and the focus to be put on projects with safety-dedicated budgets; and
- a research study analysing the socio-economic effects of intelligent safety systems in road vehicles found that intelligent safety systems have already proven to be promising instruments with the capability of reducing the number of accidents and their severity.

In the sub-theme concerning transport operation, research on the safety design of automotive vehicles successfully demonstrated the integration of several new and important control functions for higher levels of system automation.

In the sub-theme concerning transport infrastructure and vehicles:

- An evacuation study for large double-deck passenger aircraft showed that handling more passengers in emergency situations is a demanding task for cabin crew with the likely panic among passengers being understood to have major impact on the achievable evacuation times;
- research with a view to establishing a European culture of safe road engineering came up with a road safety index used for assessing and monitoring road safety addressing aspects, a catalogue of ranked, performance-based road safety recommendations, and interactive application of the catalogue; and
- research in the maritime sector has produced a set of advanced tools for ship design, developed an approval process and risk acceptance criteria for risk-based ship systems and functions, and applied these design criteria to eight novel ship designs of which two were chosen for further detailed design.

In the sub-theme concerning driver, passenger and non-user safety:

- Research in the field of crash testing using frontal impact dummies identified the principal occupant injuries in frontal impact car crashes, and new biomechanical data, leading to the design of a new generation prototype frontal impact dummy; and
- studies on safety applications contributing to road safety have highlighted the need to consider advanced communication technologies, new sensorial devices, lane-keeping support systems, concepts for sensors and communication, active 3D sensor technology, location and classification of obstacles, concepts for advanced sensors, safety-enhanced digital maps for ADAS applications, and generic impact assessment for all functions.

In the sub-theme concerning working conditions, research in the automotive sector has dealt with the issue of getting accident risk estimates that incorporate both a driver's state and driving performance as expressed in commonly used parameters like speed and lane positioning accuracy.

1. Introduction

This paper provides a structured review of the research relating to safety and security in transport, carried out in EU-funded transport research projects. “Safety and security” is one of the thirty themes in the classification scheme adopted by the TRKC project, shown in the table below.

Table 1. The classification scheme adopted in TRKC

Dimension 1: sectors
• passenger transport • freight transport
Dimension 2: geographic
• urban transport • rural transport • regional transport • long-distance transport • EU accession issues
Dimension 3: modes
• air transport • rail transport • road transport including walking and cycling • waterborne transport • innovative modes • intermodal freight transport
Dimension 4: sustainability policy objectives
• economic aspects • efficiency • equity and accessibility • environmental aspects • user aspects • **safety and security**
Dimension 5: tools
• decision support tools • financing tools • information and awareness • infrastructure provision including Trans-European Networks (TENs) • integration and policy development • Intelligent Transport Systems (ITS) • regulation/deregulation • land-use planning • transport management • pricing and taxation • vehicle technology

The scheme has been adopted to enable search facilities in the TRKC portal, and to en-

sure comprehensive coverage of research results and appropriate policy analysis in the Thematic Research Summaries (TRS). Definitions for each theme are found on the TRKC portal at www.transport-research.info/web/projects/transport_themes.cfm.

In the predecessor EXTR@Web project, TRSs were produced for 28 out of the thirty themes (resulting from merging of some themes into a single TRS). The TRKC project is producing first versions of TRS for a sub-set of themes for which a critical mass of results from projects is available by July 2008 (including this one on safety and security). Final versions of TRSs for the full set of themes are planned for production in December 2009.

A high number of research projects have dealt with the theme addressed by this paper. The TRS "Safety and security" produced in the predecessor project EXTR@Web[1], had reviewed research from European projects belonging to the Fourth Framework Programme (FP4), the Fifth Framework Programme (FP5) and selected national projects. The present paper adds new projects, mainly European projects from FP5 and the Sixth Framework Programme (FP6).

The research reviewed in this paper does not represent the entire range of research dealing with safety and security aspects carried out in Europe. The paper focuses on research from those projects which have made documentation on results available to the TRKC team after the issue of the EXTR@Web paper in 2006. A summary of the research reported on in the EXTR@Web paper is also included to make the reader aware of the full range of research which has dealt with the theme. For completeness, a list of projects from FP6 which are on-going or which, although completed, have not yet made results publicly available, is also provided.

The paper is organised as follows. Sections 2 and 3 set the scene. Section 2 includes a brief analysis of the scope of the theme. Section 3 provides a brief overview of the relevant policy developments at EU level, which underpin the research objectives. The sources for this section are principally European Commission documents which have set the policy agenda such as white papers, green papers, and communications.

Section 4 reports on the results from research projects. The section is structured according to sub-themes to make the broad area of research which has dealt with safety and security more manageable.

[1] EXTR@Web project (2006)

The following eight sub-themes are considered:

- sub-theme 1: reporting and common guidance;
- sub-theme 2: assessments;
- sub-theme 3: transport operation;
- sub-theme 4: transport infrastructure and vehicles;
- sub-theme 5: driver, passenger and non-user safety;
- sub-theme 6: qualifications and behaviour;
- sub-theme 7: working conditions; and
- sub-theme 8: security.

For each sub-theme, overall research objectives are presented and research findings are synthesised. A special focus is given to the policy implications of research results. Section 4 concludes with a brief overview of the perceived implications for future research, based on the findings from the projects reviewed. Sources for section 4 are documents available from the projects and reporting on their achievements, essentially the project final reports.

The Annex includes the list of the EU-funded research projects for each of the eight sub-themes. Addresses of the websites of the projects reviewed are included with hyperlinks. In several cases these websites make the project documentation available to the public. This may include final reports and project deliverables.

2. Scope of the theme "safety and security"

Safety implies freedom from danger. The ultimate level of safety would be a situation without any risk of personal accident, injury or material damage. In reality, this is impossible because a widespread set of dangers cannot be avoided completely. So safety generally refers to the level of danger that is socially acceptable in a real-life situation, taking into account other factors such as efficiency, cost, liberty and comfort.

In the case of transport safety, risk arises when human beings are exposed to any part of the transport system. Different levels of risk attach to different modes and to different activities. The acceptable level of risk is judged according to the choices made by individuals – as operating staff, drivers or passengers.

The safety performance of a technical system is the measurable consequence of the extent to which it behaves as expected, with and without the interaction of human beings. The objective is to come as close as possible and reasonable to the ideal safety performance.

Security is the undertaking to protect human beings, transport means and transport infrastructure against unauthorised and unexpected actions of any kind. It generally refers to systems, rules and procedures aimed at preventing, discouraging and detecting negligent, irresponsible or malicious human acts which threaten safety.

Safety issues concern the means of transport (such as vehicles) and the infrastructure of transport (such as roads), as well as human beings involved directly or indirectly in any transport operation. When the transport safety system, or the infrastructure on which the transport system operates, fails to behave as designed, there are often serious consequences. Such failures also decrease the efficiency of a transport system.

Elements of transport systems have to be tested and validated, concerning their ability to fulfil their functions and the consequences of malfunctions and failures. Safety issues affect operations, requiring ongoing organisation and expenditure to maintain levels of safety. Safety must be described in terms of the risks to different categories of transport users, as well as non-transport users who are in proximity to the transport system or suffer from the consequences of transport. Safety is often measured in terms of the numbers of fatalities, injuries and material damage by distance travelled (passenger-km or freight tonne-km), or the risk of serious injuries in percentage terms, or perceived safety in qualitative terms.

Safety is a high priority issue within the transport sector across all modes. All European countries provide some guidelines for achieving similar goals:

- Safer transport systems;
- technical standardisation; and
- improved training.

Major topics to categorise safety aspects are:

- Transport means;
- transport infrastructure; and
- human performance and behaviour including operation.

The topic can be structured in terms of the affected groups of users and non-users.

Safety and security of users and systems

- Staff of transport undertakings (drivers, pilots, crew, terminal and maintenance staff etc);
- private individuals in control of a vehicle, vessel or aircraft (e.g. car drivers or private pilots);
- passengers;
- goods being transported; and
- security of transport infrastructure and systems.

Safety of non-users

- Drivers and passengers of other vehicles (or vessels or aircraft);
- other modes; and
- general public.

