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REFINET INFRASTRUCTURE MOBILITY

REthinking Future Infrastructure NETworks

REFINET

Project Duration: **2015.05.01 – 2017.04.30**
Grant Agreement number: **653789**
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WP4

D4.1 | D'Appolonia

REFINET Strategy for the Deployment of the SIP

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Revision history

Date	Version	Author/Contributor	Revision By	Comments
18.08.2016	V01	D'Appolonia	Alain Zarli	Peer review by CSTB
27.10.2016	V02	D'Appolonia	All partners	Peer review by all partners
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Abbreviations

Acronym	Full name
ACARE	Advisory Council for Aviation Research
ALICE	Alliance for logistics Innovation through collaboration in Europe
BP	Best Practice
CSA	Coordination and Support Action
CEF	Connecting Europe Facility
DoA	Document of Action
EC	European Commission
ECTP	European Construction Technology Platform
ERDF	European Regional Development Funds
ERTRAC	European Road Transport Research Advisory Council
ERRAC	European Rail Research Advisory Council
ESIF	European Social and Innovation Fund

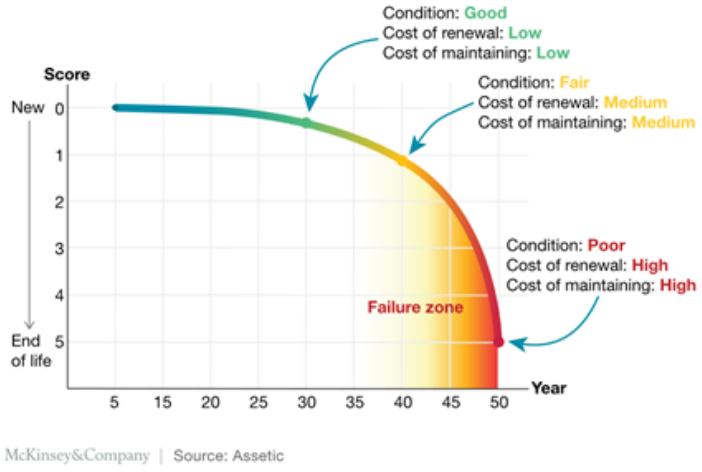
EU	European Union
FEHRL	Forum of European National Highway Research Laboratories
FP7	Framework Programme 7
H2020	Horizon 2020
HPT	High Potential Technologies
HLSI	High Level Service Infrastructure
IRL	Innovation Readiness Level
KPI	Key Performance Indicator
PCP	Pre-Commercial Procurement
RMMTI	Refinet Multimodal Model for Transport Infrastructure
S2R	Shift to Rail
SIP	Strategic Implementation Plan
TRL	Technology Readiness Level
TI	Transport Infrastructure

Definitions

Term	**Definition**
Multimodal transport	Multimodal transport: The carriage of freight or passengers or both, using two or more modes of transports.
Best Practice	Innovative solutions widely used and recognised as best practice by the industry.
High potential Technologies	Existing technologies that are not yet widely used but having high potential to become so.
R&I Project Innovations	Innovations coming out of recently closed R&I projects (mostly FP7 & H2020 projects) related to TI having generated interesting incoming technologies still in demonstration and validation phases.

INTRODUCTION: RATIONALE FOR THE DEPLOYMENT OF THE REFINET SIP

European Transport Infrastructure (TI) needs modernising[1]. As stated in the Transport European First Semester 2016 Thematic Fiche prepared by the Commission, "European transport network infrastructures, and in particular the trans-European transport network (TEN-T), require a proper level of investment (to support) new infrastructure, refurbishment and modernisation of the existing network, as well as an increased coordination between Member States affected by cross-border infrastructure projects[2]". Financially now is a good time for the EU TI to be brought up-to-date; as stated by Economic Science Nobel Prize recipient Paul Krugman[3] , European Member States should seize the current opportunity of low interest rate on bank loans to renew an old and quickly degrading transport infrastructure. Waiting too long will increase the price of renewal or maintenance as shown by the consultancy firm McKinsey in a recent article published on their website[4]:



However investments at public level across European Member States have been decreasing over the last ten years due to an unfavourable economic climate and a focus on other more urgent priorities. In this context as underlined by Travis P. Dunn and Joseph M. Sussman[5], a **multimodal approach** to investment decisions can be very strategic: "the potential benefits include more effective, efficient investments characterised by a reduction in the level of public resources necessary for transportation infrastructure while maintaining or improving the level of service of the transportation system as a whole."

In line with this idea, the overarching aim of REFINET is to contribute to establishing a coherent research and innovation programme for Transport Infrastructure at European level, promoting multimodality, and sustainable innovation in the whole value chain and demonstrating the relevance of the sector in public R&I programmes.

The REFINET's **Vision** to achieving that aim (see D3.1 and D3.4 for more details) is to use REFINET's main output, the **RMMTI Model**, a bespoke blueprint, to help with the formation of a new European

[1] See D3.4 for a detailed analysis of the state of European TI.
[2] Source: http://ec.europa.eu/europe2020/pdf/themes/2016/transport_201605.pdf
[3] Source: Internazionale, July 2016, http://www.internazionale.it/.
[4] Source: "Using 'asset genetics' to unlock hidden capital", http://www.mckinsey.com/industries/infrastructure/our-insights/using-asset-genetics-to-unlock-hidden-capital?cid=other-soc-lkn-mip-mck-oth-1607&kui=IDn5kwzg83LVR1keZHYk3Q
[5] Source: http://www.trforum.org/journal/downloads/2011v50n2_02_MultimodalInfrastructure.pdf

multimodal transport infrastructure network by 2050, which can ensure the efficient transport of goods and passengers through the High Level Service Infrastructure concept over urban networks, multimodal hubs and long-distance corridors and which would respond to state of the art performance indicators – Green, Cost-Efficient, Social/Inclusive, Resilient and Safe/Secure – and taking into account a systemic perspective – for what regards Governance, Communication, Financial/Economic, Legal/Standards and Risks/Interdependency aspects.

In the REFINET **Strategic Implementation Plan (SIP)**, the RMMTI Model (briefly outlined here in section 1), a key output of REFINET, helps structure the various paths towards the achievement of the project Vision. In addition, built *upon* the RMMTI Model, other bespoke REFINET solutions have been generated to help achieve the project Vision. They are as follows and will be presented in detail in this document:

- The Framework for the Monitoring R&I projects
- The Catalogue of Best Practice
- The Catalogue of High Potential Technologies
- The Geo-Clustering Platform
- Identified future R&I priorities

These solutions are now to going to be disseminated through a **deployment strategy** to help stakeholders – Public Bodies, Members States Ministry, The European Commission, Infrastructure Managers and Operators – make better-informed decisions and identify the technologies they need to improve their TI.

The deployment of the REFINET SIP will be characterized by **two time-scales**:

1. **A short-term approach** to support TI Managers and Operators in identifying solutions to their current needs by enabling the transfer of existing and incoming innovative technologies, such as materials, components, IT systems and processes, etc. to support Transport Infrastructure (TI) update, modernization, etc. Two case study countries – Italy and Romania – have been identified to start mapping the actual deployment of the REFINET solutions. Specific roadmaps will be developed as part of task 4.2.
2. **A medium to long-term approach** to support Policy Makers including the European Commission and Public Authorities in Members States in identifying future research topics in TI based on an analysis of the current existing technology offer and the future demands. In later stages of the project (as part of task 4.2), specific recommendations will be made to the Commission and other key stakeholders of the TI in a dedicated roadmap, the outline of which is presented in this document.

1. PREPARING TO DEPLOY THE SIP

Various activities have taken place to prepare the strategy for the deployment of the REFINET SIP. Their outputs are presented in the following sections; they aimed at ensuring a clear understanding:

- of the solutions about to be deployed as part of the SIP (section 1.1)
- of the status of TI across Europe to be able to, whenever necessary, fine-tune the main deployment strategy (section 1.2)
- of the financial instruments and initiatives enabling the development of TI (section 1.3).

1.1 The REFINET Solutions

The Strategic Implementation Plan of REFINET includes the deployment of a number of solutions generated by the project as follows:

- The RMMTI model (output of WP3 and presented in full detail in D3.1)
- The Framework for the Monitoring R&I (output of both WP3 and WP4, presented and used in D3.2, D3.3 & D4.1)
- The Catalogue of Best Practice (output of WP3 and presented in full detail in D3.2)
- The Catalogue of High Potential Technologies (output of WP3, presented in full detail in D3.3)
- The Catalogue of R&I project innovations (output of WP4 T4.1, presented at Annexes 2 & 3)
- The Geo-Clustering REFINET Platform (output of WP4 and presented in this D4.1)
- The identification of future R&I priorities (output of WP3 and presented in full detail in D3.4)

Each one of these tools is outlined hereafter to offer a complete picture of the solutions available as part of the SIP. Please note that the Geo-Clustering Platform is presented in a more in-depth manner as a specific result of WP4 task 4.1.

1.1.1 The REFINET Multi-Modal Transport Infrastructure (RMMTI) model

REFINET has developed a model aiming at helping to **assess existing transport infrastructures and set standards for new ones**, defining the different KPIs and their thresholds, specifically for each transport mode.

Figure 1 – REFINET Multi-Modal Transport Infrastructure model

- *Level 1* aims to identify which key features should be considered to define the European Multi-modal Transport Infrastructure of the future. Which are the desired performance parameters for the RMMTI model of the future from the point of view of all stakeholders (end-users, operators/owners, construction companies, engineering firms, public administration)?
- *Level 2* helps identify the key aspects to be considered when implementing a multimodal systemic approach, that is, from the perspective of the transport network as a whole. Which are the targets to focus on when implementing a systemic approach?
- *Level 3* aims to identify which key technologies/knowledge need to be developed in the short/medium/long term. Which projects are necessary to boost the sector?

The **RMMTI Model** helped structure the priority areas and actions of the Strategic Implementation Plan around five performance features defining the High-Level Service Infrastructure in Level 1 of the model (around Green, Cost-Efficient, Social/Inclusive, Resilient and Safe/Secure parameters), as well as around other five performance features related to the Systemic approach in level 2 of the model.

1.1.2 The Framework for Monitoring R&I projects

The framework to monitor R&I projects and their outcomes has been created as part of REFINET to provide a template for collecting and analysing essential pieces of information regarding an existing or an incoming technology, helping potential users better understand the parametres of that technology. The framework has been developed based on the following taxonomy of the Transport Infrastructure sector[6]:

[6] See D3.2 for further explanation about how the taxonomy was defined.

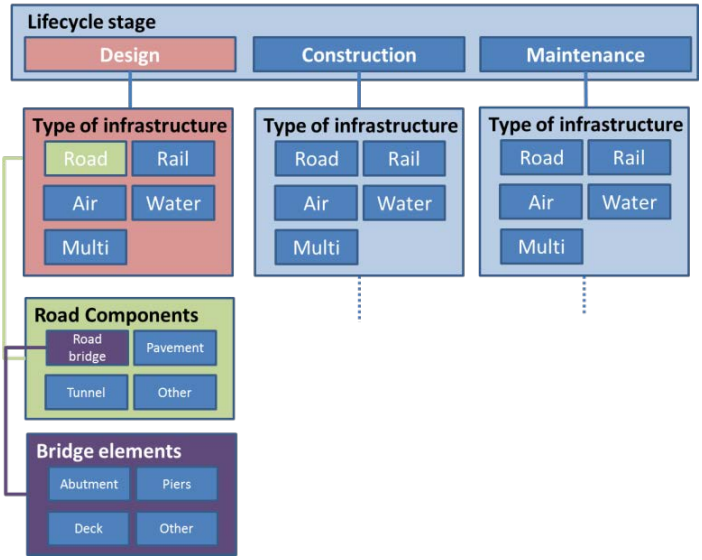


Figure 2 – REFINET Taxonomy

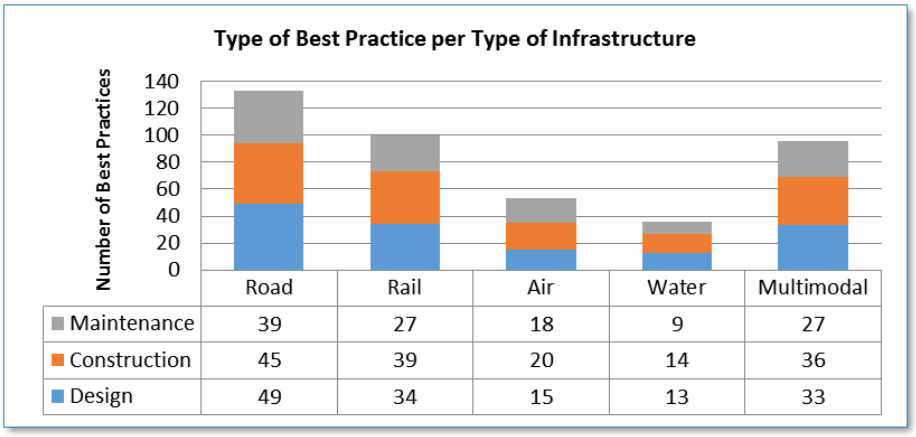
An essential element of the Framework resides in the presence of a "Key Performance Indicator" field which is underpinned by the RMMTI model. These KPIs – when available – are a very powerful decision point at the time of TI investment (either in further research or in technology transfer or adaptation). The Framework reads as follows:

Field	Description
Title and Keywords.	Title of the best practice or technology and main keywords
Source of best practice	Organization providing the best practice or technology or other reference to the source (e.g. conference, etc.).
Lifecycle stage	Design, Construction or Maintenance.
Type of infrastructure	Road, Rail, Air, Water, Multi-modal.
Component of infrastructure	Bridge, tunnel, pavement, etc.
Element of the infrastructure	Specific element belonging to a component. For instance, in a bridge it could be a pier, segment of a deck, abutment, foundation, etc.
Short Description	Scenario for application, technology and how is applied, geographical coverage
Success factors	For example, what are the conditions for successful replication.
Constraints	Which are the factors restraining the application of the best practice (e.g. environmental or weather conditions).
Main impacts	For instance economic or environmental benefits, advantages to users, increased safety, reduction of disturbance, etc.
Maturity and degree of implementation	For example technically feasible, replicable, adaptable.
Key Performance Indicators (optional)	Indicators according to the definition of the RMMTI model that help to assess the efficiency of the described practice.
Further information	Links, references and / or contact details for further information.

To increase pertinence for the users, additional elements such as KPIs, but also deliverables, leverage factor from industry and RTO, number of patents, number of products, etc. need to be added to the Framework in collaboration with key actors of the TI in a second stage of development of the framework, beyond REFINET. Going forward, the Framework could become a standard tool for the Commission and the various Technology Platforms to ensure the collect of consistent data sets. The framework was used to collect information on 97 Best Practice and 111 promising technologies (see section 1.1.3 & 1.1.4). The framework was also tested in REFINET WP4 task 4.1 on 89 recently closed projects[7] across FP7/H2020 collating enough information to fill in the template afore mentioned for each project. These tests helped verify the acceptability and usefulness of the framework.

1.1.3 The Catalogue of Best Practice

REFINET carried out an **extensive work of identification and assessment of best practices** (BP) which resulted in a rich catalogue[8] of innovative solutions widely used and recognised as best practice by the industry, available to be browsed in a catalogue by decision-makers to improve the quality of their TI. Ninety-seven of those have been identified and documented in Deliverable 3.2 using the Strategy Framework presented in the previous section[9]. They are distributed per life cycle stage of the infrastructure and transport modes as follows:



	Road	Rail	Air	Water	Multimodal
Maintenance	39	27	18	9	27
Construction	45	39	20	14	36
Design	49	34	15	13	33

Figure 3 - Type of Best Practice per Type of Infrastructure.

1.1.4 The Catalogue of High-Potential Technologies

In addition, 111 existing technologies that are not yet widely used but having high potential to become so have been identified and categorised. The catalogue was submitted to the Commission as Deliverable 3.3 and can be consulted for further detail. Hereafter figure 3 shows the distribution of the existing technologies identified by REFINET by transport mode. Each existing technology was documented using the Strategic Framework.

[7] See Annex2 for the full list of projects.
[8] See Deliverable 3.2.
[9] These "Fiches" can be consulted as part of D3.2 of REFINET.

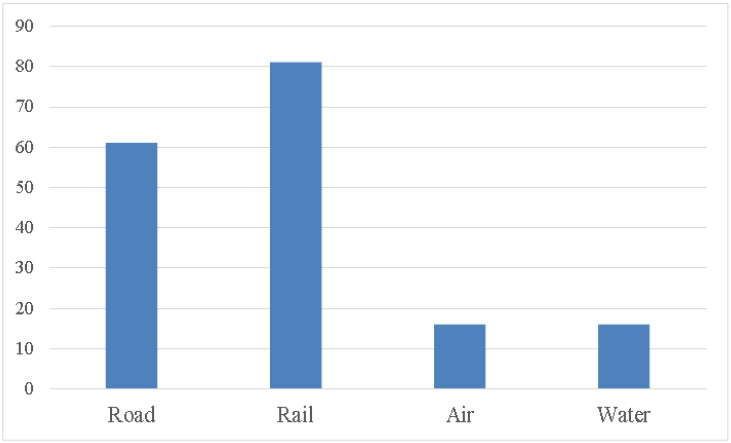


Figure 4 – Distribution of Identified High Potential Technologies (HPT) per Transport Mode

1.1.5 The Catalogue of R&I Project Innovations

As part of WP4 task 4.1, REFINET mapped 89 innovations coming out of recently closed FP7/H2020 projects[10] related to TI having generated interesting incoming technologies that are still in demonstration and validation phases. As can be seen from the graphs below, a majority of the projects studied have a multimodal approach, can be used mainly for Design and Operation stages and are outputs of the FP7 ICT and Transport programmes primarily:

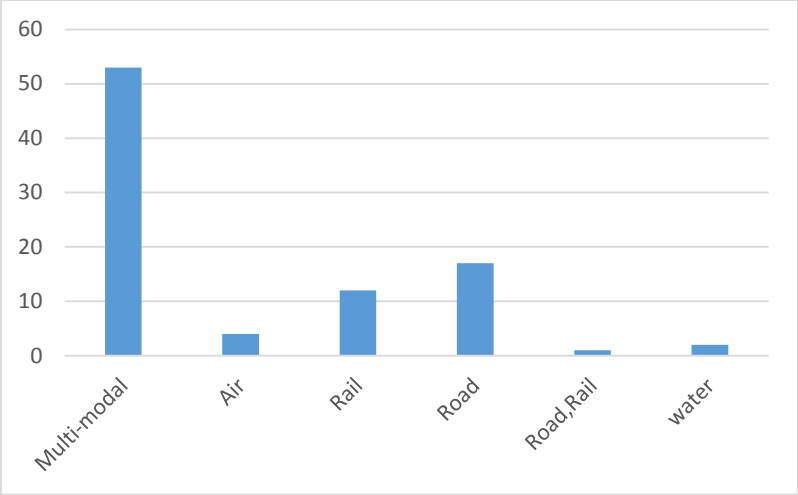


Figure 5 – Distribution of Identified R&I Project Innovations per Transport Mode

[10] See Annexes 2 & 3 for full list of projects and fiches.

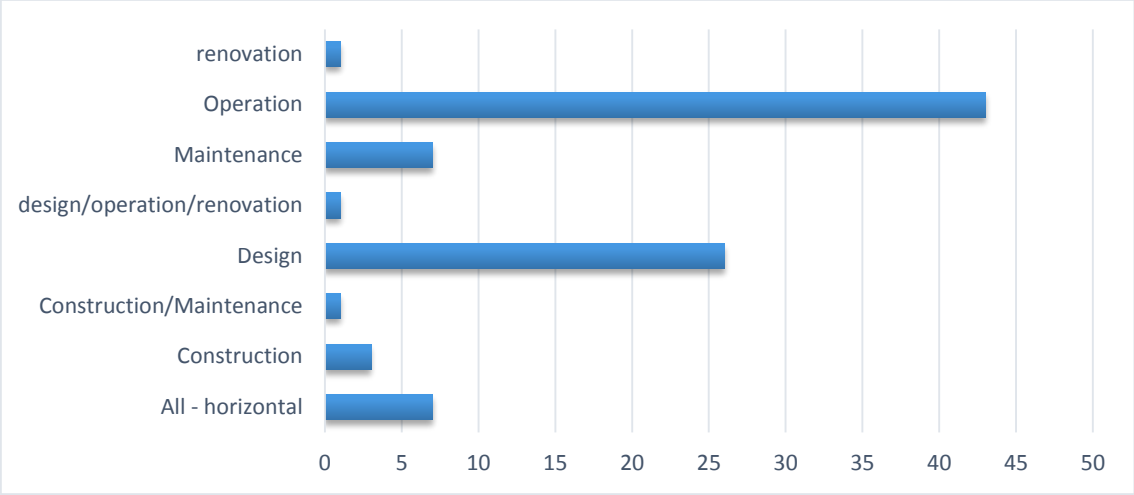


Figure 6 - R&I project innovations by Life-Cycle stage

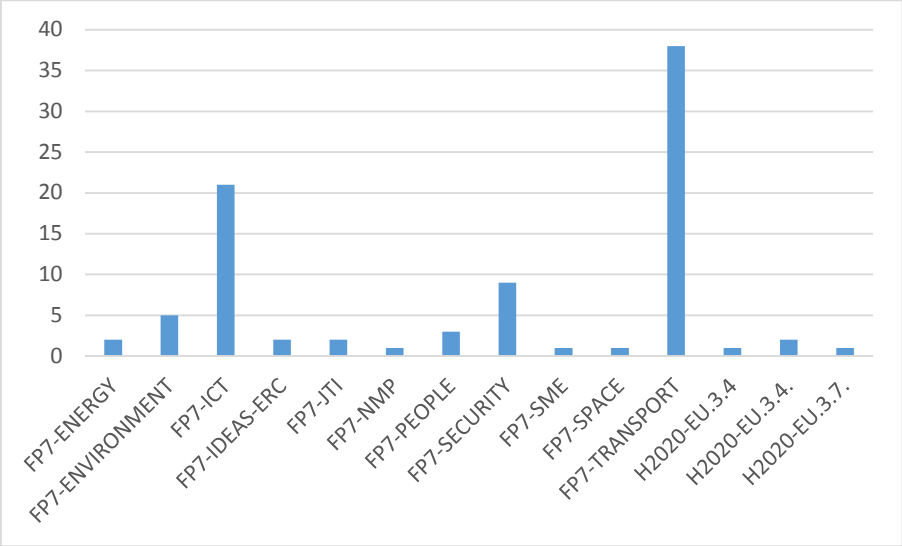


Figure 7 - R&I project innovations split by Financing Programme

When that information was available, projects with TRL levels 6 or above 6 (a high enough level to ensure reasonable timeframes for availability) have been added to the REFINET Geo-Clustering platform presented in the following section.

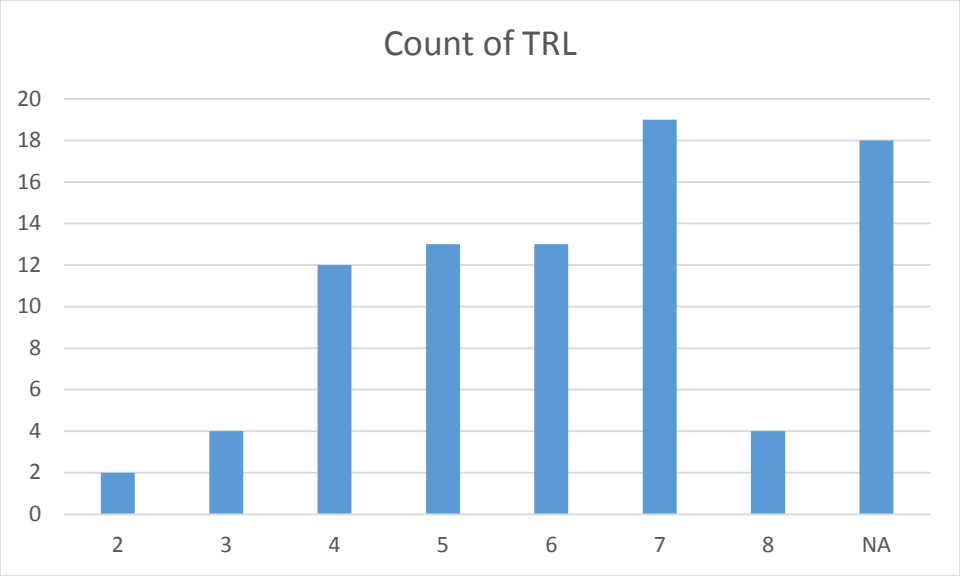


Figure 8 - R&I project innovations split by TRL (when data was available)

1.1.6 The Geo-Clustering REFINET Platform

To automatize the RMMTI model and the maximise the use and the potential interest on it, a Geo-Clustering Platform is being created as part WP4, Task 4.1.

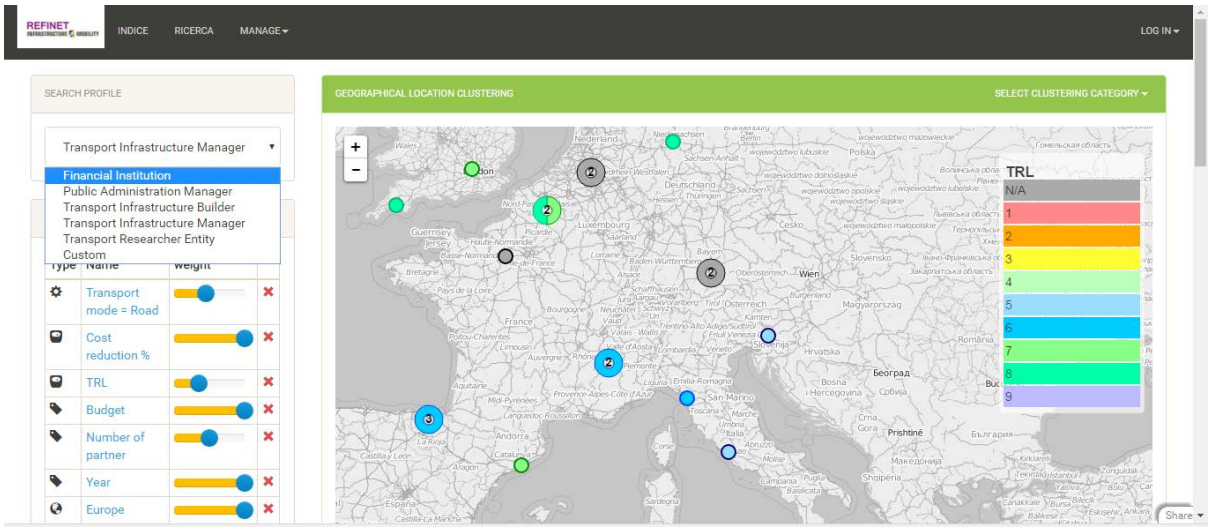


Figure 9 – REFINET Geo-Clustering Platform

Geo-clusters can be defined as geographic areas sharing similar characteristics (e.g. orography, demography, social aspects, economic development, orography, weather conditions, etc.). They provide a backbone of geographical nodes grouping solutions targeting local/national/etc. characteristics from several points of view (technological, socio-economical, regulatory, etc.). The Geo-Cluster Platform makes use of Geographic Information System (GIS) format to enable viewing, understanding, questioning, interpreting and using data in many ways that reveal relationships, patterns, and trends in the form of maps, globes, reports, and charts. GIS are widely in Transport applications and notably in the US by transport management agencies to view asset condition data

using 2D mapping[15]. GIS allows agencies to compare asset condition data with socio-economic, environmental, financial, and other types of data to identify relationships that they may have not considered before and make better decisions. Frequently the result of this analysis is a series of possible outcomes (scenarios) which are then summarised and presented for final analysis and decision-making by stakeholders, interest groups, and policy makers.[11]

Within the scope of REFINET, the Platform makes use of all the data identified by project (see Section 1.1, page 8) and presents them in a format that can be used as a decision-support tool for stakeholders active in European Transport Infrastructure, with the aim of:

- Providing an **easy-to-use** decision support tool to different stakeholders in accessing to a set of technologies, best practices, innovations, projects outcomes, etc. which can be applied to European Transport infrastructures
- Allowing the **visualization of data on an interactive maps/layers**, featuring the possibility to combine different information related to different aspects (e.g. technological, regulatory, maturity, indicators, etc.)
- Identifying **best practices/technologies**, etc. for specific assets, in a specific environment, with specific boundaries (as sets by the KPIs, standard, etc.)

In this sense the Platform can be seen as a tool, that digitalize all the information collected in the project, and make the available for visualization, search, query, analysis etc. The idea is to keep the platform up and running after the projects ends, and allow data/information/technology providers to update the information already available, to add new ones, by making use of the taxonomy and characterization (data model) made by the project. The latter ensure that although more information will be added, the same quality and granularity of information is kept.

