

FEHRL

Strategic European Road Research Programme V (SERRP V)

2011-2016



ABOUT FEHRL

FEHRL is a registered International Association with a permanent Secretariat based in Brussels. Formed in 1989 as the **Forum of European National Highway Research Laboratories**, FEHRL is governed by the national institutes nominated by their respective countries.

It provides a coordinated structure for cooperation between more than 40 national research/technical centres and with third parties including industry, academia and others.

Through research collaboration, the objectives of FEHRL are:

- To provide scientific input to Europe and national government policy on highway engineering and road transport matters.
- To create and maintain an efficient and safe road network in Europe.
- To increase innovation in European road construction and road-using industries.
- To improve the energy efficiency of highway engineering and operations
- To protect the environment and improve quality of life.

ABSTRACT

Over its 20 years of operation, FEHRL's research activities have revolved around the development and implementation of an on-going **Strategic Road Research Programme (SERRP)**. This activity has been defined by a series of detailed plans based on research need. In the first four of these plans, research need was identified on the basis of problems defined by stakeholders, coupled with the available and projected research capacity of FEHRL institutes. The projects that were carried out in this way addressed individual problem statements but were insufficiently integrated into an overall programme or coordinated in terms of an overall synthesis of results. With each iteration of SERRP, FEHRL has taken a longer-term and more holistic view of the process. This has resulted in a more integrated approach to the conduct of the research projects arising from it, as well as a shift in the way of defining the research needs and conducting the research.

With four phases of SERRP complete, this document sets out the basis for the fifth, known as SERRP V. The challenge addressed is to develop a truly inspiring vision for how roads will be built, operated and maintained in the 21st century. The result is the **Forever Open Road** – a revolutionary concept that will bring together the best of what we have today with the best of what is to come. The Forever Open Road is adaptable, automated and climate change resilient; based upon a concept for building and maintaining roads that can be applied whether motorway, rural or urban, and regardless of region or country.

At the time of writing, the road sector and wider society is still recovering from the global financial crisis. Many national authorities are grappling with austerity measures. Therefore SERRP V also takes these pressures into account. The priorities of the national Road Directors form a basis on which to ground the research and innovation activities to be carried out. The European Commission's Roadmap to a Single European Transport Area also forms an important policy context against which to formulate the research and innovation needed. Against this background, the Forever Open Road concept has been further realised and developed into a concrete plan that will be achieved through a combination of:

- current best practice in construction and technology,
- transfer of technologies and methods from other sectors,
- use of early stage and emerging techniques and products, and
- new research into technologies and products.
- and the demonstration of all the technologies and systems developed.

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1. INTRODUCTION

Road transport is, and will remain, the dominant mode of transport for goods and people in Europe for the foreseeable future. However, considerable work is needed to achieve a situation where road transport can meet societal needs without undue negative impact. Such developments require careful consideration, and the identification of the research needs to achieve a vision for a sustainable European road network is imperative.

In FEHRL, the European organisation of national road research centres, these considerations resulted in the development of a rolling series of Strategic Road Research Programmes (SERRP). These are operated on a four/five-year timeframe with a specific research agenda formulated for each period. Each SERRP document is based on national input from the FEHRL member institutes, which was synthesised at the European level and then discussed with national Road Directors and the European road industry. The suggested implementation of this programme addresses both immediate short-term problems and future issues in the mobility of Europe's citizens over a longer-term basis.

Whereas the first three SERRP's followed an approach where research needs were primarily identified from the perspective of the individual national road directorates expressed through their national FEHRL institutes, the development of the fourth version gave a growing emphasis to the needs of industry and other partners. This balanced approach serves both societal and industrial needs on the basis that society needs a competitive and innovative industry to continue to deliver the services required.

This fifth SERRP now sets out to reinforce this approach by introducing a comprehensive and consistent systems approach for plan-driven research and implementation guided by clear objectives and active engagement with stakeholders for cooperation, collaboration and governance.

This SERRP contains six key sections; these being Chapters 2 to 7.

Chapter 2, The role of research, describes the underlying need for research, innovation and implementation and why this programme is required.

Chapter 3, Stakeholder concerns and needs, analyses the priorities of the key stakeholders with focus on the needs of the national road directors and the relationship with European policy.

Chapter 4, The vision underlying the programme, describes how FEHRL's thinking has been updated to take into account the individual specific needs within a forward looking systems approach.

Chapter 5, The Forever Open Road, details the core programme based on a concept of the next generation of roads that are adaptable, automated and climate-change resilient

Chapter 6, A consistent and holistic approach, explains how SERRP V takes into account the role of road research within a broader transport perspective and builds on and continues to provide for traditional needs

Finally **Chapter 7**, Delivering the strategy, describes the programme elements and instruments that will be needed to bring about SERRP V.

2. THE ROLE OF RESEARCH

In presenting a research programme, it is important to be clear why research is relevant. The objective is not to promote or support research for the sake of research itself. The focus is on the goal of the research. In this context, research itself plays many roles.

- In the longer term, research serves as a tool for the strategic development of the road transport sector.
- In the shorter term, it provides knowledge to raise the current level of services to road users, improve the current construction and maintenance practices or the costs of these practices, or both.
- In both of the above situations, researchers must sustain the end users' anticipation of the results of ongoing research and be prepared to follow up on these results to facilitate their implementation.
- In addition, but often overlooked, research provides the setting in which the fundamental professional knowledge about how to build, maintain and operate roads is sustained, reorganised as needed, challenged and re-evaluated.

As highlighted earlier, the challenges faced by road operators are mounting rapidly as traffic increases and funding becomes limited, while the political push for efficiency, safety and environmental sustainability intensifies. These challenges call for strategies that will require innovation in many different functions in the road transport sector. Implementation of innovation is fuelled by insights obtained through research.

Such insights are not necessarily new or even originally aimed at the applications for which they become utilised. Research results are often “on the shelf” for quite some time before the situation arises in which they are eventually mobilised and adapted for use. As a result, the research community has an important role as guardians of a large body of knowledge, which at any time is waiting to be revisited and brought into play. This is an important responsibility of the FEHRL institutes both individually and collectively. It requires researchers to be constantly attentive to opportunities for innovation where already existing knowledge can be used.

SERRP reflects the initial outcome of the traditional programme definition phase, in which problem owners realise that solutions they are seeking will require research, and the needs for research on specific but still rather broad fields are recognised and recorded.

While the research processes are underway, the researchers involved need to be effective communicators to the potential end users. This is important not only to be able to adjust the research plans to accommodate changing user needs, but also to prepare the user for implementation of the expected results as they were envisaged when the need was identified and the research was planned.

The final role of research, even after the results have been delivered, is to generate discussion and provide guidance and advice on how to implement and benefit from innovation. Experience has shown that continuous encouragement and dialogue is required between different parties, public and private sector, to overcome the hesitation of end-users when facing the inevitable risks of implementing innovation. This final step is the difference between research results filling archive shelves and contributing tangible benefits for society.

3. STAKEHOLDER CONCERNS AND NEEDS

As was the case with each of the previous strategic plans, SERRP V focuses on the needs of FEHRL's major stakeholders. These are primarily those of the National Road Authorities (NRAs) and the European Union (EU) where it is concerned with the policy context in which road operations are carried out. Regional and urban road owners needs are also important stakeholders. In general terms, they face many of the same challenges as those of the NRAs and those generic needs are addressed below whilst the specific needs are considered more fully in Section 6. FEHRL's objectives are focused on those public authorities responsible for roads, however it is recognised that a close partnership with the private sector is necessary to be able to deliver the needed solutions. Therefore the role of industry partners in helping to shape the programme is important. Industry plays an important part in the EU priorities outlined below and SERRP V recognises that their direct role in shaping the programme is vital.