Besides standardisation and regulation, improved safety procedures, and safer design, the implementation of Intelligent Transport Systems can contribute to overall safety in transport, e.g. through telematics based traffic control and driver assistance. Within the freight transport area, a further safety topic is the transport of hazardous goods.

The above summary of topics describes the principal breakdown of technical, organisational and managerial aspects that come under the theme, whereas Section 4 of this document reflects sub-themes according to actual priorities in transport research policy.

3. Policy context

3.1 Safety in land, waterborne and air transport

In the year 2006, roughly 43,000 persons were killed and still around 2 million injured by car related accidents in the 27 EU Member States alone[2]. The number of persons injured may be even higher, by a factor of two, due to under-reporting of minor incidents. These statistics demonstrate the significance of the theme.

Other modes like air and rail are much safer, but especially in aircraft accidents the chance of survival is very limited. Not only are the human tragedies of great importance, but also the external costs associated with accidents having a significant economic impact.

The external costs of transport related accidents are roughly estimated at 1.5% of gross domestic products. The socio-economic importance of safety for the European economy is obvious. There can be no real transport efficiency without transport safety.

The Maastricht Treaty provided the EU with the legal means to establish a framework and introduce measures in the field of road safety. While progress has been made in some countries as a result of increased education and enforcement together with improved highway engineering, other countries have road safety records well below those of the best performing countries and urgent integrated action taking account of human and technical factors is needed if the EU is to come close to the 2001 Transport White Paper goal of reducing the number of deaths on the road by half.

Though responsibility for taking measures to halve the number of road deaths by 2010 will fall chiefly to the national and local authorities, the European Union too needs to contribute to this objective, not just through the exchange of good practice, but also through action at three levels:

- Promotion of new technologies to improve road safety;
- pursuing safety-related standardisation and legislation within its areas of competence; and
- harmonisation of penalties and cross-border enforcement.

To that respect, the 2006 mid-term review of the Transport White Paper stresses that con-

[2] CEC (2008a)

certed action to further improve vehicle design and technology, including technologies for accident avoidance and vehicle infrastructure co-operation ("e-Safety"), and road infra-structure and driver behaviour must be taken.

Concrete actions to reach the road safety targets are hence:

- Implementation of an integrated approach to road safety which targets vehicle design and technology, infrastructure and behaviour, including regulation where needed;
- organisation of awareness efforts, such as annual road safety days;
- review and completion of safety rules in all other modes; and
- strengthening the functioning of the European safety agencies and gradually extending their safety-related tasks.

The FP7 Cooperation work programme 2007-2008 stressed that ensuring the level of safety and security of the transport system will respond to the increasing mobility demand and crime emergence is of major importance:

- The focus in aeronautics research will hence be on active and passive safety measures with special emphasis on the human element; and
- the key aim of research for sustainable surface transport will be on establishing a common foundation for a common control/command system for urban rail transport and a common approval process at European level with regard to safety and security.

3.2 Security agenda

The Transport Advisory Group in its FP7 work programme 2008 "Safety and security in Transport" in addition proposed research on specific aspects of safety and security in transport, identifying the priority areas:

- Technologies for accident avoidance (e-Safety); and
- technologies to confront the sustained terrorist threat concerning all modes of transport, i.e. civilian aircraft, passenger ships, rail and other forms of public transport.

The September 2001 terrorist attacks in the USA have spurred several activities related to the security of the European transport system. Legislation and the introduction of quality control schemes have since boosted security levels in aviation and the maritime sector. However, the extension of security rules to land transport, including urban transport and railway stations, and intermodal logistics chains is still pending. As a secondary aspect, a level playing field among all modes of transport needs to be ensured where the costs of security measures must not distort competition.

The 2006 mid-term review of the Transport White Paper[3] hence proposes the following actions in the field of security:

- Examination of the functioning and costs of current security rules in air and maritime transport, and proposing adjustments where needed on the basis of experience and in order to avoid distortion of competition; and
- reflection on the need to extend security rules to land and intermodal transport and critical infrastructure.

[3] CEC (2006)

4. Research findings

4.1 Introduction

The research which is reviewed in this paper deals with eight sub-themes, as illustrated below:

Sub-theme 1 Reporting and common guidance	**Sub-theme 2** Assessments	**Sub-theme 3** Transport operation	**Sub-theme 4** Transport infrastructure and vehicles
Sub-theme 5 Driver, passenger & non-user safety	**Sub-theme 6** Qualifications and behaviour	**Sub-theme 7** Working conditions	**Sub-theme 8** Security

The first sub-theme deals with **Reporting and (common) guidance**. In this area research aims to understand the different reports and protocols for handling accidents within Europe, with a particular focus on the maritime and road sectors. Based on this knowledge, a common framework for unified reporting is under development. This should provide the basis for deriving specific safety measures, such as an onboard ”black box” systems like those long established for commercial aircraft.

The second sub-theme deals with **Assessments**. In this area methods are being analysed and developed to assess safety impacts of emerging technologies, or to provide risk analyses, mostly supported by simulations. In the context of the Single European Sky initiative this concerns future air traffic management concepts and technologies, as well as comparable approaches in the waterborne sector. In the road sector, two EU-funded initiatives – EuroNCAP for vehicle assessment and EuroRAP for road risk assessment – cover a wide range of safety aspects.

The third sub-theme deals with **Transport operation**. This area comprises one of the principal aspects of active safety where research aims to specify, develop and demonstrate a range of components and measures. Factors such as maintenance and life-cycle considerations also fall under this sub-theme. Prominent examples for the implementation of advanced operational schemes are the European Air Traffic Management System (EATMS), and the European Rail Traffic Management System (ERTMS).

The fourth sub-theme deals with **Transport infrastructure and vehicles**. This area has the widest scope in terms of active safety as it deals with improvements of transport infrastruc-

tures and systems for all modes of transport. Secondly, all technology improvements with regard to advanced materials and design approaches for vehicles fall under this sub-theme. The particular focus is on developing, testing and demonstrating components, measures and methods to increase active safety of transport infrastructures as well as vehicles.

The fifth sub-theme deals with **Driver, passenger and non-user safety**. In this area the focus is on the active safety provided by vehicles in order to ensure the best possible safety of drivers and passenger by minimising the impacts for these groups as well as for non-users of these means of transport.

The sixth sub-theme deals with **Qualifications and behaviour**. Key to this research area is the investigation of the human role in current and future transport systems. This includes assessing the necessary skills of staff affected by the introduction of new technologies or procedures, and the provision of tools for qualifying the people involved. A further topic in this context is the development of standards and simulators for training operators to minimise human errors in operation. A major issue for the road sector is the improvement of driver behaviour, promoting driver awareness and improving safety by effective enforcement.

The seventh sub-theme deals with **Working conditions**. The objectives in this area are two-fold: (a) the safety impacts of current working practices are being analysed, and (b) the required adaptation of methods of working in light of the introduction of new technologies, systems and advanced human/machine interfaces. Research in this area focuses on devising measures to improve the working environment in order to ensure that operators are able to cope with changes.

The eighth sub-theme deals with **Security** in transport. Triggered by the 2001 terrorist attacks in the USA, and reinforced by subsequent attacks on urban transport systems in Madrid and London, particular focus has been recently put on assessing the vulnerability of transport infrastructures and systems with a view to passive safety and the security of passengers and operators.

The previous EXTR@Web paper[4] reported on findings from a total of 46 projects originating from the Fourth and Fifth Framework Programmes as well as national research initiatives. These projects contributed to the first seven sub-themes mentioned above, while no security-related research findings were available at the time the paper was completed.

The current issue of the thematic research summary on Safety and Security draws on findings from 11 completed projects, four of which belong to the Fifth Framework Programme while seven belong to the Sixth Framework Programme.

[4] EXTR@Web project (2006)

The following table provides reference to all projects potentially contributing to the theme of Safety and Security, however, on the practical assumption that at least a Project Profile has been available allowing for the allocation of some 120 projects to the eight sub-themes.