Main Functionalities

The REFINET Platform consists of:

a) A Knowledge base repository containing data gathered during the REFINET project, such as:
   - Directory of stakeholders
   - Elements of the RMTTI model (KPIs)
   - Catalogue of best practices in design, operation and maintenance
   - Catalogue of High-Potential Technologies
   - Catalogue of R&I project innovations
   - Catalogue of recent R&D projects
   - European and National funding priorities and schemes
b) Maps (layers) for visualization and as support to management of data
c) Indexing and querying implementing full text search capabilities
d) Decision support logics to correlate different data set composing the Knowledge Base

Indeed, from these data, the Platform generates multi-dimensional maps (“layers”) displayed in an easy peer-to-peer communication and information sharing geographical reference format. In addition, indexing and querying engine implement advanced full text search capabilities. This makes

[11] Federal Highway Administration (US) “Best Practices in GIS-Based Transportation Asset Management”

the platform a decision support tool that correlates the different data set composing the REFINET Knowledge Base (see picture below).

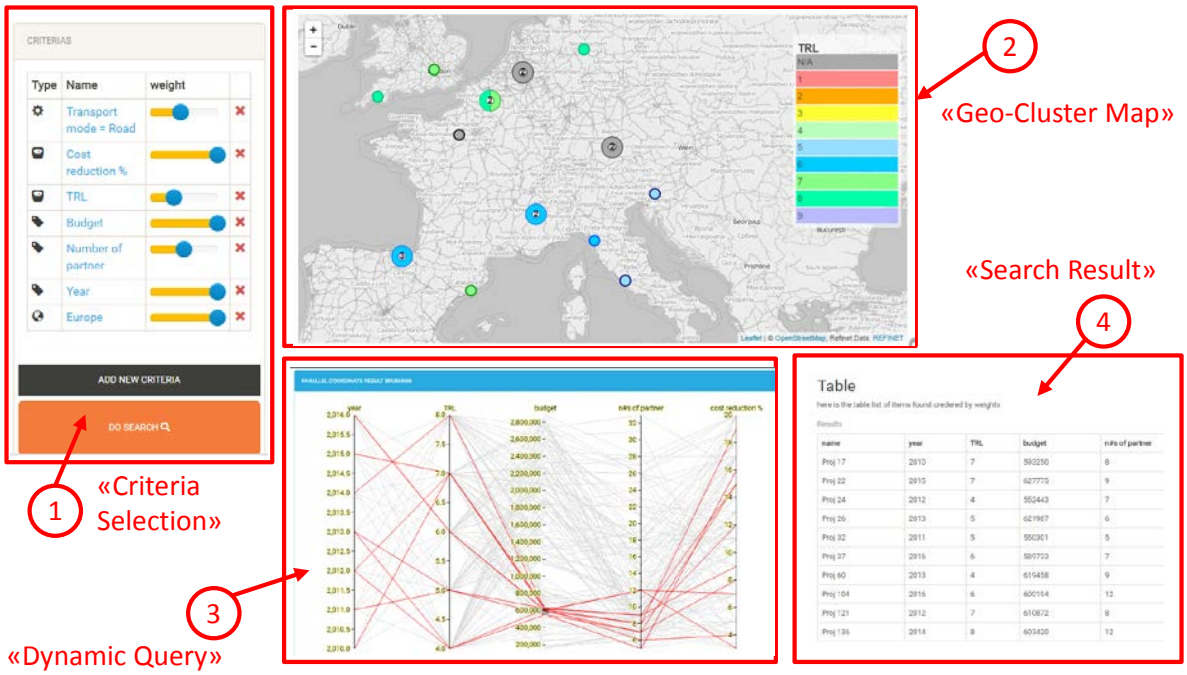


Figure 10 – REFINET Geo-Clustering Platform Functionalities

The prime users of the platform are on one side Public Bodies and Agencies (at Regional, National, EU level) and on the other side Asset (Infrastructure) Managers and Operators (including companies contracted to deliver design, operation and maintenance work).

In Annex 4 of this document, two storyboards Illustrates exemplary uses that the two main stakeholder types (as listed above) could make of the platform.

Status of the Platform and way forward

The design of the REFINET Platform started in the last months of the projects, after the completion of the data gathering activities (WP3 and Task 4.1). The development of the Platform will follow the Within the end of 2016: first version of the Platform will be available online containing:

- the entire set of data collected during the project
- a subset of functions

Continuous interaction with Stakeholders and Experts are foreseen from November 2016 up to March 2017 to allows improvements, elicitation of requirements and feedback on the usability. Webinar sessions are foreseen to be organized to show the platform updates and train interested users and get their feedbacks.

As part of the deployment activities of tasks 4.2 tests and further improvements of the Platform will take place. By April 2017, a final version of the Platform with the entire set of functionalities will be released and dedicated dissemination activities will be carried out.

The idea is that the platform will be kept up and running after the project ends to stimulate a collaborative feeding of information so that to expand to other countries, to dig up at the level of data quality, accessibility, etc. In the future the REFINET Platform could potentially have, according to the two typology of stakeholders aforementioned, two modes of use:

- A public one for users belonging to Public Entities, Agencies, Authorities as well as for any stakeholders in the sector (including Academia and Research Entities) that are interested in using the tool for making advanced analysis of technologies and correlations among technologies, at different level of development (according to the TRL) or use. Only public information will be used and released.
- A private one for customers (Infrastructure Managers and Operators, Technology Suppliers and providers, etc.) that are willing to use the tool as ad advanced analyser to support their planning and decisions making in terms of investments, adoption of one technology, etc. In this sense the tool can be seen as a sort of market place where demand and offer can be combined.

1.1.7 Future R&D priorities

A key output of REFINET WP3, which also builds upon the RMMTI Model, is a list of upcoming R&D priorities that the project has identified as being critical trends for the TI research effort of the future (the priorities are presented in full detail as part of D3.4). To achieve this result, the **REFINET "research needs" matrix** - a tool of the RMMTI Model - has been used to **prioritise** investments in R&D in the three Transport Network Pillars – i.e. urban mobility, multimodal hubs and long-distance corridors – and in a fourth systemic dimension transversal to the whole TI sector. The matrix filters priorities by TRL levels and gives for each of them critical information on scope, impact, costs, timeline, scale and any further comments which can help a user in prioritising.

PRIORITY AREA A			Scope	Impact	€	Timeline	Scale	Comments
RESEARCH TRL<5	PERFORMANCE 1	R1.1	1 Sentence	3 lines				
		R1.2						
		R1.3						
	PERFORMANCE 2	R2.1						
		R2.2						
		R2.3						
	PERFORMANCE 3	R3.1						
		R3.2						
		R3.3						
INNOVATION 6<TRL<8	PERFORMANCE 1	I1.1						
		I1.2						
		I1.3						
	PERFORMANCE 2	I2.1						
		I2.2						
		I2.3						
	PERFORMANCE 3	I3.1						
		I3.2						
		I3.3						
DEPLOYMENT 8<TRL		D1						
		D2						
		D3						

Table 1 - REFINET Research & Innovation needs

Considering the current challenges and barriers to the modernisation of existing TI and to the construction of new TI[12], when using the matrix for example for Priority A "Urban mobility", the following research actions (TRL below 5) have been identified:

[12] Analysis available as part of **D3.4 REFINET Strategic Implementation Plan (SIP)**

PRIORITY AREA A: URBAN MOBILITY		ID	Scope
RESEARCH TRL<5	GREEN	R1.1	Air quality issues - technologies e.g. coatings
		R1.2	Reducing air pollution in cities
		R1.3	Relationship between smart grids + energy storage electric vehicles
		R1.4	Research in Reuse and after life disposal
		R1.5	Heat removal of tube lines
		R1.6	Undergrounding large avenues with connections to local car-parks in the cities
		R1.7	Technologies for automated transport means inside the cities
		R1.8	Solar road
		R1.9	Inductive technology - electrification
	COST-EFFICIENT	R2.1	Risk sharing and transactions in construction
		R2.2	3D-printing large scale
		R2.3	Vehicles as a service
		R2.4	Financial innovation to fund new /maintenance of old infrastructure
		R2.5	New construction techniques to decrease time scales
		R2.6	Composite materials for sale, smart, cheap structures
		R2.7	Prefabrication - modular construction/upgrade
	SOCIAL / INCLUSIVE	R3.1	Approaches to improving access
		R3.2	Congestion & evacuation / Crowd control
		R3.3	Smartening versus vulnerable group of people (disabled, old people,…)
		R3.4	Journeys pertinent to user and not generic
		R3.5	Assessing HCD aspects of urban mobility + modeling - simulation - accuracy
		R3.6	Sensors for real-time geolocalised information to cars
		R3.7	Co-planning and management of all infrastructure (transport, water, other networks)
	RESILIENT	R4.1	Self-healing materials
		R4.2	Asset degradation / residual life for older structures
		R4.3	Impacts of severe weather events-adaptation measures
		R4.4	Adaptation to abrupt increase of temperature and moisture content
		R4.5	Governance of transport system
	SAFE / SECURE	R5.1	cyber security / privacy issues related to "smart"
		R5.2	Cyber security R&D to keep ahead hackers
		R5.3	Autonomus vehicles / trains, etc.
		R5.4	PRT systems
		R5.5	Safety standards processes for SIS - ISO 26262
		R5.6	Forgiving road
		R5.7	Automated and connected vehicle - Adaptation of transport infrastructure
		R5.8	Flood partial management by infrastructures (road?) based on new materials / new construction methods.
		R5.9	Robotics for silent, undisruptive "keynote surgery" construction/rehabilitation
		I1.1	Low carbon whole -life costing

And the following innovation actions (TRL 6 to 8) have been identified:

		R5.9	Robotics for silent, undisruptive "keynote surgery" construction/rehabilitation
INNOVATION 6<TRL<8	GREEN	I1.1	Low carbon whole -life costing
		I1.2	Multiple-benefit design
		I1.3	Advanced materials e.g. materials that repai
		I1.4	Electric buses
		I1.5	Movement energy harvesting
		I1.6	Superabsorbing surface materials (CO2, Nox)
		I1.7	Integration of nature-based solutions (both GREEN & SOCIAL / INCLUSIVE)
		I1.8	Inductive technology - electrification
		I1.9	rapid-charging of electric vehicles-deployment and usage in cities
		I1.10	Noise & pollution reduction
	COST-EFFICIENT	I2.1	Greater use of standardiesed approaches
		I2.2	Standard way of commicating innovation in infrastructure
		I2.3	whole life time -> intelligent signs in vehicles for instance.
		I2.4	Low cost sensors in mobility infrastructures
		I2.5	Modular, prefabricated roads + sidewalks
		I2.6	Warm-mix asphalt (prefabrication)
		I2.7	self-healing (long lasting)
		I2.8	DPI - > airspace and departure planning
		I2.9	Generalisation of data-communication networks along transport avenues (sensors, cameras, etc.) to improve transport management
		I2.10	Infrastructure for autonomous travel
	SOCIAL / INCLUSIVE	I3.1	Transport links info on delays across modes
		I3.2	Informing custome - providing choice-traveller needs
		I3.3	Autonomous vehicles/hybrid systems
		I3.4	Vwide spread technology APP
	RESILIENT	I4.1	Use of real time info to forecast environmental hazards
		I4.2	Prioritisation of asset maintenance + investment
		I4.3	Real time travel options to users
		I4.4	Addictive manufacturing (3D printing)
		I4.5	Networked trials and evaluation to engage with SME groups to accelerate TRL progress
		I4.6	Design for upgradebility, retrofiting
	SAFE / SECURE	I5.1	Public communication & awareness
		I5.2	System of systems thinking requeriment
		I5.3	Responsive infrastructure - ligths that came on when you walk past
		I5.4	Autonomous vehicles -> trials + testing in representative environments/hybrid systems
		I5.5	Management of people/public during upgrade of infrastructure
		I5.6	Roadway ligthing systems
DEPLOYMENT 8<TRL		D1	Connectivity for vehicles
		D2	Open information of data
		D3	Public acceptance of major infrastructure works.
		D4	Green procurement for vehicles + infrastructures
		D5	24/7/365 operation
		D6	Reduction on impact on adjacent networks whilst infrastructure works being undertaken.

EXAMPLE for Priority area A (URBAN MOBILITY) and performance GRE

Scope	Impact	Barriers/Specific challenges
Optimization of construction materials for prefabrication, including additive manufacturing: The design, development and validation of new materials, processes and constructive solutions for low embodied energy constitute a peremptory challenge in order to mitigate the effects of climate change. New developments can increase the added value of European industry in the field of materials and construction products by 1) increasing the sustainability of processes and products, reducing waste generation and metabolizing waste of other sectors; 2) incorporation of new nanostructured materials that enable building systems provide new features and 3) adoption of new intelligent production processes by combining evolutionary algorithms and additive manufacturing systems for the development of multifunctional and ultralight prefabricated components. Additive manufacturing (AM), its possibilities, feasibility and advantages over existing techniques lay on the development of suitable materials. New sustainable solutions such as cementitious materials with low embodied energy, concrete that include aggregates from waste streams (CDW,....), has to be developed considering the characteristic properties of concrete that are important for AM technology: plasticity, workability and consistency. **include reciclying – recovery – reuse**	*Designing and manufacturing concrete pieces of very complex geometries that develop architectural and most ambitious infrastructure projects in terms of design and incorporate new features in prefabricated parts in a more optimized way, ensuring at least 15% cost reduction. *Incorporate at least 50% of raw materials valued from CDW. *Optimization of benefits in infrastructure designs. The new challenges of reducing the use of resources in buildings and infrastructures and the subsequent reduction of greenhouse gases, established in Europe for the period 2020-30, are leading the demand for lighter and structurally efficient prefabricated products. Lighten at least 15% of the piece by topology optimization. *Optimizing performance in infrastructure. With regard to the structural strength, structural integration in early stages of project ensures not only more resistant effectiveness, but also expand the suitable solutions and formal possibilities beyond conventional structural types, creating complex shapes with different branches and thicknesses and wherein the material is inhomogeneous, using different materials in different areas of the part, according to the required functional performance. This technique will lighten the pieces of concrete without losing structural performance, optimize manufacturing costs, minimize the use of resources and reduce carbon footprint.	The precast concrete industry in Europe, with an annual turnover of 24 billion euros and employing 164,000 people, faces the challenge of improving the efficiency of resources (materials and embodied energy) and competitiveness by implementing the following strategies: i) optimizing the use of alternative raw materials with special emphasis on resources from CDW; ii) lighten up of structural components; iii) reduction of carbon footprint along the value chain .; iv) reducing manufacturing and assembly cost throughout the different stages of the value chain; v) selective incorporation of new high-value functions in specific parts of the pieces There is broad consensus in the European Union (EU) on the fact that economic growth must come driven by a strategic policies on material resources. The flagship initiative for an efficient Europe in the use of resources, within the Europe 2020 strategy, supports the transition to an efficient, sustainable, low-carbon economy that is oriented toward paradigms of circular economy where the utilization of waste and by-products maximize the use of resources. In Europe, buildings and infrastructures consume vast amounts of materials and energy in its phases of construction and use. Both the manufacture of construction materials, such as power generation carry enormous associated CO2 emissions. It is well-known the high environmental impact associated with the construction and operation of buildings and infrastructures.

1.2 Performance in TI in the EU28 and Identification of Case Study Countries

To prepare for the deployment of the REFINET SIP, a good understanding was required of how each of the 28 EU Member States performs as far as TI is concerned, to better understand where and how the REFINET tools could be used. This analysis (carried out as part of WP4 task 4.1) enabled the design of the main deployment strategy for the SIP and helped identify test countries with which developing roadmaps for the local deployment of the SIP as part of upcoming Task 4.2.

Performance in a single country depends on a complex array of political, regulatory, financial, orographic and climatic parameters. If the Commission insists on the fact that: "the focus on development and deployment of innovative infrastructure technologies and elements should be increased in all Member States[13]", it is evident that TI presents very different levels of priorities and challenges in the various Member States. Some countries must first upgrade and maintain the existing infrastructure, others need to develop or expand their transport network; for example, the Commission acknowledges that "the availability and quality of transport infrastructure is particularly low in the eastern part of the EU. Renovation and upgrading of an otherwise extensive railway infrastructure is also a fairly common challenge there, notably because in the last two decades of efforts have concentrated mainly on completing the primary high capacity road network (motorways and expressways)[14]". Member States in which the stock of infrastructure is low, or has suffered from underinvestment, would undoubtedly benefit from higher infrastructure investment.

To identify the current status of quality and performance of the European Transport Infrastructure in EU28, REFINET has reviewed ratings[15] of all the 28 EU Member States in four areas (Quality of roads; Quality of railroad infrastructure; Quality of port infrastructure; and Quality of air transport infrastructure) to obtain a consolidated picture[16] of the quality of their transport infrastructure is

[13] http://ec.europa.eu/europe2020/pdf/themes/2016/transport_201605.pdf
[14] http://ec.europa.eu/europe2020/pdf/themes/2016/transport_201605.pdf
[15] (http://ec.europa.eu/transport/facts-fundings/scoreboard/index_en.htm).
[16] Please see Annex 6 of this document for further detail.

concerned. The prime source of knowledge used has been the Transport Scoreboard[17] an online platform which compares the performance of the EU Members States in various transport-related categories. The result of this exercise is the identification of groups of "performers".

The analysis on country's quality of transport infrastructure is based on the overall average rating calculated for each country over four categories* (railroad, port, air and road) and so defining a minimum and maximum level of quality (values depicted in the picture below reported). Following, two thresholds are defined: a top threshold indicating the average quality beyond the 80% and the low threshold indicating the countries with an average quality under 20% of the overall quality range. The ranking can be modified in a close future according to details and criteria that REFINET cannot control and which are provided in the transport scoreboard.[18] For more information on the data/ranking see Annex 5 of this document.

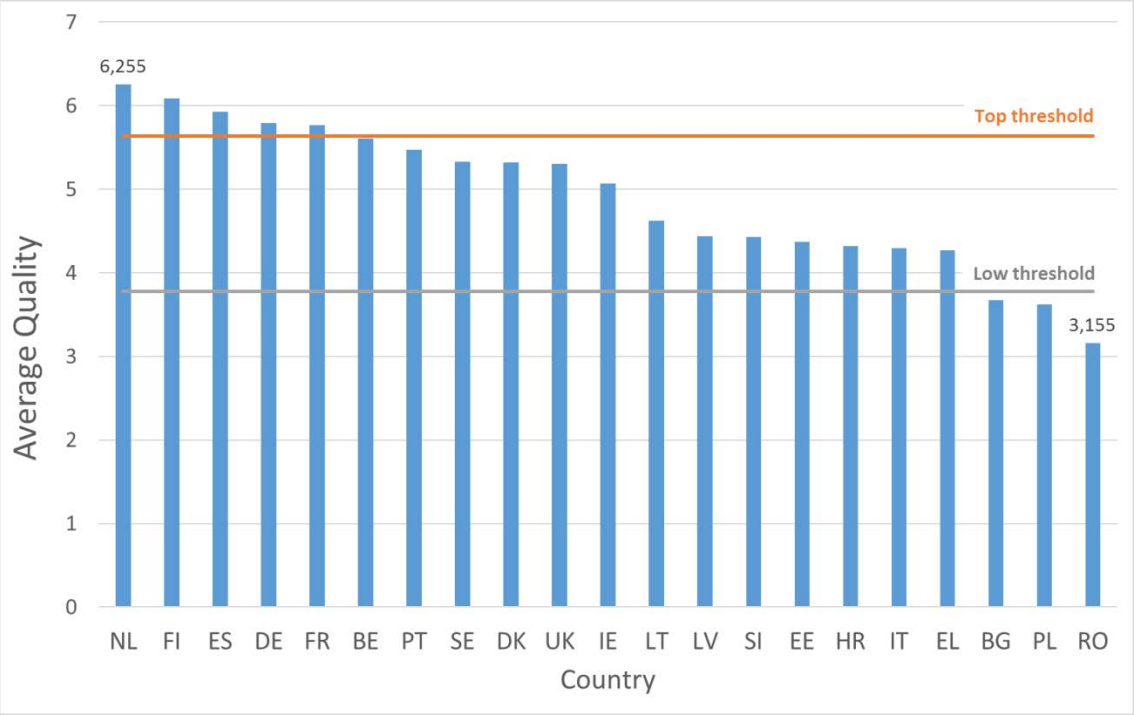


Figure 11 – Average quality of Transport Infrastructure according to[19] (only countries with data of all categories are evaluated)*

This allows identifying the following three groups of performers

- Group#1: Top performers (top 20% quality performers)
- Group#2: Medium performers
- Group#3: Low performers (countries under 20% of overall quality range)

Group	Countries
Group#1: Top performers benchmark study (above top threshold)	NL, FI, ES, DE, FR
Group#2: Medium performers case study	BE, PT, SE, DK, UK, IE, LT, LV, SI, EE, HR,

[17] http://ec.europa.eu/transport/facts-fundings/scoreboard
[18] http://ec.europa.eu/transport/facts-fundings/scoreboard
[19] http://ec.europa.eu/transport/facts-fundings/scoreboard

(below top threshold and above low threshold)	IT, EL
Group#3: Low performers (below low threshold)	BG, PL, RO

Table 2 - TI performances across EU28

Moreover, in order to provide a full picture and detail a bit more the quality performance over the four categories of transport infrastructure, the following picture shows how many times* a single country is classified as top (blue), medium (orange) or low (grey) performers.

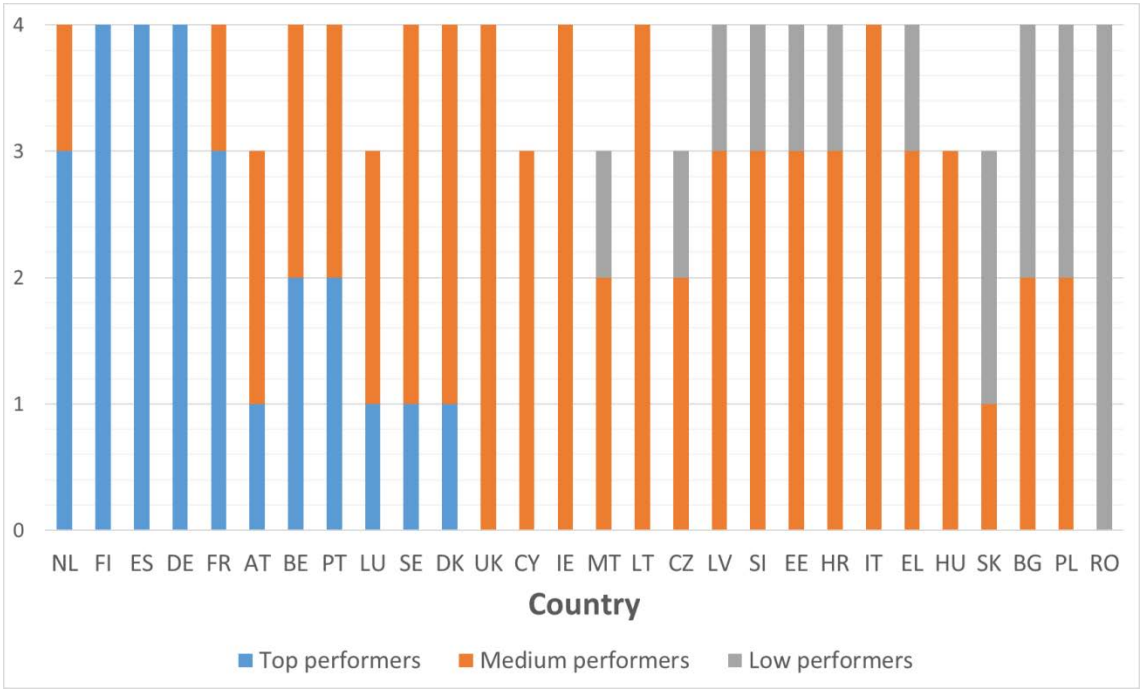


Figure 12 – Number of times in Top, Medium, Low performance for country (source:[20]) - the quality of infrastructure is not considered in case of not available data (countries with only 3 categories considered: AT, LU, CY, MT, CZ, HU, SK))

Work Plan

After a realistic assessment of the effort available within REFINET WP4 it was agreed amongst the partners that **two case study countries** would give the project a good test base to build the deployment roadmaps planned in later stages of the project (Task 4.2): one of the medium and one of the low performing groups[21]. Partners have proposed to stakeholders from **Italy and Romania** – two countries where god access to TI stakeholders could be ensured - to take part in the deployment activities. In the preparation of and following the first task 4.2 workshop held in Rome on 26 October 2016[22] both country representatives agreed enthusiastically.

Group	Countries	Case study country
Group#2: Medium performers case study	BE, PT, SE, DK, UK, IE, LT, LV, SI, EE, HR, IT, EL	**Italy:** Italy's transport infrastructure receives ratings **slightly below EU average**, with a

[20] http://ec.europa.eu/transport/facts-fundings/scoreboard
[21] As per REFINET DoA (as per the project contract, REFINET aims at "reducing the current disparities among countries or in the worst case ensuring that the existing gaps will not be enlarged").
[22] Workshop organised as part of Task 4.2.

(below top threshold and above low threshold)		slight decrease since the last reporting period (2010-2012) on some of them.
Group#3: Low performers (below low threshold)	BG, PL, RO	**Romania:** As far as the quality of transport infrastructure is concerned, ratings for all modes of transport in Romania are **quite low.**

On that basis, the REFINET Deployment Strategies and Roadmaps will include proposals for the definition of *ad hoc* solutions which can be further defined and implemented in dialogue with key Italian and Romanian stakeholders. To increase the chances of the case study countries fully leveraging the solutions offered by the REFINET SIP, the roadmaps will be linked to investment and funding opportunities existing today in Europe and which can support the development of TI at European and local levels. These opportunities are presented in the following section.

1.3Mapping Financial Tools Enabling TI Modernisation

Developing transport infrastructure requires substantial investments, be it for research and development activities, demonstration, adaptation (to a specific context or need) or technology transfer. REFINET has carried out a top-level analysis of the European and national programmes that can support these investments (as part of task 4.1)[23]. Special attention has been paid to the opportunities offered by the European Commission through the European Social and Innovation Fund (ESIF) and the main Pan-European programme for the financing of Innovation, Horizon 2020. As part of the deployment strategy of the REFINET SIP for the case study countries, interactions with the various programme managers are planned, with the scope of collaborating on the definition of research priorities for future H2020 or ESIF calls (as per Obj3.3 of DoA). Interactions will take the form of interviews, email consultations and direct exchange during two dedicated workshops (as part of REFINET Task 4.2). The process used to gather data on existing funding opportunities to support the deployment of the REFINET SIP and analyse it for 28 MS involved desk searches by a number of REFINET partners. The full data set is available upon request and will be used to build the REFINET Platform. Hereafter we present the main programmes identified and rationale for use or collaboration in the case study deployment countries.

1.3.1 Main Programmes Identified and Rationale for Use

To reach the targets set in the overarching strategy "Europe 2020" and the specific aims of each EU countries relating to innovation identified in their Smart Specialisation Strategy[24], one main financing instrument exist at European level to support infrastructure projects of high economic importance and relevance for the EU single market and compensate budgetary deficiencies at national level; it is the European Structural and Innovation Fund (**ESIF**) within which the European

[23] A more detailed research for the case study deployment countries will be performed as part of task 4.2 to have a deeper understanding of the funding landscape.

[24] RIS3 supports the creation of knowledge-based jobs and growth not only in leading research and innovation (R&I) hubs but also in less developed and rural regions. RIS3 is a key part of the proposed EU Cohesion Policy reform supporting thematic concentration and reinforcing strategic programming and performance orientation. RIS3 focuses economic development efforts and investments on each region's relative strengths, exploiting its economic opportunities and emerging trends, and taking action to boost its economic growth.

Regional Development Funds (**ERDF**) and the Cohesion Funds (with its dedicated "Connecting Europe Facility, **CEF**[25]") can be leveraged in order to support the modernisation of the European TI. In addition, at Pan-European level, the **H2020** programme support the development of innovative solutions which may underpin infrastructure projects. It is important to note that, if infrastructure has been an element of the EC Framework Programmes for Research and Development for many decades, it is only since 2014 that a specific item of the Transport Work Programme in Horizon 2020 has been dedicated to the topic. Targeted initiatives such as "Infravation" and "Shift2Rail", funded under H2020 or its predecessor FP7, have recently been launched (in 2014 and 2015 respectively) and will start generating validated technologies in the next two years at the earliest.