The following sections present an analysis of the environment within which FEHRL's research strategy functions, in particular the strategic objectives from the NRAs (section 3.1) and the EU (section 3.2). In the conclusion (section 3.3), the key components are identified which form the basis for the updated FEHRL vision for 2025 in Chapter 4.

3.1 Conference of European Directors of Roads (CEDR)

In the early years of FEHRL, the understanding of national road authority needs was accomplished through the relationship between each FEHRL member and their respective Road Director. Whilst that input still plays an important role, the ongoing development of the **Conference of European Directors of Roads (CEDR)** provides FEHRL with a well-coordinated overview of needs at a European level. This is then supplemented with individual national interests, especially from those FEHRL members from countries not represented in CEDR.

In 2005, SERRP IV focused heavily on the CEDR strategic plan for the period 2005-2009. In turn, SERRP V focuses on the challenges identified by CEDR in their current Strategic Plan, in which the European Directors of Roads concluded that despite smaller budget allocations, several major challenges for transport have to be overcome to satisfy the mobility needs of European society (see box).

CEDR Strategic Plan; major challenges

- to lower the impact of mobility on the environment, make transport "cleaner" and "greener", reduce energy consumption, improve energy efficiency and enhance security of energy supply by decreasing dependency on fossil fuels,
- to optimise the use of existing infrastructure, make transport more efficient, improve mobility in urban and inter-urban transport, increase infrastructure throughput and reduce congestion,
- to improve traffic and transport safety and security
- to adjust the design and construction methods to climate change and future trends of heavy vehicles
- to determine and apply the correct price for road transport considering the external costs induced by road traffic.

In addressing these challenges, the activities of CEDR are arranged in 17 specific tasks around the three thematic domains (TD) in line with the life-cycle of the road network, namely Management, Construction and Operation of the network (see table).

CEDR TD, Key questions	Tasks
<p>Management</p> <ul style="list-style-type: none"> • How can the infrastructure be best operated and maintained, despite its consistent aging over the years and within ever-tightening budget constraints without jeopardising the wellbeing of society and its economy? • How best to adapt the transport sector and thus to structure the roads sector within the trend of inevitable scarcity of petroleum resources and the corresponding rise in energy prices? • How can research provide scientific insights, methodological instruments and practice-related measures? 	<p>1: <i>Costs for maintenance and operation</i> 2: <i>Networks-Data-Performance Indicators</i> 3: <i>Long term investments in road infrastructure</i> 4: <i>Research</i></p>
<p>Construction</p> <ul style="list-style-type: none"> • How can CEDR contribute to the efforts deployed by standardisation bodies to establish and update modern standards in line with the objectives of the NRAs and how to facilitate the individual use of new standards? • How can CEDR monitor the European lawmaking and take appropriate action on EU directives? • How can CEDR develop and share knowledge on a sustainable infrastructure? • How can the existing road safety tools be implemented on a large scale throughout Europe? • How best to address the vehicle/road/driver interactions? 	<p>5: <i>Monitor and support the efforts for standards</i> 6: <i>Monitor the efforts for European directives</i> 7: <i>Wildlife and traffic</i> 8: <i>Road noise</i> 9: <i>Monitor/support EU activities on Road Safety</i> 10: <i>Forgiving and self explaining roads</i></p>
<p>Operation</p> <ul style="list-style-type: none"> • How can the demand for transportation be accommodated or altered despite its consistent growth over the years within an expanding global economy, whilst preserving the planet's equilibrium? • How best to promote modern and efficient means of communicating with the public, so as to ensure transparency in decision-making and the promotion of road infrastructure projects? • How best to fight congestion while being confronted with increasing urban and interurban traffic and being aware that greater road capacity does not always represent the best response to rising mobility demands, especially at a time when public-sector financing is becoming increasingly scarce? 	<p>11: <i>Comparison of Congestion Policies of NRAs</i> 12: <i>Traffic Management to reduce congestion</i> 13: <i>Incident & Emergency Management</i> 14: <i>NRA's roles in ITS, Easyway, eSafety</i> 15: <i>Customer orientation of NRAs (ERUS)</i> 16: <i>Adapting to climate change</i> 17: <i>Mitigating climate change</i></p>

3.2 European Commission (EC)

The second set of major strategic objectives that form the basis for this SERRP V are those elaborated by the EC in their transport policy documents and in particular their recent White Paper¹ on Transport. The White Paper sets strategic research and innovation focus to achieve sustainable and globally competitive single transport area in the EU. Although it is concerned with all modes of transport, the White Paper acknowledges that road transport and the respective infrastructure constitutes the key element now and in the foreseeable future. Hence a significant number of policy issues in the White Paper are related to sustainable road operations in the economic, societal and environmental sense.

¹ COM(2011) 144 final: 'Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system'

Amongst the specific policy issues raised by the White Paper that FEHRL recognises are:

Economy: Europe's economy needs seamless flowing transport to keep its world leadership on many industrial and services domains. Following on the principle that *"Curbing mobility is not an option"*, the way forward is to optimise the transport flows over the available modes and to implement innovative solutions to decongest the infrastructures and improve accessibility as well as bring together the infrastructure quality in the eastern and western part of Europe.

- **Corridors.** The White Paper focuses on developing the economic lifelines first: *"The EU needs specially developed freight corridors optimised in terms of energy use and emissions, minimising environmental impacts, but also attractive for their reliability, limited congestion and low operating and administrative costs."*
- **Decarbonisation.** This theme is related to the ambitious goals on Green House Gas (GHG) emissions from transport. The White Paper in particular marks the challenges on energy-efficiency, electro-mobility, supply structures for alternative fuels and construction materials.
- **International Connectivity.** Next to developing efficient transport infrastructures within the European realm itself, the White Paper aims to extend EU's *"transport and infrastructure policy to our immediate neighbours, to deliver improved infrastructure connections and closer market integration."*
- **Climate Resilience.** Climate change effects are acknowledged as impairing efficient transport and therefore impairing Europe's competitiveness: *"Moreover, new projects and infrastructure upgrades will need to be made resilient to foreseen negative impact of climate change such as rising sea level and more extreme weather including floods, droughts and more frequent storms."*
- **Cost and Funding.** Moving to an advanced and efficient transport infrastructure will cost considerably more than can be funded by public bodies alone. Therefore, *"Diversified sources of finance both from public and private sources are required"*. This includes the paradigm that *"Transport users pay for the full costs of transport in exchange for less congestion, more information, better service and more safety."*

Societal: The societal challenges that Europe is facing are distinct from emerging markets. Ageing, high-quality employment and diversification over the social strata are key factors to consider in research and innovation.