Sub-theme	Contributing projects
Reporting and common guidance	Projects covered in this paper: B-VHF; GST Projects to include if reports become available: ADELINE; ADHER; AERONEWS; AIRNET; ASPASIA; ASSIST; EASIS; e-Scope; HASTAC; HEAVYROUTE; iFly; PEGASE; SKY-Scanner; STAR; NEWSKY Projects covered by EXTR@Web paper: DUMAS; HALTI; S-CBB; VERA2
Assessments	Projects covered in this paper: SEISS; ROSEBUD Projects to include if reports become available: AISHA; Episode 3 (EP3); ISAAC; SELCAT; SUSTAINABLE BRIDGES; TRANSPOWER Projects covered by EXTR@Web paper: ADVISORS; BOJCAS; CHAMELEON; SAFET; SAMNET; SEAM; SUNFLOWER
Transport operation	Projects covered in this paper: SPARC Projects to include if reports become available: ALERT; ASAS-TN2; ASSTAR; CREATING; EUDDPLUS; EURAMP; FLAGSHIP; FLY-SAFE; GIFT; INOUI; INTERGAUGE; MARNIS; MISS; OPTIMAL; POP&C; RESET; SAFE OFFLOAD; SAFEICE; SIMBA; SINBAD; SOFIA; SPREEX; CHINOS Projects covered by EXTR@Web paper: ESCUGIBRI; NAUPLIOS; NOPSEURA; S240B; SAMRAIL; SIMTAG; THEMES; The study of relations between telematics and road safety
Transport infrastructure and vehicles	Projects covered in this paper: RANKERS; SAFEDOR; VERRES Projects to include if reports become available: AC-DC; ADLAND; ANASTASIA; ARCHES; ARTIMA; ASICBA; AUTOCOM; AVITRACK; CAATS II; CAS; CESAR; COCOMAT; EMMA;

Sub-theme	Contributing projects
	ERTRAC; ERTRAC II; EURNEX; FAR-Wake; FIDELIO; HYSYS; IMPROVE; IN-SAFETY; INTRO; ISEREST; MARSTRUCT; MESEMA; MODURBAN; POMEROL; POSSEIDON; RE-ACT; RIPCORD; SAFE-RAIL; SAFETEL; SafetyNet; SAND.CORe; SCOUT; SENARIO; SICOM; SIRENA; SMIST; TATEM; TURN-OUTS; UFAST; URBAN TRACK; VISIONS; VULCAN; LIGHTNING; DATAFORM; SPI-CYCLES Projects covered by EXTR@Web paper: COMPOSIT; FURORE; INDICATORS; LIIKU-TUS; PODS IN SERVICE; RESPONSE 2; S205Q; The promotion of walking and cycling on village roads
Driver, passenger and non-user safety	Projects covered in this paper: FID; PREVENT Projects to include if reports become available: APROSYS; APSN; HELISAFE TA; ONBASS; PISa; SAFECRAFTS; SAFEINTERIORS; SIM Projects covered by EXTR@Web paper: 212034: Extending CabinAir; DENSE TRAF-FIC; ECBOS; GOING-SAFE; IMMORTAL; S101D; Air travel & venous thrombolism; Re-view of research on school travel; Safety of children in road traffic in connection with child safety equipment in motor vehicles
Qualifications / behaviour	Projects covered in this paper: None. Projects to include if reports become available: 2TRAIN; CAST; DRUID; TRAIN-ALL; ECOD-RIVEN Projects covered by EXTR@Web paper: ESSAI; R000238497; S214G; S224J; TRAI-NER; VIRTUAL; The long-term effects of hands free legislation on mobile phone use
Working conditions	Projects covered in this paper: AIDE Projects to include if reports become available: ATENAA; HIGHWAY; HILAS; ROTIS II; SAFE-AIRPORT; SAFEDMI; SAFETOW; SE-CURCRANE Projects covered by EXTR@Web paper: LOCOPROL; TALIS; VINTHEC II

Sub-theme	Contributing projects
Security	Projects covered in this paper: None. Projects to include if reports become available: CASAM; OPTAG; SAFEE; COUNTERACT Projects covered by EXTR@Web paper: None.

For full project title and further details on individual projects, please refer to the Annex.

4.2 Sub-theme 1: Reporting and common guidance

4.2.1 Background

Research reported in the EXTR@Web paper[5] in the field of reporting and (common) guidance covered results of projects related to the following:

- An Urban Safety Management (USM) framework for the design and assessment of urban safety initiatives;
- the issue of cross-border enforcement in the road sector has been addressed by drafting the text for a future Directive, and by devising the eNFORCE concept for an organisational network to facilitate cross-border enforcement;
- the discussion of options for conducting automatic speed enforcement through the involvement of police, municipalities and road authorities; and
- devising the functional architecture of a secured cargo black box application which allows tracking and tracing of vessels at all times.

[5] EXTR@Web project (2006)

4.2.2 Research objectives

As a contribution to the eSafety action plan, targeting a 50% reduction of road fatalities, the creation of a horizontal market for deployment of online services based on open standards has been the objective of one EU research project[6].

The development of a next generation VHF broadband channel system is intended to replace ageing legacy systems, targeting increased efficiency and reliability for future aeronautical communications needs while focusing on an initially parallel deployment concept with existing VHF systems[7].

4.2.3 Research results

Research concerning the creation of online services helping to reduce casualties in road transport[6] has:

- Identified the requirements of users, car manufacturers, control centre operators, middleware providers, terminal manufacturers, and service providers;
- defined an overall framework architecture for open telematics across the 7 subprojects, as well as specifications for the key interfaces; and
- developed a common validation plan to ensure that the site validation results can be aggregated and compared at the project level.

Findings of research focusing on the replacement of current VHF technology[7] comprise:

- Definition of B-VHF system requirements, functional scope, architecture and high-level system design;
- development of a B-VHF system operational concept, and a detailed system design;
- development of a broadband VHF channel model, and simulation framework;
- conduct of B-VHF system performance simulations, and elaboration of detailed deployment scenarios; and
- implementation and evaluation of a test-bed.

4.2.4 Policy implications

Safety in road transport as a major challenge for society has been addressed by devising safety services through exploitation of existing European, national and corporate research, with a particular view to enabling specifications and standardisation proposals.

6 GST project (2007)
7 B-VHF project (2006)

The findings of the research project on future VHF technology became valuable inputs to the future communications study jointly launched by Eurocontrol and the US Federal Aviation Administration (FAA). Further it became part of the Eurocontrol datalink policy discussions as a technology for the VHF band and L-band, respectively.

4.3 Sub-theme 2: Assessments

4.3.1 Background

Research reported in the EXTR@Web paper[8] in the field of assessments covered results of projects related to the following:

- Development of a global, though flexible and non-restrictive approach to tunnel safety incorporating both performance based and prescriptive approaches;
- development of a risk analysis method based on failure mode analyses and applied to behavioural, legal and organisational risks of a set of Advanced Driver Assistance System (ADAS) subsystems;
- the potential to improve car restraint systems, through definition of a concept of pre-crash applications, implemented in a demonstrator car;
- road safety programmes in Sweden, the United Kingdom and the Netherlands were found to have generally similar approaches but different ways of implementing policy measures for the three categories of vehicle, road and road user;
- advanced airframe technology, design guidelines for primary composite bolted joints based on analyses and tests, and basic research information on the behaviour of composite bolted joints has been compiled;
- implementation issues related to the Railway Safety Directive have been addressed by a thematic network aiming to build consensus on issues where opinions differ by organising debates and formal discussions on these issues, and by proposing common positions and identifying needs for further action; and
- research in the maritime domain has identified hazards and collected related data for three key issues: ballast water management, anti-fouling paints, and quality of fuel and emissions.

[8] EXTR@Web project (2006)

4.3.2 Research objectives

One EU project[9] aimed at providing policy makers with a sound basis for making judgements on the most effective, efficient and sustainable ways for implementing safety schemes.

An exploratory study[10] aimed to provide a survey of current approaches to assess the impact of new safety functions, and to develop a methodology for assessing the potential impacts of intelligent safety systems. The focus was on typical measures for increasing the effectiveness used to quantify safety performance including aspects such as overall accident rates, the accident fatality rate, the accident injury rate, and health care costs.

4.3.3 Research results

Research on the options for deciding on the best ways for implementing safety measures[9] has come up with the following recommendations:

- Safety effects estimated should satisfy the criteria of correct safety evaluation;
- databases on safety measures should cover implementation costs in order to allow for comprehensive assessment of options;
- a handbook should be developed comprising best practice examples on the evaluation of safety effects, and international experience gained in that area allowing for the performance of correct and systematic "ex-ante" studies;
- inclusion of typical scenarios is considered useful for testing the sensitivity of results, and should become common for the usual evaluation practice;
- for standardised cost-benefit analyses it is considered useful to elaborate on the categorisation of cases, indicating the types of impacts relative to the category of measures; and
- it is suggested to focus efficiency assessments with regard to safety impacts on projects with safety-dedicated budgets and on projects aiming at improving safety.