However, Member States still need to develop local/last-mile infrastructure which is critical for proper incorporation of large infrastructure projects in the local transport system[26]. Hereafter is an overview of the programmes and their scope and modality of financing:

[25] Multi-Annual Work Programmes available at http://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/project-funding/work-programmes_en.htm
[26] http://ec.europa.eu/europe2020/pdf/themes/2016/transport_201605.pdf

ERDF/CEF/H2020:

Programme name & Geography	Programme scope	Modalities
Available at regional level (regions being primarily regions within individual countries)		
European Regional Development Fund (ERDF) (as part of the ESIF 2014-2020 European structural and investment funds[27])	TI is covered as part of the ERDF, as follows financing for development of: *Rail* • *New:* Poland, Greece, Spain • *TEN-T new:* Greece & Spain • *Reconstructed:* In 16 countries: Slovenia, Lithuania, Croatia, Sweden, Czech Rep, Slovak Rep, Greece, Estonia, Bulgaria, **Italy**, **Romania**, Hungary, Latvia, Spain, **Poland**, Portugal • *TENT-T Reconstructed* in 16 countries: Slovenia, Lithuania, Croatia, Sweden, Czech Rep, Slovak Rep, Greece, Estonia, Bulgaria, **Italy**, **Romania**, Hungary, Latvia, Spain, **Poland**, Portugal *ROAD:* • *New* in 14 countries: Slovenia, Lithuania, Croatia, Czech Rep, Slovak Rep, Greece, Estonia, Bulgaria, **Italy**, **Romania**, Hungary, Spain, Poland, France • *TEN-T new:* In 10 countries: Slovenia, Lithuania, Czech Rep, Slovak Rep, Greece, Estonia, Bulgaria, **Romania**, Hungary, Poland • *Reconstructed:* In 17 countries: Lithuania, Sweden, Czech Rep, Slovak Rep, Greece, Estonia, Bulgaria, **Italy**, **Romania**, Hungary, Latvia, Spain, Poland, Cyprus, Malta, **UK**, France • *TEN-T reconstructed:* In 12 countries: Malta, Cyprus, **UK**, Sweden, Lithuania, Czech Rep, Greece, Estonia, Bulgaria, **Romania**, Hungary, Poland	**Funds available at regional level** Through a procurement process Organisations that can benefit from regional funding include public bodies, some private sector organisations (especially small businesses), universities, associations, NGOs and voluntary organisations. Foreign firms with a base in the region covered by the relevant operational programme can also apply, provided they meet European public procurement rules.

[27] The ESIF procure a critical mass of investment in key EU priority areas through a budget of €454 billion for 2014-20; it is the European Union's main investment policy tool. ESIF Coordinated Funds are as follows:

- European Regional Development Fund (ERDF)
- European Social Fund (ESF)
- Cohesion Fund (CF)
- European Agricultural Fund for Rural Development (EAFRD)
- European Maritime & Fisheries Fund (EMFF)

	Innovative technologies identified by REFINET can be embedded in these creation and modernisation projects.	
Top-up funding to regional funds available Europe-wide		
Connecting Europe Facility (CEF) — Cohesion Fund allocation (as part of ESIF)	To select and finance projects, the TEN-T policy is supported by the Connecting Europe Facility (CEF) — Cohesion Fund allocation[28] **a pan-European** top-up funding instrument for TI development. CEF financial support takes primarily two forms: • Grants, which are non-reimbursable investments from the EU budget; • Contributions to innovative financial instruments, developed together with entrusted financial institutions such as the European Investment Bank, such as: the Marguerite Fund, the Loan Guarantee for TEN Transport (LGTT) and the Project Bond Initiative. Concerning the Grants, the 2016 work programme for CEF project funding lays out the following priorities: • Removing bottlenecks, enhancing rail interoperability, bridging missing links and, in particular, improving cross-border sections; • Ensuring sustainable and efficient transport systems in the long run, with a view to preparing for expected future transport flows, as well as enabling all modes of transport to be decarbonised through transition to innovative low-carbon and energy-efficient transport technologies, while optimising safety. Nb: For each transport mode, the work programme gives additional detail as to which challenges need to be tackled.	Maximum amount of EU financing for grants for works is 40%. Applications must be presented by: • one or more Member States, and / or • with the agreement of the Member States concerned, by international organisations, joint undertakings, or public or private undertakings or bodies or entities established in Member States.
Develop and deliver better policy		
Interreg Europe (financed as part of ERDF 2014-2020)	Interreg Europe helps regional and local governments across Europe to develop and deliver better policy. By creating an environment and opportunities for sharing solutions, Interreg Europe aims to ensure that government investment, innovation and implementation efforts all lead to integrated and sustainable impact for people and place. Interreg Europe aims to get maximum return from the EUR	

[28] http://ec.europa.eu/transport/themes/infrastructure/reference-documents/docs/2016/c(2016)1775-annex.pdf

	359 million financed by the European Regional Development Fund (ERDF) for 2014-2020. Interreg Europe can assist **three types of beneficiaries:** ▪ **Public authorities –** local, regional and national ▪ **Managing authorities/intermediate bodies** - in charge of the Investment for Growth and Jobs programmes or European Territorial Cooperation ▪ **Agencies, research institutes, thematic and non-profit organisations** – although not a main target group, these types of organisations can also work with Interreg Europe by *first* engaging with their local policymakers to identify options for collaboration. Transport as a sector is covered in various of the main priority themes of the scheme such as low carbon economy or competitiveness[29].	
Pan-European R&I funding programme		
EU H2020 (2014-2020) Whole of EU28 + associated countries	Mainly financing R&D innovation Only recently introduced Transport Infrastructure as a separate topic– recent in Transport WP from 2014 dedicated section (before was horizontal) • 19M in 2014 • 17.5M in 2015 • 37M for R&D for infrastructure for 2017 – more resilient TI, declining financial resources to maintain TI 2018-2020 new topics, results by 2030	Call for proposals mainly; any EU28 MS and associated countries can apply Often through collaborative projects
Shift2Rail	A public private Joint Undertaking established in 2014 for coordinating research activities with a view to driving innovation in the rail sector in the years to come. Shift2Rail prioritises the following main	Public-private partnership

[29] Selected Interreg Europe funded projects in the field of transport such as SMART-MR working on promoting sustainable measures for achieving low-carbon and resilient transportation in metropolitan regions - http://www.interregeurope.eu/smart-mr/ - or Regio-Mob working on mutual interregional learning of local transport authorities to face increasing mobility demand while coping with higher congestion levels - http://www.interregeurope.eu/regio-mob/ - are being mapped as part of WP4 task 4.2 in order to explore how their outputs would be leveraged as part of the roadmaps for the deployment strategy.

Joint Undertaking (partly funded through H2020)	objectives: • Achieve the Single European Railway Area • Radically enhance the attractiveness and competitiveness of the European railway • Help the European rail industry to retain and consolidate its leadership on the global market The activities of the Shift2Rail Joint Undertaking (S2R JU) are identified in a common, forward-looking strategic Master Plan and are organised around five key "Innovation Programmes": cost-efficient and reliable trains, including High-Speed and high-capacity trains; advanced traffic management & control systems; cost-efficient and reliable high capacity infrastructure; IT Solutions for Attractive Railway Services; Technologies for Sustainable & Attractive European Freight.	Public funding through H2020. 7-year work programme Two types of calls: open (to non-members) and closed (only open to founding and/or associated members) first projects have been evaluated end of June 2016 Beneficiaries: Rail infrastructure managers, responsible for the safety, planning, construction, operation, management and maintenance of rail infrastructure, will benefit from innovations in the field of command and control, harmonisation of specifications and increased line capacity, helping to overcome network saturation and ensure better intermodal connections. Innovations in the field of assets, safety and energy management will also help to significantly reduce maintenance costs.
Facilitating market take up of innovative transport infrastructure solutions through **H2020 Public Procurement of Innovative Solutions**	Rationale: • Infrastructure innovation, supported by targeted up-stream research activities, must be deployed at integrated system level • However, testing and implementing solutions at system level is much more challenging than at component level in view of the number of technological and organisational parameters involved, their interdependency, the scale of investment and the potential impact on stakeholders • Therefore instruments such as Public Procurement of Innovative Solutions (or Pre-Commercial Procurement) are essential to support the testing & implementation of innovative solutions	At least 3 member states to launch the PCP together Conditions (financials and form of projects) are being reviewed. Dedicated call in 2015, H2020 COFUND-PPI COFUND (PPI) MG-8.3-2015 call for TI did not get one application funded

Variable geometry funding for R&I projects		
Infravation EC (FP7) + National funding from 11 countries + EC and USA (no participation from Eastern EU countries)	FP7 initiative under the ERA-NET scheme[30] Pooled research fund to develop transport infrastructure innovations Infravation brings together funding from the Netherlands, Denmark, France, Germany, Iceland, Israel, Italy, Norway, Spain, Sweden, USA and the EU into one common transnational Call framework, to fund joint research projects.	Currently closed. May re-open in 2018. ERA-NET Plus Infravation 2014 Call (SST.2013.1-3. ERA-NET Plus "Advanced systems, materials and techniques for next generation infrastructure") aimed funding projects for cost-effective advanced systems, materials and techniques in road infrastructure construction and maintenance, including repair, retrofitting and revamping. The solutions called for include materials technology, methods and processes, and supporting systems, such as for monitoring, communication and energy.

1.3.2 The Specific Instance of ERDF in the REFINET Case Study Countries

For each of the case study countries (Italy and Romania/Test Deployment Countries) the available opportunities under the European Regional Development Funds have been further explored. In medium performing areas, such as Italy, the needs to modernise the local TI is greater and the planning of investments in the area is thereof greatly influenced:

Italy	**OP on "Infrastructures and Networks" (PON Infrastrutture e Reti 2014-2020)**: **re-balance the Italian transport system, currently characterised by a predominance of road traffic, by modernising and extending**	01) Supporting a **multimodal Single European Transport Area by investing in the TEN-T network (total funding: EUR 1,095m, 62%)**	ERDF & National funds: Fondo di rotazione	01) Supporting a multimodal Single European Transport Area by investing in the TEN-T network 02) Developing and improving environmentally-friendly	Ministero delle Infrastrutture e dei Trasporti - Direzione Generale per lo Sviluppo del territorio, Sistemi informativi e statistici: Divisione II -

[30] In FP7, ERA-NET Plus Actions provided a Community financial contribution to those national research programmes that pool financial resources to organise and fund a joint call for transnational research projects.

	sustainable transport modes for passengers and freight, along the Trans-european core transport network TEN-T in less developed regions. The programme will focus on actions in three sectors: **railways, port infrastructure and intelligent transport systems**. The competitiveness of key ports and multimodal logistic platforms will be improved through appropriate intermodal connections with inland transport. Highways and road arteries will not be co-financed by this programme. Focus regions: Basilicata, Calabria, Campania, Puglia and Sicilia; will invest in 3 sectors: railway and port infrastructure and intelligent transport systems.	02) **Developing and improving environmentally-friendly (including low-noise) and low-carbon transport systems,** including inland waterways and maritime transport, ports, multimodal links and airport infrastructure, in order to promote sustainable regional and local mobility (total funding EUR 684.2 million, 38%)	nazionale (Euro 460.933.334)	(including low-noise) and low-carbon transport systems, including inland waterways and maritime transport, ports, multimodal links and airport infrastructure, in order to promote sustainable regional and local mobility	Programmi europei e nazionali per le reti e la mobilità Via Nomentana, 2 00161 Roma

In low performing regions, such as in our case study country Romania, developing the local TI is a top priority:

Romania	**Large Infrastructure Operational Programme (LIOP)** aims at promoting sustainable economic growth as well as safe and efficient use of natural resources. It addresses the **development challenges identified at national level in terms of transport infrastructure, sustainable urban transport**, environment, energy and risk prevention. The programme will mainly invest in **removing the main transport bottlenecks and developing sustainable, efficient and green transport modes in the country.** Another strong focus lies on measures to increase energy efficiency and protect natural resources. It also invests in environment infrastructure and risk prevention.	- **Improving mobility through the development of the TEN-T and the metro network** **- Development of a multimodal, high-quality, sustainable and efficient transport system** - Development of environmental infrastructure based on an efficient management of resources - Environmental protection by taking measures to preserve biodiversity, air quality monitoring and de-contamination of historically contaminated sites	CF (Cohesion Fund) ERDF	- Travel time on the road TEN-T core network reduced to 74,1 Min/100km - Travel time on the rail TEN-T network reduced to 79,2 Min/100km - The quantity of goods carried by inland waterways will increase to 32,2 tonnes/year - The number of road fatalities per million inhabitants will decrease to 73 - The number of passengers embarked and disembarked in airport transport will increase to 20 million/year - An increase in the containerised	Ministerul Fondurilor Europene - Autoritatea de Management LIOP Bd. Ion Mihalache, nr 15-17, Tower Center București http://www.fonduri-ue.ro

		- Intelligent and sustainable transport systems for electricity and natural gas		cargo volume handled in intermodal terminals to 70.000 - A decrease to half of the waiting time in customs at exit points in agglomerated periods (carriers)	
	Regional Operational Programme (ROP) aims at promoting smart sustainable and inclusive growth in all regions in Romania making them more attractive places in which to live and work. The programme addresses the major development challenges for Romania: regional competitiveness, sustainable urban development, the low-carbon economy, and economic and social infrastructure at regional and local level.	- Promoting the low-carbon economy through investments in energy efficiency in buildings, public lighting and sustainable multimodal urban mobility. - **Improving regional connectivity.**	ERDF	- **Improving urban public transport attracting 140 million additional passengers per year in less developed regions** - **Rehabilitation and modernisation of more than 2,000 km of roads improving regional connectivity to the TEN-T network**	Autoritatea de Management POR - Ministerul Dezvoltarii Regionale şi Administraţiei Publice Str. Apolodor nr. 17 Bucureşti, Sector 5 (+40 37) 211 14 09 info@mdrap.ro http://www.mdrap.ro

All 3 main programmes presented here aim at supporting the quality of infrastructure in the three Transport Network Pillars – i.e. urban mobility, multimodal hubs and long-distance corridors**.** ERDF/ESIF have agendas differing based on local needs (agendas that are aligned to national, regional and local TI financing strategies); CEF & H2020 on the other hand are Pan-European programmes open to all EU Members States and Associated Countries. Specific opportunities for financing will be explored in more details as part of the roadmapping activity (see next section). The information concerning programmes available in the two case study countries will be leveraged during the deployment activities (Task 4.2).

2. DEPLOYMENT STRATEGY

The previous section presented the preliminary activities needed to prepare a strong deployment strategy for the SIP. Clearly identifying:

- the solutions to be deployed (the "What");
- the ecosystem within which they would be deployed (the "Where");
- and the financing opportunities that could be leveraged if needed, to enable deployment (the "Enablers").

The present section includes these elements in the perspective of a strategic plan (the "How") for the deployment of the SIP.

The REFINET model and the SIP will help guide investment decisions in TI to fund new research and innovation and transfer or adapt available technologies and best practice. Stakeholders of the TI concerned by these two investment types are primarily TI Managers and Operators and European and national Policy Makers and Public Bodies including ministries. The deployment of the REFINET SIP to these stakeholders will be characterized by **two time-scales**:

- **A short-term approach to support TI Managers and Operators** in identifying solutions to their current needs by enabling the transfer of existing and incoming innovative technologies, such as materials, components, IT systems and processes, etc. to support Transport Infrastructure (TI) update, modernization, etc.
- **A medium to long-term approach to relay information to Policy Makers and Public Bodies** (including Transport Authorities) in identifying future research topics in TI based on an analysis of the current existing technology offer and the future demands.

They are presented in further details hereafter.

2.1Supporting TI Managers - The short to medium term approach

Aim: Developing a short to medium term (from 3 to 8 years) tactical roadmap at the level of the member states to help TI Managers, as well as operators, deploying best practices and high-potential technologies as identified and validated in REFINET

The REFINET model and the SIP will help guide investment decisions in TI in the case study countries for what concerns i) the deployment or adaptation (before deployment) of available technologies and ii) the need for research and innovation in new technologies with the support of EU, national and regional funding. To structure this "investment path", the **strategy for the deployment of the REFINET SIP** proposes a four-step process as follows:

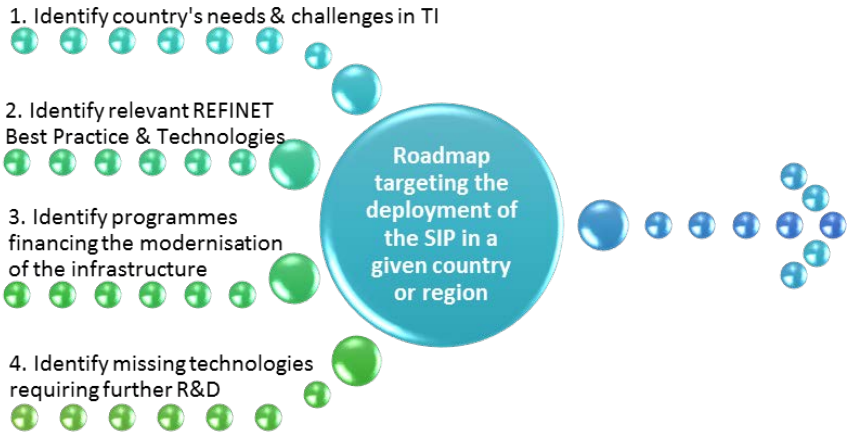


Figure 13 - REFINET mapping for a given country or region

In the frame of Task 4.1 some background work has been carried out to prepare for the development of the Deployment roadmaps in Task 4.2. concerning the short-term deployment strategy with TI Managers, background research on the two case study countries has been done. The results are presented here and will be further detailed and leveraged as part of task 4.2 in direct dialogue with stakeholders from the two countries.

2.1.1 Deployment approach

Step #1: Identify country's needs and challenges in TI

- For each case study country, we have first browsed relevant documents to understand their Innovation Readiness Level (IRL) such as the RIO (Research and Innovation Observatory) country reports. Those reports, produced by JRC, monitors R&I policies and performances in all 28 EU Member States are available at https://rio.jrc.ec.europa.eu/en/country-analysis; they include references to Research and innovation strategies for smart specialisation -RIS3 (with further details available at http://s3platform.jrc.ec.europa.eu/home). Hereafter are key facts and figures on the two case study countries that will be useful and relevant to start building their roadmaps in Task 4.2. they give indication of their Innovation Readiness Levels (IRL) and TI status of development.

Step #2. Identify relevant REFINET Best Practice & Technologies (both High Potential & Incoming)

- For each case study country, the catalogues produced by REFINET are browsed to identify typologies of projects responding to the country needs and challenges.

Step #3. Identify programmes financing the modernisation of TI

- For each case study country, the programmes offering financing opportunities for modernisation of the TI are scouted to identify possible routes for financing the required technology adaptation projects that will respond to the country needs and challenges.

Step #4. Identify missing technologies requiring further R&D

- Finally, for each case study country, whenever the need or challenge require a brand new approach to anything tried out before, recommendations for investment into further R&D is made.

The following two tables present an early analysis of the research that is being carried out as part of Task 4.2 to prepare the country-specific roadmaps.

2.1.2 Case study country#1: Italy

Step #1: ***The Italian needs and challenges – overview***

IRL: Research and Innovation Observatory – Italy Country Report (2015)[31]

- Italy's GDP is still far below pre-2008 levels
- The Italian economy is showing signs of recovery after the years of recession that followed the financial crisis in 2008 and the euro area sovereign debts crunch of 2011.
- For the first time in years, gross domestic product (GDP) is forecast to grow by 1.4% in 2016.
- The debt/GDP ratio is one of the highest in the euro area, at 132.3% (2014).
- The unemployment rate is 12.7%, with a very alarming 42.7% rate of unemployment among young people (less than 25 years old).
- Both labour utilisation and labour productivity are low.
- Unfavourable innovation and business environment (OECD, 2015).
    - Italy put in place a set of strong fiscal consolidation measures
    - But in doing so it did not preserve its public support for R&D
    - As a consequence, Italy did not implement a smart fiscal consolidation strategy.
- The Ministry for Education, Research and Universities (MIUR) is the main player in research and innovation (R&I), in charge of coordinating national and international scientific activities, supervising the academic system, funding universities and research agencies, and supporting public and private research and technological development.
- The Ministry for Economic Development (MISE) manages industrial innovation.
- The national research programme 'PNR 2014-2020', delayed since early 2014, has been finally approved.
- Italy's R&D intensity is 1.29%, still far from the Europe2020 national target of 1.53%, which will not be reached if the current trend persists.
- To reach the Europe2020 target the yearly R&D investments should increase – assuming a constant GDP – by €4b, a much greater amount than the resources made available by present policies.
- Moreover, the share of gross domestic expenditure on R&D (GERD) performed by the business sector (54%) is low for industrialised economies (OECD, 2014) and much lower than the EU-28 average of 63.67%.

The Innovation Union Scoreboard 2016 defines Italy as a moderate innovator, performing below the EU average in most dimensions, in particular in Finance and support and in Firm investments. Nonetheless Italy has been increasing its innovation performance relative to the EU from 78% in 2008 to almost 83% in 2015.

Italian Transport Infrastructure Overview

Transport Score Board Factsheet:

- Overall country rank: 17 Area (1000km2): 301.3
- Nominal GDP 2015 (million €): 1 636 372
- Population 2015 (million): 60.796
- Expenditure per head on transport-related items 2014 (€): 2 000
- Planned Allocation of Community funding for transport 2014-2020 (million €): 3 820.35
- Number of proposals selected for CEF Transport (2015 call only): 4 Global Expenditure on TEN-T – 2007-2013 (million €): 58 956

According to the World Bank Logistics Performance Index, Italy's transport infrastructure receives ratings slightly below the EU average, with however a positive tendency across all modes. The completion rate of the

[31] https://rio.jrc.ec.europa.eu/en/country-analysis/Italy/country-report

TEN-T Core Network is close to the EU average, with most development needed in high speed rail.

Case study (data collected at WP4 Task 4.2 workshop in Rome on 26 October 2016 – source: AISCAT):

The Italian Motorway Network - Motorways represent about 3% of the National road network, or 5,980 km in operation of which: 1,800 km with three lanes per way, 115 km with four lanes per way, more than 25 km of International Tunnel, 1,608 bridges and viaducts which length is above100 m and 686 tunnels which length is above 100 m. in the last 2 years, 180 km of new sections have come into operation and 40 km of new sections are under construction. The main challenge is managing traffic growth: over the last 30 years, the tolled motorway network extent has been increasing of only 15%, to be compared with a 118% traffic growth (Light Vehicles +117% and Heavy Vehicles +121%). However despite this major challenge, fatalities have decreased by 63% between 1990 and 2015, making toll motorways the safest road infrastructure in the country. To enable this result, a lot of innovation is constantly needed and Italy has adopted amongst other innovative solutions Traffic Control Centres, SOS Posts, Weather Stations, Ice and Fog Detectors, Tutor, dynamic lane, and big data central system.

Possible impact of climate change Italy

Main effects of climate change on transport system may include the following:

- changes in stability and resistance of the transport system and infrastructures, as well as in the choice of transport modality directly dependent on temperature rise that thus indirectly affects the overall quality of transport;
- possible inaccessibility or disruption of the transport network due to SLR and more frequent and intense precipitation, mainly in relation to floods;
- indirect negative effects of changing precipitation patterns on air transport timeliness as well as fuel supply;
- maritime and riverine navigation paths and conditions affected by ice melting.

Infrastructure

Small increases in climate extremes above thresholds or regional infrastructure 'tipping points' have the potential to result in large increases in damages to all forms of existing infrastructure nationally and to increase disaster risks. Since infrastructure systems as a whole or not at all, an extreme event that exceeds an infrastructure design or 'tipping point' can sometimes result in widespread failure and a potential disaster.

Adaptation strategies

Climate change will require changes in building codes and standards where they exist.

Priorities according to ESIF/ERDF
OP on "Infrastructures and Networks" (PON Infrastrutture e Reti 2014-2020):

To re-balance the Italian transport system, currently characterised by a predominance of road traffic, by modernising and extending sustainable transport modes for passengers and freight, along the Trans-European core transport network TEN-T in less developed regions. The programme focuses on actions in three sectors: railways, port infrastructure and intelligent transport systems.

Developing and improving environmentally-friendly (including low-noise) and low-carbon transport systems, including inland waterways and maritime transport, ports, multimodal links and airport infrastructure, in order to promote sustainable regional and local mobility (total funding EUR 684.2 million, 38%)

Step #2. Identify relevant REFINET Best Practice (BP) & Technologies (HPT & IC)

Italy needs readily available solutions and incoming technologies too.
Example of relevant technologies:
Railways
Low-noise:

- BP27 – "Reducing noise from rail transport" (maintenance)
- HPT – "Generator Set Enclosure acoustic barrier for rail generators" (Construction), Echo Barrier (UK)

- IC/FP7-TRANSPORT "QUIET-TRACK - Quiet Tracks for Sustainable Railway Infrastructures".

Low-carbon:

- IC/FP7 "OSIRIS - Optimal Strategy to Innovate and Reduce energy consumption In urban rail Systems"

Port infrastructure

- IC/FP7 "NEWS - Development of a Next generation European Inland Waterway Ship and logistics system"
- HPT – "Modular manufacturing for construction of new container port and logistics terminal" (Design / Construction) World London Gateway (UK)

Intelligent transport systems

Low-noise

- HPT – "Temporary Sound Control solutions on transport construction projects", (Construction), SOUNDEX Solutions, Network Rail, Copenhagen Metro Underground

Low-carbon:

- IC/FP7 "COLOMBO - Cooperative Self-Organizing System for low Carbon Mobility at low Penetration Rates"
- IC/FP7 "e-SAVE - Energy Efficiency in the Supply Chain through Collaboration, Advanced Decision Support and Automatic Sensing"
- IC/FP7 "IMPACTS - The impact of the quality of CO2 on transport and storage behaviour"
- IC/FP7 "COMPASS - optimised co-modal passenger transport for reducing carbon emissions"

Other ITS

- IC/FP7 "OPTIRAIL - development of a smart framework based on knowledge to support infrastructure maintenance decisions in railway corridors"
- IC/FP7 "FAULT-ADAPTIVE - Fault-Adaptive Monitoring and Control of Complex Distributed Dynamical Systems"
- IC/FP7 "SECCRIT - SEcure Cloud computing for CRitical infrastructure IT"

Airport infrastructure

- HPT – "Asset management tools enable increase in proactive maintenance of airports" (Maintenance / Operation), IBM, Dubai (UAE)
- HPT – "Smart baggage handling at airports" (Design / Operation), IBM, Schipol Airport (NL)

Step #3. Identify programmes financing the modernisation of TI

Relevant programmes for the transfer of existing technologies:

- H2020 Pre-Commercial Procurement to adapt and adopt existing technologies
- ERDF OP on "Infrastructures and Networks

Step #4. Identify missing technologies requiring further R&D

Keywords Italy: railways, port infrastructure and intelligent transport systems; environmentally-friendly (including low-noise) and low-carbon transport systems, including inland waterways and maritime transport, ports, multimodal links and airport infrastructure

Relevant REFINET Priority actions:

- *New rail infrastructure technologies*. This will include new track forms, switches and crossings, and their potential for commercial development. Development of intelligent infrastructure maintenance and inspection and defect detection technologies carried out at commercial speeds.
- *Infrastructure adaptation to climate change*: Adverse weather conditions have a negative impact on transport service performance and related costs. These costs are expected to increase because of changing climate patterns resulting in an increase in the intensity and frequency of extreme weather events. Weather conditions also affect the ageing of railway infrastructure. In order to mitigate the impact of climate change on transport systems there is a need for infrastructure resilient to climate change.
- *Improved management of critical interfaces with others modes and smart methods for monitoring road-rail intersections* with the use of advanced solutions (GNSS systems, advanced CCTV tools, etc.) and analysis (collaborative tools) integrated by new human centred safety measures, e.g. Level crossing for rail/road with the aim to minimize risks at and around level crossings by developing a fully integrated cross-modal set of innovative solutions and tools for the proactive management and new

design of level-crossing infrastructure. Properly adapted technical solutions deployed within an appropriate human, legal and organisational framework are necessary.

- *Security against terrorism attacks in transit environments (preparedness, prevention, robustness and recovery)*: Security in transit environments refers to the security of airport terminals, buses stops, stations and interchanges, to the immediate vicinity of transport stops and stations and to the 'en route' travel (on board of different modes). Criminal acts are a result of 1) the environment of the transport node itself (e.g., design of platforms, CCTVs, dark corners, hiding places) and, 2) the social interaction within those environments (e.g., poor guardianship, crowdedness). A multi- and interdisciplinary approach is required to tackle transit security and demands more integrated, holistic and cross-disciplinary approach. Also, the identification and assessment of transport infrastructure vulnerabilities regarding man-made threats can contribute to the strengthening of the resilience of the European Transport Network against various man-made hazards, by providing road owners and operators with an easy to manage, practice-oriented tool for the assessment of the infrastructure.
- *Security by design*: There is a considerable scope in the design and planning of station infrastructure to include proven and effective security measures to prevent, mitigate or deter attacks from terrorists. Multi modal hub infrastructure should be designed to ensure the control of flow of persons or goods in any circumstances but without jeopardizing the performances of activities. The measures to improve security include the implementation of appropriate physical secure stations/terminals against bomb blast, CBRN (Chemical, Biological, Radiological and Nuclear) attacks involving particle dispersion and fire events); security procedures (screening, materials detection, intrusion detection systems, and tracking applications) should be considered at all stages of station development. The containment (where possible) of building services and power supplies, locating public car parks as far away from station buildings, creating a distinct separation with other 'crowded places' are examples of possible measures.