- **Safety and Security.** The objective is to ensure that *"the EU is a world leader in safety and security of transport in all modes of transport."* This ambition is accompanied by clear targets for 2020 (*"halving road casualties"*) and 2050 (*"close to zero fatalities in road transport"*). The White Paper stresses the vulnerable road users and indicates that safer infrastructure is needed complementary to vehicle technologies.
- **Informed User.** The future user will be on line continuously requesting reliable and accurate information to help plan his actions and travel routes. This offers an excellent window of opportunity to influence the user's expectations and behaviour towards more sustainable patterns. Complementary to this is the user's right to be informed, for which the White Paper envisages a staged approach by first targeting common principles before considering adopting *"a single EU framework Regulation covering passenger rights for all modes of transports (EU Codex)."*
- **User and Stakeholder Needs.** Transport serves the user; therefore the user needs are at the centre of the policy issues of the White Paper. However, the user's expectation and

behaviour are not static, but change in an ever increasing pace. Therefore not only the user needs themselves need to be understood thoroughly, but also the dynamics behind them.

Environmental: The EU aims at the effective preservation of the environment either on the local scale or on the global scale. Several policy issues are related to mitigating fragmentation on natural habitat, awareness and behaviour and reducing GHGs.

- **Natural Habitat Conservation.** The EU emphasises the planning and construction of infrastructure *“in a way to minimise land fragmentation and interference with environmentally sensitive areas, for example by including eco-ducts or eco-bridges, multifunctional zones and ‘green’ urban elements.”*
- **Sustainable materials.** *The greening of infrastructure is an important parameter to consider in the maintenance and development of infrastructure. Attention should also be paid to construction materials, which can enhance durability, reduce maintenance requirements, and improve safety and CO2 performance.*

3.3 Conclusion

The strategic objectives of CEDR’s Strategic Plan and the EC’s White Paper largely coincide on the issues they address, although there is a noticeable difference in their orientation on value disciplines. Both put the user/society at the centre. But, where the CEDR strategic plan puts its accent on operational excellence (highest efficiency in service providing through standardisation and optimisation), the EC focuses on product leadership (best possible service through focused innovation) to be world leader.

Further analysis of the CEDR and EC strategies lead to the following key issues that can be attributed to road operations:

- **Energy-efficiency.** Through intelligent traffic management and advanced material properties (rolling resistance), road operations can contribute considerably to the required increase of energy-efficiency of the (road) transport system.
- **Safety and Security.** Next to intelligent traffic management and proper maintenance, the design of roads has a major influence on the casualties in road transport.
- **Reliability and Availability.** The disturbance/disruption of the traffic flow due to failures, incidents and climate effects can be largely overcome by innovative measures on the durability of materials and components, the speed and planning of maintenance and repair activities and the adaptation to extreme weather events.
- **Liveability impacts.** The liveability features of road operations need to be improved considerably. In particular through better planning, design and construction as well as through intelligent traffic/demand management.
- **Cost and Financing.** In developing and maintaining infrastructure, the financial perspective will always be important. New financial instruments will be developed and the whole-life models on which they are based will need to be reviewed.

Both the EC’s objectives and those of CEDR take into account the requirement for innovation. These issues are addressed in the review of FEHRL’s vision for 2025 elaborated in Chapter 4 as well as detailing the forward priorities for SERRP V.

4. THE VISION UNDERLYING THE PROGRAMME

The CEDR strategy is based on the identified needs for NRAs. These include a mixture of immediate and future needs. FEHRL has supplemented this and the EC policy objectives by revisiting the comprehensive vision that it established in 2005 for the roads of the future. At the time, FEHRL adopted a twin-track approach by:

- defining a vision for the roads in the future relating to the core part of FEHRL's activities, which considers inputs from key stakeholders
- contributing to the development of complementary visions together with other stakeholders, especially from industry. These included ERTRAC - the European Road Transport Research Advisory Council – and ECTP – the European Construction Technology Platform - in the definition of their respective vision of an improved European transport system.

The two approaches complemented each other and, in turn, inspired the definition of specific visions developed in the framework of individual FEHRL projects. This continues to foster linkages among projects and ensure greater consistency to FEHRL activities.

The FEHRL vision for Europe's road transport in 2025 was based on future European road needs, considering the national and regional differences, and taking into account external factors such as European enlargement, the importance of addressing road user needs including those of an ageing population, the need to adapt to climate change, safety and security of the road network, globalisation issues.

The FEHRL vision included the emphasis given to the actual needs of users and their interaction with the systems. All administrations and their interests are focusing far more strongly on what the user wants and how the user reacts to what he or she gets. A vision should include not only the road networks themselves and the vehicles that run on them, but also, importantly, the users of the system, the owners, operators and suppliers of the road systems, and others affected by them - people who live near the roads for example.

In developing a vision, the objective for FEHRL is to assist organisations involved in using, operating and maintaining the road network to plan for their longer term needs. In the shorter term, the vision helps identify the research needs over the next five years.

The FEHRL vision was structured to move from a statement of the current position, and future trends to consider possible scenarios. From them, common themes have been drawn out and differences between scenarios sketched. From the scenarios, would-be decision areas have emerged - subject areas and time windows during which decisions made by national governments will influence which paths are subsequently taken and which futures are likely to result. Finally, the objective was to draw out the consequences of these arguments and formulate what is the most likely picture of the roads in 2025.

The FEHRL Vision consists of **a number of key ingredients or elements**.

Firstly, **infrastructure features** are to be considered. They comprise not only roads, interchanges, and the physical structures that support them. By 2025, other major components

will also play a crucial role such as communications, IT, the control of information systems and the **financial methods and systems** for raising the investment for construction, operation and maintenance. Finally connections between these three pillars of the infrastructure should be put in place.

Taking Europe as a whole, the main ingredients of its 2025 road system are likely to be the **major links and corridors** needed for transport within Europe and beyond. These corridors, whilst largely road-based, would increasingly in the period to 2025 become integrated multi-modally for passenger transport, and provide logistical connections for freight, including routine, scheduling and real-time decisions in both freight and passenger movement. This element of the Vision has been realised through the White Paper.

The other key element is related to the **land use planning and development**. Land use distributions in member states across Europe have generally been built up on the basis of a growing and heavy car dependency, particularly for the western European countries. Although vehicles are not currently part of the physical infrastructure, they are likely to change substantially and they will become part of it by 2025. **Vehicles** will be very thoroughly linked by telematics to the infrastructure; and this will give influence and control over driving patterns.

In the years to 2025, patterns may change substantially, and the traditional approach to **finance** of government funding from general taxation will be reviewed. This might move more closely to an operation based on pay-at-the-point-of-use. The second area for finance is from the private sector. There are many models, most of them in some sort of hybrid with government that can be considerably developed.

From a broad perspective, a far-reaching and yet realistic vision is required for a number of reasons. Policies that just stumble forward from one short-term decision to the next simply will not allow the EU and nation countries to get the enormous potential that is being offered by developments in transport and associated activities. In these circumstances, evidence-based decision-making within a clearer overall picture of where to go and be over the years to 2025 is vital. It will enable the enormous technical potential being offered by new computing and communications systems to be maximised and the growing importance of the road and, in general, transport user to be much more fully recognised. It will enable sustainable and cost-efficient solutions, sometimes quite novel ones, to be developed.

Overall, the view of FEHRL is that the development of the vision is also a prerequisite for the development of the organisation. Firstly, there is a need for FEHRL to operate on sound business practices and define more forward-looking plans of what type of business to do in the years to 2025. Secondly, in order to develop researchers and other key staff, it is vital to share common goals and aspirations. Organisations that are able to present in clear terms their sense of purpose and view of the future are those with the most motivated people and the most attractive for potential recruits. Finally, the road network is founded mainly on infrastructure that is intended to last for many decades. As a result, future implications for, in some cases, one hundred or more years, should be considered and evaluated carefully.