A research study analysing the socio-economic effects of intelligent safety systems in road vehicles[10] found that intelligent safety systems have already proven to be promising instruments with the capability of reducing the number of accidents and their severity. It comprised an overview of safety-based systems and characteristics of the market, identified key variables, and developed methods for the assessment of socio-economic impacts.

4.3.4 Policy implications

[9] ROSEBUD project (2006)
[10] SEISS project (2005)

To foster a broader basis of expertise in efficiency assessment, it has been proposed to launch an international education and training campaign, based on a harmonised syllabus and the use of multi-media tools, in order to contribute to the harmonisation of methods and procedures for structured data collection and efficiency assessment. An internet portal is seen as the logical solution to disseminate data and knowledge on implementation costs of safety schemes.

A brief policy guidance note by the Commission on the broad vision, interest, and high-level goals for urban transport is proposed that should clarify actions needed at the European level, such as monitoring, benchmarking and specification of harmonised data collection standards for certain indicators. Complementary, local, regional and national authorities are encouraged to employ methods, such as public perception surveys to address public involvement and public views with regard to urban transport policy development.

Study work helped compile a survey of current approaches to assess the impact of new safety functions, developed a methodology to assess the potential impact of intelligent safety systems in Europe, provided criteria for estimating the socio-economic benefits resulting from the application of intelligent road safety systems, and developed a framework for exploring market deployment scenarios.

4.4 Sub-theme 3: Transport operation

4.4.1 Background

Research reported in the EXTR@Web paper[11] in the field of transport operation covered results of projects related to the following:

- An in-depth maritime demonstration project has evaluated new long range surveillance services that could benefit from the implementation of the Galileo satellite services;
- a comprehensive framework of safety assessment and management for waterborne transport has been devised to facilitate adoption of good safety practice in the industry;
- a commonly agreed structure for the Safety Management System (SMS) regarding the implementation of the Rail Safety Directive has been proposed comprising a number of different elements, specifying requirements and guidance for each element;
- a rail study has looked into enhancing and sharing knowledge about electrical systems compatibility among all players in the railway community with the aim to improve safety and operational reliability;
- a research study on various intelligent transport systems has clearly confirmed positive impacts on traffic safety both in urban environments and on highway networks;
- the effect of vehicles' mean speed on the accident frequency on rural roads in the UK has been investigated which confirmed that e.g. a 10% increase in mean speed results in a 26% increase in the frequency of all injury accidents;
- passive and active driver support tools have been investigated which proved that a recording Intelligent Speed Adaptation (Recording ISA) system can be a good and cost-effective safety measure which may be taken into operation fairly quickly; and
- a web portal has been set up to help access services specialising in hazardous cargo combined with information about the exact location and status of cargo.

4.4.2 Research objectives

A research and technical development project[12] aimed at:

- development of an accident-avoiding vehicle using a Decision Control System (DCS) compensating for driver failure probability;
- describing and validating clear software / hardware interfaces for automotive redundant control systems thus combining results from other related European projects;
- extending the modular concept devised for heavy goods vehicles to full tractor-trailer combinations;
- validating the scalability of the concept by transferring it from heavy-duty trucks to small passenger cars through completion of four validation vehicles; and

[11] EXTR@Web project (2006)

- ensuring European technology leadership for x-by-wire vehicles.

4.4.3 Research results

Research on the safety design of automotive vehicles[12] successfully demonstrated the integration of several new and important control functions for higher levels of system automation, such as secure vector, co-pilot assistance, electromechanical wedge brakes, a fault-tolerant processing architecture, and intelligent energy distribution and management. A key output was the developed scalable road vehicle platform supporting the integration of x-by-wire and active safety systems.

4.4.4 Policy implications

Research has paved the way for the homologation of certain smart automotive features to be followed up by future x-by-wire research activities.

4.5 Sub-theme 4: Transport infrastructure and vehicles

4.5.1 Background

Research reported in the EXTR@Web paper[13] in the field of transport infrastructure and vehicles covered results of projects related to the following:

- a thematic network on fire safety related to the future use of composite materials in the transport sector has found possible areas of collaboration for the aerospace, automotive and rail industries;
- recognising the differences in transport policy objectives and priorities among Member States, a typology of goals and objectives has been refined, establishing relationships between the goals, objectives, and measurements of transport system performance;
- consolidating specialist knowledge on energy and fuels, powertrain technologies and complete vehicle aspects an Automotive R&D Technology Roadmap has been elaborated;
- a broad infrastructure scheme in the UK trialled a total of 24 different measures for improving road junctions;

[12] SPARC project (2007)
[13] EXTR@Web project (2006)

- following a national development plan for the main road network helped reduce the overall number of persons injured by focusing on the worst road sections where cost-effectiveness can be best achieved;
- a human factors centred Code of Practice (CoP) for speeding up market uptake of ADAS technology has been proposed that would provide guidance during the design and validation process, promote the safety benefits of new systems and eventually would contribute to reducing accident rates across Europe; and
- the recent introduction of podded propulsors on large ships prompted a full scale monitoring campaign on-board four vessels, employing three different makes of podded propulsion units.

4.5.2 Research objectives

The aspect of post-accident passenger and crew survivability on large commercial aircraft has been aimed at by an evacuation study[14], comprising evacuation exercises as well as computer simulations.

The development of scientifically sound guidelines on road infrastructure safety, enabling optimal decision-making by road authorities in their efforts to promote safer roads and eradicate dangerous road sections has been the key objective of one EU project[15]. The anticipated user group for this research were road operators who would be most interested in having available a set of practical recommendations to avoid the constitution of accident cluster zones through preventive identification mechanisms and remedial measures ranked according to cost-effectiveness criteria.

A research project[16] targeting safety enhancements through innovation to strengthen the competitiveness of the European maritime industry aimed to:

- Develop a risk-based and internationally accepted regulatory framework to facilitate first principles approaches to safety;
- develop design methods and tools to assess operational, extreme, accidental and catastrophic scenarios, accounting for the human element, and integrate these into a design environment;
- produce prototype designs for European safety-critical vessels to validate the proposed methodology and document its practicability;
- transfer systematically knowledge to the wider maritime community and add a stimulus to the development of a safety culture; and
- improve training at universities and aptitudes of maritime industry staff in new technological, methodological and regulatory developments in order to attain more acceptance of these principles.

4.5.3 Research results

Triggered by the development of the double-deck Airbus A380 aircraft, an evacuation study[14] showed that handling more passengers in emergency situations is a demanding task for cabin crew, even though proportion between crew and passengers is anticipated to be the same as for smaller aircraft. Evacuation from the upper deck of very large aircraft likely leads to passengers hesitating at emergency exits, though the exercises performed didn't provide consistent results here. In any case, the likely panic among passengers in the event of an emergency is understood to have major impact on the achievable evacuation times.

Research with a view to establishing a European culture of safe road engineering[15] came up with the following key results:

- A road safety index used for assessing and monitoring road safety addressing aspects such as human / driver behaviour, vehicle response and infrastructure;
- a catalogue of performance-based road safety recommendations ranked according to their efficiency; and
- an interactive application of the catalogue – available via the internet – extended to urban vulnerable road users.

Research in the maritime sector[16] delivered the following key findings:

- A set of new tools and significant enhancements to existing tools were developed, addressing transient flooding, structural integrity, dynamic intact stability, collision, grounding and fire;
- development of a high-level approval process for risk-based ships and related risk acceptance criteria;
- development of an approval process and risk acceptance criteria for risk-based ship systems and functions; and
- implementation and application of a new process for eight novel ship designs (i.e. two cruise ships, three ropax, one gas tanker, one oil tanker and one container vessel) from which two designs have been selected for further detailed design.