2.1.3 Case study country#2: Romania

Step #1: ***The Romanian needs and challenges – overview***

Innovation Readiness Level - Romania

Research and Innovation Observatory – Romania Country Report (2015)[32]

Compared to 2007, when Romania joined the EU, the R&I system performance has improved to a certain extent in several departments, but it still lags behind the EU average and similar countries.

- One of the lowest GDPs per capita in Europe (2014, 54% of the EU28 average)
- Large discrepancies the eight regions: Bucharest registers more than double of the GDP per capita compared with the second-best region (West Region) and close to four times compared with the region with the lowest level (North East).
- Deprioritising funding to carry on R&I activities
  - The economic crisis hit severely the country in 2009 and 2010
  - The rising trend of R&I investments from previous years was halted
  - And R&I investments were cut or delayed at both public and private levels
- Economic growth increased again to around 3% of GDP in 2013,
- But the cuts in public R&D expenditures have not been scaled back
- Structural Funds (SF) for R&I did not fill the gap: Romania allocated one of the
- Lowest shares in the EU of total ESIF funding to R&I activities.
- The adoption of the National RDI Strategy 2014-2020 in October 2014
- But the commitment for public resources has been already broken.
- One of the most important policies introduced in the last 5 years concerns the 50% tax deduction for R&D expenditures
- The National RDI Plan, which should warrant the implementation of this strategy, has just been

[32] https://rio.jrc.ec.europa.eu/en/country-analysis/Romania/country-report

adopted, after an extended delay.

- The National RDI Strategy 2014-2020 which includes an important component of smart specialisation identifies a set of four priorities: Bioeconomy; ICT, Space and Security; Energy, Environment and Climate Change; Eco-nano Technologies and Advanced Materials.

The Innovation Union Scoreboard 2016 defines Romania as modest innovator, ranking last among the EU Member States.

Transport Score Board Factsheet - Romania

- Overall country rank: 28 Area (1000km2): 238
- Nominal GDP 2015 (million €): 160 353
- Population 2015 (million): 19.871
- Expenditure per head on transport-related items 2014 (€): 536
- Planned Allocation of Community funding for transport 2014-2020 (million €): 7 771.45
- Number of proposals selected for CEF Transport (2015 call only): 7
- Number of innovation/new technologies proposals selected for CEF Transport (2015): 2
- Global Expenditure on TEN-T - 2007-2013 (million €): 6 166

As far as the quality of Romania's transport infrastructure is concerned, ratings of respondents to a survey by the World Economic Forum are low, with a small improvement only as regards the air transport infrastructure. The development of the TEN-T Core Network is in its first stages for all but the Inland Waterways Network, which is 91% completed.

Territoriality

Romania's is endowed with a distinctive geography and many of the country's development challenges and opportunities have a profound spatial character. Only one of Romania's eight regions is highly developed and dynamic.

With some variation, the remaining seven regions have larger rural populations and agriculturally based activities, lack modernisation and fully functioning markets. Social and economic inclusion varies across space, with rural areas significantly disadvantaged in their access to opportunities and to public services. Geographical position and features influence development pattern and opportunities.

The infrastructure challenge

Romania is hampered in pursuing growth by underdeveloped and outdated infrastructure. Although Romania sits on important routes connecting Central Europe with the Black Sea and the Caucasus, its transport infrastructure is under developed relative to the volume of goods and passengers that transit Romanian territory, and accessibility remains a major barrier to regional growth. Connectivity via all transport modes is suboptimal due to the backlog of investments, as well as administrative deficiencies in the maintenance and operation of the infrastructure.

Case study Rail System[33] *(input from web – see source below and from contribution to WP4 Task 4.2 workshop in Rome on 26 October 2016)*

The Romanian network of rail lines open to commercial traffic is about 11 000 km long (the eighth largest in the EU). It comprises more than 1 000 stations, almost 200 tunnels and around 6 800 bridges. It is also in an advanced state of disrepair due to a chronic lack of maintenance: most of the track-related assets are on their last legs. As a consequence, the rail system is very inefficient and it continues to deteriorate. The speed is limited to 50 km/h on almost a third of the network and to 80 km/h on another 40% (not to mention the numerous temporary speed restrictions). Moreover, a lot of lines (72% of which are single track) are closed for maintenance during the morning. This results in low commercial speeds and poor frequencies. According to the Romanian Ministry of Transport this deterioration is due to the lack of money, which is partly true: the poor situation is also due to poor management and operating practices affecting the infrastructure manager as well as railways. Moreover, endemic corruption is undermining the development and modernisation of the rail

[33] http://www.europarl.europa.eu/RegData/etudes/IDAN/2015/540376/IPOL_IDA(2015)540376_EN.pdf

sector as a whole. Consequently, even when significant funds have been invested to upgrade segments of the network, the journey times have had little or no impact. For instance travel times after rehabilitation work on the Bucharest-Constanta corridor (one of the parts of the network permanently affected by theft of cables and other equipment) are longer than before rehabilitation. It follows that the traffic volume collapses. Despite a fully open market, the volume of passengers dropped by 85%9 between 1990 and 2012, the volume of freight by 71%10.

Impact of climate change - Romania

Vulnerabilities of transport system due to climate change - Romania[34]

The following vulnerabilities with respect to infrastructure and buildings have been identified:

- Increase of the risk of earth slides;
- Modification of the characteristics of building materials and of the building foundations (e.g. setting time of concrete);
- Damage to buildings, infrastructure and transport conditions due to increased storm intensity, earth slides and coastal erosion;
- Damage of the localities and infrastructure due to more frequent floods;
- Loss of the existing construction stability in uneven areas, on fields sensitive to humidity or in flooded areas;
- Increased costs of material and thermal isolation of building;
- Damage of harbour infrastructure and river-borne transportation conditions as a result of the Danube flowing conditions;
- Reduction of protection level of dams and quay walls due to sea level rise;
- Increase of costs to build and maintain the transport infrastructure.

Infrastructure

Small increases in climate extremes above thresholds or regional infrastructure 'tipping points' have the potential to result in large increases in damages to all forms of existing infrastructure nationally and to increase disaster risks. Since infrastructure systems, such as buildings, water supply, flood control, and transportation networks often function as a whole or not at all, an extreme event that exceeds an infrastructure design or 'tipping point' can sometimes result in widespread failure and a potential disaster.

Adaptation strategies

A selection of adaptation strategies that have been proposed:

- revision of infrastructure such as drainage of rainwater, earth moving, roads, railways, bridges, tunnels;
- identification of alternative transportation routes;
- protection of railway infrastructure against erosion;
- reinforcement of harbour structure to face heavier storms;
- replacement of surface cables by underground cables;
- promotion of new technologies for street carpet and runway, based on modified asphalt to prevent the permanent deformations (because of high temperature) and to provide resistance to cracking (because of low temperature);
- promotion of different transport modes (railway, marine, river-borne transportation);
- afforestation of the areas affected by floods and earth slides close to the communication lines;
- promotion of prevention systems and fast efficient intervention in case of extreme weather phenomena;
- increase urban storm water drainage capacity;
- development of pavements that provide infiltration of rainwater;
- extent green areas and water supply to reduce excessive heat in cities;
- development of construction standards for green buildings (storage and cycling of rainwater, water saving by efficient installations, thermal isolation);
- use of renewable energy sources, and promotion of materials and constructive solutions suitable for

[34] http://www.climatechangepost.com/romania/transport-infrastructure-and-building/

the potential effects of climate change.

Priorities according to ESIF/ERDF

Large Infrastructure Operational Programme (LIOP)

- Removing the main transport bottlenecks and developing sustainable, efficient and green transport modes in the country.
- Improving mobility through the development of the TEN-T and the metro network
- Development of a multimodal, high-quality, sustainable and efficient transport system:
  - Travel time on the road TEN-T core network reduced to 74,1 Min/100km
  - Travel time on the rail TEN-T network reduced to 79,2 Min/100km
  - Quantity of goods carried by inland waterways will increase to 32,2 tonnes/year
  - Number of road fatalities per million inhabitants will decrease to 73
  - Number of passengers embarked and disembarked in airport transport will increase to 20 million/year
  - Increase in the containerised cargo volume handled in intermodal terminals to 70.000
  - Halve the waiting time in customs at exit points in agglomerated periods (carriers)

Regional Operational Programme (ROP): Improving regional connectivity.

- Improving urban public transport attracting 140 million additional passengers per year in less developed regions
- Rehabilitation and modernisation of more than 2,000 km of roads improving regional connectivity to the TEN-T network

Step #2. Identify relevant REFINET Best Practice (BP) & Technologies (HPT & IC)

Romania needs readily available technologies and incoming technologies TRL6 to 8 at least.

Key challenges:

Remove transport bottlenecks

- IC/FP7 – "ICSI - Intelligent Cooperative Sensing for Improved traffic efficiency", TRL6

Sustainable, Efficient and green

- HPT – "Efficient Urban Interchangers – The City-Hub Model" (Design) Technical University of Madrid (S)
- HPT – "Energy Management Control Systems for Rail" (Operation) Bombardier (DE)
- HPT – "Design for Manufacture Assembly (DfMA) for efficient on-site construction and reduction in wastes and risks to the environment" (Design / Construction), Highways England, White Young Green, Laing O'Rourke (UK)
- HPT – "Carbon reduction through use of environmentally-friendly material for filler in backfill for culvert refurbishment", (Construction / Renovation), Trafikverket, Sweden
- BP71 – "Sustainable use of construction materials for transport infrastructure" (Planning and construction – road/rail)

Railway & Road Rehabilitation and modernisation

- HPT – "Self-healing concrete surfaces for highway pavement refurbishment", (Design) Cardiff University project (UK)
- HPT – "Birmingham Highways Maintenance and Management Service upgrading traffic signals and traffic management systems" (Operation), Siemens, Amey, Birmingham City Council Birmingham City (UK)
- HPT – "LOCORPS: Lowering the Costs of Railways using Preformed Systems" (Design / Construction) Heriot-Watt University (UK)
- BP21 – "Asphalt mixture incorporating RAP (reclaimed asphalt pavement)", (construction/maintenance - road/railway)
- BP22 – "Recycled asphalt mixture with foamed bitumen" (design - road)
- BP61 – "Infrastructure Life Cycle Management" (design/construction/maintenance – road/railway)

- BP63 – "Performance-based design" (design/construction/maintenance – road/railway)
- IC/FP7 "HERMES - Innovative, Highly Efficient Road Surface Measurement and Control System" TRL8

Increase safety

- HPT – "Sensors for track-side safety and lone works" (Maintenance / Operation), Digital Barriers (UK)
- IC/FP7 – "MAXBE - interoperable monitoring, diagnosis and maintenance strategies for axle bearings" rail – TRL7
- IC/H2020 – "GREENRAIL : sustainability, safety and saving in the railroad sleeper of tomorrow" rail – TRL8
- IC/FP7 - "SMARTRAIL - Smart Maintenance and Analysis of Transport Infrastructure" rail – TRL6

Step #3. Identify programmes financing the modernisation of TI

Keywords Romania: remove transport bottlenecks, sustainable, efficient and green; Railway & Road Rehabilitation and modernisation; increase volume of air and urban transport; increase safety

CEF:

- Railways:
  - Works or studies aiming at accelerating the removal of bottlenecks (in terms of capacity and service quality) which hinder the traffic flows on Core Network.
  - Studies that shall contribute to the start-up of the implementation of works on sections or parts which are most critical to the "success" of the completion of the Core Network, i.e. which are of vital importance for smooth traffic flows along the entire axis and would, if not completed within the agreed period, reduce the benefits
- Roads:
  - Removal of bottlenecks;
  - Coordinated development and management of road networks.

Large Infrastructure Operational Programme (LIOP) - to remove the main transport bottlenecks and developing sustainable, efficient and green transport modes in the country; to improve mobility through the development of the TEN-T and the metro network and develop a multimodal, high-quality, sustainable and efficient transport system and the ***Regional Operational Programme (ROP): Improving regional connectivity,*** to improve urban public transport attracting 140 million additional passengers per year in less developed regions, to rehabilitate and modernise more than 2,000 km of roads improving regional connectivity to the TEN-T network.

Step #4. Identify missing technologies requiring further R&D

Safety

- *Modelling of consequences via different scenarios assessment and preparedness to disruptive events, study of interdependencies, cascade effects and other consequences*: More and more man-made events occurs in our society. Resilience is the goal of all transport infrastructure taking into account business continuity approach and people safety. Thus, it is needed more effective strategies to: 1) prevent the occurrence of this dramatic events; 2)mitigate the effect both in the risk scenario as well as the repercussion in the net; 3)better response the crisis taking into account mobility of both people and goods and 4)better recovery strategies taking into account both redesign, reconstruction approaches.
- *Performance based approach for maintenance of transport infrastructure*: New methods and tools for monitoring and assessing (the status of) existing structures, relatively to structural loading and deterioration potential. New (non-destructive) testing methods (radar, ultrasound, optical fibre, wireless smart sensors...) for diagnostic, early damage detection and maintenance of the infrastructures; Smart inspection and robotics for maintenance. Integration of terrestrial and satellite systems for the structural health monitoring of key infrastructures located in a natural risk prone area (earthquakes, landslides, floods). Risk control by means of monitoring. Indicators may be monitored and the measured values can continuously be compared to the threshold values previously established. Alarm systems may be installed which are activated in the event of outcrossing. Safety measures can therefore be adopted depending on the consequences of the observed non-

compliance. Based on such an approach, and by using modern information technology, inspections of large infrastructures may be automated and optimized. Cost effective maintenance process, based on infrastructure performance assessment and risk control/ New methods for infrastructure performance monitoring and assessing."

- *Responsive infrastructure* - lights that came on when you walk past - Management of people/public during upgrade of infrastructure - Roadway lighting systems
- *Traceability of materials & products to ensure the performance and durability of materials and hence, the user´s safety*: An important issue limiting the uptake of using recycled materials nowadays is the uncertainty about the exact composition and quality of the recycled material. For instance it could contain contaminations or undesired materials, or even dangerous substances such as asbestos. Development of systems to trace the materials and products to where they come from could help to provide the trust needed for construction companies to use recycled materials. Additionally, development of the proper risk methods, test protocols and measurement equipment could help to reduce the probability of using contaminated or bad quality materials.

This background analysis will be discussed and refined in direct dialogue with case study country stakeholders in task 4.2 in view to generating a final roadmap (Deliverable 4.2).

2.2Supporting Policy Makers - The medium to long-term approach

Aim: Developing a Pan-European roadmap at policy level to support the medium to long-term development (from 8 to 20 years) of the Transport Infrastructures in the Members States through Research, Development and Innovations plans

Ultimately REFINET aims at guiding the evolution of the TI in the whole of the EU. With this strategic goal in mind, at EU-wide level the specific research priorities and actions identified by REFINET will be promoted through recommendation and position papers and events to various key actors who will be able to use these results strategically to help them **contribute to shaping the European Multi-modal Transport Infrastructure** of the future; these actors include:

- The European Commission
- The European Parliament
- The 28 Member States (through their Ministry of Transport and Infrastructure)
- Public Authorities and Decision Bodies (e.g. authorities in charge of Transport Safety, in charge of transport policy for adaptation to climate changes, etc.)
- The European Technology Platforms in Transport (ACARE, ERRAC, ERTRAC, Waterborne, ALICE),
- The European Construction Technology Platform (ECTP) and its Infrastructure and Mobility (I&M) Committee,
- Other Relevant Associations such as the European Network of Construction Companies for R&D (ENCORD), the European Infrastructure Managers (EIM), Community of European Railway and Infrastructure companies (CER), European Union Road Federation (ERF), International Road Federation (IRF), World Road Organization (PIARC), Airports Council International Europe (ACI EUROPE), European Sea Ports Organisation (ESPO), European Association for Battery, Hybrid and Fuel Cell Electric Vehicles (AVERE), European Federation of Inland Ports (EFIP), European Federation for Transport and Environment (T&E), UNIFE as the European rail manufacturing industry representing body, European Construction

Industry Federation (FIEC) , European Network of Construction Companies for Research and Development (ENCORD), European Passengers Federation, among others.

Once the SIP of REFINET is published, a roadmap for its long-term deployment will be refined; it will inform the above-mentioned stakeholders of the future priorities for funding R&D developments. The actual deployment of the SIP at political level will then need to be implemented post-REFINET by a consensus among these actors.

CONCLUSIONS AND NEXT STEPS

This deliverable has presented an overview of the key outputs achieved through WP3 and WP4 which the project intends to deploy as part of the REFINET SIP. The deployment of the SIP is targeting two main types of stakeholders: TI managers/operators on the one side and policy makers on the other side. To give an overview of the various solutions and the rationale for their deployment to the stakeholders here is a summary table:

REFINET SIP	Purpose of the Deployment Strategies	
	Support TI Managers & Operators (country level: e.g. Romania/Italy)	**Support Policy Makers & Public Bodies (e.g. EC)**
The RMMTI model	To frame future national investments efforts in TI to the performance indicators of the HLS	To frame all future investments efforts at EU-wide level in TI to the performance indicators of the HLS
The Framework for the Monitoring R&I projects	To collect consistent sets of data across the various strands of the R&D and innovation financing instruments such as H2020, ERDF & CEF, etc.	To collect consistent sets of data across the various strands of the R&D and innovation financing instruments such as H2020, ERDF & CEF, etc.
The catalogue of Best Practice	To identify most relevant practices for a specific (industrial) project/need	To avoid replicating already funded projects/technologies
The catalogue of High Potential Technologies	To identify most relevant technologies for a specific need/project that are ready to be deployed in a short term	To follow up financed projects and understand their technology readiness level and whether they have made it to the market or not
The catalogue of R&I project innovations	To identify most relevant incoming technologies for a specific need/project that are ready to be deployed in a short term	To follow up financed projects and understand their technology readiness level and whether they have made it to the market or not
The Geo-Clustering Platform	To support planning and decisions making in terms of investments, adoption of technologies, understanding of trends, etc. in an easy to use way	To map financed projects and understand their technology readiness level and tracking their development in a use to use way
Future R&D priorities	To map future research topics at national and EU level in TI which will need public financing lined up	To make use of a validated source of future research topics at EU-wide level in TI which will need public financing lined up

Table 3 - Overview table of REFINET Solutions and their Purpose to Stakeholders

Dialogues with both stakeholder types are being initiated as part of task 4.2. as a first step, on October 25th at a dedicated project workshop in Rome a number of TI Managers and Operators got together to discuss the deployment strategy proposed by REFINET and to agree the next steps in the deployment (more details in Annex. As an output of that first approach to the SIP deployment, a roadmap addressed to TI Managers and Operators roadmap will be developed; it might be further declined into two fine-tuned roadmaps for each of the two case study countries, Romania and Italy. A second workshop will be organised early 2017 to address the second approach to the SIP Deployment and its target audience: policy makers. Once again, through a dialogue with selected Policy Makers such as the European Commission or key policy influencers such as the Transport

Technology Platform or the Construction Technology Platform, task 4.2 will work on the creation of a second roadmap, focusing on shaping the long-term development of the European multi-modal TI through the REFINET strategic research agenda (priorities and actions).

ANNEXES

Annex 1 - REFINET Workshop in Rome

The below gives a number of early outputs from the WP4 workshop held in Rome on 26th October 2016. Participants (listed below) were sent a week before the event a preparation document in which the main outputs of WP3 (Vision & RMMTI model, SIP) and WP4 (Deployment strategy) were presented and questions (see below) were asked for them to come ready on the day of the workshop.

List of participants:

Participant	Company	Country
Claudia de Stasio	TRT TRASPORTI E TERRITORIO srl	Italy
Wolfgang Steinicke	Eurnex	Germany
Livia Pardi	Autostrade Italiane (P)	Italy
Federico Di Gennaro	Aiscat (T)	Italy
Valentina Ranucci	(T/P) Rete Ferroviaria italiana	Italy
Martin Lamb	Maple-Consulting	UK
Ad van 't Zelfde	BAM	Netherlands
Dan Costescu	Former Minister of Transportation CN CFR SA (Romanian railway infrastructure manager) Director of Strategy and Regulation	Romania
Roxana Proca	PM/Investments Sector -National Railways Company CFR-S.A	Romania
Klaus Luetjens	Head of Department, Air Transport Operations and Infrastruct, DLR	Germany
Piero Vendittelli	Rai - Radiotelevisione Italiana S.p.A.	Italy
Alain Zarli	CSTB	France
Savina Carluccio	ARUP	UK
Jesús Rodriguez	PTEC,	Spain
Jon Aurtenetxe	TECNALIA	Spain
Miguel Segarra	DRAGADOS	Spain
Thierry Goger	FEHRL	Belgium
Clemente Fuggini	D'Appolonia	Italy
Célia Gavaud	D'Appolonia	Italy
Simone Genta	D'Appolonia	Italy
Eric Bessmann	IFFSTAR	France
Jesus Isoird	Tecnalia	Spain
Johan Marigny	UIC	France

Scope of the Workshop and Agenda

Scope: Discuss the strategy for the deployment of the REFINET Strategic Implementation Plan (SIP)

REFINET aims at identifying future research needs and at supporting the technology transfer and mass-market deployment of existing innovative technologies, such as materials, components, systems and processes to support Transport Infrastructure (TI) modernisation using a multimodal approach to TI investment decisions, especially for what concerns urban mobility, multimodal hubs and long-

distance corridors. To achieve both objectives, REFINET offers a number of solutions enabling decision-makers to carry out an integrated evaluation and selection of projects and programs.
The REFINET solutions banks on the "High Level Service Infrastructure" (HLSI) framework, being based on the implementation ofthe "Multi-Modal Transport Infrastructure" (RMMTI) model defined in the project. The RMMTI model, filled in with a catalogue of Best Practice a High-Potential Technologies, is the kernel of the REFINET Geo-Clustering Platform, that can be used as a tool for multimodal transport infrastructure decisions on investments and future priorities. The project outcomes solutions are now to be disseminated through a deployment strategy to help stakeholders (e.g. Decision and Public Bodies, Members States Ministries, The European Commission, Infrastructure Managers and Operators, etc.) make informed decisions and identify the technologies they need to improve their TI or the network overall. As part of a series of two workshops for the deployment of the REFINET SIP, the first event to be held on 26 October by D'Appolonia, leader of the Deployment of the REFINET Strategy, will be the occasion to discuss the deployment strategies with a number of experts including Infrastructure Managers. Feedback will be gathered during dedicated interactive sessions enabling the co-creation of the strategy and ensure its effective deployment. We look forward to getting your feedback!

9:45	Welcome & roundtable	Clemente Fuggini, D'Appolonia
10:00	REFINET project presentation • The rationale behind the 3 CSAs: FOX & USE-IT & REFINET • Opportunity for clustering activities for dissemination • REFINET project presentation	Alain Zarli, CSTB
10:20	Presentation of the REFINET Strategic Implementation Plan (SIP) & REFINET Vision	Jesus Isoird, Tecnalia
10:50	*Coffee break*	
11:10	Presentation of the Deployment Strategy (DS) for the SIP • A focus on Italy and Romania • The role of experts in the deployment strategy Overview of the REFINET Geo-Clustering Platform	Clemente Fuggini & Célia Gavaud, D'Appolonia
12:00	Italian Highway Network: a challenging scenario	Aiscat
12:20	Developments in the Romanian rail system	CFR-SA
12:40	*Lunch*	
13:45	Workshop session: Deployment Strategy Discussion	**Session #1:** 13:45-14:45 SIP deployment with a focus on the Italian and Romania Cases Study Facilitator: D'Appolonia **Session #2:** 14:45-15:45 REFINET Geo-Clustering Platform Facilitator: D'Appolonia
15:45	Debrief and Wrap-up	Clemente Fuggini, D'Appolonia
16:00	*End of event*	

Workshop Preparation Document

As said, a document was prepared and sent in advance to the workshop to the participants in order to clarify the workshop objectives, to provide them clear and synthetic material to raise their awareness and expectations and to let them start thinking at the questions that have been formulated during the workshop. The content of page1 provided below. The document is available for consultation.

SIP & DEPLOYMENT OF THE SIP WORKSHOP PREPARATION DOCUMENT

Executive summary

REFINET has two main streams of work:

1. **Identifying future research topics** in the area of Transport Infrastructure (TI) based on an analysis of the current existing technology offer and the future demands and relay that analysis to policy makers.
2. **Supporting TI managers in identifying solutions to their current needs by enabling the transfer of existing and incoming innovative technologies**, such as materials, components, IT systems and processes, etc. to support Transport Infrastructure (TI) update/modernization.

REFINET uses a multimodal approach to TI investment decisions, especially for what concerns **urban mobility, multimodal hubs and long-distance corridors.** To achieve both objectives, REFINET offers a number of **solutions** enabling decision-makers to carry out an integrated evaluation and selection of projects and programs. The REFINET solutions banks on the "High Level Service Infrastructure" (HLSI) framework, whose operation translation is by means of the "Multi-Modal Transport Infrastructure" (RMMTI) model defined in the project. The RMMTI model, filled in with a catalogue of Best Practice a High-Potential Technologies, is the kernel of the REFINET Geo-Clustering Platform, that can be used as a tool for multimodal transport infrastructure decisions on investments and future priorities. The project outcomes are now to be disseminated through a **deployment strategy** to help stakeholders (e.g. Decision and Public Bodies, Members States Ministry, The European Commission, Infrastructure Managers and Operators, etc.) make informed decisions and identify the technologies they need to improve their TI. The workshop in Rome will focus on the **second stream**.