From the elements of this Vision and the reflections on stakeholder policy objectives and needs, has emerged the basis of FEHRL's thoughts on the next generation of roads that will be needed.

5. THE FOREVER OPEN ROAD

Following the analysis of its external environment in the previous section, FEHRL has initiated the Forever Open Road (FOR) programme to enable the next generation of roads that is capable of meeting with society's future demands and expectations on the reliability, availability, maintainability, safety, environment, health and cost of road operations. The concept of FOR has been developed with the acknowledgement that our road transport network can no longer meet society's demands and expectations. Indeed, under the pressure of rapidly-developing societal challenges and fiscal constraints, it has already become difficult, if not impossible, for road operators to ensure the 24/7 operation for 365 days of the year. In the 21st century, society expects better and needs better.

The FOR programme will enable a new concept for intelligent roads that can be adopted both for maintaining the existing network and building new roads. The concept is an intelligent road that will enable future road operators to adopt emerging innovations, such as electric vehicles and automated driving, whilst overcoming the increasing constraints on capacity, transfer, reliability and integration.

To ensure constant availability, FOR will involve a new system of travel by road; whereby the vehicle, its driver and the road operator are integrated through a common communications and power system; where the operator automatically provides inbuilt vehicle guidance, as well as travel information and performance measurement. Power systems will match the needs of emerging electronic vehicles, as well as harvest solar energy to service highway systems requirements. The road will be built from sustainable material, will cope with excess water and temperature change, and will be able to clean and repair itself. It will also be built to adapt to future maintenance needs, changing capacity demand and evolving vehicle concepts.

5.1 Societal Benefits

The FOR concept is conceived in line with the ambitions set out by the NRAs and the EU to enable their road operations to provide the world's highest levels of reliability, availability, maintainability, safety, security, health, liveability at the lowest cost. This is to be achieved in the recognition that the effective utilisation of the available road network should increase by at least 50% to accommodate the expected growth in traffic between 2010 and 2050, whilst decongesting our roads and reducing fatalities and severe injuries towards zero in the long term. In addition, the resulting road operations should comply with the policies set on noise, air quality and natural habitat and

Selected key figures on transport

- Europe has more than 45 million km of paved roads.
- The cost of infrastructure in the EU alone that would be required to match the demand for transport would be over €1.5 trillion for 2010-2030.
- For the completion of the TEN-T network by 2020 €550 billion is needed, out of which €215 billion is for the removal of the main bottlenecks.
- In 2006-2009 the EU invested €859 billion in its transport infrastructure.
- The cost of one km of motorway varies between €7.1 and €26.8 million.

Societal cost of Road Transport in 2050 (adapted; BAU)

- Congestion costs Europe are about 1% of GDP every year and are projected to increase, to nearly €200 billion annually (+50%).
- Noise related external costs are projected to increase by €20 billion (+40%).
- Accident related external costs are projected to increase to €60 billion (+35%).
- Air pollution related external costs would decrease by 60%.

also seek decarbonisation by aiding the energy-efficiency of the freight and passenger transport process as well as reducing its net energy consumption during operation as well as those used in construction and maintenance.

This vision is translated in ambitious guiding objectives concerning Decarbonisation, Reliability, Safety, Liveability and Cost. Table 1 below shows the objectives that will be set for the next generation of roads to meet, once the FOR concept is fully implemented on the European road network.

Table 1: Leading Indicators and Guiding Objectives

The guiding objectives are attributable to road operations only and are consistent with those recently-stated by the ERTRAC platform² and the e-Safety forum³. Research and innovation on the other road transport system components (vehicles, services and energy and resources) may yield additional societal benefits.

Societal Challenge	Indicator	Guiding Objective
Decarbonisation	Energy-efficiency of passenger and freight transport (pkm/kWh resp. tkm/kWh)	+10-20%*
	Energy consumed by road operations	Net zero
	Energy enclosed in materials	-25%*
Reliability	Failure frequency and duration	-35%*
	Time lost to maintenance, repair, reconstruction, and incidents	-50%*
Safety & Security	Fatalities and severe injuries	-35%*
	Cargo lost to theft and damage	-40%*
Liveability	Air quality, Noise, Natural Habitat	Policy compliance
Cost	Total Cost of Ownership	-30% *

*= vs. 2010 best practices baseline

Taken together, the indicators and their respective guiding objectives represent a considerable improvement in the road operations services to the user of the road network, which may be reflected in an improved appreciation. User appreciation will be an important factor in the cost-benefit evaluations that lead to a decision on the actual implementation of the individual solutions in the toolbox.

5.2 Roadmaps towards implementation

Full-scale deployment of the FOR concept is envisaged for 2025, and a roadmap has been developed that will set out the tasks to make it reality. The required technology will be developed and demonstrated in three distinctive stages. The transition between the stages is marked by concrete milestones (see figure 1).

The first stage is concerned with proving single technologies, such as sensors or prefabricated components. In this stage, all preparations and preliminary actions will also take place that are essential for the successful field tests results in the two later stages. They are concerned with actions such as agreeing on the routes/corridors to serve as test beds on which the field tests will be focused, aligning the current and future programmes from road authorities, industry and services as well as the collation and harmonisation of data, models, methods and regulation.

² ERTRAC Strategic Research Agenda 2010; Towards a 50% more efficient road transport system in 2030

³ E-Safety Forum Plenary meeting of April 2011; results from experts consultation as agreed upon by the Plenary.

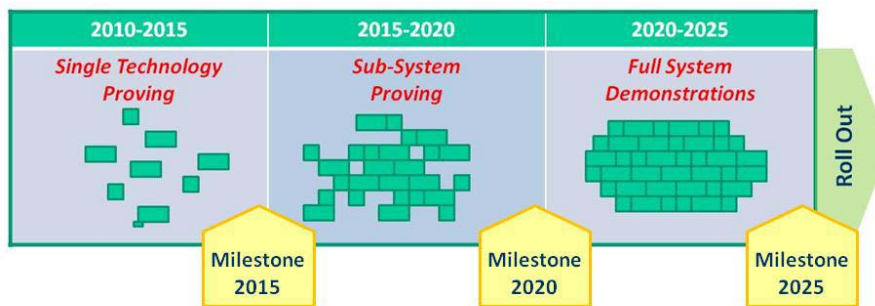


Figure 1: FOR follows a staged integration of viable single technologies into full-scale systems proving

Once a variety of single technologies is tested and all preliminary actions and preparations are done, **the second stage** is entered in which the successful single technologies are integrated to be proven in sub-systems. This stage

is planned to commence as from 2015. As a general principle, the scale of the respective field test will also increase to correspond with the increase in complexity the sub-system will have to address (e.g. city rings).

Once the integrated technologies are proven to be viable on a sub-system, **the third stage** of field test is entered. In this stage, the technologies are integrated to the full-scale systems level. This stage is planned to commence as from 2020. Again as a general principle, the scale of the field test increases to involve the entire pilot corridors/routes.

By 2025, it is expected that the full-scale systems field tests will have yielded first conclusive results, yielding three corridors/routes that are significant to the European economy and that are effectively upgraded in line with the FOR-concept. By then, a fully-developed toolbox is available to road operators that holds many proven viable solutions on all integration levels, and which are provided with corresponding common standards, guidelines and specifications.