4.5.4 Policy implications

For aviation research it has been recommended to perform further trials regarding enhanced flight crew / cabin crew communication in the event of accidents or incidents, and precautionary situations. Also, the location of cabin crew onboard large passenger aircraft should be investigated in experiments with special attention being on panic mitigation and passenger flow redirection. Furthermore, passenger safety information concepts should be revisited with a view to the use of certain media, and their timing.

[14] VERRES project (2003)
[15] RANKERS project (2008)
[16] SAFEDOR project (2008)

In road infrastructure, research has proposed to fully revise existing guidelines in order to improve and harmonise future EU standards with a particular focus on new criteria for road signs and infrastructure.

In the maritime sector research has paved the way for a risk-based regulatory framework aimed at developing a high-level description of the whole approval process in case of risk-based designs for selected ship types, including all major accident scenarios.

4.6 Sub-theme 5: Driver, passenger and non-user safety

4.6.1 Background

Research reported in the EXTR@Web paper[17] in the field of driver, passenger and non-user safety covered results of projects related to the following:

- A UK study has monitored a BAe146 regional jet and a Boeing 737 narrowbody jet during real flight trials with a view to the cabin air quality of modern aircraft;
- a research study on air travel and venous thrombolism confirmed the information in previous medical literature on travellers' thrombosis and the causal mechanisms, stressing seated immobility as a key risk factor independent of the form of travel;
- optimisation of the design of a new aircraft seat featuring 3-point shoulder harness, backrest, an energy absorbing device, spreaders, seat pan, front beam, rear and front legs and fittings;
- development of a second generation Forward Looking Radar (FLR) sensor which is essential for implementing Adaptive Speed Control (ASC) systems;
- a statistical accident analysis exploiting governmental databases, studying the main injury mechanisms according to crash type derived from detailed accident reconstructions, themselves drawing on component tests and gave recommendations to amend existing regulations and directives, and suggest new regulations, respectively;
- a study on the use of drugs in car driving has confirmed that the proportion of drugged drivers has increased and that mixed consumption of alcohol and drugs has become more frequent;
- a British study with a focus on the analysis of road safety interventions for children living in rural areas compared to measures in built-up areas has shown that there were considerably fewer accidents to children in non-built up areas and that the majority of child casualties in non built-up areas were car passengers;
- another study reviewed other UK and international research on travel to school published since 1995; and

[17] EXTR@Web project (2006)

- promotion of the case of child safety equipment in cars, a study has tested child restraint systems against UN ECE Regulations No. 44 and 16.

4.6.2 Research objectives

One project[18] aimed to contribute to a further reduction of the amount of injuries and fatalities in frontal car collisions through the introduction of an improved frontal impact crash test dummy with realistic movements and injury indicating measurements for future automotive crash testing fatalities.

A further research effort[19] in the road sector aimed at:

- Developing, demonstrating, testing and evaluating preventive safety applications, using advanced sensor, communication and positioning technologies integrated into on-board systems for driver assistance;
- assisting technological development and integration as well as decreases component costs;
- contributing to the rapid market penetration by helping to overcome major barriers including risk assessment and liability issues in introducing such systems; and
- creating greater awareness of the active safety approach leading to increased user demand for preventive and active safety.

4.6.3 Research results

Research in the field of crash testing[18] using frontal impact dummies identified the principal occupant injuries in frontal impact car crashes, and new biomechanical data concerning the behaviour of the human thorax/shoulder, pelvis/femur/knee and the lower leg during frontal impacts. Based on these findings a new generation prototype frontal impact dummy, drawing on the existing THOR-Alpha design, has been built, assisted by a computer model of the THOR-Alpha crash test dummy.

Research on safety applications contributing to road safety[19] has produced the following:

- Communication technologies to improve the detection, locating and evaluation of hazards;
- new sensorial devices integrating obstacle detection and communication;

[18] FID project (2003)
[19] PREVENT project (2008)

- lane-keeping support systems for situations with poor road and environmental conditions;
- concepts for sensors and communication aimed to road markings and crossing traffic recognition;
- active 3D sensor technology for pre-crash and blind spot surveillance;
- location and classification of obstacles, such as cars, pedestrians, and bikes;
- concepts for advanced sensors & sensor data fusion;
- safety-enhanced digital maps for ADAS applications; and
- generic impact assessment for all functions.

4.6.4 Policy implications

The prototype instrumented frontal impact dummy developed is understood to be suitable for inclusion in the so-called Frontal Directive as a successor of the currently used Hybrid-III dummy.

Road safety improvements have been supported through integrated research activities undertaken by the European automotive industry in order to develop and demonstrate preventive safety applications and technologies.

4.7 Sub-theme 6: Qualifications and behaviour

4.7.1 Background

Research reported in the EXTR@Web paper[20] in the field of qualifications and behaviour covered results of projects related to the following:

- A UK study on the behaviour of 10 and 11 year old youngsters has revealed changes in travel patterns, most notably a decline in the number of trips around made unaccompanied by adults;
- training 'safe place finding', 'roadside search', 'gap timing' and 'perception of intentions' skills in a British study has proven to be very beneficial for three groups of children between 6 and 10 years of age;
- another UK study targeted the safety training for pedestrian skills of 7 to 9 year olds, devising a ‘visual timing and gap selection’ test and a ‘safe place crossing location’ test;
- development of an interactive, multimedia training tool and two modules of a driving simulator (static and semi-dynamic one), paying attention to their cost-effectiveness;
- the inclusion of virtual reality techniques in car driving simulators has been demonstrated in a three-step approach;
- an investigation into the implications of the use of hands-free mobile phones during car journeys following the recent tightening of related legislation; and
- Situational awareness and threat management in aviation have been investigated in depth starting with a literature review adopting the view that situational awareness is an activity or skill rather than the 'mental state' of humans involved.

4.7.2 Research objectives

No contributing projects yet.

4.7.3 Research results

No contributing projects yet.

[20] EXTR@Web project (2006)

4.7.4 Policy implications

No contributing projects yet.

4.8 Sub-theme 7: Working conditions

4.8.1 Background

Research reported in the EXTR@Web paper[21] in the field of working conditions covered results of projects related to the following:

- Development of a new multi-technology satellite based train location system combining fail-safe on-board track mapping and interlocking;
- advancing the whole array of information services available in the aircraft cockpit, a concept has been conceived of global, interoperable and dynamic availability of services such as traffic information service in contract mode, innovative weather service, and applications for increased pilot situational awareness; and
- understanding the implications of shared Situational Awareness in aircraft operation, a study has investigated critical Crew Resource Management skills.

4.8.2 Research objectives

Comprehensive road vehicle research[22] targeted the generation of knowledge and the development of methodologies and human-machine interface technologies required for safe and efficient integration of novel driver assistance systems. It aimed at:

- Maximising the efficiency, and hence the safety benefits, of advanced driver assistance systems;
- minimising the level of workload and distraction imposed by in-vehicle information systems and nomad devices;
- enabling the potential benefits of new in-vehicle technologies and nomad devices in terms of mobility and comfort; and
- designing, developing and validating a generic adaptive integrated driver-vehicle Interface.

4.8.3 Research results

[21] EXTR@Web project (2006)

Research in the automotive sector[22] has dealt with the issue of getting accident risk estimates that incorporate both a driver's state, e.g. his/her momentary level of workload or level of alertness, and his/her driving performance as expressed in commonly used parameters like speed and lane positioning accuracy. The output was a requirements definition for a fully integrated in-vehicle human/machine interface (AIDE HMI) including all IVIS and ADAS functionalities and their interaction with the driver.

4.8.4 Policy implications

A project consortium comprising many key players in the automotive sector has made sure all relevant findings are properly disseminated across the industry through partnerships with e.g. ERTICO, including key members of European ITS industry and national governments, and the EUCAR SGI (Systems Group Interaction) group, which focuses on coordinating the EUCAR research and development activities in the human/machine interface area.

4.9 Sub-theme 8: Security

4.9.1 Background

Security has indeed become a major topic of FP6 and FP7 addressing a couple of specific objectives mainly in the air and maritime sector, such as:

- Tightening air security, aiming at the prevention of illegal acts in the field of aviation;
- introducing tougher controls at airports, and improving training and co-ordination of the staff responsible for security;
- elaborating international standards on the reinforcement of cockpit doors for commercial aircraft;
- enhancing ship and port facility security, i.e. controls on ships prior to and on entry to a port; and
- allocating new responsibilities for maritime security to the European Maritime Safety Agency and the Committee on Safe Seas and the Prevention of Pollution from Ships.

