

EUROPEAN RESEARCH PROJECTS AND POLICY FOR SAFE AND EFFICIENT TUNNELS

George Katalagarianakis
European Commission, DG Research, Belgium

ABSTRACT

The increase in transport needs and the general requirement for reliable mobility in Europe has resulted in review of both the infrastructure transport capacity and its safety. Several new tunnelling projects are expected to be launched and this fact poses the question of design for safety, efficiency and sustainability. In addition to these needs related to new tunnels, existing tunnels should be upgraded to respond to modern transport loads and safety requirements. The European Commission through the Framework Programmes puts considerable efforts in promoting European collaboration for research in this domain.

1. THE 5TH FRAMEWORK PROGRAMME PROJECTS

A major objective of several programmes inside this Framework programme was to support actions for competitive and sustainable growth of European industry.

In view of progress towards this general objective, the European Commission together with other actions in the legislative domain has embarked upon a major review of tunnel safety. An important means of achieving progress is innovation in technology and holistic interactive evaluations of safety levels. Seven European research projects were initiated in the period 2001-2003:

Fire In Tunnels (FIT), launched in March 2001, is a four year “Thematic Network” of 33 partners from 12 European countries, co-ordinated by BBRI (Belgium). It aims to establish and develop European networking and optimise efforts on fire safety in tunnels. The network’s ambition is to enhance the exchange of knowledge and develop a European consensus on fire safety for road, rail and metro.

FIT forms an important first stage in the European wider action with the gathering of existing information and comprises of three technical work-packages related to six consultable databases. The work packages include a state-of-the-art on design fires, guidelines on fire safe design and definition of best practices for fire response management. The six consultable databases on tunnel and fire are available on line. FIT members, and the registered corresponding members, are invited to consult - and provide input to - the databases on research projects, test sites, numerical models, equipment, fire accidents and tunnel upgrade activities.

Web site: www.etnfit.net/

Durable and Reliable Tunnel Structures (DARTS) is a three year project, also launched in March 2001, undertaken by eight European partners co-ordinated by COWI (Denmark) through six technical workpackages. DARTS aims at developing, for each individual case, operational methods and supporting tools for the choice of cost optimal tunnel type and

construction procedures regarding environmental conditions, technical qualities, safety precautions and long service life.

It is a cradle -to-grave approach, ensuring up-front decision making. The dominating innovation of DARTS is the integration of reliability based structural design, geotechnical issues, service life design, hazard design including risk assessment, environmental aspects, societal needs, sustainability, and economic aspects. DARTS is primarily concerned with new tunnels, but develops decision procedures applicable also to upgrading existing tunnels. Fire issues (12% of total effort) are directly co-ordinated with the achievements of FIT and represent a key element of the hazards considered, which to a lesser extent also includes explosions, water inundation and earthquakes.

Web site: www.dartsproject.net/

Upgrading Tunnels (UPTUN) stands for “Cost-effective, sustainable and innovative upgrading methods for fire safety in existing tunnels”. It is a four year research and development project with 41 partners from 13 different EU Member States and from three associated countries. Additional organisations are involved in an Advisory Board headed by CETU (France). UPTUN is by far the largest of the tunnel safety projects funded by the EU under the 5th Framework programme. It was initiated in September 2002 and is co-ordinated by TNO (Netherlands) and ENEA (Italy). UPTUN’s primary objectives are:

(a) to develop, validate and promote innovative, sustainable and low-cost (preventive, detecting, monitoring and mitigating) measures, where appropriate, to limit the probability and consequences of fires in existing tunnels;

(b) to develop, demonstrate and promote a holistic evaluating and upgrading procedure for existing tunnels (including decision support models and knowledge transfer), based on the innovative measures developed in objective (a) to allow owners, stakeholders, designers and emergency teams to evaluate and upgrade human and structural safety levels.

Web site: www.uptun.net/

Safety in Tunnels (SafeT), co-ordinated by TNO, started in 2003 for a duration of three years. Its objectives will include the drafting of harmonised European guidelines for tunnel safety drawing upon the knowledge accumulated and developed in the other EU funded projects but with a focus on the management and cross-border issues. The contributions of local authorities, fire brigades and other organisations will be of primary importance in this project.