Table 2 presents the highlights in enabled technologies for the three consecutive milestones (2015, 2020 and 2025). In the description of the milestones, the scale of the field tests is distinguished between tests on local, sections, regional or national scale and test on the scale of the entire corridor/route.

Table 2: Milestones towards enabling the Forever Open Road

2015 <i>Single Technologies Proven</i>	2020 <i>Sub-Systems Proven</i>	2025 <i>Full-Scale Systems Proven</i>
Programme level		
<ul style="list-style-type: none"> • 3 Pilot Corridors Agreed & Assessed • Stakeholders engaged • Corresponding Programmes Aligned • Best Practices Disseminated 	<ul style="list-style-type: none"> • Full-Scale System Proving Agreed • Impacts Ex-Ante Assessed • Best Practices Disseminated • Common Regulatory Framework proposed 	<ul style="list-style-type: none"> • Full-Scale system Proving performed (3 Pilot Corridors are 'FOR' grade) • Impacts Ex-Post Assessed • Roll-Out Plans Agreed • Common Regulatory Framework agreed • Best practices disseminated
Technology Level		
<p><u><i>On local ↔ national level:</i></u></p> <ul style="list-style-type: none"> • Open Standard Interfaces (national) • Climate Adaptation (Snow & Icing Removal (regional)) • Durable pavement concepts (Long Lasting Overlays (regional) Improved Reservoir Pavements (local)) • Rapid & Automated Inspection & Survey Methods (local) • Asset Management (national SLA, Road Network planning & Asset Observatory) <p><u><i>For 3 pilot corridors:</i></u></p> <ul style="list-style-type: none"> • User Expectations Identified • Climate Effects Assessed (Vulnerability Maps Available, Adaptation Technologies validated, business models available, full-scale deployment plans coordinated with relevant stakeholders, first start of deployment) • Cooperative Systems (communication technology available, standards set, impact assessment & CBE done; large-scale FOTs ongoing/partly completed) • Harmonized Tools (Cost-Benefit Evaluation Method /LCC calculation tools) 	<p><u><i>On local ↔ national level:</i></u></p> <ul style="list-style-type: none"> • Prefabrication Methods & Modular Design (local) • Rapid & Automated Inspection & Survey Methods (In-Built & Wireless Sensors (local)) • Climate adaptation (Drainage Systems and flood resilience (regional), Freeze-Thaw Damage Abatement (regional, Dedicated Weather Proofing Systems (local)) • Rapid & Automated/Robotized Maintenance (local) • Durable pavement concepts (Rejuvenation Methods (sections)) • Rapid & Automated Inspection & Survey Methods (national) • Advanced Traffic Management (Dynamic, Weather Extremities and Maintenance (regional), Incident Management Systems (national), Remote Operation Concepts (national)) • Cooperative Roads (Automated operation enabled, Probe vehicle technologies available, decentralized Traffic Management) • Asset Management (Multi-Modal SLA; national/regional sections, Risk/Performance Management) <p><u><i>For 3 pilot corridors:</i></u></p> <ul style="list-style-type: none"> • Open Standard Interfaces • Localized Weather Forecasting • Harmonized Tools (Technology and Process Standards, Area-oriented Approach) 	<p><u><i>On local ↔ national level:</i></u></p> <ul style="list-style-type: none"> • Prefabrication Methods & Modular Design (regional) • Rapid & Automated Inspection & Survey Methods (In-Built & Wireless Sensors (sections)) • Calculated Redundancy (national) • Self-Explaining & Forgiving Infrastructure (sections) • Low Carbon Concepts (local) • Rapid & Automated/Robotized Maintenance (sections) • Automated Transport (first FOT) <p><u><i>For 3 pilot corridors:</i></u></p> <ul style="list-style-type: none"> • Rapid & Automated Inspection & Survey Methods (Robotized Construction, Inspection, Automated Asset Condition Monitoring) • Durable pavement concepts (Integrated Manufacturing Process Control, harmonized Durability of Pavements & Expansion Joint, Self Repairing Abilities) • Remote Operation Concepts • Climate adaptation (Geo-Technical Stability & Early Warning Systems) • Advanced Traffic Management (Dynamic, adapted for Weather Extremities and Maintenance, reliable Forecasting abilities) • Cooperative Corridors • Asset Management (Fully optimised for three corridors on basis of a common set of performance indicators, Road Asset Observatory/ BIM, Reliable Operations Forecasting) • Harmonised tools ((Risk-driven) Decision Supporting Models)

It should be noted that the milestone planning applies in general to the technology that is either already available but holds considerable untapped potential, or that is near market and can easily be adapted to road operations testing. In practice, it will be seen that for emerging technologies it will take longer to reach the stage of field test. Therefore, the milestone description shows that at the indicated dates (2015, 2020 and 2025) some of the technologies are still in the process of being field tested in a 'single' mode (i.e. not yet integrated). As a consequence, the toolbox is expected to evolve even after 2025 with new proven solutions added.

5.3 Delivery strategy

The vision behind the FOR programme is that many of the required solutions exist already from previous research, but are not (yet) implemented to their full potential. Investigation on the untapped potential and the eventual barriers to their implementation will undoubtedly offer quick wins to the road operators.

Therefore, the FOR delivery strategy is aimed at delivering early results from bringing together existing knowledge and best practices and systematically building that up in the following years. Following the schematic representation in Figure 2, the realisation of the FOR concept will be achieved through a combination of:

- Current best practice in construction and technology,
- Transfer of technologies and methods from other sectors,
- Use of early stage and emerging techniques and products, and
- New (grass roots) research into technologies and products.

The programme actions are set out to provide the stakeholders, already over the next two years, with a significant portfolio of demonstrated solutions. In the years following on from then, the results from current field test projects will be added to this solutions base making it more comprehensive and versatile. This action will continue over the entire programme period.

At the same time, starting in 2011, systematic analysis will focus on identifying the remaining technology gaps to be followed on by new research. The first focus for this new research will be to investigate if the adoption of near-market technologies offers the opportunity to short track the development cycle by avoiding the basic research stage with the promise of early field tests. Only when this investigation offers no opportunities will new research be initiated from a grass roots level with the premise that field tests be scheduled on a significantly longer term basis. As these technologies require considerable research to bring them to results, the first scan will start in 2011.

During the entire term, all demonstrated results will be actively disseminated to the relevant stakeholders. This will be done through a variety of instruments ranging from the public availability of a well-managed database through to publications, interactive seminars and workshops.



The FOR toolbox will cover the entire range of proven solutions: from single technologies to integrated solutions on the full-system level. It will concern physical technology as well as data, models, and methods.

5.4 The FOR Systems' Approach

To focus and prioritise its research and innovation efforts in line with the guiding objectives set out, the FOR programme follows a comprehensive and consistent systems approach (see also figure 3). This approach gives focus to the key elements of the FOR concept (ADAPTABLE, AUTOMATED, RESILIENT). The enabling research and innovation is categorised in nine themes that cover the entire system of road operations.