4.9.2 Research objectives

No contributing projects yet.

[22] AIDE project (2008)

4.9.3 Research results

Projects to include if reports become available:

- CASAM – Civil aircraft security against MANPADs; FP6. Status: Project profile available.
- OPTAG – Improving airport efficiency, security and passenger flow by enhanced passenger monitoring; FP6. Status: Project profile available.
- SAFEE – Security of aircraft in the future European environment; FP6. Status: Project profile available.
- COUNTERACT – Cluster of user networks in transport and energy relating to anti-terrorist activities; Other. Status: Project profile available.

4.9.4 Policy implications

No contributing projects yet.

4.10 Implications for further research

Road infrastructure safety is a topic that has recently received more attention from research activities because the perception of a lack of knowledge in the field, and / or a lack of comprehensive data being available for basing reliable design and safety recommendations prevails. Hence it has been suggested in the course of recent research to collect more data on the performance of the same (design and safety) countermeasures in different accident situations. Also, information on infrastructure and maintenance costs of various design and safety measures would need to become more easily available. Eventually, known tools such as road safety inspections should be re-assessed in order to demonstrate the benefits they can provide to road safety improvements.

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GST project (2007) – Global system for telematics. FP6 IST.
www.gstforum.org

PREVENT project (2008) – Preventive and active safety application. FP6 IST.

RANKERS project (2008) – Ranking for European road safety. FP6 SUSTDEV-2.
www.rankers-project.com

ROSEBUD project (2006) – Road safety and environmental benefit-cost and cost-effectiveness analysis for use in decision-making. FP5 GROWTH.
partnet.vtt.fi/rosebud/

SAFEDOR project (2008) – Design, operation & regulation for safety. FP6 SUSTDEV-3.
www.safedor.org

SEISS project (2005) – Exploratory study on the potential socio-economic impact of the introduction of intelligent safety systems in road vehicles. FP5 IST.
www.vdivde-it.de/SEiSS

SPARC project (2007) – Secure propulsion using advanced redundant control. FP6 IST.
www.sparc-eu.net

Transport Advisory Group (2007c): FP7 Work Programme 2008

VERRES project (2003) – VLTA emergency requirements research evacuation study. FP5 GROWTH.
fseg.gre.ac.uk/fire/VERRES_Project.html

Annex: List of projects

Sub-theme 1: reporting and common guidance				
Project acronym	Project title	Programme	Project website	Coverage
ADELINE	Advanced air-data equipment for airlin-ers	FP6	www.adeline-aero.org	if reports become available
ADHER	Automated diagnosis for helicopter engines and rotating parts	FP6		if reports become available
AERONEWS	Health monitoring of aircraft by non-linear elastic wave spec-troscopy	FP6		if reports become available
AIRNET	Airport network for mobiles, surveillance and alerting	FP6	www.airnet-project.com	if reports become available
ASPASIA	Aeronautical surveil-lance & planning by advanced satellite-implemented applica-tions	FP6		if reports become available
ASSIST	Alpine safety, security and informational	FP6		if reports become available

Sub-theme 1: reporting and common guidance				
Project acronym	Project title	Programme	Project website	Coverage
	services and technologies			
B-VHF	Broadband VHF – Aeronautical communications system based on MC-CDMA	FP6	www.b-vhf.org	this paper
DUMAS	Developing urban management and safety	FP5		EXTR@Web paper
EASIS	Electronic architecture and system engineering for integrated safety systems	FP6	www.easis.org	if reports become available
e-SCOPE	e-safety observatory	FP6	www.escope.info	if reports become available
GST	Global system for telematics	FP6	www.gstforum.org	this paper
HALTI	Comparison between different legislative systems of automatic speed enforcement	project from Finland		EXTR@Web paper
HASTAC	High stability altimeter system for air data computers	FP6	www.sintef.no/content/page13____8848.aspx	if reports become available

Sub-theme 1: reporting and common guidance				
Project acronym	Project title	Programme	Project website	Coverage
HEAVYROUTE	Intelligent route guidance of heavy vehicles	FP6		if reports become available
iFLY	Safety, complexity, and responsibility-based design and validation of highly automated Air Traffic Management	FP6		if reports become available
NEWSKY	Networking the sky for aeronautical communications	FP6		if reports become available
PEGASE	Helicopter and aeronef navigation airborne systems	FP6	dassault.ddo.net/pegase/	if reports become available
S-CBB	Secured cargo black box	FP5		EXTR@Web paper
SKY-SCANNER	Development of an innovative LIDAR technology for new generation ATM paradigms	FP6		if reports become available
STAR	Secure ATM CDMA software defined ra-	FP6		if reports become available

Sub-theme 1: reporting and common guidance				
Project acronym	Project title	Programme	Project website	Coverage
	radio			
VERA2	Video enforcement for road authorities 2	FP5		EXTR@Web paper

Sub-theme 2: assessments				
Project acronym	Project title	Programme	Project website	Coverage
ADVISORS	Actions for advanced driver assistance and vehicle control system implementation, standardisation, optimum use of the road network and safety	FP5	www.crfproject-eu.org	EXTR@Web paper
AISHA	Aircraft integrated structural health assessment	FP6	www.aishaproject.info	if reports become available
BOJCAS	Bolted joints in composite aircraft structures	FP5		EXTR@Web paper
CHAMALEON	Pre-crash application all around the vehicle	FP5		EXTR@Web paper
Episode 3 (EP3)	Single European Sky Implementation Support through validation	FP6		if reports become available
ISAAC	Improvement of safety ac-	FP6	www.cert.fr/isaac	if reports become available

Sub-theme 2: assessments				
Project acronym	Project title	Programme	Project website	Coverage
	tivities on aeronautical safety complex systems			
ROSEBUD	Road safety and environmental benefit-cost and cost-effectiveness analysis for use in decision making	FP5	partnet.vtt.fi/rosebud/	this paper
SAFET	Safety in tunnels thematic network	FP5	www.safetunnel.net	EXTR@Web paper
SAMNET	Safety management and interoperability thematic network	FP5	samnet.inrets.fr	EXTR@Web paper
SEAM	Assessing concepts, systems and tools for a safer, efficient and environmentally aware and friendly maritime transport	FP5	seam.mettle.org	EXTR@Web paper
SEiSS	Exploratory study on the potential socio-economic impact of the introduction of intelligent safety systems in road vehicles	FP5	www.vdivde-it.de/SEiSS	this paper
SELCAT	Safer European level crossing appraisal and	FP6		if reports become available

Sub-theme 2: assessments				
Project acronym	Project title	Programme	Project website	Coverage
	technology			
SUNFLOWER	Comparative assessment of safety strategies in Sweden, Britain, and the Netherlands	FP5	sunflower.swov.nl	EXTR@Web paper
SUSTAINABLE BRIDGES	Assessment for future traffic demands and longer lives	FP6	www.sustainablebridges.net	this paper
TRANSPOWER	Supervised implementation of sustainable urban transport concepts	FP6	www.transpower-rp6.org	this paper

Sub-theme 3: transport operation				
Project acronym	Project title	Programme	Project website	Coverage
ALERT	Assessment of life-cycle effect of repairs on tankers	FP6	alert.ncl.ac.uk	if reports become available
ASAS-TN2	Airborne separation assistance system – Thematic Network II	FP6		if reports become available
ASSTAR	Advanced safe separation technologies and algorithms	FP6		if reports become available

Sub-theme 3: transport operation				
Project acronym	Project title	Programme	Project website	Coverage
CHINOS	Container handling in intermodal nodes – optimal and secure	FP6	www.martrans.org/chinos/	if reports become available
CREATING	Concepts to reduce environmental impact and attain optimal transport performance by inland navigation	FP6	www.creating.nu	if reports become available
ESCUGIBRI	ESC UserGroup and InfoBank to support rail interoperability	FP5		EXTR@Web paper
EUDDPLUS	European Driver's desk advanced concept implementation – contribution to foster interoperability	FP6		if reports become available
EURAMP	European ramp metering project	FP6	www.euramp.org	if reports become available
FLAGSHIP	European framework for safe, efficient, and environmentally friendly ship operations	FP6		if reports become available
FLYSAFE	Airborne integrated systems for safety improvement, flight hazard protec-	FP6	www.eu-flysafe.org	if reports become available

