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## REFINET: REthinking Future Infrastructure NETworks

Alain Zarli <sup>a,\*</sup>, Luc Bourdeau <sup>b</sup>, Miguel Segarra <sup>c</sup>

<sup>a</sup>CSTB, 290, route des Lucioles, B.P. 209, 06904 Sophia Antipolis cedex, France

<sup>b</sup>ECTP, REH, rue d'Arlon 63-67, 1040 Brussels, Belgium

<sup>c</sup>DRAGADOS S.A, Avda. del Camino de Santiago 50, 28050 Madrid, Spain

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### Abstract

The European transport infrastructure network is considered as the lifeblood of European trade and society, and is commonly regarded as a shared heritage of great economic value. But it is also recognised today that this network is composed of many existing infrastructures that no longer fulfil the current functional requirements and today's safety and quality standards, and requires refurbishment and increased capacities, potentially relying on innovative technologies, components and systems. The ECTP (European Construction Technology Platform) reFINE (Research for Future Infrastructure Networks in Europe) initiative aims at the development and delivery of innovative design, construction, maintenance and upgrading concepts and solutions that promote and strengthen seamless transport links for passenger and freight, while keeping up with future technological trends. The REFINET European Coordination action is an instrument supporting the reFINE initiative: based on a sustainable research network that integrates relevant stakeholders' representatives of all transport modes (road, railway, maritime, fluvial...) and transport infrastructure sectors. Its primary objective is to create a shared European vision of how the multimodal European transport infrastructure network of the future should be specified, designed, built, renovated, and maintained, and elaborate a SIP (Strategic Implementation Plan) that will define the innovation activities required to make this vision a reality.

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\* Corresponding author. Tel.: +33-493-956-736 ; fax: +33-493-956-733.  
*E-mail address:* [alain.zarli@cstb.fr](mailto:alain.zarli@cstb.fr)

## 1. Introduction

The sector of the construction and renovation of infrastructures today represents around 4,000 billions of dollars world-wide, and it is anticipated that this figure will be doubled by 2025. In Europe, the transport infrastructure network is a shared heritage of great economic value, enabling wealth to be generated across the continent. The magnitude of Europe's transport infrastructure is indeed quite high – in terms of (1) Roads, with a total road network of approximately 5 million km in the 28 EU Member States, (2) Railways, with a total length of lines around 215,000 km, and (3) Waterways, with 41,000 km of navigable inland waterways. Europe possesses one of the densest and most developed infrastructure networks in the world, but most of these infrastructures were constructed in the period 1960-1970 and were designed for a working life of 50 years. Now these infrastructure networks are often strained far beyond their intended capacities in terms of traffic flows and loads, they require significant refurbishing, and face climate change that may be also different from the design stage conditions. Consequently, many of the existing infrastructures no longer fulfill current functional requirements and today's safety and quality standards, and require being strengthened and transformed. Several European initiatives share this vision, among which the ECTP reFINE initiative that advocates the need for developing High-Level Service Infrastructures (HLSI) – as core elements of a future EU-wide multimodal integrated transport by 2030 – and as introduced in Section 2.

This paper provides with an introduction to the background, objectives, and approach of the REFINET CSA (*Coordinated and Support Action*), funded by the European Commission in the framework of its Horizon 2020 programme, whose overarching aim is creating a sustainable innovation network that integrates relevant stakeholders' representatives of all transport modes (road, railway, maritime, fluvial...) and transport infrastructure sectors in order to:

1. create a shared European vision of how should be specified, designed, built or renovated, and maintained the multimodal European transport infrastructure network of the future (including, but not only, cross-modal aspects) in order to enhance the effectiveness of the sector;
2. elaborate a Strategic Implementation Plan that will define innovation activities that are required to make this vision a reality - considering two complementary scenarios:
  - Maintenance and upgrading of already existing transport infrastructures,
  - Development of new transport infrastructures (multimodal infrastructure).

REFINET is to contribute to create European-wide consensus on where to focus by 2020 and beyond in terms of research and innovation in order to further increase the performance of multimodal transport infrastructure through improving the productivity of the assets (reducing maintenance costs, extending the life span...) and to reduce drastically traffic disruptions of transport flows from inspection, construction and maintenance activities to accommodate increasing/changing traffic demand. REFINET, supporting the EU 2020 strategy, will kick-start a long-term ambition and initiative, paving the way to enhanced technology transfer and mass-market development for innovative materials, components, systems and processes supporting the pan-European generalisation of advanced multimodal infrastructures.

## 2. European context for infrastructures

Europe possesses one of the densest and most developed infrastructure networks in the world, a huge legacy and accumulated investment inherited from its long history. It owns the oldest road networks, the first ever underground trains and the railway networks that facilitated its prosperity. Most of these infrastructures were constructed in the period 1960-1970 and were designed for a working life of 50 years, as shown in Figure 1. Now these infrastructure networks are often strained far beyond their intended capacities in terms of traffic flows and traffic loads. Large sections already require significant refurbishing. Furthermore, climate change may also have altered the climatic conditions considered at the design stage. Consequently, many of the existing infrastructures no longer fulfill the current functional requirements and today's safety and quality standards.

We now face the issue that, with a 50-years design life at an end, a large part of the existing infrastructure reaches the end of its lifetime. Is it still safe enough to continue being used? Will it have to be demolished, strengthened and/or put under structural behaviour monitoring? The ensuing reconstruction works will inevitably create an

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