Key elements of the FOR concept. The next generation of roads is marked by high levels of adaptability, automation and resiliency to climate effects. Hence the following elements are defined:

- **The adaptable road:** The adaptable road focuses on ways to allow the road operator to respond in a flexible manner to changes in the road users' demands and constraints as they are defined in the service level agreements with the road owner. Within this element, innovation themes will address quick and cost-effective road design, construction and (year-round) maintenance as well as minimising the local and global environmental impact of road operations and management. As such, it holds innovation topics, such as modular design and prefabrication concepts; self repairing abilities; rejuvenation methods and robotised construction, inspection and maintenance. The adaptable element will accommodate the automated and climate change resilient elements.

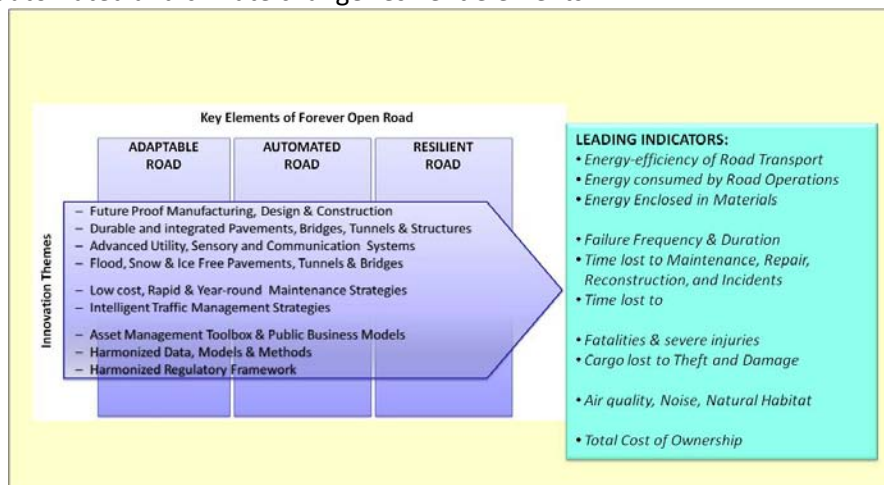


Figure 3: The FOR programme follows a comprehensive and consistent systems approach

- **The automated road:** The automated road focuses on the full integration of roadside intelligence with Information and Communication Technologies (ICT) applications on the user, and in the vehicle, the services and the road operations and management itself. Within this element, innovation themes will address intelligent systems and strategies to maximise the utilisation of available infrastructure and monitor asset condition. As such it holds innovation topics such as cooperative systems; built-in and wireless sensors advanced utility and sensory and communication systems for intelligent traffic and incident management.

- **The climate change resilient road:** The climate change resilient road focuses on ensuring adequate service levels of the road network under extreme weather conditions. Within this element, innovation themes will address adaptation of road operations and management to the effects of extreme weather (flooding, snow, ice, storm, drought, heat) to such extent that adequate service levels are ensured. As such it holds innovation topics such as soil strengthening and rock stabilisation, early warning systems based on local weather forecasts, and dedicated weather proofing systems.

Research and Innovation themes. The research and innovation activities that enable the key elements of FOR and the features they hold are categorised in nine themes that together are comprehensive for all aspects of road operations. Within each of these themes, key topics are identified that will be fitted with concrete technological innovation targets that reflect the ambition level set by the societal objectives of the FOR programme. This in turn provides a practical yardstick to evaluate project proposals as well as achieve results (see table 3).

5.5 Programme Deliverables

The FOR programme will deliver a toolbox of solutions for building, maintaining and operating roads that can be applied whether they are motorway, rural or urban, and regardless of region or country. This toolbox is built up from system trials and full-scale field tests that relate to the key challenges to road operations in view of the societal needs for efficiency improvement. These field tests will provide road, industry and services with the evidence that the FOR concept will produce the stream of benefits that it is seeking (see figure 4).

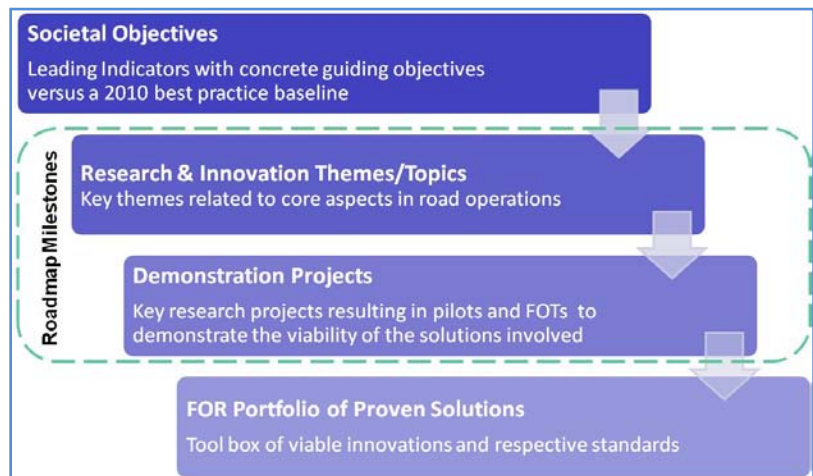


Figure 4: Societal Objectives guide the Roadmaps and the Project portfolio

The solutions will contain future innovations as well as current best practices to allow the road operator to upgrade its operations to different degrees depending on local or regional requirements. For example, in key economic centres and urban areas, a maximum upgrade could be in order, involving all applicable solutions, whereas in remote rural regions it could be the case that only a basic upgrade, involving a selection from the current best practices is supported.

To enhance easy implementation of the toolbox, the solutions will be accompanied by (proposals for) common standards, specifications and guidelines that are easy to adapt to specific national conditions and requirements. A sound knowledge transfer and dissemination process will be executed to ensure awareness in the sector and monitor implementation experiences. Throughout the programme deployment, stakeholders will be engaged to cooperate and collaborate in consolidating the roadmap milestones, executing the projects and disseminating the results.

Table 3: FOR Research and Innovation Themes and Topics

Innovation Themes	Innovation Topics	ADAPTABLE ROAD	AUTOMATED ROAD	RESILIENT ROAD
Future Proof Manufacturing, Design & Construction	<ul style="list-style-type: none"> • Prefabrication Methods & Modular Design • Calculated Redundancy • Self-Explaining & Forgiving Infrastructure • Low Carbon Concepts /alternative materials • Robotised Construction, Inspection • Integrated Manufacturing Process Control 	√		
Durable and integrated Pavements, Bridges, Tunnels & Structures	<ul style="list-style-type: none"> • Long Lasting Overlays (technical & functional lifespan) • Self Repairing Abilities • Harmonised Durability of Pavements & Expansion Joints • Geo-Technical Stability & Early Warning Systems 	√		√
Advanced Utility, Sensory and Communication Systems	<ul style="list-style-type: none"> • In-Built & Wireless Sensors • Open Standard Interfaces • Vehicle Recharging Systems • Low Energy Lighting & Signage • Automated Asset Condition Monitoring and forecasting • Integration of Alternative Energy sources and utility functions 	√	√	
Flood, Snow & Ice Free Pavements, Tunnels & Bridges	<ul style="list-style-type: none"> • Drainage Systems and flood resilience • Improved Reservoir Pavements • Freeze-Thaw Damage Abatement • Snow & Icing Removal • Dedicated Weather Proofing Systems (including wind, fog etc) 			√
Low cost, Rapid & Year-round Maintenance Strategies	<ul style="list-style-type: none"> • Rejuvenation Methods • Maintenance that is invisible to traffic • Rapid & Automated/Robotized Maintenance • Rapid & Automated Inspection & Survey Methods 	√		
Intelligent Traffic Management Strategies	<ul style="list-style-type: none"> • Cooperative Systems & Automated Transport • Optimisation of Network utilisation • Traffic Management for Weather Extremities and Maintenance • Incident and Calamities Management Systems and Processes • Remote Operation Concepts • User oriented Multimodal traffic and travel information services 	√	√	√
Asset Management Toolbox & Public Business Models	<ul style="list-style-type: none"> • Road Network Planning • Public Procurement • Road network Financing & Funding • User and Stakeholder Expectations • Risk/Performance Management 	√	√	√
Harmonized Data, Models & Methods	<ul style="list-style-type: none"> • European Road Asset Observatory/BIM • Climate Effect Vulnerability Maps • Reliable Operations Forecasting methods • Cost-Benefit Evaluation/LCC calculation tools • Regional/Local Climate/Weather Forecasts • (Risk-diven) Decision Supporting Models • Dynamic Traffic Forecasts 	√	√	√
Harmonised Regulatory Framework	<ul style="list-style-type: none"> • Liability issues • Common Technology and process Standards • EU Directives • Tender/Contract Palette • Area-Oriented Approach 	√	√	√

