**Project**

**NR2C**

**New Road Construction Concept**

**Funding:** European (6th RTD Framework Programme)

**Duration:** Dec 2003 - Nov 2007

**Status:** Complete with results

**Call for proposal:** FP6-2002-TRANSPORT-1

**CORDIS RCN:** 74283

**Background & policy context:**

Civil infrastructure systems represent huge public investments and are expected to provide services for very long periods of time. Their use spans several generations during which society will experience dramatic changes. This lengthy time span means that future developments in the transport of goods and people must be assessed and planned well in advance in order to make the right choices, not only for today but also for tomorrow. Looking ahead into the future and considering probable developments in society enables us to search for proper solutions.

The combination of constant increase in the number of road vehicles and the subsequent rise in traffic volumes and axle loads speed up developments like congestion, wear and tear of structures and, last but not least, air pollution and noise emissions. This evolution is going fast, in any case faster than over the past twenty years.

The road sector faces huge challenges, including ambitious demands such as better, quicker and cheaper production, construction and maintenance. To minimise downtime of roads for maintenance activities, the overall quality of the constructions has to be upgraded. The time slots available for repair and rehabilitation works are becoming tighter and tighter, which means that maintenance techniques have to be speeded up. Furthermore, the environmental regulations with respect to air pollution and noise emissions by traffic and the use of natural raw materials are becoming more and more stringent.

These developments also led to a new series of questions and problems.

It is thus of our responsibility to search what future road infrastructure will look like, in order to initiate today the necessary changes and advancements so that future roads and streets will continue to meet our growing transport needs, in a safer, more effective and comfortable way.

This challenge to preserve for future generations living conditions that are both functional and pleasant, calls for two main conditions:

- to turn our working methods to more global approaches, more centered on 'human' aspects;
- to develop efficient techniques, methods and tools, respectful of the environment and energy consumption, in support of renewed and innovating design and management approaches.

This requires a significant effort in the field of research and development.

**Objectives:**

NR2C was a quest for conceptual and technical answers to the mobility and transport demands of the future, and aimed at generating future-oriented initiatives for addressing accessibility problems and issues related to road infrastructure.

The objective of the project to be pursued in dialogue and cooperation with all actors concerned (such as road infrastructure owners, decisions makers, experts, users, road industry) was to develop long-term perspectives, concrete pilot studies and research recommendations, linking long-term visions and ideas to short-term actions (the vision can be considered as a focal point for policy-makers and engineers in taking the right decisions concerning use, design, construction and maintenance of infrastructure).
More in detail the project aimed to:

- Firstly, provide long-term perspectives for the road infrastructure (vision 2040), which reconciles future transport needs, expected users and social demands, and sustainability goals. This means to develop new concepts for the road of the future (high quality, cost-effective, low noise, environmentally friendly, safer, risk mitigating, low maintenance, while facilitating traffic mobility and inter-modality).
- Secondly, implement concrete short-term actions by developing specific innovations that will support this long-term vision, these innovations being relevant to the following three fields: urban infrastructure, interurban infrastructure and civil engineering structures.

**Methodology:**

A specific group of activities (WP) was dedicated to the global concept and to each of the three specialised fields:

- Development of new concepts for the road of the future (WP0);
- Innovations for urban and suburban infrastructure (WP 1);
- Innovations for interurban infrastructure (WP 2);
- Innovations for civil engineering structures (WP 3).

Based on large surveys carried out on road stakeholders, NR2C identified safe and environmentally friendly infrastructure construction and maintenance concepts. Innovative concepts were ranked and the most promising developed for further studies, aimed at establishing feasibility and clarifying unsolved problems.

All NR2C project activities were carried out in three phases:

- Phase 1 – survey and analysis: this phase is designed to clearly identify future user needs and expectations. It consists of enquiries, surveys, focus workshops and brainstorming sessions to build the vision. In parallel, state-of-the-art reports on innovations in urban and interurban areas and concerning bridges are provided.
- Phase 2 – assessment and selection: during this phase, innovations, feasibility studies and preliminary models are carefully assessed and the most promising ones selected for further development.
- Phase 3 – testing and recommendations: innovations selected in Phase 2 undergo detailed design, laboratory or pilot tests, which lead to specific recommendations.

Finally, in the continuity of the NR2C vision concepts, and taking in account Europe concerns, emblematic future research projects have been identified.

**Parent Programmes:**
- FP6-SUSTDEV-2 - Sustainable Surface Transport

**Institute type:** Public institution

**Institute name:** European Commission

**Funding type:** Public (EU)

**Lead Organisation:**

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<td><strong>Address:</strong> BOULEVARD LEBEVBRE 58</td>
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<td>75732 PARIS</td>
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<td><strong>Organisation Website:</strong> <a href="http://www.lcpc.fr">http://www.lcpc.fr</a></td>
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<td><strong>EU Contribution:</strong> €0</td>
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**Partner Organisations:**

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<tr>
<th>Ministerie Van Infrastructuur En Waterstaat</th>
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EU Contribution: €0

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Address:
Key Results:

1) Development of new concepts for the road of the future (WP0)

Taking into account other visions provided in the same period (ERTRAC Vision 2020, FEHRL Vision 2025, ECTP Vision 2030), the NR2C project defined and published the 'Vision 2040' (available on FEHRL website: www.fehrl.org/nr2c), whose original contribution consists in that it considers widely users and stakeholders, and delves deeply into the urban and peri-urban issues, attaching a lot of importance to the 'human' aspect.