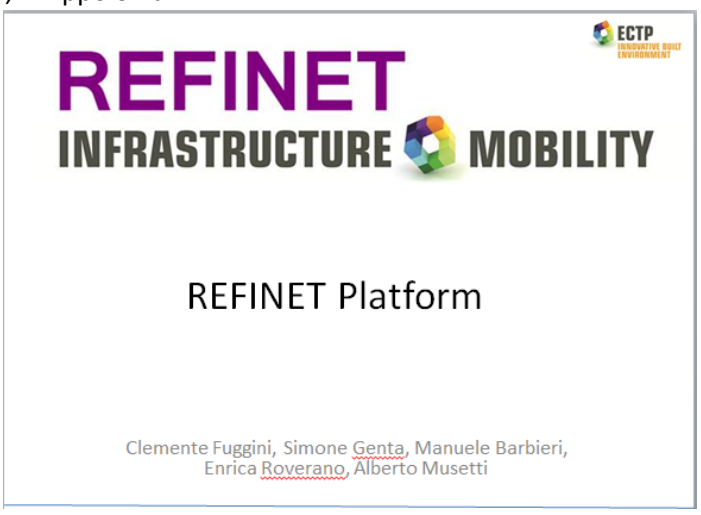
Presentations screenshots:

1. Main presentation

2. REFINET Vision & SIP - Tecnalia

3. REFINET Strategy for the Deployment of the SIP - D'Appolonia

4. REFINET Platform, D'Appolonia



5. State of Italian Motorway - AISCAT (Italian TI Representative)

6. State of Romanian Railway - CFR (Romanian TI representative)

7. Workshop session

Workshop questions:

Dear Participant,

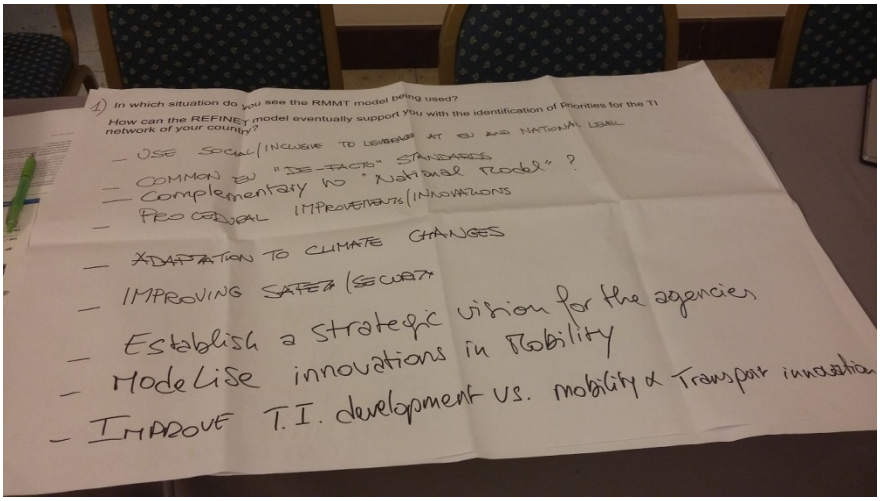
Please start thinking of your answers to these questions now. They will be asked to you specifically during the morning session of the workshop in Rome. Your answers will be collected before lunch and will serve as input during the afternoon:

1. In which situation, given your role and your knowledge of the TI in your country, do you see the RMMT model being used? How can the REFINET model eventually support you with the identification of priorities for the TI network of your country?
2. Do you see the REFINET Platform being useful to you to support strategic planning decisions? And if so how? What type of data/information/parametres would you need to see used in the tool?
3. Can the two H2020 instruments Pre-Commercial Procurements and Public Procurement of Innovation and similar instruments be (or become if their conditions were to be improved) useful instruments to facilitate the deployment of existing or incoming technologies? (https://ec.europa.eu/digital-single-market/en/public-procurement-innovative-solutions)

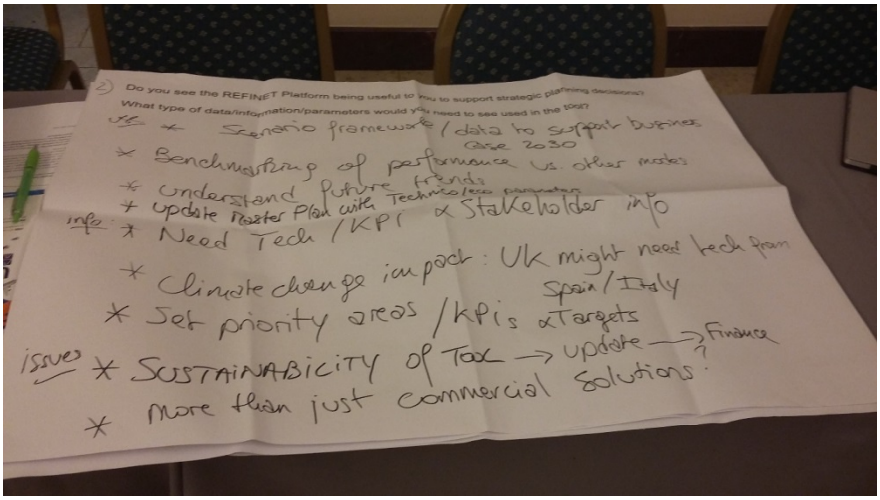
Workshop pictures:

Workshop Answers to Questions

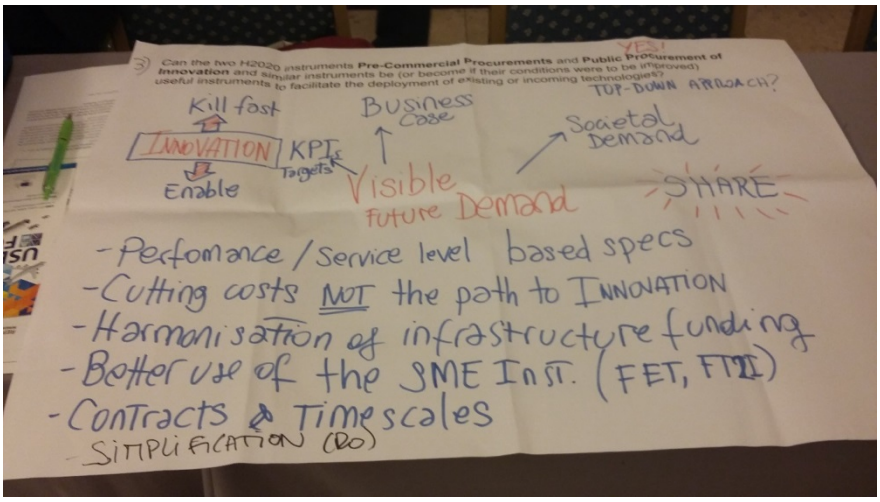
Workshop answers to Question#1:



Workshop answers to question#2:



Workshop answers to question#3:



Annex 2 - List of selected R&I project innovations

As output of Task 4.1, the list of incoming technologies from R&I projects is provided below.

Acronym	Title	Reference	Teaser	Transport mode	Lifecycle stage	Component of infrastructure / comments	TRL	Programme
ECUC	Eddy CUrrent Brake Compatibility	314244	The ECUC (Eddy-Current Brake Compatibility) project's objective is to prove that linear eddy-current brake (ECB) is a very effective and applicable solution for increasing the braking capacity of new high speed trains and solving the concerns raised by infrastructure managers.	Rail	Operation	eddy-current brake system	6	FP7-TRANSPORT
VRA	Support action for Vehicle and Road Automation network	610737	The improvement of sensors, power train control as well as communication, make possible the automation of vehicle driving. Vehicle prototypes are currently capable of driving automatically, in road and urban environment.	Road	Operation	automation of vehicle driving	NA	FP7-ICT
HERMES	Innovative, Highly Efficient Road Surface Measurement and Control System	315029	One of the most important aims in today's transport systems is the security they provide. Even-though in air and rail transports we have managed to have extremely low accident and death rates this is not the case with road transport.	Road	Operation	pavement	8	FP7-SME
EUROSKY	Single European Secure Air-cargo Space	312649	EUROSKY will deliver a high impact programme for advanced air-cargo security and facilitation measures to safeguard international supply chains and the security of citizens while fostering international co-operation and a broad stakeholder engagement.	Air	Operation	installations	7	FP7-SECURITY
GeopolyConc	Durability of geopolymers as 21st century concretes	335928	GeopolyConc will provide the necessary scientific basis for the prediction of the long-term durability performance of alkali-activated 'geopolymer' concretes.	Multi-modal	Construction	Concrete material	3	FP7-IDEAS-ERC
iMobility Challenge	iMobility Challenge and Awareness	317542	iMobility Challenge is a 24 months project aimed at demonstrating, promoting and boosting the deployment of ICT systems for efficient and	Multi-modal	Operation	ICT systems for cooperation and best	7	FP7-ICT

	Raising - iMobility Challenge		sustainable mobility.			mobility		
MOVESMART	Renewable Mobility Services in Smart Cities	609026	MOVESMART aims at providing time-dependent route planning and renewable personal mobility services using a set of crowd-sourcing tools for collecting real-time information by multimodal travellers.	Multi-modal	Operation	crowd sourcing based technologies to collect real time information for better route	4	FP7-ICT
ROBO-SPECT	ROBotic System with Intelligent Vision and Control for Tunnel Structural INSPECTion and Evaluation	611145	The latest developments in robotics and the associated fields of computer vision and sensors open the floor for automated robotic solutions, exploitable in the near to medium term in the field of inspection of the civil infrastructure in general.	Multi-modal	Maintenance	Tunnel	6	FP7-ICT
MobiS	Personalized Mobility Services for energy efficiency and security through advanced Artificial Intelligence techniques	318452	The main goal of MobiS is to create a new concept and solution of a federated, customized and intelligent mobility platform by applying novel Future Internet technologies and Artificial Intelligence methods that will monitor, model and manage the urban mobility complex network.	Multi-modal	Design	ICT systems for monitoring, modelling and manging	6	FP7-ICT
REPARA	Reengineering and Enabling Performance And poweR of Applications	609666	In recent years, traditional processors have not been able to translate the advances of silicon fabrication technology into corresponding performance gains.	Rail	Operation	safer rail system by advanced computers	NA	FP7-ICT
DIWINE	Dense Cooperative Wireless Cloud	318177	DIWINE considers wireless communication in a dense relay/node scenario where WNC (Wireless Network Coding) messages are flooded via dense massively air-interacting nodes in the self-contained cloud	Multi-modal	Operation	Intelligent Transport	NA	FP7-ICT

	Network		while the PHY air-interface.			Systems		
Local4Global	System-of-systems that act locally for optimizing globally	611538	Today's Technical Systems of Systems (TSoS) such as transport, traffic and energy management systems require the deployment of an expensive-to-deploy and operate sensor and communication infrastructure.	Road	Operation	Traffic management	NA	FP7-ICT
FABulous	Future Internet Web-Entrepreneurship for 3D Printing Virtual Fabrication in Europe	632881	The potential of 3D printing to become a major source of economic growth is huge - market size of $8.41 billion in 2020. It could (a) bring significant environmental benefits removing the need to bulky transport (b) vastly reduce the capital manufacturing costs.	Multi-modal	Design	3D printing	NA	FP7-ICT
INSIGHT	Intelligent Synthesis and Real-tIme Response using Massive Streaming of Heterogeneous Data	318225	The instrumentation of the world with diverse sensors, smart phones, and social networks acquires exascale data that offer the potential of enhanced science and services.	Multi-modal	Operation	Real time data management for emergency situations	5	FP7-ICT
INTER-TRUST	Interoperable Trust Assurance Infrastructure	317731	The main objective of the INTER-TRUST project is to develop a framework to support trustworthy applications in heterogeneous networks and devices based on the enforcement of interoperable and changing security policies.	Multi-modal	Operation	interoperable and trusty data exchange Vehicle - vehicle and vehicle - infrastructure communication	6	FP7-ICT
MoveUs	MoveUs: ict cloud-based platform and mobility services:	608885	Although large research activity has been done in Europe on Intelligent Transport Systems and Information and Communication Technologies to make people able to travel by integrating different transport modes,	Multi-modal	Operation	ICT systems for cooperation and best mobility,	6	FP7-ICT

	available, universal and safe for all users		personal integrated mobility is still far from becoming a reality i...			focused on user		
plan4business	A service platform for aggregation, processing and analysis of urban and regional planning data	296282	Urban and Regional Planning data sets are not aggregated so far, and thus it is very difficult to use them for any other purpose than for printing of simple publishing by the authorities that they were created by.	Multi-modal	Operation	Service platform to share transport infrastructure plans among others	5	FP7-ICT
MOBINCITY	SMART MOBILITY IN SMART CITY	314328	Urban transport is responsible for about a quarter of CO2 emissions from transport. The gradual phasing out of 'conventionally-fuelled' vehicles from the urban environment is a major contribution to significant reduction of oil dependence, greenhouse gas emissions.	Road	Operation	Fully electric vehicle - communication among vehicle, traffic and transport infrastructure	5	FP7-ICT
eCo-FEV	efficient Cooperative infrastructure for Fully Electric Vehicles	314411	This project will be carried out within the FP7 Work Programme 2011 COOPERATION of the European Commission addressing the objective GC-ICT-2011.6.8 ICT for fully electric vehicles.	Road	Construction	Fully Electric Vehicle integration	6	FP7-ICT
ICSI	Intelligent Cooperative Sensing for Improved traffic efficiency	317671	The architecture of the ICT infrastructure for supporting Intelligent Transportation Systems (ITS) is purely hierarchical, with sensed data flowing from the leaves (i.e., road-side or vehicle-installed sensors) to the root (i.e., the traffic management centre).	Multi-modal	Operation	Intelligent Transport Systems	6	FP7-ICT
EMERALD	Energy ManagEment and RechArging for efficient eLectric car Driving	314151	EMERALD focuses on energy use optimisation and on the seamless integration of the FEV into the transport and energy infrastructure, by delivering clear advances over the state-of-the-art. The goal is to assist the FEV in becoming a successful commercial product.	Road	Operation	ITS & Management	6	FP7-ICT

GAMBAS	Generic Adaptive Middleware for Behavior-driven Autonomous Services	287661	The overall objective of the GAMBAS project is the development of an innovative and adaptive middleware to enable the privacy-preserving and automated utilization of behavior-driven services that adapt autonomously to the context of users.	Multi-modal	Design	Installation & management	7	FP7-ICT
COLOMBO	Cooperative Self-Organizing System for low Carbon Mobility at low Penetration Rates	318622	Traffic is time and energy consuming and produces negative effects on the environment.	Multi-modal	Operation	installations and management	4	FP7-ICT
e-SAVE	Energy Efficiency in the Supply Chain through Collaboration, Advanced Decision Support and Automatic Sensing	288585	The e-SAVE project aims to contribute to an energy-efficient supply chain by providing the system, services, collaboration platform and management tools that will help companies monitor, manage and share energy use and carbon footprint data.	Multi-modal	Operation	installations and management	5	FP7-ICT
RAIN	Risk Analysis of Infrastructure Networks in response to extreme weather	608166	The RAIN vision is to provide an operational analysis framework that identifies critical infrastructure components impacted by extreme weather events and minimise the impact of these events on the EU infrastructure network. The project has a core focus on land based infrastruture.	Multi-modal	Operation	Infrastructure network	5	FP7-SECURITY
HARMONISE	Holistic Approach to Resilience and Systematic Actions to make Large Scale UrbaN Built Infrastructure Secure	312013	For the first time, more than 50% of the world's population live in urban areas. By 2050, c. 70% of people are likely to be city dwellers, compared with less than 30% in 1950.	Multi-modal	Operation	hubs	7	FP7-SECURITY

TEAM	Tomorrow's Elastic, Adaptive Mobility	318621	TEAM aims at developing systems for participants in transportation networks, which help them to behave better – by explicitly taking into account the needs and constraints of other participants and the network itself.	Multi-modal	Design	Traffic management Transportation systems	7	FP7-ICT
BioEPIC Slope	Use of BioEngineered Plant-Integrated Cover (BioEPIC) to Enhance Slope Performance	631541	Climate change threatens the stability of infrastructure slopes, which form a large proportion of the European transport network. Slope failures due to increasing intense rainfall have already resulted in significant socio-economic loss across the Europe.	Multi-modal	Operation	Slopes	4	FP7-PEOPLE
Infravation	ERA-NET Plus on Infrastructure Innovation	618109	Europe needs to redefine its transport system for the 21st century. Performance and cost-efficiency of the system need to be improved to meet future challenges.	Multi-modal	All - horizontal	Infrastructure network	NA	FP7-TRANSPORT
Viajeo Plus	International Coordination for implementation of innovative and efficient urban mobility solutions	605580	The goal of Viajeo PLUS is to benchmark outstanding solutions for innovative and green urban mobility in Europe, Latin America, China and Singapore and subsequently facilitate the uptake of these solutions across different cities in these regions.	Multi-modal	All - horizontal	Benchmark outstanding solutions for innovative and green urban mobility	NA	FP7-TRANSPORT
AIRTN-NextGen	Air Transport Network – Next Generation	604952	The action will continue the network established under previous AirTN projects enlarging it to create a platform of networking and communication between national organisations and governmental institutions supporting research and innovation in the EU Member States and Associated countries.	Air	All - horizontal	Networking		FP7-TRANSPORT
PulsarPlane	PulsarPlane: Worldwide Air Transport Operations	335063	Pulsars are fast rotating neutron stars that emit electromagnetic radiation, which is received on earth as a series of very stable fast periodic pulses with periods in between 1.4 milliseconds and 8.5 seconds.	Air	Operation	Pulsar navigation, GNSS	2	FP7-TRANSPORT
FastInCharge	Innovative fast inductive charging solution for	314284	Innovative fast inductive charging solution for electric vehicles	Road	Design	Electric vehicle charging	7	FP7-TRANSPORT

	electric vehicles					infrastructure		
ViWaS	Viable Wagonload production Schemes	314255	Single wagonload (SWL) transport is still a major component in numerous European states transport systems and in the logistics of different economic sectors such as steel, chemical industry and automotive.	Rail	Operation	Management		FP7-TRANSPORT
ToPDAd	Tool-supported policy-development for regional adaptation	308620	Adaptation in the face of climate change is currently a major challenge, not only in the EU, but all around the world. Climate change has two distinct characters: the slower trends in climatic variables such as sea water temperature, and the extreme weather phenomena.	Multi-modal	Design	Transport system	7	FP7-ENVIRONMENT
Light2CAT	Visible LIGHT Active PhotoCATalytic Concretes for Air pollution Treatment	283062	The goal of Light2CAT is to develop new, highly efficient visible-light-activated titanium dioxide for inclusion in concretes to be used in structures across the whole of Europe to improve ambient air quality independent, for the first time, of local climate conditions. The n...	Multi-modal	Construction	Material: Concrete		FP7-ENVIRONMENT
UNPLUGGED	Wireless charging for Electric Vehicles	314126	UNPLUGGED project aims to investigate how the use of inductive charging of Electric Vehicles (EV) in urban environments improves the convenience and sustainability of car-based mobility.	Road	Design	EV, charging infrastructure	7	FP7-TRANSPORT
CAPACITY 4RAIL	Increasing Capacity 4 Rail networks through enhanced infrastructure and optimised operations	605650	In 2011, the White Paper on European Transport reasserted how fundamental transport was for society, for the mobility of European citizens and for the growth and vitality of the European economy.	Rail	Maintenance	All	7	FP7-TRANSPORT
STRUCTURES	Strategies for the Improvement of Critical infrastructure Resilience to	285257	Security and quality of life in industrialized countries depend on continuous and coordinate performance of a set of infrastructures (energy systems, ICT systems, transportation etc.) which can be therefore defined “critical infrastructures” (CI).	Multi-modal	Operation	Transport as a critical infrastructure (hubs, network,	7	FP7-SECURITY

	Electromagnetic Attacks					bridges, ...)		
LCE4ROADS	Life Cycle Engineering approach to develop a novel EU-harmonized sustainability certification system for cost-effective, safer and greener road infrastructures	605748	The EU Ecolabel identifies products and services that contribute to sustainability because they have demonstrated a reduced environmental impact throughout their life cycle. There are already more than 17,000 EU Ecolabelled products on the market, but there are no references ...	Road	Design	pavement	7	FP7-TRANSPORT
CO2QUEST	Techno-economic Assessment of CO2 Quality Effect on its Storage and Transport	309102	The CO2QUEST proposal addresses the fundamentally important issues regarding the impact of the typical impurities in the gas or dense phase CO2 stream captured from fossil fuel power plants on its safe and economic transportation and storage. The proposed work programme will ...	Multi-modal	Operation	CO2	NA	FP7-ENERGY
SWARM	Demonstration of Small 4-Wheel fuel cell passenger vehicle Applications in Regional and Municipal transport	303485	This project will establish a demonstration fleet of small passenger vehicles that builds on and expands existing hydrogen refuelling infrastructure.	Road	Design	Fuel cell passenger vehicle	8	FP7-JTI
ECOSSIAN	European Control System Security Incident Analysis Network	607577	The protection of critical infrastructures increasingly demands solutions which support incident detection and management at the levels of individual CI, across CIs which are depending on each other, and across borders.	Multi-modal	Operation	Transportation system as Critical infrastructure (hubs, …)	7	FP7-SECURITY

FABRIC	FeAsiBility analysis and development of on-Road chargIng solutions for future electric vehiCles	605405	FABRIC addresses directly the technological feasibility, economic viability and socio-environmental of dynamic on-road charging of electric vehicles. FABRIC responds to the need to assess the potential and feasibility of a more extensive integration of electric vehicles.	road	Operation	electric vehicles, charging	NA	FP7-TRANSPORT
IRUSAT	Improving Resilience of Urban Societies through Advanced Technologies	329871	Urban societies depend heavily on the proper functioning of infrastructure systems such as electric power, gas, potable water, and transportation networks. Normally invisible, this reliance becomes painfully evident when infrastructure systems fail during disasters.	Multi-modal	Design	urban bridges, pipelines	4	FP7-PEOPLE
UDRIVE	eUropean naturalistic Driving and Riding for Infrastructure & Vehicle safety and Environment	314050	Road transport is indispensable for the exchange of goods and persons, but at the same time has severe negative consequences, among others related to road safety and environment.	road	Operation	drivers	6	FP7-TRANSPORT
MOWE-IT	Management of weather events in transport system	314506	The MOWE-IT project shall assess factors that prerequisite cross-modal transferability between the air and surface-based European transport systems in order to protect the passengers, shippers, European institutions and citizens against travel delays, cancellations.	Multi-modal	Operation	transportation network	7	FP7-TRANSPORT
MAXBE	INTEROPERABLE MONITORING, DIAGNOSIS AND MAINTENANCE STRATEGIES FOR AXLE BEARINGS	314408	The axle bearing damage process has safety and economic implications on the exploitation of railways systems, as proved by the selection of this topic for inclusion in the present call for research proposals of the FP7 of the EU.	rail	Maintenance	railway axle bearing	7	FP7-TRANSPORT
POLARIS	Preventative OperationaL procedures for	651823	Protection of critical infrastructure in particular in the areas of energy/transport and communication grids is now crucial within our	air	Operation	operation	3	H2020-EU.3.7.

	space weAtheR threats to CrItical InfraStructure		highly technical dependent societies.					
ACEM-RAIL	Automated and cost effective maintenance for railway	265954	ACEM-Rail project deals with automation and optimisation of railway infrastructure maintenance. It focuses on the track. The final goal is to reduce costs, time and resources required for maintenance activities and increase the availability of the infrastructure. The project includes both conventional and high speed lines.	rail	Maintenance	tracks	5	FP7-TRANSPORT
CLOSER	Connecting LOng and Short-distance networks for Efficient tRansport	234180	The European Transport Policy (ETP) proposes the concept of co-modality as an essential instrument to achieve, at the same time, a high level of mobility and of environmental protection. The purpose is to develop innovative tools for the analysis of interfaces, check these tools in a number of case studies, and make recommendations to stakeholders.	Multi-modal	renovation	n/a	1	FP7-TRANSPORT
GREENRAIL	Greenrail: sustainability, safety and saving in the the railroad sleeper of tomorrow	662376	Greenrail aims to introduce an innovative and sustainable railroad sleeper into the market, able to revolutionize rail transport sector for these features: sleeper composition (internal structure in concrete, coated by an outer shell made up of recycled plastic and rubber from end of life tires usable in any rail lines; sleeper capacity to generate green power during train transit thanks to an integrated piezoelectric system.	rail	Design	Railroad sleeper	8	H2020-EU.3.4
NETTUN	New Technologies for Tunnelling and Underground Works	280712	The NeTTUN 54M project will enable groundbreaking change in the construction, management and maintenance of tunnels addressing key scientific and technical challenges.	Multi-modal	All - horizontal	Tunnel	7	FP7-NMP
PANTURA	Flexible Processes and Improved Technologies for Urban Infrastructure Construction Sites	265172	More than 50% of bridges in European cities are older than 40 years and bridges are a vital part of the infrastructure. The aims are to improve highly flexible off-site production processes, create resource-efficient construction sites, improve technologies and tools for bridge construction in densely populated areas and enhance communication between local authorities and construction companies.	Multi-modal	All - horizontal	bridge	5	FP7-ENVIRONMENT

SMARTRAIL	Smart Maintenance and Analysis of Transport Infrastructure	285683	The SMART Rail project brings together experts in the areas of highway and railway infrastructure research, SME's and railway authorities who are responsible for the safety of national infrastructure, The goal of the project is to reduce replacement costs, delay and provide environmentally friendly maintenance solutions for ageing infrastructure networks.	rail	Maintenance	bridge, track, transition zone	6	FP7-TRANSPORT
APSE	Use of eco-friendly materials for a new concept of Asphalt Pavements for a Sustainable Environment	603862	The main objective of the project is the demonstration and validation of an eco-innovative design of asphalt pavements based on the integration of more sustainable materials into its production cycle. This goal will be achieved by working on two asphalt mixtures' main components, binders and aggregates.	Road	Design	asphalt pavements	6	FP7-ENVIRONMENT
INFRARISK	Novel Indicators for identifying critical INFRAstructure at RISK from natural hazards	603960	The INFRARISK project will develop reliable stress tests on European critical infrastructure using integrated modelling tools for decision-support. It will lead to higher infrastructure networks resilience to rare and low probability extreme events, known as "black swans". INFRARISK will advance decision making approaches and lead to better protection of existing infrastructure while achieving more robust strategies for the development of new ones.	Road, Rail	Construction/ Maintenance	ICT System for decision support in the hazard assessment	5	FP7-ENVIRONMENT
DEMANES	Design, Monitoring and Operation of Adaptive Networked Embedded Systems	295372	Large scale societal challenges require large scale monitoring and control solutions. Technological developments will make it possible to design and build these large systems.	Multi-modal	All - horizontal	Bridge, Tunnel, Airport, Smart home, etc.	5	FP7-JTI
MODULUSHCA	Modular Logistics Units in Shared Co-modal Networks	314468	The objective of Modulushca is to achieve the first genuine contribution to the development of interconnected logistics at the European level, in close coordination with North American partners and the international Physical Internet Initiative.	Multi-modal	Design	Bridge, Tunnel, Airport, Station, Port,…	5	FP7-TRANSPORT

NODES	New tOols for Design and OpEration of Urban Transport InterchangeS	314618	Urban mobility is of growing concern to citizens. To be more efficient urban mobility systems require a greater integration at urban level (city and its hinterland). Interchanges need to better integrate: - various urban transport modes, which can be urban, regional and long distance.	Multi-modal	Design	Urban Transport Interchange	5	FP7-TRANSPORT
SPIDER PLUS	Sustainable Plan for Integrated Development through the European Rail network – Projecting Logistics & mobility for Urban Spatial design evolution	314090	SPIDER PLUS objective is to provide a new 2050 mobility VISION through a Strategic Design & Plan, and a Road Map delivering Sustainable Solutions by then. In such Plan the electrified Rail has a central role both for passengers and freight.	rail	Design	High-Speed and Traditional Rail.	3	FP7-TRANSPORT
OSIRIS	Optimal Strategy to Innovate and Reduce energy consumption In urban rail Systems	284868	"For many transport modes, energy reduction strategies can be effectively formulated at the level of the vehicle or vessel. New technologies can therefore be introduced to a vehicle and the direct energy savings can be readily quantified.	Rail	Design	Rail vehicles, Urban Rail infrastructure.	5	FP7-TRANSPORT
QUIET-TRACK	Quiet Tracks for Sustainable Railway Infrastructures	604891	"The objective is to provide step changing track based noise mitigation systems and maintenance schemes, to provide reliable improved TSI based rolling noise calculation procedures with harmonized monitoring of the required input parameters and to provide track noise management.	Rail	Maintenance	Track solutions, including embedded track systems. Monitoring systems.	4	FP7-TRANSPORT
FAULT-ADAPTIVE	Fault-Adaptive Monitoring and Control of Complex	291508	"The emergence of networked embedded systems and sensor/actuator networks has facilitated the development of advanced monitoring and control applications, where a large amount of sensor data is collected and processed in real-time in order to activate the appropriate actuator.	Multi-modal	Design	Bridge, Tunnel, Airport, etc.	5	FP7-IDEAS-ERC

	Distributed Dynamical Systems							
CARONTE	Creating an Agenda for Research ON Transportation sEcuity	606967	Easy, efficient, safe and secure transportation is a core factor for European growth, collaboration and employment and therefor an item in the Europe 2020 strategy.	Multi-modal	Design	Bridge, Tunnel, Terminal, Ports, etc.	2	FP7-SECURITY
IMPACTS	The impact of the quality of CO2 on transport and storage behaviour	308809	The impact of the quality of CO2 on transport and storage behaviour will underpin the realisation of the EU CCS European Industrial Initiative implementation plan by developing knowledge and technology needed for Carbon Dioxide Capture, Transport and Storage (CCS)	Multi-modal	Operation	N/A	4	FP7-ENERGY
PRECYSE	"Prevention, protection and REaction to CYber attackS to critical infrastructures"	285181	Today, attackers are using more sophisticated technologies, making existing “add-on” security solutions obsolete or insufficient, and the number of stakeholders involved –both human and machines– is always increasing.	Multi-modal	design/ operation / renovation	Signalling and other ICT equipment	4	FP7-SECURITY
VRUITS	Improving the safety and mobility of vulnerable road users through its applications	321586	In the past, Intelligent Transport Systems (ITS) success has been achieved primarily though equipment of the vehicle and infrastructure. The focus of these ITS has been on clean, safe and efficient mobility for vehicles.	road	design	Intelligent Transport Systems	4	FP7-TRANSPORT
ZEEUS	Zero Emission bUs Systems	605485	Electrification of the public transport is a raising trend in Europe, and electric buses are soon expected to enter markets as one of the most interesting options for matching urban environmental targets. Electrification is driven by both economics and politics.	road	design	Electric charging infrastructure	8	FP7-TRANSPORT
PLATINA II	Platform for the implementation of NAIADES	321498	PLATINA II is a Coordination Action aimed at the implementation of the NAIADES Action Areas. PLATINA II builds on the results of the FP7 project PLATINA (2008-2012) and is in line with the NAIADES action	water	Maintenance	Inland waterways	3	FP7-TRANSPORT