6. A CONSISTENT AND HOLISTIC APPROACH

Many different challenges have been addressed through the different incarnations of SERRP. For the most case, the programme described in each SERRP document was completed. Some common topics have continued throughout the years as the challenges evolved or different aspects were exposed. In the intervening years, some of the challenges addressed earlier have also evolved with, for example, different technologies to be examined, stricter environmental standards or other changes. Therefore, alongside the core elements described in the FOR programme, some elements of the previous SERRPs will always remain active (see table).

In developing SERRP, it has also been recognised for a long time that better interfaces must be developed with other modes. SERRP III specified that sharing the results of road infrastructure research for the benefit of railway infrastructure was of indirect benefit for the road sector. Conversely, developments in railway infrastructure could also be applied to roads. FEHRL’s objective of supporting the development of a safe and efficient road network would be achieved by ever more transfer of goods and passengers to other modes. Less traffic on Europe’s roads could allow faster implementation of improved

Main themes of recent SERRPs	
SERRP III	SERRP IV
Mobility	Mobility, Transport & Infrastructure <ul style="list-style-type: none"> • Optimising capacity • Efficient goods transport • Urban mobility
Safety	Safety & Security <ul style="list-style-type: none"> • Preventative Road Engineering • Impact mitigation & post-crash • Road Transport system security
Environment	Energy, Environment & Resources <ul style="list-style-type: none"> • Energy consumption • Pollution and Environmental Control • Nuisance and societal/cultural impacts • Sustainable construction
Asset management	Design & Production <ul style="list-style-type: none"> • Implementation of innovation • Flexibility of production & maintenance • Lifetime resource use
Innovations in road construction and maintenance	
Road and rail freight transport	
Research areas specific to Accession Countries	
Basic research	

safety and journey time reliability. Therefore FEHRL has supported all efforts to encourage the modal-shift of the form that is right for the travelling public, for business and the environment. However, no one in the road sector can sit back and wait expectantly for modal-shift to come to our rescue by taking damaging freight transport off the roads. Indeed, our worst-case scenario is one in which roads are not prepared for the future and other modes of transport cannot deliver the levels of service needed. This would result in a chaotic situation for both the road network, the transport network and for society at large. For this reason, SERRP V calls for greater research cooperation between experts in all transport sectors. There is much that can be learnt and taught; many experiences that can be shared and therefore a more integrated research and innovation programme would be beneficial. Therefore, a more systematic approach to civil engineering and related topics must be undertaken.

In delivering SERRP V, greater attention will therefore be paid to a broader range of infrastructure topics in both transport and other sectors. These will include:

- Railway infrastructure, airfield construction design and maintenance
- Ground works (including dykes and levees) and underground construction activities

- Environment and energy-related aspects of infrastructure (planning, environmental standards, recycling, environmental and climate-change effects)
- Economic aspects of transport infrastructure
- Urban (or rural) transport, e.g. interchange with urban transport systems, urban road planning and maintenance.
- Infrastructure needs for public transport and vulnerable road users (including cyclists and pedestrians).

Many of these topics will have some benefits for the core FOR activities, but will also be pursued independently, taking into account the needs of the members and our partners.

Moreover, whilst being independent, wider research will always be reviewed for its relevance to FOR and vice-versa. In taking forward the innovations needed, the overall concept follows the pyramid approach illustrated in Figure 2 in Chapter 5. Solutions to the challenges highlighted in Chapter 3 will be delivered through a combination of:

- current best practice in infrastructure technology and practises,,
- transfer of technologies and methods from other sectors,
- use of early stage and emerging techniques and products, and
- new research into technologies and products.

Alongside this, considerable emphasis must be placed on the knowledge transfer of existing knowledge and the implementation of previously-completed research. FEHRL will support much greater knowledge transfer than previously and work with other stakeholders in the translation of the very best of the best practices developed. FEHRL will continue to support the implementation of innovation. This support will include training at both European and national levels (with local language support). The role of the standardisation process in supporting the uptake of innovation will also remain a priority. The outcome of research will be submitted to standardisation bodies where appropriate and, in turn, research to support the implementation of standards will be conducted to support the needs of standardisation bodies and national initiatives..

Specific opportunities for cooperation also exist in the area of Research Infrastructures. These could include new testing facilities for emerging or unmet challenges such as structure or pavement testing for climate change, developing data links including tele-presence between existing centres, databases such as the European Road Infrastructure Asset Database that could be mined for improving existing models and developing new predictive tools.

7. DELIVERING THE STRATEGY

In the past, FEHRL has used a number of well-established instruments to carry forward the research issues described in the core part of this document. These instruments cover a broad range of implementation, ranging from short-term internal FEHRL projects to longer-ranging contracts under the Framework Programmes of the EC.

In the future, the scale of effort that will be required will increase considerably. For this reason, new approaches will need to be developed. These will include the further development of FEHRL's role in a programming capacity as well as a larger role in the Public-Private partnerships (PPP) established between the European Technology Platforms and the EC.

The different levels of FEHRL's programme delivery strategy for SERRP V will be based on two aspects. The first is the relevance and appropriateness of the project instrument to provide a success outcome. This may take into account the geographic dimension, the stakeholders that need to be involved and the platform where the result must be presented. The second aspect determining where the project elements need to be carried out is that of funding. In other words, is the project instrument the right one for the task and is there sufficient money available. Therefore, developing the appropriate level of funding and coordinating the different sources is also a critical part of the delivery plan.

The three parts of the strategy are:

1. Use of traditional (tried and tested) project instruments
2. The further development of FEHRL's programming role to fill gaps in functionality between current instruments and mechanisms
3. Strengthen the partnership with other stakeholders where this gives added value and furthers the systems approach.

7.1 Continue to use the traditional range of instruments

In delivering SERRP V, use will be made of a range of project types. These include;

- **FEHRL Internal Projects**, where FEHRL members and third parties work together on defined tasks.
- **National projects** form an important part of the delivery strategy. Not all research needs to be carried out at a pan-national level and FEHRL will encourage and support projects where members can share the knowledge generated domestically
- **Joint FEHRL-industry projects** usually consider projects where there is a specific need of an industry where FEHRL has a legitimate interest. This could involve the implementation of standards or specific policy instruments or examples of best practice.
- **European Cooperation in Science and Technology (COST) Actions** provide a structure for developing pan-national agreements on specific technical or policy issues.
- **EC co-funded projects** such as those through the Framework Programmes are especially important because they usually involve a wide range of partners.