Sub-theme 3: transport operation				
Project acronym	Project title	Programme	Project website	Coverage
	tion and all weather operations			
GIFT	Gas import floating terminal	FP6		if reports become available
INOUI	Innovative operational UAV integration	FP6		if reports become available
INTERGAUGE	Interoperability, security and safety of goods movement with 1435 and 1520 (1524) mm track gauge railways: new technology in freight transport including hazardous products	FP6		if reports become available
MARNIS	Maritime navigation and information services	FP6	www.marnis.org	if reports become available
MISS	Monitor integrated safety system	FP6	www.missproject.net	if reports become available
NAUPLIOS	Navigation and perilous goods input and output system	FP5		EXTR@Web paper
NOPSEURA	Telematic speed control systems in motor vehicles	project from Finland		EXTR@Web paper

Sub-theme 3: transport operation				
Project acronym	Project title	Programme	Project website	Coverage
OPTIMAL	Optimised procedures and techniques for improvement of approach and landing	FP6		if reports become available
POP&C	Pollution prevention and control-safe transportation of hazardous goods by tankers	FP6	www.pop-c.org	if reports become available
RESET	Reduced separation minima	FP6		if reports become available
S240B	Rural speed management	project from UK		EXTR@Web paper
SAFE OFFLOAD	Safe offloading from floating LNG platforms	FP6		if reports become available
SAFEICE	Increasing the safety of icebound shipping	FP6		if reports become available
SAMRAIL	Safety management in railways	FP5	www.samnet.inrets.fr	EXTR@Web paper
SIMBA	Transforming road transport through worldwide cooperation	FP6		if reports become available
SIMTAG	Safe intermodal transport across the globe	FP5		EXTR@Web paper
SINBAD	Safety improved with a	FP6		if reports become available

Sub-theme 3: transport operation				
Project acronym	Project title	Programme	Project website	Coverage
	new concept by better awareness on airport approach domain			
SOFIA	Safe automatic flight back and landing of aircraft	FP6	www.sofia.isdefe.es	if reports become available
SPARC	Secure propulsion using advanced redundant control	FP6	www.sparc-eu.net	this paper
SPREEX	Spill response experience	FP6	www.spreex.net	if reports become available
THEMES	Thematic network on safety assessment of waterborne transport	FP5		EXTR@Web paper
	The study of relations between telematics and road safety	Project from Hungary		EXTR@Web paper

Sub-theme 4: transport infrastructure and vehicles				
Project acronym	Project title	Programme	Project website	Coverage
AC-DC	Automotive chassis development for 5-day cars	FP6	www.acdc-project.org/public/	if reports become available
ADLAND	Adaptive landing gears for improved impact ab-	FP6	smart.ippt.gov.pl/adland/adland.html	if reports become available

Sub-theme 4: transport infrastructure and vehicles				
Project acronym	Project title	Programme	Project website	Coverage
	sorption			
ANASTASIA	Airborne new and advanced satellite techniques and technologies in a system integrated approach	FP6		if reports become available
ARCHES	Assessment and rehabilitation of central European highway structures	FP6	arches.fehrl.org	if reports become available
ARTIMA	Aircraft reliability through intelligent materials application	FP6	www.aero.upm.es/artima/	if reports become available
ASICBA	Aviation safety improvement using cost benefit analysis	FP6	www.asicba.org	if reports become available
AUTOCOM	Automotive control and mechatronic research centre for actively safe, clean and efficient road vehicles – the AUTOCOM centre	FP6		if reports become available
AVITRACK	Aircraft surroundings, categorised vehicles and individuals tracking for	FP6		if reports become available

Sub-theme 4: transport infrastructure and vehicles				
Project acronym	Project title	Programme	Project website	Coverage
	apron's activity model interpretation & check			
CAATS II	Cooperative approach to Air Traffic Services	FP6	www.caats.isdefe.es	if reports become available
CAS	Cost effective inspection and structural maintenance for ship safety and environmental protection throughout its life cycle	FP6		if reports become available
CESAR	Cost effective small aircraft	FP6		if reports become available
COCOMAT	Improved material exploitation of a safe design of composite airframe structures by accurate simulation of collapse	FP6	www.cocomat.de	if reports become available
COMPOSIT	The future use of composites in transport	FP5		EXTR@Web paper
DATAFORM	Digitally adjustable tooling for manufacturing of aircraft panels using multipoint forming methodology	FP6		if reports become available

Sub-theme 4: transport infrastructure and vehicles				
Project acronym	Project title	Programme	Project website	Coverage
EMMA	European airport movement management by A-SMGCS	FP6	www.dlr.de/emma/	if reports become available
ERTRAC	European road transport 2020: a vision and strategic research agenda	FP6		if reports become available
ERTRAC II	Technology platform for European road transport research	FP6		if reports become available
EURNEX	European rail research network of excellence	FP6	www.eurnex.net	if reports become available
FAR-Wake	Fundamental research on aircraft wake phenomena	FP6	www.far-wake.org	if reports become available
FIDELIO	Fibre laser development for next generation LIDAR onboard detection system	FP6		if reports become available
FURORE	Future road vehicle research – a roadmap for the future	FP5		EXTR@Web paper
HYSYS	Fuel-cell hybrid vehicle system component development	FP6	www.hysys.de	if reports become available

Sub-theme 4: transport infrastructure and vehicles				
Project acronym	Project title	Programme	Project website	Coverage
IMPROVE	Design of improved and competitive products using an integrated decision-support system for ship production and operation	FP6		if reports become available
INDICATORS	TEN-T Performance indicators	EC DGTREN-funded project		EXTR@Web paper
IN-SAFETY	Infrastructure and safety	FP6	www.insafety-eu.org	if reports become available
INTRO	Intelligent roads	FP6	intro.fehrl.org	if reports become available
LIGHTNING	Lightning protection for structures and systems on aircraft utilising lightweight composites	FP5		if reports become available
LIIKUTUS	Cost-effectiveness of road investment projects from the road safety perspective	project from Finland		EXTR@Web paper
MARSTRUCT	Network of excellence on marine structures	FP6	www.mar.ist.utl.pt/marstruct	if reports become available
MESEMA	Magnetoelastic energy systems for even more	FP6	www.mesema.info	if reports become available

Sub-theme 4: transport infrastructure and vehicles				
Project acronym	Project title	Programme	Project website	Coverage
	electric aircraft			
MODURBAN	Modular urban guided rail system	FP6	www.modurban.org	if reports become available
PODS in SERVICE	Safety and reliability of podded propulsors under service conditions	FP5		EXTR@Web paper
POMEROL	Realizing enhanced safety and efficiency in European transport	FP6		if reports become available
POSSEIDON	Progressive oil sensor system for extended identification on-line	FP6		if reports become available
RANKERS	Ranking for European road safety	FP6	rankers.desk02hosting.be	this paper
REACT	Realizing advanced safety and efficiency in European road transport	FP6	www.react-project.org	if reports become available
RESPONSE 2	Advanced driver assistance systems: from introduction scenarios towards a code of practice for development and testing	FP5		EXTR@Web paper

Sub-theme 4: transport infrastructure and vehicles				
Project acronym	Project title	Programme	Project website	Coverage
RIPCORD-ISEREST	Road infrastructure safety protection – core research and development for road safety in Europe	FP6	www.ripcord-iserest.com	if reports become available
S205Q	Junction improvements for vulnerable road users	project from UK		EXTR@Web paper
SAFEDOR	Design, operation and regulation for safety	FP6	www.safedor.org	this paper
SAFE-RAIL	Development of an innovative ground-penetrating radar system for fast and efficient monitoring or rail track substructure conditions	FP6		if reports become available
SAFETEL	Safe electromagnetic telecommunications on vehicles	FP6	www.safetel-project.com	if reports become available
SafetyNet	The European road safety observatory	FP6	www.erso.eu	if reports become available
SAND.CORe	Coordination action on advanced sandwich structures in the transportation industry	FP6	www.sandcore.net	if reports become available