	(PLATINA II)		programme.					
2MOVE2	New forms of sustainable urban transport and mobility	296036	Mobility for each citizen as well as the transport of goods must be ensured in combination with a free choice of transport modes. However, actions of mobility management should be strengthened to raise people s awareness towards sustainable mobility.	Multi-modal	design	Roads, bike and footpaths	4	FP7-TRANSPORT
Future Sky Safety	Future Sky Safety	640597	The EC Flight Path 2050 vision aims to achieve the highest levels of safety to ensure that passengers and freight as well as the air transport system and its infrastructure are protected.	Multi-modal	design	Bridge, tunnel, pavement, etc.	4	H2020-EU.3.4.
BENEFIT	Business models for enhancing funding and enabling financing of infrastructure in transport	635973	BENEFIT takes an innovative approach by analysing funding schemes within an inter-related system. Funding schemes are successful (or not) depending on the Business Model that generates them.	Multi-modal	All - horizontal	Bridge, tunnel, pavement, etc.	4	H2020-EU.3.4.
WEATHER	Weather Extremes: Assessment of impacts on Transport Systems and Hazards for European Region:		Assessing disruptive effects of extreme weather events on operation and performance of EU transport system	Multi-modal	Operation	infrastructure network, vehicles, facilities, services	6	FP7-TRANSPORT
STAR-TRANS	Strategic Risk Assessment and Contingency Planning in Interconnected Transport Networks		Risk assessment methodology interdependencies among transport infrastructure, emergency resources use	Multi-modal	Design	ICT System for risk assessment	7	FP7-SECURITY
SECUREST	Passenger station and terminal		Reduction the impact of blast, fire and the dispersion of toxic agents on	Multi-	Design	station,	7	FP7-

ATION	design for safety, security and resilience to terrorist attack		passengers, staff and infrastructure.	modal		terminal, hub		TRANSPORT
EWENT	Extreme Weather impacts on European Networks of Transport		Assess the impacts and consequences of extreme weather events on EU transport system	Multi-modal	Operation	infrastructure, operations and indirect impacts (elements of supply chain)	6	FP7-TRANSPORT
COMPASS	Optimised co-modal passenger transport for reducing carbon emissions		ICT data based traveller information to improve the co-modality	Multi-modal	Operation	ICT and ITS systems	7	FP7-TRANSPORT
GETAWAY	Generating simulations to Enable Testing of Alternative routes to improve WAYinding in evacuation of over-ground and underground terminals		New mobility/organisational schemes: interconnection between short and long-distance transport networks	Multi-modal	Operation	terminal, hubs	7	FP7-TRANSPORT
INTERCONNECT	Interconnection between short and long-distance transport networks		The proposal addresses the potential for greater efficiency and reduced environmental impact of passenger transport by judicious encouragement of integration, co-operation and, where appropriate, competition in the provision of local connections, paying attention to land, air and maritime modes	Multi-modal	Operation	short and long-distance transport network	4	FP7-TRANSPORT
OPTIMISM	Optimising Passenger Transport	284892	OPTIMISM's main outcomes is the creation and development of different sets of strategies and methodologies for optimising passenger transport systems based on co-modality ICT solutions. The main scope is	Multi-modal	Design	ICT solutions, strategies and recommendatio	NA	FP7-TRANSPORT

	Information to Materialize Insights for Sustainable Mobility		to provide a scientifically documented insight of the transport system and people's travel choices via the study of social behaviour, mobility patterns and business models. This will also allow to define future changes in the passenger's travel system that would lead to more sustainable method/mode(s) of travelling.			ns for interconnectivity		
SECCRIT	SEcure Cloud computing for CRitical infrastructure IT	312758	Cloud Computing is a style of computing where elastic IT-related capabilities are provided as optimized, cost-effective, and on-demand utility-like services to customers using Internet technologies.	Multi-modal	Operation	passenger transport behaviour, ICT services	NA	FP7-SECURITY
BRIDGE SMS	Intelligent Bridge Assessment Maintenance and Management System	612517	Government agencies, the public and private sectors and professional engineering sectors across Europe need to come together and proactively meet the challenge of creating a climate resilient infrastructure system.	road	Operation	Bridge, hydraulic vulnerability of bridges over water	NA	FP7-PEOPLE
PROS	Priorities for Road Safety Research in Europe	314427	"In spite of all improvements in European road safety, almost 100 people are killed and about 40,000 get injured on European roads each day. The progress made so far is to a large extent based on intensive, publicly funded road safety research activities.	road	design	Passenger transport behaviour, road	NA	FP7-TRANSPORT
I-C-EU	Impact of Transport Infrastructure on International Competitiveness of Europe	314395	"The transition process between the Lisbon Agenda and the Europe 2000 strategy plans happens exactly in the time when Europe is undergoing its hardest economic crisis since its formation.	Multi-modal	Operation	passenger transport behaviour	NA	FP7-TRANSPORT
NEAR2	Network of European – Asian Rail Research capacities	314254	"The rapid development of Asian economies, particularly China, India and Russia has dramatically increased the trade volumes between Europe and Asia, with the largest trading partners of Europe actually being located in Asia.	Multi-modal	Operation	infrastructure, passenger transport behaviour, freight	NA	FP7-TRANSPORT
OPTIRAIL	Development of a smart framework	314031	"In a context of wide use of transport, it is necessary to increase efficiency of the different transport modes as well as their interaction.	Rail	Operation	railway	NA	FP7-

	based on knowledge to support infrastructure maintenance decisions in railway corridors		To that effect, rail transport will play an important role in the future by increasing its capacity. Thus, it would be necessary to st...			corridors		TRANSPORT
NEWS	Development of a Next generation European Inland Waterway Ship and logistics system	314005	"The proposed project “Development of a Next generation European Inland Waterway Ship and Logistics System” aims at 1. developing and validating a novel container ship (hull) which will include the following TECHNICAL INNOVATIONS: a) re-design of a standard inland ship hull =...	water	Operation	waterways	NA	FP7-TRANSPORT
LAMPRE	LAndslide Modelling and tools for vulnerability assessment Preparedness and REcovery management	312384	"LAMPRE proposes to execute innovative research and technological developments to increase GMES limited operational capacity to cope with triggered landslide events and their consequences, in Europe and elsewhere. LAMPRE will enhance landslide risk mitigation/preparedness.	Multi-modal	Operation	passenger transport behaviour	NA	FP7-SPACE

Annex 3 - Fiches of R&I project innovations

Following the list of incoming technologies provided above, details on each selected project are reported in the 89 fiches hereafter.

Catalogue of R&I projects 1_ ECUC	
Field	**Description**
Technology title and keywords	Eddy current brakes Electromagnestism Thermo-mechanic
Source of technology	Eddy CUrrent Brake Compatibility / FP7-TRANSPORT / 314244
Lifecycle stage	Operation
Type of infrastructure	Rail
Component of infrastructure	eddy-current brake system
Short Description	The ECUC (Eddy-Current Brake Compatibility) project's objective is to prove that linear eddy-current brake (ECB) is a very effective and applicable solution for increasing the braking capacity of new high speed trains and solving the concerns raised by infrastructure managers by proposing concrete and realistic solutions to overcome the drawbacks that ECB have experienced on some lines. This proposal is submitted in answer to call SST.2012-2.5.1 Rail System Interoperability. ECUC establishes a work plan to demonstrate the technical feasibility of braking systems with eddy current brakes, independent of adhesion conditions, and to clarify the interaction of ECB with track and trackside equipment. In addition a new generation linear eddy-current brake will be designed and a study of electromagnetic incompatibilities and critical thermo-mechanical parameters will also be carried out. As a result, ECUC will propose new designs and engineering and operational guidelines for ECB and signalling equipment, and it will define Technical Recommendations, input for revisions of Technical Specifications for Interoperability. The strategy for the dissemination of ECUC benefits from input from the ECUC Advisory Group and a wide dissemination strategy towards UNIFE. ECUC addresses the main stakeholders in the European railway sector using various communication and diffusion tools. The impact of ECUC embraces the terms safety, interoperability and economy, and is addressed to the main stakeholders in the European railway industry. The medium-sized ECUC consortium is formed by CEIT (S), KNORR-BREMSE (D), ALSTOM (F), SNCF (F), DEUTSCHE BAHN (D), NETWORK RAIL (UK), UNIFE (B) and FRAUSCHER (AUT). The proposal describes the consortium's strategy in order to guarantee highly efficient coordination. This alliance offers unique advantages in terms of technical competence, complementary representation of all the key players, quality assurance and research orientation.
Maturity	TRL6
Link to REFINET high Level Service Infrastructure	SAFE/SECURE
Key performance Indicators	braking time reduction in (min)

Year of project ends	2015
Further information	http://www.ecuc-project.eu/

Catalogue of R&I projects 2_ VRA	
Field	**Description**
Technology title and keywords	Vehicle and road automation
Source of technology	Support action for Vehicle and Road Automation network / FP7-ICT / 610737
Lifecycle stage	Operation
Type of infrastructure	Road
Component of infrastructure	Automation of vehicle driving
Short Description	The improvement of sensors, power train control as well as communication, make possible the automation of vehicle driving. Vehicle prototypes are currently capable of driving automatically, in road and urban environment. The automation is provided by systems in the vehicle and/or deployed on the road infrastructure, so that the process is named Vehicle and Road Automation. Partial or full automation of vehicles will improve traffic safety by reducing the number of incidents due to human errors, driver's distraction or reduced vigilance. Furthermore, Vehicle and Road Automation is likely to improve the traffic efficiency by smoothening the flow of vehicles as well as reducing congestions due to accidents. The resulting reduction of vehicle emissions and fuel consumption will have a positive impact on the environment. Research activities on Vehicle and Road Automation have significantly increased over the past few years especially in US and Japan. Therefore, it is important to ensure that the expert community share their expertise and reach common views on Vehicle and Road Automation. This objective will be achieved through networking and promotion activities. VRA is a Support Action for networking and international cooperation on Vehicle and Road Automation addressing in particular the deployment needs. VRA intends to address common issues and agree on solutions enabling good market conditions for a seamless and fast deployment. Therefore this support action for Vehicle and Road Automation is an initiative to share expertise and cooperate, at European and International level. It aims to: Maintain an active European network of Vehicle and Road Automation experts and stakeholders, Contribute to EU-US-Japan international collaboration on Vehicle and Road Automation, Identify deployment needs for the different domains of Vehicle and Road Automation, Promote the European Research on Vehicle and Road Automation through an innovative set of dissemination tools. VRA will address the identified deployment needs from different perspectives: the deployment scenarios, the legal and regulatory needs and finally the standardisation and certification requirements. VRA spins off from the iMobility Forum Automation WG discussions in order to build together an open network to support the deployment of Vehicle and Road Automation over Europe and beyond.

Maturity	Not Applicable
Link to REFINET high Level Service Infrastructure	LEGAL ASPECTS COMMUNICATION (non-technological)
Key performance Indicators	Does common European normative exist in Vehicle and road automation? (YES/NO QUESTION)
Year of project ends	2016
Further information	http://vra-net.eu/

Catalogue of R&I projects 3_ HERMES	
Field	**Description**
Technology title and keywords	Road surface measurement GIS techniques Laser scanner Monitoring longitudinal and transversal
Source of technology	Innovative, Highly Efficient Road Surface Measurement and Control System / FP7-SME / 315029
Lifecycle stage	Maintenance
Type of infrastructure	Road
Component of infrastructure	Pavement
Short Description	One of the most important aims in today's transport systems is the security they provide. Even-though in air and rail transports we have managed to have extremely low accident and death rates this is not the case with road transport. The majority of the EU countries are now heading towards "the Vision Zero philosophy" in which road deaths become as unacceptable as they are in a factory, in the air or on a railway. However in order to reach this aim several improvements are needed in numerous area including cars, drivers and roads. The HERMES project aims at improving this last factor, the road, by proposing a novel road quality measurement solution based on a pioneering approach. The proposed system enables, for the first time, measurements of both the longitudinal and transversal profiles of a road to be simultaneously undertaken from a specially equipped vehicle travelling at normal road speeds and at a low infrastructure cost. This approach represents a significant advancement in the state of the art by eliminating the requirement for an inertial reference level whilst, additionally, improving accuracy of measurements by providing a solution for resolving errors otherwise resulting from the dynamics of a moving vehicle, Moreover, within HERMES the road profile measurements will be integrated with their precise geographical location while an innovative toolset for data analysis will be developed so as to allow the efficient processing of the huge amounts of data collected by the HERMES vehicles. In general, HERMES augments the traditional road roughness indices by additionally identifying and pinpointing locations requiring urgent repair to result in improved safety for road users, while those locations can be identified with very high accuracy, low-cost and at normal road speeds. This latter is very important

	since in large countries the national road network requires the measuring and maintenance of thousands of kilometers per year.
Maturity	TRL8
Link to REFINET high Level Service Infrastructure	SAFE/SECURE
Key performance Indicators	International Roughness Index number of crashes due to road surface condition
Year of project ends	2014
Further information	http://www.hermesroadmeasurement.eu

Catalogue of R&I projects 4_ EUROSKY	
Field	**Description**
Technology title and keywords	Secure Air- Cargo Space secure management
Source of technology	Single European Secure Air-cargo Space / FP7-SECURITY / 312649
Lifecycle stage	Operation
Type of infrastructure	Air
Component of infrastructure	installations
Short Description	EUROSKY will deliver a high impact programme for advanced air-cargo security and facilitation measures to safeguard international supply chains and the security of citizens while fostering international co-operation and a broad stakeholder engagement from all segments of the air-cargo industry. The main outputs will be: 1. The EUROSKY Blueprints to provide a Europe wide cooperative model for air cargo security and facilitation including Key Performance Indicators. 2. A multi-energy based automated detection and alarm resolution solution to provide faster and more accurate detection of dangerous substances with reduced false positive rate. 3. The EUROSKY Ecosystem to provide a technological infrastructure for electronically connecting air-cargo stakeholders together, amplifying their security capabilities through faster communications, shared scans and intelligence, real-time optimisation, pooled resources and synchronised actions. 4. Provide Integrated Air-cargo Security Solutions including cargo profiling, screening of the identity and intent of the people who had their hands on the container, and integration of detection technologies in supply chain flows with remote monitoring options 5. Six EUROSKY Demonstrators to be used across several representative operating scenarios characteristic of the air-cargo security sector, covering all aspects of air-cargo security at National and International level and considering access threats, content threats and human error threats, to evaluate outputs and to provide data for impact assessment. Special attention will be given in EUROSKY to building improved understanding of prevailing complexities and vulnerabilities and ensuring long term sustainability of project outputs and market take-up based on a Stakeholder Engagement Strategy emphasising international co-operation both to promote harmonisation in regulations and in supporting further development and implementation of international

	standards.
Maturity	TRL7
Link to REFINET high Level Service Infrastructure	SAFE/SECURE
Key performance Indicators	Time delays in country borders
Year of project ends	2017
Further information	http://www.euroskyproject.eu/

Catalogue of R&I projects 5_ GeopolyConc	
Field	**Description**
Technology title and keywords	Alkali-activated geopolymer durable concrete
Source of technology	Durability of geopolymers as 21st century concretes / FP7-IDEAS-ERC / 335928
Lifecycle stage	Construction
Type of infrastructure	Multi-modal
Component of infrastructure	Concrete material
Short Description	GeopolyConc will provide the necessary scientific basis for the prediction of the long-term durability performance of alkali-activated 'geopolymer' concretes. These materials can be synthesised from industrial by-products and widely-available natural resources, and provide the opportunity for a highly significant reduction in the environmental footprint of the global construction materials industry, as it expands to meet the infrastructure needs of 21st century society. Experimental and modelling approaches will be coupled to provide major advances in the state of the art in the science and engineering of geopolymer concretes. The key scientific focus areas will be: (a) the development of the first ever rigorous mathematical description of the factors influencing the transport properties of alkali-activated concretes, and (b) ground-breaking work in understanding and controlling the factors which lead to the onset of corrosion of steel reinforcing embedded in alkali-activated concretes. This project will generate confidence in geopolymer concrete durability, which is essential to the application of these materials in reducing EU and global CO2 emissions. The GeopolyConc project will also be integrated with leading multinational collaborative test programmes coordinated through a RILEM Technical Committee (TC DTA) which is chaired by the PI, providing a route to direct international utilisation of the project outcomes.
Maturity	TRL3
Link to REFINET high Level Service Infrastructure	GREEN
Key performance Indicators	Reduction in the environmental footprint

Year of project ends	2018
Further information	http://cordis.europa.eu/project/rcn/110058_en.html

Catalogue of R&I projects 6_ iMobility Challenge	
Field	**Description**
Technology title and keywords	ICT systems for passengers
Source of technology	iMobility Challenge and Awareness Raising - iMobility Challenge / FP7-ICT / 317542
Lifecycle stage	Operation
Type of infrastructure	Multi-modal
Component of infrastructure	ICT systems for cooperation and best mobility
Short Description	iMobility Challenge is a 24 months project aimed at demonstrating, promoting and boosting the deployment of ICT systems for efficient and sustainable mobility. The project will highlight both off-the-shelf products (i.e. technologies that have just been launched on the market) and emerging technologies addressed by current research. In particular focus will be placed on current EU Research conducted in the field of cooperative systems for energy efficient and sustainable mobility. Intelligent mobility is notably characterised by efforts to better integrate and connect intelligent drivers, intelligent cars and intelligent infrastructures together, and this can be achieved through cooperative systems. The benefits of ICT systems for efficient and sustainable mobility should be better disseminated to end-users, decision-makers, the research community and the industry. The added value of iMobility Challenge will be to raise awareness of such benefits among those distinct target groups.
Maturity	TRL7
Link to REFINET high Level Service Infrastructure	SOCIAL/INCLUSIVE
Key performance Indicators	Time saving (min) Fuel consumption reduction
Year of project ends	2014
Further information	http://www.imobilitychallenge.eu/

Catalogue of R&I projects 7_ MOVESMART	
Field	**Description**
Technology title and keywords	Urban mobility Data sharing Route Planning
Source of technology	Renewable Mobility Services in Smart Cities / FP7-ICT / 609026
Lifecycle stage	Operation

Type of infrastructure	Multi-modal
Component of infrastructure	crowd sourcing based technologies to collect real time information for better route
Short Description	MOVESMART aims at providing time-dependent route planning and renewable personal mobility services using a set of crowd-sourcing tools for collecting real-time information by multimodal travellers. The core of MOVESMART is a hierarchical urban-traffic infrastructure that is hosted and maintained by a cloud architecture. MOVESMART envisions the server-based creation and maintenance of time-dependent urban-traffic metadata as well as live-traffic logging, hosted in an urban traffic knowledge base (UTKB). The contents of UTKB are maintained and handled so as to allow rapid route planning for energy efficient and personalised mobility services in real time. The traffic reports are securely and anonymously gathered directly by the travellers via simple portable navigation device and/or smartphone application interfaces. After assessing their importance, all the necessary traffic-metadata updates and/or responses to emergent disruptions are applied to the contents of the UTKB and are broadcast to the relevant travellers. The traffic-reporting is conducted via a crowd-sourcing service, which allows the live (in-route / emergency) reports as well as post-route assessments of travellers for the recommended route plans. A crucial advantage of the MOVESMART infrastructure is the design and implementation of novel time-dependent renewable mobility services that will incorporate eco-friendly modes of transport, most notably that of electric vehicles. A set of innovative cloud-based mobility services will be delivered, such as Renewable Mobility on Demand, Vehicle Sharing and Integrated Personal Mobility, on which new business models will be deployed involving service providers, electric car manufacturers and public authorities. The project plans to validate the proposed solutions in two different cities with diverse characteristics in order to ensure that the MOVESMART crowd-sourcing personal mobility paradigm can be applicable to a large extent, after the end of the project.
Maturity	TRL4
Link to REFINET high Level Service Infrastructure	SOCIAL/INCLUSIVE
Key performance Indicators	Travel time reliability
Year of project ends	2016
Further information	http://www.movesmartfp7.eu/

Catalogue of R&I projects **8_ ROBO-SPECT**	
Field	**Description**
Technology title and keywords	Robotic system Tunnel Inspection
Source of technology	ROBotic System with Intelligent Vision and Control for Tunnel Structural INSPECTion and Evaluation / FP7-ICT / 611145
Lifecycle stage	Maintenance

Type of infrastructure	Multi-modal
Component of infrastructure	Tunnel
Short Description	The latest developments in robotics and the associated fields of computer vision and sensors open the floor for automated robotic solutions, exploitable in the near to medium term in the field of inspection of the civil infrastructure in general and transportation tunnel infrastructure in particular. The latter infrastructure is ageing urgently requiring inspection and assessment. Presently, inspection is mostly performed through tunnel wide visual observations by inspectors. This process is slow, labour intensive, expensive, subjective and often requiring lane shutdown during inspection at a time of limited budgets and inspector resources and heightened requirements for safety and maximum tunnel uptime. ROBINSPECT, driven by the tunnel inspection industry, adapts and integrates recent research results in intelligent control in robotics, computer vision tailored with semi-supervised and active continuous learning and sensing, in an innovative, integrated, robotic system that automatically scans the intrados for potential defects on the surface and detects and measures radial deformation in the cross-section, distance between parallel cracks, cracks and open joints that impact tunnel stability, with mm accuracies. This permits, in one pass, both the inspection and structural assessment of tunnels. Intelligent control and robotics tools are interwoven to set an automatic robotic arm manipulation and an autonomous vehicle navigation so as to minimize humans' interaction. This way, the structural condition and safety of a tunnel is assessed automatically, reliably and speedily. The initial dataset on tunnel defects is provided from case studies (e.g., from London Underground) to be used not only for transfer learning but also for the evaluation of the structural models. The robotic system is evaluated and benchmarked at the research infrastructure of tunnels of VSH, at three road tunnels of the Egnatia Motorway and sections of the railway tunnel of London Post Office.
Maturity	TRL6
Link to REFINET high Level Service Infrastructure	COST-EFFICIENT GREEN
Key performance Indicators	Time to assess tunnel structural condition
Year of project ends	2016
Further information	http://www.robo-spect.eu/

Catalogue of R&I projects 9_ MobiS	
Field	**Description**
Technology title and keywords	Monitor, model and manage urban mobility infrastructures Sensor Social networking data
Source of technology	Personalized Mobility Services for energy efficiency and security through advanced Artificial Intelligence techniques / FP7-ICT / 318452

Lifecycle stage	Design
Type of infrastructure	Multi-modal
Component of infrastructure	ICT systems for monitoring, modelling and manging
Short Description	The main goal of MobiS is to create a new concept and solution of a federated, customized and intelligent mobility platform by applying novel Future Internet technologies and Artificial Intelligence methods that will monitor, model and manage the urban mobility complex network of people, objects, natural, social and business environment in real-time. MobiS federation and intelligence is based on the symbiotic relation between these stakeholders, innovative prediction and reasoning methods that are using learned multi-criteria function to provide more efficient, energy-aware and environmental friendly citizen mobility. MobiS will be able to federate novel artificial intelligence services and traditional information platform services coming from the following sources: a) existing transport private or public service providers, b) ambient data, based on sensor infrastructures and c) social networking data. To achieve these challenging objectives, the project will develop MobiS federated platform, prediction/planning/reasoning services, multi-criteria decision function and, federated mobility-based services that correspond to the above mentioned information sources. Solutions will be tested in three pilots: 1) An inter-city mobility scenario in Sweden (Stockholm-Hudiksvall-Sundsvall), where an existing crowdsourcing application will be used, 2) an intra-city scenario in Greece (Thessaloniki) combining a traffic information system and the crowdsourcing application and, 3) a country-wide (inter-city) mobility scenario in Slovenia with a social media application, and selected traffic information system already operated in various parts of the country and in the main cities. The project has 32 months duration, is led by Insiel (IT), technically coordinated by ATOS (Spain) and will be implemented by a consortium of 9 partners from 6 different EU countries.
Maturity	TRL6
Link to REFINET high Level Service Infrastructure	SOCIAL/INCLUSIVE
Key performance Indicators	Time saving
Year of project ends	2015
Further information	http://www.mobis-euproject.eu/

Catalogue of R&I projects 10_ REPARA	
Field	**Description**
Technology title and keywords	Software engineering methodology, development tools, computer hardware design and analysis, automated software support tools
Source of technology	Reengineering & Enabling Performance And poweR of Applications/FP7-ICT/609666
Lifecycle stage	Operation
Type of infrastructure	Rail

Infrastructure Component	Safer rail system by advanced computers
Short Description	In recent years, traditional processors have not been able to translate the advances of silicon fabrication technology into corresponding performance gains. This has been due to weaknesses inherent in the current sequential programming model, which has not changed significantly since the late 1940's, as well as due to physical constraints, such as practical limits on the energy consumption and the associated cooling efforts for a processor. To keep satisfying the ever-growing demand for computing power, these difficulties have forced a shift from homogeneous machines relying on a one single kind of fast processing element (the CPU) such as typical PCs some years ago, programmed mostly sequentially, to heterogeneous architectures combining different kinds of processors (such as CPUs, GPUs and DSPs) each specialized for certain tasks, and programmed in a highly parallel fashion yet poorly optimising the available resources towards performance and low energy consumption. The REPARA project joins forces of experts in software engineering methodology, development tools, computer hardware design and analysis, all working hand-in-hand with industrial end-users to achieve a unified programming model for heterogeneous computers developing also the required automated software support tools. Relative to the base line of a sequential algorithm executed on a current general-purpose processor, REPARA expects to achieve at least a 50% reduction of energy consumption combined with a performance improvement of at least by a factor of two. REPARA will also allow for an increased productivity realizing designs in half of the development time that would be required using non-unified programming methods for the different components of a heterogeneous system. Combined, REPARA will lead to fourfold gain in efficiency for energy savings and performance. These objectives will be verified in 5 real-world use cases in the domains of railway, healthcare and industrial maintenance and robotics. Achieving such ambitious objectives will create opportunities for the involved contractors and the European citizens on various strands. The industrial contractors EVOPRO and IXION are active in the targeted use cases and will earn improved competitiveness over other players in their respective markets turning the REPARA results into higher profits and increased employment.
Maturity	NA
Link to REFINET high Level Service Infrastructure	GREEN COST-EFFICIENT
Key performance Indicators	Expects to achieve at least a 50% reduction of energy consumption combined with a performance improvement of at least by a factor of two
Year of project ends	2016
Further information	http://repara-project.eu/

Catalogue of R&I projects 11_ DIWINE	
Field	**Description**
Technology title and keywords	Wireless communication
Source of	Dense Cooperative Wireless Cloud Network / FP7-ICT / 318177

technology	
Lifecycle stage	Operation
Type of infrastructure	Multi-modal
Component of infrastructure	Intelligent Transport Systems
Short Description	DIWINE considers wireless communication in a dense relay/node scenario where WNC (Wireless Network Coding) messages are flooded via dense massively air-interacting nodes in the self-contained cloud while the PHY air-interface between the terminals (sources/destinations) and the cloud is simple and uniform. A complex infrastructure cloud creates an equivalent air-interface to the terminal, which is as simple as possible. Source and destination air-interfaces are completely cloud network-structure-blind. The cloud has its own self-contained organising and processing capability. This concept facilitates energy-efficient, high-throughput and low-latency network communication performed directly at the PHY layer, which is capable of operating in complicated, dense, randomly defined network topologies and domains. The applications of the DIWINE paradigm are generic, being relevant to complex systems ranging from intelligent transport systems to healthcare and even machine-type communication in wireless networks. However, to exhibit practical, highly focused and high impact results, DIWINE concentrates on two core application/demonstration cases: i) smart metering networks and ii) critical industrial monitoring and control applications. To this end, DIWINE algorithms and theoretical technology will be integrated into two industrial proof-of-concept demonstration platforms targeting the aforementioned applications. Both applications require low-latency, dense networking solutions and are sure to be integral to future European policy and society as evidenced by recent European Commission initiatives such as EUROPE 2020.
Maturity	NA
Link to REFINET high Level Service Infrastructure	COST-EFFICIENT
Key performance Indicators	Not available
Year of project ends	2016
Further information	http://diwine-project.eu/public/

Catalogue of R&I projects 12_ Local4Global	
Field	**Description**
Technology title and keywords	Technical Systems of Systems (TSoS) web-based, "plug-and-play" software system
Source of technology	SYSTEM-OF-SYSTEMS THAT ACT LOCALLY FOR OPTIMIZING GLOBALLY / FP7-ICT / 611538
Lifecycle stage	Operation
Type of infrastructure	Road