Innovative systems and frameworks for enhancing of traffic safety in road tunnels (Safe Tunnel) is a three year project of nine partners initiated in September 2001 and co-ordinated by Centro Recherché FIAT (Italy). Its main objective is to contribute to the reduction of the number of accidents in road tunnels by preventive safety measures. The main focus is to achieve a dramatic decrease of the “fire accidents”. The basic ideas are to avoid the access into the tunnel to those vehicles with detected or imminent onboard anomalies and to introduce measures to achieve the control of the speed of the vehicles inside tunnel.

Web site: www.crfproject-eu.org

‘SIRTAKI’ stands for Safety Improvement in Road and rail Tunnels using Advanced information technologies and Knowledge Intensive decision support models. This three year project, initiated in September 2001, is undertaken by a consortium of 12 European partners, co-ordinated by ETRA (Spain). It aims at developing an advanced tunnel management system that specifically tackles safety issues and emergencies and is fully integrated in the overall network management. The proposed system will be evaluated in several road and rail tunnel sites. SIRTAKI plans to provide innovations in four main aspects of tunnel management and

emergencies: the prevention of conflictive situations and emergencies; supporting tunnel managers; integrated management within the transport network; improvements to sensors and surveillance. The Decision Support System (DSS) is one of the main components of SIRTAKI. Basically, the DSS provides a smart aid between, on the one hand, the crisis manager and the real time information needed to analyse the situation and, on the other, between the crisis manager and the emergency response means.

Web site: www.sirtakiproject.com/

‘Virtual Fires’ (Virtual Real Time Fire Emergency Simulator) is a three year project with eight partners from five European countries, initiated in November 2001 and co-ordinated by the Institute for Structural Analysis (Austria). The aim of the project is to develop a simulator that allows the training of fire fighters in the efficient mitigation of fires in a tunnel, using a computer generated virtual environment. This will be a low-cost and environmentally friendly alternative to real fire fighting exercises involving burning fuel in a disused tunnel. The simulator can also be used to test the fire safety of a tunnel and the influence of mitigating measures (ventilation, fire suppression etc.) on its fire safety level. End users will include tunnel operators, designers and government regulatory authorities.

Web site: <http://www.virtualfires.org>

2. THE 6TH FRAMEWORK PROGRAMME (2002 – 2006)

2.1 The policy

The key characteristic of this Framework Programme is that it becomes an instrument for the implementation of a new policy for the creation of a true European Research Area (Web site: <http://www.cordis.lu/era/home.html>) to strongly improve the co-ordination of the various regional, national and European research activities. Another important overall objective is the achievement of a sustainable society by strongly reducing the environmental impact of production and consumption patterns including energy usage. The Framework Programme should enhance the innovative capacity and the competitiveness of the European industry in a knowledge-based society. At least 15% of the funding is earmarked for the participation of Small and Medium Sized Enterprises. Special attention will be given to the integration of organizations from the 13 candidate EU countries with the European Union research community. Furthermore, there is considerable scope for international research co-operation with non-EU third countries such as with the Mediterranean countries, the NIS countries, USA, Russia, and China. (Web site of FP6: <http://fp6.cordis.lu/fp6/home.cfm>)

2.2 Funding instruments

In addition to funding instruments that already existed in the Fifth Framework Programme such as Targeted Research Projects, Coordination Activities through Thematic Networks, CRAFT projects for Small and Medium Sized Enterprises and Marie-Curie Research Training Bursaries, there are two new and priority funding instruments named “Integrated Projects” and “Networks of Excellence”.

Integrated Projects are research and technology collaborations with very high critical mass and European added value. They are carried out by enterprises, research organisations, universities and other stakeholders such as standardisation bodies or industry associations. Integrated Projects may also contain modules for demonstration, exploitation, dissemination, exchange of researchers and training. Integrated Projects could be co-funded between the EU,

private sources, national and regional funding and include the mobilisation of venture capital. The size of the research effort in Integrated Projects may be up to tens of millions Euro if needed. Integrated Projects have significant flexibility in the implementation of the overall objectives and could for instance adapt their work-programme dynamically to changing research needs and adapt the composition of the consortium. Organizations from third countries may also participate in Integrated Projects if this improves the viability of the project.