The NR2C vision is based on four key concepts representing the dominant characteristics of the society’s expectations for the road of the future:

1. **Reliable infrastructure**, standing for optimizing the availability of infrastructure. Availability and reliability are the key issues of durable infrastructure, which means high quality and low maintenance of the construction parts of the infrastructure. In the case of maintenance, the impact of these activities on the traffic flow must be minimal. Upgrading this infrastructure is possible without dismantling the existing construction.

2. **Green (environmentally-friendly) infrastructure**, standing for reducing the environment impact of traffic and infrastructure on the sustainable society. Minimising environmental impacts on communities and natural habitats are the main issues of this concept. Green infrastructure fits into its surroundings and contributes by means of design and composition to minimising the impact of traffic (noise, air pollution and vibrations) and energy consumption of the transport system. It also optimises the use of non-traditional materials for road building and reduces the use of natural resources.

3. **Safe and smart infrastructure**, standing for optimizing flows of traffic of all categories of road users and road construction work safety. Smart and safe infrastructure observes (traffic flow, circumstances and itself), interprets, decides and acts to promote safe and comfortable travel and help the owner of the roads keep the infrastructure objects in safe condition.

4. **Human infrastructure**, standing for harmonizing infrastructure with the human dimensions. The main characteristics of this concept are multi-functionality and multi-use of the space occupied by infrastructure. Human infrastructure offers the main categories of road user the elementary facilities which guarantee social security. The main points are sh

Technical Implications

NR2C recommends for each of the direction of solution of the four key concepts, the following projects and issues.

1) **Reliable infrastructure**

*Lifetime engineering*
• Research performance and failure mechanisms by means of micron and nano technologies in order to develop high performance materials and maintenance technologies.
• Achieve high quality performance levels to guarantee around the clock availability e.g. by developing more durable materials to reduce need for maintenance.

Fast hindrance free maintenance

• Develop modular roads assembled from standard modules (preferably based on European standard dimensions), prefabricated under controlled circumstances, based on the concept of functional separation of long lifetime and short lifetime components, including the whole production chain.
• Design constructions and maintenance techniques including materials to minimise the impact of maintenance activities on traffic flows, like: high speed techniques for replacing thin surface layers; hindrance free maintenance techniques for underground utilities; hindrance free winter maintenance techniques; temporary by-passes (temporary bridges); self-cleaning and regenerating surface layers; sprays to renew or revitalise surface characteristics to postpone major maintenance work.

Balancing Demand and capacity

• Design infrastructure with options for (temporarily) increasing road network capacity by means of dedicated lanes, temporary bypasses, flexible lane width and lanes with the ability to change travel direction depending on traffic demand.
• Accommodate infrastructure requirements and interactions with new transport systems like road trains and Bus Rapid Transit (BRT).

Asset Management Tools

• Develop hindrance free self-diagnostic real-time monitoring and inspection techniques in order to optimise maintenance planning and prevent low performance surprises.
• Design European-wide standard performance indicators and intervention levels for surface characteristics.
• Develop or upgrade in-situ sensors and Specialist Survey Vehicles in order to develop performance models for maintenance management systems.
• Develop European quality management systems for construction companies.
• Develop knowledge about lifecycles analyses (LCA) and translate this into tools for decision-making.

2) Green Infras

Policy implications

There is still plenty of progress to be made in the construction and maintenance of infrastructure. However, at any moment, the progress in ongoing optimisation of existing concepts will no longer meet the demands and requirements, so that changes in the concepts will be necessary. To achieve these ambitious goals, the sector must move faster in the direction of the innovation level of redesigning existing concepts. Therefore the introduction of new proven research technologies from other sciences such as physics and chemistry is vitally important. A new generation of problems requires a new generation of approaches in setting up research. In this context NR2C has selected a number of projects (defined as 'development required') needing special attention from all stakeholders involved, since they will provide the sector with new basic knowledge standards for trend setting developments and innovations required to face the future with confidence. In particular, these projects aim at upgrading the innovation level in the road engineering sector and thus change the mind set from 'traditional' and 'conventional' to 'high tech' and 'sexy' because they are amongst others:

• crossing the traditional boarders of the common research approaches;
• incorporating knowledge from other sciences;
• provoking and challenging engineers to cross the boarders of traditional solutions;
• delivering fundamental basic knowledge for break through inventions;
• receiving common interest of all European countries.

They require high research investments in the initial stage of development, so European-wide cooperation and governmental support and funding are the key factors to success. These projects are (see the final report of the project for their description):

• New age binder design technologies;
• Integrated models of urban (human) design;
• Lifetime engineering for roads;
• Asset management tools;
• Modular prefabricated pavements;
• Low temperature asphalt with reclaimed asphalt;
• Bridge eco-assessment;
• TYROSAFE: optimising tyre-road interaction;
• Energy controlled pavements.

Documents:
- Final Publishable Report (Final report)

STRIA Roadmaps: Infrastructure
Transport mode: Road transport
Transport sectors: Passenger transport, Freight transport
Geo-spatial type: Infrastructure Node