Component of infrastructure	Traffic management
Short Description	Today's Technical Systems of Systems (TSoS) such as transport, traffic and energy management systems require the deployment of an expensive-to-deploy and operate sensor and communication infrastructure. Moreover, they need a very time/effort-consuming modelling, analysis and control design procedure to achieve an efficient performance. On the contrary, Natural Systems of Systems (NSoS) such as the human brain, animal herds (swarms), teams of interacting/cooperating humans or animals achieve a highly efficient, elegant and supreme functionality without the need of an expensive infrastructure as they primarily rely on local information between neighbouring systems and, most importantly, they do not need any modelling, analysis or control design tools to achieve such a functionality. If the powerful attributes of NSoS were possible to be transferred and embedded into TSoS, this would lead not only to more efficient TSoS operations but, most importantly, to TSoS that are significantly easier, safer and more economical to design, deploy and operate. This is the main objective of Local4Global:to develop, test and evaluate a new ground-breaking, generic and fully-functional methodology/system for controlling TSoS which - as in the NSoS case - optimizes the TSoS performance at the global level without the need of deployment and operation of an expensive sensor and communication infrastructure and, most importantly, without the need for the use of elaborate and time/effort consuming modelling, analysis and control design tools. By embedding in TSoS attributes currently found only in NSoS, Local4Global's ambition is to develop a system that can be embedded in every day TSoS operations, produce substantial savings and Quality-of-Service improvements with the requirement of using the minimum possible infrastructure and minimum installation/operation effort. The economic and societal impact and consequences of the availability of such a system will be tremendous in literally any activity of everyday life: for instance, drivers/travellers will spend significantly less time for commuting, building occupants will see their energy bills significantly reduced and, most importantly, energy consumption and pollution will be substantially reduced. Furthermore, Local4Global application will not be only limited to areas and systems where no sophisticated control is currently employed (due to the requirement for an elaborate infrastructure). It will also be of great significance to areas and systems where, despite that the infrastructure is there, current control and management systems "cannot do the job". The Local4Global advances will lead to a fully-functional and ready-to-use system (Local4Global final product) - delivered in the form of an embedded, web-based, "plug-and-play" software system for generic TSoS. This system will be deployed and extensively tested in 2 real-life TSoS Use Cases, a Traffic TSoS Use Case and a Building TSoS Use Case.
Maturity	NA
Link to REFINET high Level Service Infrastructure	COST EFFICIENT
Key performance Indicators	Not available
Year of project ends	2016
Further information	http://local4global-fp7.eu/

Catalogue of R&I projects 13_ FABulous	
Field	**Description**
Technology title and keywords	Software-enabled ecosystem 3D printing
Source of technology	Future Internet Web-Entrepreneurship for 3D Printing Virtual Fabrication in Europe / FP7-ICT / 632881
Lifecycle stage	Design
Type of infrastructure	Multi-modal
Component of infrastructure	3D printing
Short Description	The potential of 3D printing to become a major source of economic growth is huge - market size of $8.41 billion in 2020. It could (a) bring significant environmental benefits removing the need to bulky transport (b) vastly reduce the capital manufacturing costs making it easier for entrepreneurs to launch ideas (c) give customers a new level of choice for products to be custom-built to their needs. IT industry is realising that 3D printing technology goes beyond a manufacturing technology. It represents a software-enabled ecosystem. This ecosystem includes 3D printers, CAD applications; scanners and online collaboration, much of which is open source. Successfully providing a FI based innovation ecosystem in 3D printing (FABulous) will secure employment and growth, capitalising on European global tangible assets (manufacturing capabilities, bespoke services, digital marketplaces) and intangible ones (creativity, design). Failing to meet the challenge means once more we lose the innovation battle to American counterparts.FI is at the epicentre of the 3D printing ecosystem. All required infrastructures and enabling technologies for FI response are available- FI-WARE GEs, FITMAN FIspace and FI-Content platforms. Therefore, FABulous FI service scope will lie in key areas: Crowd-sourcing design. Cloud based design with IPR management. 3D printing mobile apps. Logistics & manufacturing services. FABulous will bring together 150 entrepreneurs, creative professionals, 3D printing adopters and investors. It is a highly connected (EIT ICT Labs, EIG, EuroHub, EMN, EBN, ECIA, EFFRA) high-performance business acceleration programme combining best of breed technical background (FI), with solid business modelling routed in the FI, with access to smart investment strategies from public and private investors leveraging FI services for 3D printing. The European Talent Mobility network provides FABulous access to high-quality talent to support SME growth.
Maturity	NA
Link to REFINET high Level Service Infrastructure	
Key performance Indicators	Not available
Year of project ends	2016
Further information	http://fabulous-fi.eu/about-fabulous-project/

Catalogue of R&I projects 14_ INSIGHT	
Field	**Description**
Technology title and keywords	Emergency planning and response Real-time massive streaming of heterogeneous data. Urban environment
Source of technology	Intelligent Synthesis and Real-tIme Response using Massive Streaming of Heterogeneous Data / FP7-ICT / 318225
Lifecycle stage	Operation
Type of infrastructure	Multi-modal
Component of infrastructure	Real time data management for emergency situations
Short Description	The instrumentation of the world with diverse sensors, smart phones, and social networks acquires exascale data that offer the potential of enhanced science and services. In particular, a better societal management of the overall cycle of disaster monitoring and response becomes possible, citizens may now become involved in decision making and data acquisition (crowd-sourcing), and advanced planning can conserve resources. Current systems are limited in three important elements: (i) lack of methods for handling heterogeneous data streams in real-time, (ii) absence of social computing integrated with big data analysis, (iii) real-time prediction and alarm capabilities have not yet been incorporated into the infrastructure for intelligent management. The goal of the INSIGHT project is to radically advance our ability of copying with emergency situations in Smartcities by developing innovative technologies, methodologies and systems that will put new capabilities in the hands of disaster planners and city personnel to improve emergency planning and response brings together a strong group of researchers with domain experts in three representative case studies of urban transportation, flood management, and emergency response. A large collection of data sets of different types ranging from Twitter to Traffic Flow Sensing and Mobile Phone Data are available and in use by the project partners Dublin City Council, German Federal Office of Disaster Assistance BBK, Fraunhofer, University of Athens and Technion. Their value will be enhanced by data analysis and data fusion. Geographically and socially correlated aspects will be considered by novel methods for streams, parallel data handling (Hadoop, GPUs), and data analysis. Data will be enriched by pro-active social computing with incentives and prepared for different usages. INSIGHT aims at a participatory approach to the automated management of resources and emergency response in smart cities and countries.
Maturity	TRL5
Link to REFINET high Level Service Infrastructure	RESILIENCE
Key performance Indicators	Time to response
Year of project ends	2015
Further information	http://www.insight-ict.eu/

Catalogue of R&I projects 15_ INTER-TRUST	
Field	**Description**
Technology title and keywords	ICT Data exchange security Interoperability
Source of technology	Interoperable Trust Assurance Infrastructure / FP7-ICT / 317731
Lifecycle stage	Operation
Type of infrastructure	Multi-modal
Component of infrastructure	interoperable and trusty data exchange - e.g. Vehicle - vehicle and vehicle - infrastructure communication
Short Description	The main objective of the INTER-TRUST project is to develop a framework to support trustworthy applications in heterogeneous networks and devices based on the enforcement of interoperable and changing security policies. This framework will allow developers, integrators and operators of systems to act during the development and operation phases to obtain systems with components that communicate and share data in a secure trusted manner dictated by negotiated security policies that we also refer to as dynamic security Service Level Agreements. The result will incorporate trustworthiness by integrating legal, social and economic concerns, allowing applications and devices to negotiate and be constrained by them. It will offer scalable and economically viable security and privacy policy management and enforcement solution that will assure secure interoperability to applications and devices in heterogeneous environments. High level researchers and developers from academia and security software companies will bring the know-how and innovation to solve complex issues guaranteeing that the dynamic solution is applicable and does not introduce any vulnerability. Advanced enabling technologies will be integrated including: formal based monitoring and testing to detect malicious behaviour; negotiation, delegation, dynamic protection and prevention mechanisms based on Aspect Oriented weaving techniques; and, enhanced protection techniques to avoid introducing new vulnerabilities. INTER-TRUST intends to validate the results using two different case studies with complex, highly demanding critical services. The two case studies, E-voting and Vehicle-to-Vehicle and Vehicle-to-Infrastructure Communications for Intelligent Transport Systems, involve key European players and will perfectly illustrate the importance and cross-domain applicability of the INTER-TRUST's results and offer unique opportunities for their wide-spread exploitation.
Maturity	TRL6
Link to REFINET high Level Service Infrastructure	SAFE/SECURE
Key performance Indicators	security level of the data exchanged
Year of project ends	2015
Further information	http://inter-trust.lcc.uma.es/home

Catalogue of R&I projects

16_ MoveUs	
Field	**Description**
Technology title and keywords	ICT systems for passengers Data Sharing Urban Mobility Travel Recommendations
Source of technology	MoveUs: ICT CLOUD-BASED PLATFORM AND MOBILITY SERVICES: AVAILABLE, UNIVERSAL AND SAFE FOR ALL USERS / FP7-ICT / 608885
Lifecycle stage	Operation
Type of infrastructure	Multi-modal
Component of infrastructure	ICT systems for cooperation and best mobility, focused on user
Short Description	Although large research activity has been done in Europe on Intelligent Transport Systems and Information and Communication Technologies to make people able to travel by integrating different transport modes, personal integrated mobility is still far from becoming a reality in the so-called smart-cities and people still prefer driving their private cars without questioning the energy expense and the environmental impact that this decision involves. MoveUs radically changes the European users' mobility habits by offering intelligent and personalized travel information services, helping people to decide the best transport choice and providing meaningful feedback on the energy efficiency savings obtained as a result. Information from a wide variety of transport modes and mobility systems such as public buses, car/bike sharing systems, traffic management systems, equipped vehicles to measure traffic density, and users' mobile phones will be integrated and processed in an innovative and high-capacity computing platform. The MoveUs platform will allow: i) to measuring "the pulse of urban mobility" from a global perspective; 2) to obtain valuable information on how the traffic density evolves and how the public transport is used; 3) to learn how individual users can move along the city in a eco-friendlier way. On top of the platform, a set of smart mobility services will be deployed focusing directly on users, such as travel recommendations, in-advance traffic information, incident warning, eco-routing and carbon footprint metering, among others, offered through smartphone-based applications. These services will be supported by an effective incentive-based model targeted to foster the use of shared and public transport. Coupons, rewards and special offers will be offered in return for the adoption of sustainable mobility habits. The platform and the services will be tested in three smart-city pilots placed in Madrid, Tampere and Genoa. Gathered in Living Lab communities, representatives from the cities will be deeply engaged in the project: city councils, transport/mobility operators, citizens and local technology partners. This will ensure a broad and effective user engagement for suggesting real and sustainable user-driven business cases. MoveUs will deliver: 1. a cloud-based mobility management platform with high-performance data analytics capabilities;2.\tan API toolkit, granting data access to developers;3 innovative user-centric services with an effective incentive-

	based model, rewarding the use of sustainable mobility modes;4. fully integrated smart mobility applications, running on users' smartphones (mobility assistant) and at control centres (mobility management);5. energy efficiency assessment tools to measure users' energy efficiency gains. MoveUs will facilitate the take-up of ICT-based mobility services proving significant energy efficiency gains in smarter and greener cities.
Maturity	TRL6
Link to REFINET high Level Service Infrastructure	SOCIAL/INCLUSIVE
Key performance Indicators	Time saving Accessibility to different public transport modes
Year of project ends	2016
Further information	http://www.moveus-project.eu/

Catalogue of R&I projects 17_ plan4business	
Field	**Description**
Technology title and keywords	Data Sharing Aggregation, process and analysis of planning data
Source of technology	A service platform for aggregation, processing and analysis of urban and regional planning data / FP7-ICT / 296282
Lifecycle stage	Design
Type of infrastructure	Multi-modal
Component of infrastructure	Service platform to share transport infrastructure plans among others
Short Description	Urban and Regional Planning data sets are not aggregated so far, and thus it is very difficult to use them for any other purpose than for printing of simple publishing by the authorities that they were created by. Creating time series or comparative analyses on these data sets is not yet possible; researchers, spatial planners and professionals from the real estate world and other disciplines, such as insurance industry, investors, or market-relevant activities related to urban development have a growing stake in such capabilities. The plan4business project consequently aims to develop a platform that can serve users a full catalogue of planning data such as transport infrastructure, regional plans, urban plans and zoning plans. The platform offers clients not just the data itself in integrated, harmonised and thus ready-to-use form, but it also offers rich analysis and visualisation services via an API and an interactive web frontend. Functions offered range from simple statistical analysis to complex trend detection and to 2D/3D representations of these. The two main challenges that have so far hindered usage of planning data in such a manner are the required integration and harmonisation, which needs to be highly automated, as well as the need for an ICT system that can efficiently answer complex queries over the diverse and complex planning data sets. The business model for the plan4business platform foresees several different groups of active stakeholders: data providers (planning authorities, engineering bureaus, researchers), data curators (who perform integration and quality assurance), clients and the data brokers who will be hosting and

	exploiting the plan4business portal. Revenue is to be generated via on-demand and subscription services to different customer groups ranging from environmental and planning authorities and companies to banks and real estate companies and developers.
Maturity	TRL5
Link to REFINET high Level Service Infrastructure	COMMUNICATION (non-technological)
Key performance Indicators	Number of different stakeholders involved in the same data platform
Year of project ends	2014
Further information	http://www.plan4business.eu/

Catalogue of R&I projects 18_ MOBINCITY	
Field	**Description**
Technology title and keywords	Urban transport Optimum charging strategies Trip planning and routing
Source of technology	SMART MOBILITY IN SMART CITY / FP7-ICT / 314328
Lifecycle stage	Operation
Type of infrastructure	Road
Component of infrastructure	Fully electric vehicle - communication among vehicle, traffic and transport infrastructure to improve the autonomy range of FEV
Short Description	Urban transport is responsible for about a quarter of CO2 emissions from transport. The gradual phasing out of 'conventionally-fuelled' vehicles from the urban environment is a major contribution to significant reduction of oil dependence, greenhouse gas emissions and local air and noise pollution. Fully Electric Vehicles (FEV), for public and private transport, can contribute significantly to the lowering of the current pollution levels. However, the FEV use is currently facing several weaknesses which are delaying its wider deployment, mainly related to overall limited efficiency and limited driving range. With this regard, MOBINCITY aims at the optimization of FEV autonomy range and the increase in energy efficiency thanks to the development of a complete ICT-based integrated system able to interact between driver, vehicle and transport and energy infrastructures, taking advantage of the information provided from these sources in order to optimise both energy charging and discharging processes (trip planning and routing).Main specific objectives are: To develop a system to be installed within the vehicle able to receive information from the surrounding environment, which can have influence in the vehicle performance (traffic information, weather and road conditions and energy grid). To optimise the trip planning and routing of FEV using information from these external sources including alternatives from other transport modes adapted to user's needs. To define efficient and optimum charging strategies (including routing) adapted to user and FEV needs and grid conditions. To implement

	additional energy saving methods (as driving modes and In-Car Energy Management Services) within the FEV interaction with the driver. In order to reach its objectives, MOBINCITY joins together an outstanding group of 13 partners, coming from five different countries, covering relevant sectors as traffic management, energy, ICT and telecommunications and automotive industry.
Maturity	TRL5
Link to REFINET high Level Service Infrastructure	SOCIAL/INCLUSIVE GREEN
Key performance Indicators	Information for users Reduction of noise and air pollution levels
Year of project ends	2015
Further information	http://www.mobincity.eu/

Catalogue of R&I projects 19_ eCo-FEV	
Field	**Description**
Technology title and keywords	Traffic monitoring Charge while driving
Source of technology	efficient Cooperative infrastructure for Fully Electric Vehicles / FP7-ICT / 314411
Lifecycle stage	Operation
Type of infrastructure	Road
Component of infrastructure	Fully Electric Vehicle integration
Short Description	This project will be carried out within the FP7 Work Programme 2011 COOPERATION of the European Commission addressing the objective GC-ICT-2011.6.8 ICT for fully electric vehicles. In particular, the project aims at fulfilling the specific targeted outcome f): Integration of the FEV in the cooperative transport infrastructure. It proposes will develop an integrated IT platform that enables the connection and information exchanges between multiple infrastructure systems that are relevant to the FEV such as road IT infrastructure, EV backend infrastructure and EV charging infrastructure. Over this platform, multiple advanced electric mobility services can be provided to FEV users to improve the energy management efficiency and usability of the FEV.
Maturity	TRL6
Link to REFINET high Level Service Infrastructure	SOCIAL/INCLUSIVE
Key performance Indicators	accessibility to FEV driving info
Year of project ends	2015
Further information	https://www.eco-fev.eu/

Catalogue of R&I projects 20_ ICSI	
Field	**Description**
Technology title and keywords	ICT Traffic efficiency Cooperative sensing Travel management strategies
Source of technology	Intelligent Cooperative Sensing for Improved traffic efficiency / FP7-ICT / 317671
Lifecycle stage	Operation
Type of infrastructure	Road
Component of infrastructure	Intelligent Transport Systems
Short Description	The architecture of the ICT infrastructure for supporting Intelligent Transportation Systems (ITS) is purely hierarchical, with sensed data flowing from the leaves (i.e., road-side or vehicle-installed sensors) to the root (i.e., the traffic management centre). The current approach does not scale adequately with the inclusion of a significant number of new elements, is not flexible in supporting an incremental growth or changes of the ITS, and exhibits latency and security issues. In ICSI we tackle all these issues by proposing a new architecture where the intelligence for sensing and actuation is distributed over some of the elements, called gateways, which host a software platform for running ITS applications, using the local storage and computation capabilities available. Communication with the remote centre happens only for the transmission of aggregated data for long-term operations, e.g., data mining, software upgrades, and logging. The approach proposed in ICSI enables scientific and technological innovations: advanced sensing algorithms will be defined, which make use of real-time availability of data; efficient distribution of context-rich data lays the foundations for novel traffic and travel management strategies. Both directions will be studied in the project. However, research challenges are associated at all levels to the realization of the system, especially for the communication among sensors, gateways, and vehicles, which are fully addressed in the project activities. Prototypes of sensors, road-side units, and communication units suitable for the cooperative operation envisaged in ICSI will be developed and integrated into an end-to-end demonstrator, which will be used in on-field experiments for the use cases of smart urban traffic management and accident recovery in highway.
Maturity	TRL6
Link to REFINET high Level Service Infrastructure	SOCIAL/INCLUSIVE
Key performance Indicators	travel cost time saving
Year of project ends	2015
Further information	http://www.ict-icsi.eu/

Catalogue of R&I projects 21_ EMERALD	
Field	**Description**
Technology title and keywords	Energy use optimisation Automatic scheduling of recharging stops in route FEV integration
Source of technology	Energy ManagEment and RechArging for efficient eLectric car Driving / FP7-ICT / 314151
Lifecycle stage	Operation
Type of infrastructure	Road
Component of infrastructure	ITS and Management
Short Description	EMERALD focuses on energy use optimisation and on the seamless integration of the FEV into the transport and energy infrastructure, by delivering clear advances over the state-of-the-art. The goal is to assist the FEV in becoming a successful commercial product. To this end, EMERALD will innovate a range of novel ICT solutions, each one seamlessly integrated with the others, providing a multifaceted and comprehensive approach on these issues. EMERALD will introduce Integrated in-vehicle energy management, comprising: •Dynamic energy-driven management of FEV auxiliaries, tightly integrated with consumption prediction functionality, enabling pre-emptive energy conservation measures.• Energy-efficient long-range route planning and optimisation, enabling extension of FEV's driving range and automatic scheduling of recharging stops en route. •Performance-centric machine learning for consumption prediction, introducing optimisation and cooperative training of machine learning functions targeted for energy consumption and traffic prediction based on experience. •Driver profiling functionalities, through monitoring of acceleration/braking patterns, for the enhancement of route consumption prediction functionality. •V2G traffic and consumption data synchronisation, as a new cooperative information-sharing scheme. User-centric charge and discharge management, enabling automatically-generated, optimal for the user, charge and discharge schedules, accessible both on-board and on his mobile phone. EMERALD will also introduce: Enhanced FEV-related power demand prediction and power flow management support, taking advantage of consumption patterns as shared in a cooperative manner by the FEVs themselves, as well as from FEVs' recharging bookings; Cooperative FEV fleet management, though holistic and dynamic, multi-parameter, fleet control optimisation, taking into account energy and recharging limitations; and FEV-specific driver training for energy efficiency.
Maturity	TRL6
Link to REFINET high Level Service Infrastructure	SOCIAL/INCLUSIVE GREEN
Key performance Indicators	Information for users energy saving
Year of project ends	2016
Further information	http://www.fp7-emerald.eu/

Catalogue of R&I projects 22_ GAMBAS	
Field	**Description**
Technology title and keywords	Urban transport - information tool Open & distributed tool Interoperable and extensible tool Context-aware and privacy preserving tool Internet of things
Source of technology	Generic Adaptive Middleware for Behavior-driven Autonomous Services / FP7-ICT / 287661
Lifecycle stage	Operation
Type of infrastructure	Multi-modal
Component of infrastructure	installations and management
Short Description	The overall objective of the GAMBAS project is the development of an innovative and adaptive middleware to enable the privacy-preserving and automated utilization of behaviour-driven services that adapt autonomously to the context of users. With the advent of powerful Internet-connected objects an increasing number of Europeans have constant access to information on the Internet. Nowadays, these connected objects are causing a drastic paradigm shift in the way people deal with information. Yet, the technical means to access information have only changed marginally. In most cases, information is accessed via the web which requires persons to memorize long URLs, click through web pages or browse through search results. In contrast, ubiquitous computing envisions services providing distraction-free support. To realize this vision, services themselves must adapt to the user's situation, behaviour and intents at runtime. This requires services to gather and process the user's context. Internet-connected objects provide a promising basis for determining user context in an automated manner on a large scale. The vision of ubiquitous computing, however, extends beyond the boundaries of a single service as it envisions seamless support for everyday tasks. To close the resulting gaps, the GAMBAS project has the following scientific and technical objectives:1. Development of a generic adaptive middleware for behaviour-driven autonomous services that encompasses: a. Models and infrastructures to support the interoperable representation and scalable processing of context. b. Frameworks and methods to support the generic yet resource-efficient multi-modal recognition of context. c. Protocols and tools to derive, generalize, and enforce user-specific privacy-policies. d. Techniques and concepts to optimize the interaction with behaviour-driven services.2. Validation of the middleware and its components using lab tests and a prototype application in the public transportation domain.
Maturity	TRL7
Link to REFINET high Level Service Infrastructure	SOCIAL/INCLUSIVE

Key performance Indicators	Time saving Information for users
Year of project ends	2015
Further information	http://www.gambas-ict.eu/

Catalogue of R&I projects 23_ COLOMBO	
Field	**Description**
Technology title and keywords	Urban transport Advanced traffic light control Simulation software Traffic surveillance
Source of technology	Cooperative Self-Organizing System for low Carbon Mobility at low Penetration Rates / FP7-ICT / 318622
Lifecycle stage	Operation
Type of infrastructure	Multi-modal
Component of infrastructure	installations and management
Short Description	Traffic is time and energy consuming and produces negative effects on the environment. The first pillar of the Green Paper on Urban Mobility: Towards a new culture for urban mobility adopted by the EU commission in 2007, puts a strong emphasis on (1) reducing congestion and its impact in everyday life on urban environments, and (2) developing smarter urban transport systems, whose aim is to spread good practices towards more efficient urban transport. Traffic control systems should cope with the ever-increasing demand by determining the situation on the road network and by controlling traffic flows. Emerging cooperative techniques like vehicle-to-infrastructure communication increase the knowledge about road traffic participants and open new channels for delivering information to these participants. However, most cooperative systems require large penetration rates to assure their functionality, making the first steps towards their deployment unattractive. COLOMBO will overcome this hurdle by delivering a set of modern, self-organizing traffic management algorithms designed for being applicable even at low penetration rates, asserting their usability from the very first deployment days on. COLOMBO will focus on two traffic management topics: traffic surveillance and advanced traffic light control algorithms. Herein, cost-efficiency and the reduction of vehicular emissions will be the project's key objectives. Both results are assumed to be more than a pure technology step. Rather than that, they lay the foundations for new, cost-effective and comprehensive way to measure and handle traffic. Additional results will include prototypes for incident and emission monitoring at intersections, going far beyond current state of the art. COLOMBO will achieve its tasks by bringing together experts and methods in swarm intelligence, optimization, communication, traffic light control, traffic simulation, and vehicular emissions modelling.
Maturity	TRL4

Link to REFINET high Level Service Infrastructure	GREEN SOCIAL/INCLUSIVE
Key performance Indicators	Reduction of emissions Time saving
Year of project ends	2015
Further information	http://www.colombo-fp7.eu/

Catalogue of R&I projects 24_ e-SAVE	
Field	**Description**
Technology title and keywords	Energy consumption Carbon emissions Supply chain management considering environmental KPIs
Source of technology	Energy Efficiency in the Supply Chain through Collaboration, Advanced Decision Support and Automatic Sensing / FP7-ICT / 288585
Lifecycle stage	Operation
Type of infrastructure	Multi-modal
Component of infrastructure	Installations and management
Short Description	The e-SAVE project aims to contribute to an energy-efficient supply chain by providing the system, services, collaboration platform and management tools that will help companies monitor, manage and share energy use and carbon footprint data to support operational as well as strategic decision making and supply chain design decisions. The project will specifically focus on the consumer goods sector, by involving the ECR Europe organisation, representing all major manufacturers and retailers in this sector, as well as one of its active members, Barilla, who pioneers in environmental sustainability practices. Emphasis is placed on industry adoption and quantifiable impact assessment. The e-SAVE technical approach relies on an interoperable information infrastructure that integrates ERP systems with automatic data capturing technologies (mainly smart energy meters and unique product identification technologies) in order to support generic components for energy efficiency monitoring and life cycle assessment; upon these e-SAVE deploys new optimization algorithms for energy-efficient supply chain operations, simulation models and tools for strategic supply chain design decisions and dynamic energy-efficiency product labelling. The project will further build on existing market-leading tools owned by the e-SAVE partners in the fields of energy-monitoring, life-cycle assessment and simulation. Contribution to information sharing standards and energy efficiency ontologies will also be sought. Overall, the e-SAVE project aims to deliver a modular and extensible information, collaboration and management support infrastructure that not only captures the data required for effectively monitoring energy use and other environmental measures, but also provides the management tools that utilize this information and support decisions and every day operations for reducing energy consumption and carbon emissions in a feedback loop.
Maturity	TRL5

Link to REFINET high Level Service Infrastructure	GREEN
Key performance Indicators	Fuel saving (%) due to best route option
Year of project ends	2014
Further information	http://www.e-save.eu/

Catalogue of R&I projects 25_ RAIN	
Field	**Description**
Technology title and keywords	Weather induced disruptions Cascading & inter-related land infrastructures Extreme weather risk Analysis of vulnerabilities and impacts
Source of technology	Risk Analysis of Infrastructure Networks in response to extreme weather / FP7-SECURITY / 608166
Lifecycle stage	Operation
Type of infrastructure	Multi-modal
Component of infrastructure	infrastructure network
Short Description	The RAIN vision is to provide an operational analysis framework that identifies critical infrastructure components impacted by extreme weather events and minimise the impact of these events on the EU infrastructure network. The project has a core focus on land based infrastructure with a much wider consideration of the ancillary infrastructure network to identify cascading and inter-related infrastructure issues. A core component of the research will consider the implications of climate change and the subsequent impacts that this may have on an already ageing and vulnerable infrastructure system. The impact of these disruptions on both the key components and the wider pan-European network will be assessed using economic and social markers that will identify and rank a series of "worst case" scenarios. Technical and Logistic solutions will be developed to minimise the impact of these extreme events, which will include novel early warning systems, decision support tools and engineering solutions to ensure rapid reinstatement of the network. These tools will be implemented within a fresh Europe-wide operational and response strategy that will build on previous European infrastructure models. The robustness of the existing transport and energy networks to deal with changing weather conditions will be analysed in detail. The ability of this response plan to transcend borders will be guaranteed by the multi-disciplinary consortium. The project grouping will have expertise in climatology, operational analysis, transportation economics, risk analysis and mitigation, emergency planning, transportation engineering as well as engineering design and assessment. The outputs from the project will result in enhanced safety and reliability of critical infrastructure networks in the case of major weather induced disruptions and will address European policy in the areas of safety and

	security, inter-modality and emergency response planning.
Maturity	TRL5
Link to REFINET high Level Service Infrastructure	RESILIENCE
Key performance Indicators	Length of road (%) with flooding risk in the next 10 years time
Year of project ends	2017
Further information	http://rain-project.eu/

Catalogue of R&I projects 26_ HARMONISE	
Field	**Description**
Technology title and keywords	Urban built infrastructure, DSS, toolkit
Source of technology	Holistic Approach to Resilience and Systematic Actions to make Large Scale UrbaN Built Infrastructure Secure / FP7-SECURITY / 312013
Lifecycle stage	Operation
Type of infrastructure	Multi-modal
Component of infrastructure	hubs
Short Description	For the first time, more than 50% of the world's population live in urban areas. By 2050, c. 70% of people are likely to be city dwellers, compared with less than 30% in 1950. This trend brings with it increased security and safety threats in urban areas, not least to urban built infrastructure. The central aim of HARMONISE (A Holistic Approach to Resilience and Systematic ActiOns to Make Large Scale UrbaN Built Infrastructure SEcure) is to develop a comprehensive, multi-faceted, yet mutually-reinforcing concept for the enhanced security, resilience and sustainability of large scale urban built infrastructure and development. Large scale urban built infrastructure is a critical component within the intertwined networks of urban areas, which include not only physical components, but also integrated hardware and software aspects. To date, a comprehensive and holistic approach to improve the resilience and security of large scale urban developments (i.e. shopping centres/areas, sports venues or business centres with underground transportation nodes) against attacks and disruptions, has not been developed thoroughly. HARMONISE will be grounded in a holistic view of innovation, and will advocate synergies with, and augmentation of, relevant existing, past or ongoing projects. The project recognises the necessity to improve the design of urban areas and increase their security against, and resilience, to new threats. Specifically, HARMONISE seeks to deliver (a) a holistic urban resilience integrated information platform; (b) a suite of innovative tools (toolkit hosted within the HARMONISE platform); (c) greater understanding and awareness of urban security and resilience vis-a-vis dissemination activities; and, (d) commercialisation opportunities among emerging new markets in this field. HARMONISE will result in significant resilience enhancement methods for large scale urban built infrastructure.