Sub-theme 4: transport infrastructure and vehicles				
Project acronym	Project title	Programme	Project website	Coverage
SCOUT	Sustainable construction of underground transport infrastructures	FP6		if reports become available
SENARIO	Advanced sensors and novel concepts for intelligent and reliable processing in bonded repairs	FP6		if reports become available
SICOM	Simulation based corrosion management for aircraft	FP6	www.easn.net/supported-projects/sicom/	if reports become available
SIRENA	External EMC simulation for radio electric systems in the close environment of the airport	FP6		if reports become available
SMIST	Structural monitoring with advanced integrated sensor technologies	FP6		if reports become available
SPiCYCLES	Sustainable planning and innovation for bicycles	Intelligent Energy Europe Initiative		if reports become available
TATEM	Technologies and techniques for new maintenance concepts	FP6	www.tatemproject.com	if reports become available

Sub-theme 4: transport infrastructure and vehicles				
Project acronym	Project title	Programme	Project website	Coverage
TURNOUTS	New concepts for turn-outs in urban rail transit infrastructures	FP6		if reports become available
UFAST	Unsteady effects of shock wave induced separation	FP6		if reports become available
URBAN TRACK	Urban rail infrastructure	FP6	www.urbantrack.eu	if reports become available
VERRES	VLTA emergency requirements research evacuation study	FP5		this paper
VISIONS	Visionary concepts for vessels and floating structures	FP6	www.maritime-visions.net	if reports become available
VULCAN	Vulnerability analysis for near future composite/hybrid air-structures: hardening via new materials and design	FP6		if reports become available
	The promotion of walking and cycling on village roads	project from Finland		EXTR@Web paper

Sub-theme 5: driver, passenger and non-user safety				
Project acronym	Project title	Programme	Project website	Coverage
APROSYS	Advanced protection systems	FP6	www.aprosys.com	if reports become available
APSN	Network of excellence on advanced passive safety	FP6	www.passivesafety.com	if reports become available
DENSE TRAFFIC	A forward looking radar sensor for adaptive cruise control with stop & go and cut in situations capabilities implemented using MMIC technologies	FP5		EXTR@Web paper
ECBOS	Enhanced coach and bus occupant safety	FP5		EXTR@Web paper
FID	Improved frontal impact protection thorugh a world frontal impact dummy	FP5		this paper
GOING SAFE	Addressing technical and human factors involved in the implementation of 3-point shoulder harnesses, on all seats, in passenger's aircraft	FP5		EXTR@Web paper
HELiSAFE TA	Helicopter occupant safety	FP6		if reports become available

Sub-theme 5: driver, passenger and non-user safety				
Project acronym	Project title	Programme	Project website	Coverage
	technology application			
IMMORTAL	Impaired motorists: methods of roadside testing and assessment for licensing	FP5	www.immortal.or.at	EXTR@Web paper
ONBASS	Onboard active safety system	FP6		if reports become available
PISa	Powered two wheeler integrated safety	FP6	www.pisa-project.eu	if reports become available
PREVENT	Preventive and active safety application	FP6	www.prevent-ip.org	this paper
S101D	Child road safety in rural areas	project from UK		EXTR@web paper
SAFECRAFTS	Safe abandoning of passenger ships – improvement of current lifesaving appliances system	FP6	www.safecrafts.org	if reports become available
SAFEINTERIORS	Train interior passive safety for Europe	FP6		if reports become available
SIM	Safety in motion	FP6	www.sim-eu.org	if reports become available
212034: Extending CabinAir	Extending cabinair measurements to include older aircraft types utilised in high volume short haul op-	project from UK		EXTR@Web paper

Sub-theme 5: driver, passenger and non-user safety				
Project acronym	Project title	Programme	Project website	Coverage
	eration			
	Air travel and venous thrombolism	project from UK		EXTR@Web paper
	Review of research on school travel	project from UK		EXTR@Web paper
	safety of children in road traffic in connection with child safety equipment in motor vehicles	project from Czech Republic		EXTR@Web paper

Sub-theme 6: qualifications/behaviour				
Project acronym	Project title	Programme	Project website	Coverage
2TRAIN	Training of train drivers in safety relevant issues with validated and integrated computer-based technologies	FP6	www.psychologie.uni-wuerzburg.de/methoden/forschung/projekte/railhumanfactors/2train.php.en	if reports become available
CAST	Campaigns and awareness-raising strategies in traffic safety	FP6		if reports become available
DRUID	Driving under the influ-	FP6	www.druid-project.eu	if reports become avail-

Sub-theme 6: qualifications/behaviour				
Project acronym	Project title	Programme	Project website	Coverage
	ence of drugs, alcohol and medicine			able
ECODRIVEN	European campaign on improving driving behaviour, energy efficiency and traffic safety	Intelligent Energy Europe Initiative		if reports become available
ESSAI	Enhanced safety through situation awareness integration in training	FP5		EXTR@Web paper
R000238497	Changing patterns of everyday mobility	project from UK		EXTR@Web paper
S214G	Computer-based child pedestrian training	project from UK		EXTR@Web paper
S224J	Effects of road engineering modifications on child pedestrian skill development	project from UK		EXTR@Web paper
TRAIN-ALL	Integrated system for driver training and assessment using interactive education tools and new training curricula for all modes of road transport	FP6		if reports become available

Sub-theme 6: qualifications/behaviour				
Project acronym	Project title	Programme	Project website	Coverage
TRAINER	System for driver training and assessment using interactive evaluation tools and reliable meth-odologies	FP5	www.trainer.iao.fraunhofer.de	EXTR@Web paper
VIRTUAL	Virtual reality systems for perceived ergonomic quality testing of driving task and design	FP5		EXTR@Web paper
	The long-term effects of hands free legislation on mobile phone use	project from Finland		EXTR@Web paper

Sub-theme 7: working conditions				
Project acronym	Project title	Programme	Project website	Coverage
AIDE	Adaptive integrated driver-vehicle interface	FP6	www.aide-eu.org	this paper
ATENAA	Advanced technologies for networking in avionic appli-cations	FP6	www.atenaa.org	if reports become available
HIGHWAY	Breakthrough intelligent maps and geographic tools for the context aware de-	FP6	www.ist-highway.org	if reports become available

Sub-theme 7: working conditions				
Project acronym	Project title	Programme	Project website	Coverage
	livery of e-safety and added-value services			
HILAS	Human integration into the life cycle of aviation systems	FP6		if reports become available
LOCOPROL	Low cost satellite based train location system for signalling and train protection for low density railway lines	FP5		EXTR@Web paper
ROTIS II	Remotely operated tanker inspection system II	FP6		if reports become available
SAFE-AIRPORT	Development of an innovative acoustic system for the improvement of cooperative Air Traffic Management	FP6	www.safe-airport.com	if reports become available
SAFEDMI	Safe driver machine interface (DMI) for ERTMS automatic train control	FP6	www.safedmi.org	if reports become available
SAFETOW	Strategic aid for escort tugs at work	FP6	www.safedmi.org	if reports become available
SECURCRANE	Design of an innovative systems of the drive and	FP6	www.securcrane.info	if reports become available

Sub-theme 7: working conditions				
Project acronym	Project title	Programme	Project website	Coverage
	control of port cranes for safe remote operation			
TALIS	Total information sharing for pilot situational awareness enhanced by intelligent systems	FP5	talis.eurocontrol.fr	EXTR@Web paper
VINTECH II	Visual interaction and human effectiveness in the cockpit, Part II	FP5		EXTR@Web paper

Sub-theme 8: security				
Project acronym	Project title	Programme	Project website	Coverage
CASAM	Civil aircraft security against MANPADs	FP6		if reports become available
COUNTERACT	Cluster of user networks in transport and energy relating to anti-terrorist activities	FP6		if reports become available
OPTAG	Improving airport efficiency, security and passenger flow by enhanced passenger monitoring	FP6		if reports become available

Sub-theme 8: security				
Project acronym	Project title	Programme	Project website	Coverage
SAFEE	Security of aircraft in the future European environment	FP6	www.safee.reading.ac.uk	if reports become available

Note. The projects listed in the Annex are those that have had the focus on the theme “safety and security”, as well as those who have addressed safety and security as secondary topics to some extent.
On the TRKC portal (www.transport-research.info) it is possible to use the “advanced search” functionality – with the option “safety and security” – and find all research projects, EU-funded and national, which have treated, to a variable extent, aspects that can be related to the theme.