- **Collaboration Projects (CP)** and **Coordination and Support Actions (CSA)** as well as **Specific International Cooperation Actions (SICA)** all play a crucial role and in addition to the technical issues addressed provide support for;
 - Developing the European Research Area (ERA), strengthening different aspects of the overall efficiency of research and its implementation.
 - International cooperation where European nations can work on common challenges with others.
 - Standards development where EC support or direction is involved.
 - Working with a wide range of stakeholders.
 - Societal issues where specific encouragement is given to work with civil society organisations, NGOs and others representing the users.
 - Policy-related issues where projects specifically address questions posed by the EC (E.g.the Transport White Paper).
- **Commission consultancy contracts** are another specific type of instrument where specific policy or technical issues can be addressed in a very targeted way. FEHRL will continue to work with EC services to advise where these might be best developed.

These instruments are not mutually exclusive and in many cases a single project could be defined under a number of the categories above. However, in developing SERRP V it is recognised that these need to be strengthened. These will evolve and be added to by complementary processes developed by FEHRL in the following section.

7.2 Strengthen our programming function for (road) infrastructure research and innovation

In the early years of FEHRL, one of the models adopted for FEHRL projects was that of pooled fund projects. At the time, these had very modest levels of success because the coordination of national programming was not sufficiently developed. Since that time, the ERA-NET process has been developed into a successful tool with which many FEHRL members have become proficient and road authorities have grown to trust. The challenge for SERRP V will be to grow this process with a wider range of complementary funding sources.

- Here it is important that FEHRL demonstrates that it will act transparently for the benefit of the whole sector and not only the membership of FEHRL. As a reference, many members have already established FEHRL Groups linking the international and domestic research communities to our own members. Other options towards this end will be explored.
- Learning from the successful ERA-NET ROAD project, FEHRL will develop a trans-national programme bringing together stakeholders at a national, European and international level, including those from industry. In the short-term, national funding could be supplemented by EC funding through the relevant instruments which enable additional funding to be provided to supplement the contributions of different funding bodies. Cooperation with the pooled fund programmes of the United States and other countries are also expected to complement this process and will be augmented by industry engagement in projects of common interest.
- Engaging with other stakeholders will be important for the governance of this process and will build on the Stakeholder's Reference group of FOR. Selected stakeholder associations will be invited to share in the governance of the SERRP V programme. These will typically be client organisations and industry.

- FEHRL will coordinate collaboratively (pool and in-kind) funded programmes bringing together funds and resources from different sources including FEHRL members and third-parties.
- FEHRL will explore the opportunity for EU trust funds where the EC mandates an external organisation to coordinate a programme on its behalf. Initially, the objective will be for FEHRL to bring together sufficient funding to use the EC's ERA-NET+ instrument where one-third of a single programme can be funded through EC funds. The objective will be to scale this up from individual ERA-NET+ activities on a case-by-case basis and make the process more strategic and permanent.
- FEHRL will also review the role for research prizes. In many sectors, problem owners and research funding agencies have found that competitions offering prizes for advances that can be clearly quantified are successful. The most well-known example of this is the X-prize for the first private space flight. The advantages of such competitions are that significantly more research is carried out that could be funded directly. Only the winner is funded, despite the fact that losing teams might still make significant advances and no costs are incurred by the client agencies if the results are not obtained. FEHRL will examine how quantifiable targets could be set for advances in the road infrastructure and how such a competition could be organised.
- Developing a training and dissemination function is important for FEHRL and
- FEHRL will also explore and develop topics on interfaces and common interests with other modes and sectors.

7.3 Develop our roles in appropriate Public-Private partnerships, Joint Programming etc.

Road infrastructure needs to be developed as part of a system. In cases where a multi-sectoral systems approach is needed, the key European Technology Platforms provide a strong foundation on which to develop our relationship with a range of stakeholders. The most relevant of these are the European Road Transport Research Advisory Council (ERTRAC) and the European Construction Technology Platform (ECTP). Others which also share some interest include those in other transport modes such as the European Rail Research Advisory Council (ERRAC) or those which focus on specific elements such as the European Steel Technology Platform (ESTP).

Both ERTRAC and ECTP have strengthened their programming roles by establishing partnerships with the European Commission on so-called **Public-Private partnerships (PPPs)**. These are the European Green Cars Initiative (EGCI) and Energy Efficient Buildings (E2B), respectively. To date, neither of these PPPs has addressed topics of relevance to FEHRL. However, FEHRL intends to work with its partners in those platforms towards a second Green Cars programme and a new initiative called reFINE.

- For a second Green Cars programme, the emphasis for FEHRL would be to focus on a Clean (or competitive) Automotive and Road System addressing all the needs of the road sector and its interfaces with other modes.
- reFINE, or Research for Future Infrastructure Networks in Europe will focus on all of the relevant transport and energy networks.

Joint Programme Initiatives (JPIs) are created under the initiative of several member states. The overall aim of Joint Programming is to pool national research efforts in order to make better use of precious public research and development resources and tackle common challenges more effectively in a few key areas. They tackle specific societal challenges such as “urban living and mobility”. It follows a process whereby Member States agree common visions and strategic research agendas to address major societal challenges. The Initiatives should bring together relevant actors to: (i) step up research and development efforts; (ii) coordinate investments in demonstration and pilots; (iii) anticipate and fast-track any necessary regulation and standards; and (iv) mobilise demand in particular through better coordinated public procurement to ensure that any breakthroughs are quickly brought to market. FEHRL will follow the developments and contribute to the transport infrastructure elements as appropriate.

In each of the three parts of the implementation strategy outlined above, the need for regular and structured stakeholder participation is recognised. SERRP V will embed stakeholders into the governance of the programme. Key stakeholders will be consulted regularly throughout the course of SERRP V. Their guidance to the General Assembly of FEHRL will help to shape the detailed strategy and content of the programme.

8. CONCLUSION

This fifth Strategic European Research Programme (SERRP V) sets out the basic strategy for tackling the challenges facing the road system now and in the future; as well as the transport system in which the roads operate.

One element was to develop a truly inspiring vision for how roads will be built, operated and maintained. Forever Open Road – a revolutionary concept that will bring together the best of what we have today with the best of what is to come – was presented in this document. The Forever Open Road is adaptable, automated and climate change resilient; based upon a concept for building and maintaining roads that can be applied whether motorway, rural or urban, and regardless of region or country.

SERRP V also takes into account the pressures of the recovery from the global financial crisis and the resulting austerity measures. The priorities of the Road Directors and the European Commission form a basis on which to ground the research and innovation activities to be carried out.

Elements that are considered are a combination of:

- current best practice in construction and technology,
- transfer of technologies and methods from other sectors,
- use of early stage and emerging techniques and products, and
- new research into technologies and products.
- and the demonstration of all the technologies and systems developed.

Finally SERRP V, presents the instruments through which it can be delivered. These are a combination of

1. The use of traditional (tried and tested) project instruments
2. The further development of FEHRL's programming role to fill gaps in functionality between current instruments and mechanisms
3. Strengthening the partnership with other stakeholders where this gives added value and furthers the systems approach.



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