Networks of Excellence aim to achieve a strong and lasting collaboration and coordination between the activities of several (departments of) research laboratories active in a certain research field. The laboratories should establish a common work-programme and develop a joint plan for exploitation, dissemination, exchange of researchers and training. The Network of Excellence should in a sense present itself towards the outside world as a single entity. Another aspect is that a Network of Excellence should make best use of state-of-the-art data- and tele-communication.

Web site of IP's and NoE's : http://europa.eu.int/comm/research/fp6/instruments_en.html

2.3 The Main Components

The table shows the subdivision of the Sixth Framework Programme in Specific Programmes and priority thematic areas.

The Sixth Framework Programme of the European Community for Research, Technological Development and Demonstration Activities (2002 – 2006) (foreseen budgets in Million Euro)		
Focusing and Integrating Community Research		13345*
1. Life sciences, genomics and biotechnology for health	2255	
2. Information Society Technologies	3625	
3. Nanotechnologies and nanosciences, knowledge based multi-functional materials, and new production processes and devices	1300	
4. Aeronautics and space	1075	
5. Food quality and safety	685	
6. Sustainable development and global change	2120	
Sustainable energy systems		
Sustainable surface transport		
Global change and ecosystems		
7. Citizens and governance in the European knowledge based society	225	
Specific activities covering a wider field of research	1300	
Supporting policies and anticipating S&T needs		
Horizontal research activities involving SME's		
Specific measures in support of international cooperation		
Strengthening the foundations of the European Research Area		320
Support for the coordination of activities	270	
Support for the coherent development of policies	50	
Structuring the European Research Area		2605
Research and Innovation	300	
Human resources	1630	
Research Infrastructures	665	
Science / society	60	
Research and Training on Nuclear Energy (EURATOM)		1230
TOTAL (Mio Euro)		17500

*including non-nuclear activities of the Joint Research Centre: € 760 million

Table 1 Subdivision of FP6

The Specific Programme “*Focusing and Integrating Community Research*” includes research funding for the focused thematic areas. Of interest for the specific domain are the area 3 “Nanotechnologies and nano-sciences, knowledge based multifunctional materials, and new production processes and devices”, the area 6 “Sustainable development and global change” as well as area 2 Information Society technologies”.

The 6th Framework Programme offers a unique opportunity to address problems in an integrated manner creating and exploiting synergies among research objectives, stakeholders, phases of research, and funding sources. Inside an Integrated Project several components of the problems including side elements like education and training, standardisation can be planned and managed in an efficient manner.

For the specific domain of tunnelling and tunnel safety the 5th Framework Programme has created the European grouping of stakeholders in research and the clustering of its activities. This society making is now an asset to be exploited for further planning. The 6th Framework Programme should be used for twofold objectives:

- Continue the research effort in an integrated manner and coordinate research capacities
- Integrate national and private (road concession owners, railway owners) resources earmarked for research and exploit a part of new investments in infrastructure to secure sustainability of this same infrastructure through new knowledge.

2. THE FUTURE

Reflection has started for the European research after 2006. On top of the already mentioned policy for the creation of the European Research Area aiming at bringing together European and national policies of the Member States and Associated States two new elements appear.

A new idea put forward is that of Technology Platforms. These are conceived to serve as long-term strategic alliances for research, in the shape of public-private-partnerships aiming at equally long-term objectives and visions.

These platforms will be possible only through strong support by the research and the industrial community and must address breakthrough industrial initiatives and both technical and non-technical barriers.

In essence, technology platforms will be mechanisms to bring together all interested stakeholders to develop a long-term vision, create a coherent, dynamic strategy to achieve that vision and steer its implementation.

The other is the target to increase investment in research to 3% of the European Union’s GNP.

http://europa.eu.int/comm/research/era/3pct/index_en.html.

The target is to bridge the growing gap in the levels of research investment between Europe and its main trading partners, which is putting at risk long-term innovation, growth and employment potential. It is estimated that research investment should grow by an average of 8% per year shared 6% public, 9% private until 2010.

3. CONCLUSION

The European Union’s research policy provides considerable support both in terms of financial resources and in terms of collaboration among countries, stakeholders and industrial sectors. Determined and coherent action by all stakeholders is necessary to ensure that adequate knowledge is developed across the whole supply-chain and covering the whole service life of the infrastructure for responding to current and future societal needs.