Maturity	TRL7
Link to REFINET high Level Service Infrastructure	RESILIENCE
Key performance Indicators	performance criteria including effectiveness, efficiency, compatibility, fairness, implementation and ethical acceptability
Year of project ends	2016
Further information	http://harmonise.eu/

Catalogue of R&I projects 27_ TEAM	
Field	**Description**
Technology title and keywords	Mobility, traffic management, elastic mobility, communication, cloud-based
Source of technology	Tomorrow's Elastic, Adaptive Mobility / FP7-ICT / 318621
Lifecycle stage	Operation
Type of infrastructure	Multi-modal
Component of infrastructure	Traffic management Transportation systems
Short Description	TEAM aims at developing systems for participants in transportation networks, which help them to behave better – by explicitly considering the needs and constraints of other participants and the network itself. Focus will be placed upon decision-making in a time interval, above what is commonly associated with reactive safety (typically less than 5 seconds) and below long-term planning applications (typically 5 minutes and longer). In this interval, human actors can employ modern technology to collaboratively devise socially optimal strategies. Thereby, we believe we will be able to reduce the social cost of traffic while increasing its efficiency and flexibility. The project is built around four basic themes: 1. Basic technologies to realise collaborative mobility: We will advance communication technologies that underpin V2X by integrating LTE technologies, and by developing an automotive cloud-computing platform to support advanced and decentralised traffic management algorithms. 2. Infrastructure-centric technologies and algorithms for elastic mobility: We will develop proactive infrastructure-centric algorithms and technologies to enable behavioural change to improve transportation networks in a way that considers real-time needs and constraints of all network users. 3. Distributed technologies and algorithms to realise elastic mobility: We will develop proactive user-, community- and group-centric algorithms and technologies to achieve (and complement) the goals of theme 2. The vision is to use nomadic devices such as smart phones or on-board units to realise massively distributed collaborative control and optimisation concepts. 4. Demonstration: The success of the project will be demonstrated via innovative leading-edge cooperative applications and a Europe-wide mobility experiment to illustrate the systems' benefits in a pan-European setting.
Maturity	TRL7
Link to REFINET high Level Service Infrastructure	SAFE/SECURE, EFFICIENT, GREEN

Key performance Indicators	Number of Fatalities, travel cost, travel time, CO2 emissions
Year of project ends	2016
Further information	http://www.collaborative-team.eu/

Catalogue of R&I projects 28_ BioEPIC Slope	
Field	**Description**
Technology title and keywords	Slope stability, landslides, climate change, revegetation
Source of technology	Use of BioEngineered Plant-Integrated Cover (BioEPIC) to Enhance Slope Performance / FP7-PEOPLE / 631541
Lifecycle stage	Design
Type of infrastructure	Multi-modal
Component of infrastructure	Slopes
Short Description	Climate change threatens the stability of infrastructure slopes, which form a large proportion of the European transport network. Slope failures due to increasing intense rainfall have already resulted in significant socio-economic loss across the Europe. Slope revegetation is identified as a more environmentally friendly and aesthetically pleasing stabilisation technique, when compared to other high-embodied-CO2 methods such as sprayed concrete cover. However, there are series of research questions at the interface of unsaturated soil mechanics and plant biophysics relating to this application that, if answered, will allow better engineered and widespread deployment of this 'green' solution. Many of these questions relate to the effects of plant transpiration on slope stability. The key aims of this project are to improve the understanding of soil-water-plant interaction, and then to apply the improved knowledge to quantify the performance of BioEngineered Plant-Integrated Cover (BioEPIC) slopes under a changing European climate. Through laboratory testing, parameters controlling root-water uptake will be identified, and they will be used to interpret the responses of BioEPIC slopes observed from scaled centrifuge tests. By "vegetating" novel "transpiring" root models to BioEPIC slope in the centrifuge, plant effects on long-term slope failure mechanisms will be investigated. This will create a high-quality database that will give engineers increased confidence in adopting BioEPIC to mitigate slope stability problems anticipated under climate change. Through the CIG, this project will generate original findings that will provide the first step for the applicant (who is holding his first permanent academic appointment in Europe) to build his research team as an integrated component of European research; and raise the international profile of the research excellence of EU with regards to devising sustainable and low-CO2 engineering solutions for slope stabilisation.
Maturity	TRL4
Link to REFINET high Level Service Infrastructure	SAFE/SECURE, GREEN

Key performance Indicators	Embodied CO2, slope cost/m2,
Year of project ends	2018
Further information	http://cordis.europa.eu/project/rcn/187002_en.html

Catalogue of R&I projects 29_ Infravation	
Field	**Description**
Technology title and keywords	Predictive performance processes, durability, life-time extension, ND quality checks, zero-intrusive maintenance, weather, resource energy efficiency, eco-design, recycling, material substitution
Source of technology	ERA-NET Plus on Infrastructure Innovation / FP7-TRANSPORT / 618109
Lifecycle stage	Maintenance
Type of infrastructure	Multi-modal
Component of infrastructure	Infrastructure network
Short Description	Europe needs to redefine its transport system for the 21st century. Performance and cost-efficiency of the system need to be improved to meet future challenges. This means there is an urgent need for effective innovation for all components of the system; including vehicles, infrastructure, logistics etc. Transport ministries across Europe are facing ever tougher challenges to cope with the need to accommodate increased traffic growth, minimise congestion, maintain services in face of increasing climate change effects, as well as deliver on environmental and societal objectives. This is the time when innovation for road infrastructure is an absolute imperative to reduce costs without compromising on quality. To deliver this objective on a transnational basis, the ERA-NET Plus action on infrastructure innovation – Infravation - is initiated enabling national bodies to take on tasks collectively that otherwise could not be taken forward. This scheme will allow for bringing together the efforts of member states, EC and industry. The “Infravation call” will be launched in March 2014 and is expected to be supported through the FP7 2013 Work Programme. Infravation comprises 11 European countries, one region and the EC. For the first time the USA will contribute funding to an ERA-NET Plus. The total pot available for R&D funding amounts to 9,025 M€. The topics addressed reflect the needs of researchers/industry, road infrastructure owners and operators and EC for joint research on road infrastructure. Infravation will pave the way to a new quality of transnational research funding cooperation by applying a real common pot that merges national and EC top-up funding into one funding pot. This approach allows for a coordinated, common governance structure for R&D projects funded, enabling the best expertise to be used, regardless of nationality and thereby minimising programme management and allow the maximum use of resources for transnational research cooperation.
Maturity	Not Applicable (finance projects from TRL7)
Link to REFINET high Level Service Infrastructure	LOW COST, GREEN, EFFICIENT, SAFE/SECURE

Key performance Indicators	Not applicable
Year of project ends	2018
Further information	http://www.infravation.net/

Catalogue of R&I projects 30_ Viajeo Plus	
Field	**Description**
Technology title and keywords	Algorithms elastic mobility, clean vehicle, city logistics
Source of technology	International Coordination for implementation of innovative and efficient urban mobility solutions / FP7-TRANSPORT / 605580
Lifecycle stage	Operation
Type of infrastructure	Multi-modal
Component of infrastructure	Urban mobility
Short Description	The goal of Viajeo PLUS is to benchmark outstanding solutions for innovative and green urban mobility in Europe, Latin America, China and Singapore and subsequently facilitate the uptake of these solutions across different cities in these regions, and Mediterranean Partner Countries (MPCs). Over a 36-month timeframe, the Viajeo PLUS consortium will engage with leading European innovative organisations and academic institutes and cooperate with cities across Europe, Latin America, China, Singapore and MPCs to facilitate the sharing of good practices and demonstration of innovative solutions. The Viajeo PLUS project will: • Assess current mobility solutions and the potential uptake of different solutions for different scenarios. Through case studies, showcases and capacity building, it will gather key experts in mobility management, clean vehicle, public transport, infrastructure and city logistics, to develop executive plans for the implementation of existing solutions in a new and innovate way; • Create a new web-based 'Virtual Best Solution' book to facilitate wider uptake of solutions across more cities and regions; • Organise four individual "City Mobility Weeks" in Europe, Latin America, China and Singapore respectively. A City Mobility Week consists of showcases, workshops and stakeholder meetings. Through interactive showcases, participants will benefit from gaining first-hand experience of innovative solutions. Participants will exchange knowledge, information and best practice experiences through various workshops and meetings; • Organise fora in Istanbul to engage stakeholders in MPCs to lay the foundations for future inter-regional cooperation in research and development activities; • Facilitate a 'twinning cities' programme to allow representatives from cities to experience innovative solutions for future implementation. Together with SOLUTIONS, Viajeo PLUS will develop recommendations to the EC for future collaboration among cities and for research cooperation initiatives.
Maturity	Not Applicable (looking for solutions from TRL8)
Link to REFINET high Level Service Infrastructure	LOW COST, GREEN, EFFICIENT, SAFE/SECURE
Key performance Indicators	Travel cost, travel time, CO2 emissions, energy consumption

Year of project ends	2016
Further information	http://viajeoplus.eu/

Catalogue of R&I projects 31_ AIRTN-NextGen	
Field	**Description**
Technology title and keywords	CSA, research needs, air sector
Source of technology	Air Transport Network – Next Generation / FP7-TRANSPORT / 604952
Lifecycle stage	All
Type of infrastructure	Air
Component of infrastructure	All
Short Description	The action will continue the network established under previous AirTN projects enlarging it to create a platform of networking and communication between national organisations and governmental institutions supporting research and innovation in the EU Member States and Associated Countries to the EU Framework Programme in the field of Aviation (e.g. Aeronautics and Air Transport - AAT). The successful activities started in previous AirTN will be continued and improved - coordinated calls among MS, European transnational cooperation, Research Infrastructures needs and business models analysis, education and workforce mobility - including the development of studies on areas of common interest and organisation of dedicated workshops. Win-win situations, barriers and solutions for improved trans-national cooperation in research, technological developments and innovation will be identified and specific actions performed. Benefits for members of the AirTN NextGen Network supporting the CSA - The reference network (hereafter called AirTN NextGen Network) for this proposed CSA will be the 25 Member States and Associated Countries, and related Agencies/Ministries/Research Centres that are funding/managing research and innovation programmes/projects relevant to Aeronautics and Air Transport. Furthermore, the National ACARE mirror groups.
Maturity	Not relevant
Link to REFINET high Level Service Infrastructure	ALL
Key performance Indicators	All
Year of project ends	2016
Further information	http://airtn.eu/index.html

Catalogue of R&I projects 32_ PulsarPlane	
Field	**Description**
Technology title and keywords	pulsar navigation

Source of technology	PulsarPlane: Worldwide Air Transport Operations / FP7-TRANSPORT / 335063
Lifecycle stage	Operation
Type of infrastructure	Air
Component of infrastructure	pulsar navigation, GNSS
Short Description	Pulsars are fast rotating neutron stars that emit electromagnetic radiation, which is received on earth as a series of very stable fast periodic pulses with periods in between 1.4 milliseconds and 8.5 seconds. These periodic pulses and the known positions (in celestial coordinates) of the neutron stars make them ideal beacons for navigation. Air traffic management and aircraft operations are currently dependent on the use of ground-based navigation systems. Still, many areas on earth are not equipped with this kind of infrastructure. In oceanic flights and isolated areas, aircraft fly procedural tracks assisted by inertial navigation and/or GPS. as no ground equipment is available to guide them along their tracks. We propose a new navigation system, based on the signals received from pulsars. Pulsar navigation enables a means of navigation without the need for ground-based or space-based equipment. If pulsar navigation is feasible, at least 5 advantages are identified for aviation: 1 Overcome GNSS vulnerabilities; 2 Reducing operational cost of air transport; 3 Contribute to greener transport by enabling secure formation flying of commercial airplanes in oceanic and remote areas; 4 improve flexibility and accessibility of air transport; 5 Contribute to a common reference time frame for aviation. The objective of this study to investigate the feasibility of pulsar navigation for aviation, and if found positive, to analyse the impact on aviation and to identify and develop (sections of) the path towards a useable real-time navigation and timing system.
Maturity	TRL2-TL3
Link to REFINET high Level Service Infrastructure	EFFICIENT, SAFER
Key performance Indicators	
Year of project ends	2015
Further information	http://www.pulsarplane.eu/

Catalogue of R&I projects 33_ FastInCharge	
Field	**Description**
Technology title and keywords	electric vehicles, charging infrastructure
Source of technology	Innovative fast inductive charging solution for electric vehicles / FP7-TRANSPORT / 314284
Lifecycle stage	Design
Type of infrastructure	Multi-modal
Component of infrastructure	Electric vehicle charging infrastructure

Short Description	FastInCharge will last 36 months and be led by a consortium of 9 partners (France, Spain, Greece, Bulgaria, Italia and Slovakia): 1 SME specialised in charging infrastructure for electric vehicles (DBT), 1 industrial group of automotive engineering (BATZ), 3 research organisations, specialists of contactless power, automotive engineering and energy management systems (Tecnalia, TU Gabrovo, NTU Athens), 1 end-user (Douai), 1 cluster (ACWS) , 1 SME in innovation management (EQY) and 1 OEM (CRF). The overall objective of FastInCharge is to foster the democratisation of electric vehicles in the urban environment by developing an easier and more comfortable charging solution which will enable to ease the EV use by the large public and facilitate their implementation in the urban grid. FastInCharge's intention is to develop a cost-effective modular infrastructure offering a global solution for EV charging. Its success will boost research in the direction of dynamic charging solutions. The concept of FastInCharge is to create a highly performing inductive solution which will enable a 40 kW power transfer to the vehicles in two charging operational situations: one stationary and one on-route. The inductive technology developed will be integrated into: three different electric cars of different types (secondary charging block) and four charging stations, one stationary and three on-route (primary charging block). The full functional chain will be carefully scrutinised to ensure an optimal, safe and sustainable solution: battery charging, EV performance and safety, EV range, communication EV/Station, connection station to the grid, grid management and energy supply, intelligent coordinated systems. The programme consists in seven work packages: 1) Specifications, 2) Development of fast inductive charging infrastructure, 3) Development of integration solutions; 4) Prototyping and testing; 5) Demonstration, 6) Dissemination and Exploitation, 7) Management.
Maturity	TRL7
Link to REFINET high Level Service Infrastructure	GREEN, ENERGY EFFICIENT, LOW COST
Key performance Indicators	Number of cars to be charged on the roads. Time required for charging
Year of project ends	2015
Further information	http://www.fastincharge.eu/

Catalogue of R&I projects 34_ ViWaS	
Field	**Description**
Technology title and keywords	Business models and production systems
Source of technology	Viable Wagonload production Schemes / FP7-TRANSPORT / 314255
Lifecycle stage	Operation
Type of infrastructure	Rail

Component of infrastructure	Management
Short Description	Single wagonload (SWL) transport is still a major component in numerous European states transport systems and in the logistics of different economic sectors such as steel, chemical industry and automotive. However changing framework conditions and increasingly demanding market requirements have led to dramatic market losses and even to complete shutdown of SWL business in some countries. As this business segment has been evaluated as important for specific transports in a European co-modal transport system also in the future, significant improvements are needed. The ViWaS partners believe that for the success of SWL the following two issues might be crucial: (1) A viable SWL system is highly dependent on the critical mass. Thereby all options must be considered to secure a high utilisation of the trains operated on the trunk lines, including a combined production with intermodal loads. (2) Only comprehensive and complementary measures can sustainably improve and preserve the European SWL systems in accordance with increasingly demanding market requirements. The ViWaS project will follow such a comprehensive approach; therefore aiming at the development of Market driven business models and production systems to secure the critical mass needed for SWL operations, New ways for "Last mile" infrastructure design and organisation to raise cost efficiency. Adapted SWL technologies to improve flexibility and equipment utilisation, Advanced SWL management procedures & ICT to raise quality, reliability and cost efficiency. The applicability of these solutions and their effects will be proved based on pilot business cases (by demonstrations). Thereby important findings will be gained for a European wide implementation of developed solutions. The ViWaS consortium includes railway operators (SBB Cargo, Fret SNCF, Bentheimer Eisenbahn), infrastructure providers (Interporto Bologna / IB innovation, technology partners (Eureka, Wascosa) and consulting/ scientific partners (ETH Zürich, TU Berlin, HaCon, NEW OPERA).
Maturity	NA
Link to REFINET high Level Service Infrastructure	
Key performance Indicators	
Year of project ends	2015
Further information	http://www.viwas.eu/

Catalogue of R&I projects 35_ ToPDAd	
Field	**Description**
Technology title and keywords	Adaptation to climate change, decision making tools, cost benefit analysis
Source of technology	Tool-supported policy-development for regional adaptation / FP7-ENVIRONMENT / 308620
Lifecycle stage	Design

Type of infrastructure	Multi-modal
Component of infrastructure	Transport system
Short Description	Adaptation in the face of climate change is currently a major challenge, not only in the EU, but all around the world. Climate change has two distinct characters: the slower trends in climatic variables such as sea water temperature, and the extreme weather phenomena, such as heavy precipitation. The fundamental driver for regional adaptation is regional climate scenarios. Crucial for local societies is the resilience of critical infrastructures, such as Energy and Transport, against the envisaged climate scenarios. Without proper functioning of such infrastructures, many service sectors, such as Tourism, will be negatively affected. ToPDAd develops state-of-the-art socioeconomic methods& tools for an integrated assessment supporting regional adaptation decision-making. Based on these, conjectures with respect to EU level policies for the considered sectors Energy, Transport, as well as, Tourism are made. Two time frames are specified; 2010-2050 and 2050-2100 for mid-term and long-term strategy formulations. Regional strategies and EU-level policies need to be consistent across the time frames in order to avoid maladaptation. ToPDAd will also develop the European Climate Adaptation Platform (DCLIMATE-ADAPT). The CLIMATE-ADAPT is key for continuous learning, and a repository of data and tools supporting adaptation decision-making.
Maturity	TRL7
Link to REFINET high Level Service Infrastructure	RESILIENT
Key performance Indicators	
Year of project ends	2015
Further information	http://www.topdad.eu/

Catalogue of R&I projects 36_ Light2CAT	
Field	**Description**
Technology title and keywords	Visible-light-activated titanium dioxide for inclusion in concretes
Source of technology	Visible LIGHT Active PhotoCATalytic Concretes for Air pollution Treatment / FP7-ENVIRONMENT / 283062
Lifecycle stage	Construction
Type of infrastructure	Multi-modal
Component of infrastructure	Material: Concrete
Short Description	The goal of Light2CAT is to develop new, highly efficient visible-light-activated titanium dioxide for inclusion in concretes to be used in structures across the whole of Europe to improve ambient air quality independent, for the first

	time, of local climate conditions. The need to improve air quality in European Countries has been identified as a major requirement to be achieved within the next decade in the effort to control climate change, a key Europe 2020 strategy, and to improve human health. Despite vigorous efforts to reduce levels of hazardous substances in the air, targets remain a challenge. One of the most valid sustainable technologies explored so far is photocatalytic concrete. This technology is proven to reduce the amount of hazardous air pollutants up to 80 % . It also imparts self-cleaning properties to built-structures which has a secondary effect of reducing harsh cleaning chemicals entering the water systems. However, the titanium oxide based photocatalytic building materials are activated by ultraviolet light so, to date, such environmental benefits are limited to countries with a high incidence of sunlight. The concept of this project is to extend the use of photocatalytic concretes to the whole of Europe by developing materials that can also be activated by visible light. The aim is to remove climate and seasonal considerations from the use of the materials and, through higher conversion efficiencies of the catalytic components, to reduce production costs facilitating further take up of the technology within existing markets. The results of the project are initially focused on use within the transport infrastructure where the greatest impact is expected. The consortium is well conceived to achieve the results, comprising research centres leading research in these materials and industry partners including SMEs able to develop, demonstrate and market the new materials in the sector.
Maturity	NA
Link to REFINET high Level Service Infrastructure	GREEN
Key performance Indicators	
Year of project ends	2015
Further information	http://www.light2cat.eu/

Catalogue of R&I projects 37_ UNPLUGGED	
Field	**Description**
Technology title and keywords	EV, urban, smart inductive charging infrastructure
Source of technology	Wireless charging for electric Vehicles / FP7-TRANSPORT / 314126
Lifecycle stage	Design
Type of infrastructure	Road
Component of infrastructure	EV, charging infrastructure

Short Description	UNPLUGGED project aims to investigate how the use of inductive charging of Electric Vehicles (EV) in urban environments improves the convenience and sustainability of car-based mobility. In particular, it will be investigated how smart inductive charging infrastructure can facilitate full EV integration in the urban road systems while improving customer acceptance and perceived practicality. UNPLUGGED will achieve these goals by examining in detail the technical feasibility, practical issues, interoperability, user perception and socio-economic impacts of inductive charging. As one special variant, inductive en-route charging will be investigated thoroughly. As part of the project, two smart inductive charging systems will be built, taking into consideration requirements from OEMs, energy utilities and end users. The systems will be innovative and will go beyond the current state of the art in terms of high power transfer, allowing for smart communication between the vehicle and the grid, as well as being in line with the latest inductive charging standards and considering interoperability. These innovative inductive charging systems designed and built as part of the project will then be tested and assessed in order to understand their potential impacts on urban mobility and the acceptance of e-mobility. Application in an en-route charging scenario in particular will be examined for different vehicle types, ranging from cars to buses. It is anticipated that UNPLUGGED will provide clear evidence on and demonstrate whether the use of smart inductive charging infrastructure can overcome some of the perceived barriers for e-mobility, such as range and size of on-board energy storage, and practical difficulties associated with installing traditional charging post infrastructure.
Maturity	TRL7
Link to REFINET high Level Service Infrastructure	ENERGY EFFICIENT, GREEN
Key performance Indicators	
Year of project ends	2015
Further information	http://unplugged-project.eu/wordpress/

Catalogue of R&I projects 38_ CAPACITY4RAIL	
Field	**Description**
Technology title and keywords	Low maintenance, self-monitoring, low intrusive maintenance, high speed systems: bridges and transition zones • Speed and carrying capacity, Improved transhipment procedures • failure detection for infrastructure and freight vehicles monitoring for condition-based maintenance • Non-intrusive infrastructure monitoring techniques with low impact on traffic • Self-monitoring
Source of technology	Increasing Capacity 4 Rail networks through enhanced infrastructure and optimised operations / FP7-TRANSPORT / 605650

Lifecycle stage	Maintenance
Type of infrastructure	Rail
Infrastructure Component	All
Short Description	In 2011, the White Paper on European Transport reasserted how fundamental transport was for society, for the mobility of European citizens and for the growth and vitality of the European economy. CAPACITY4RAIL will deliver research that is innovative, prepares rail for the future and considers results from previous research projects and programmes. The project builds on previous useable results and will deliver both technical demonstrations and system wide guidelines and recommendations that will be the basis for future research and investment, increasing the capacities of rail networks in the future. The time used for infrastructure monitoring, maintenance and renewal means 'down time'. New concepts for low maintenance infrastructure, using standardized and "plug-and-play" concepts will be proposed. Non-intrusive innovative monitoring techniques or self-monitoring infrastructure will be investigated, allowing low or no impact on train operations. The fragility of some key component of the infrastructure system (especially in extreme weather conditions) such as switches may impact the efficiency of the whole system. The resilience of switches to any kind of known failure will be reinforced, as well as the ability of the operation system to recover from incidents. Capacity enhancements will also be achieved by higher speed freight vehicles, allowing an optimized interleaving of freight trains into mixed traffic, and improved planning models for operation. Intermodal integration within the global transport system will be improved through enhanced transhipment of passengers and freight. CAPACITY4RAIL will also look towards 2030/2050, by proposing guidelines for future deployments in the mid-term, recommendations for technologies to de developed and deployed in the long term and investigating the opportunities for funding these within national / EU funding schemes.
Maturity	TRL7
Link to REFINET high Level Service Infrastructure	RESILIENCE
Key performance Indicators	reduction in construction time, availability,
Year of project ends	2017
Further information	http://www.capacity4rail.eu/about

Catalogue of R&I projects 39_ STRUCTURES	
Field	**Description**
Technology title and keywords	Electromagnetic attack
Source of technology	Strategies for the Improvement of Critical infrastructure Resilience to Electromagnetic Attacks / FP7-SECURITY / 285257
Lifecycle stage	Operation

Type of infrastructure	ALL
Component of infrastructure	Transport as a critical infrastructure (hubs, network, bridges, ...)
Short Description	Security and quality of life in industrialized countries depend on continuous and coordinate performance of a set of infrastructures (energy systems, ICT systems, transportation etc.) which can be therefore defined "critical infrastructures" (CI). "STRUCTURES - Strategies for The improvement of critical infrastructure Resilience to Electromagnetic attacks" aims at analysing possible effects of electromagnetic (e.m.) attacks, and in particular of intentional e.m. interference (IEMI), on such CI's, at assessing their impact for our defence and economic security, at identifying innovative awareness and protection strategies and at providing a picture for the policy makers on the possible consequences of an electromagnetic attack. The work is organized into four main tasks, namely: - Scenario assessment (IEMI threat analysis; CI's analysis; modelling and experimental methodologies for investigation) - Investigation (assessment of susceptibility levels of critical systems/units; analysis and testing; innovative protection strategy identification) - IEMI sensors for real-time awareness of threats and implementation of active protection strategies - Delivery of pre-regulatory guidelines to support people in the understanding of IEMI related risk and in planning/application of proper protection strategies. Existing standards such as the "Business Continuity Management" approach (BS25999 standard) and other standardized CIIP (Critical Information Infrastructures Protection) polices will be considered to properly identify critical items and to set criteria for risk acceptance. Already existing results relevant to EMC (ElectroMagnetic Compatibility), LEMP/NEMP/HEMP (Lightning/Nuclear/High altitude ElectroMagnetic Pulse) will be considered as possible starting points leading to find effective solution to IEMI problem.
Maturity	TRL7
Link to REFINET high Level Service Infrastructure	SECURE
Key performance Indicators	Number of attacks, economical losses, disruptions
Year of project ends	2015
Further information	http://www.structures-project.eu/

Catalogue of R&I projects 40_ LCE4ROADS	
Field	**Description**
Technology title and keywords	Standards
Source of technology	Life Cycle Engineering approach to develop a novel EU-harmonized sustainability certification system for cost-effective, safer and greener road infrastructures / FP7-TRANSPORT / 605748
Lifecycle stage	Design

Type of infrastructure	Road
Component of infrastructure	Pavement
Short Description	The EU Ecolabel identifies products and services that contribute to sustainability because they have demonstrated a reduced environmental impact throughout their life cycle. There are already more than 17,000 EU Ecolabelled products on the market, but there are no references for road products and infrastructures. The concept of the LCE4ROADS project arises from the necessity of a new, green, holistic and EU-harmonised certification systems integrating by a Life Cycle Engineering (LCE) approach: environmental indicators along with the economic, technical and social aspects, for the assessment of future and existing road infrastructures, as well as their construction materials such as asphalt mixtures and cement-based materials. This methodology, together with a guide for road certification and a multi-criteria software tool to be developed, will define criteria and provide recommendations, supporting and motivating relevant stakeholders and industry to include greener, more cost-effective and safer technologies in their road construction, maintenance and renewal projects. In order to achieve the expected results a complete work plan has been performed. This plan that will move from the definition of the new certification/rating methodology considering existing relevant labelling approaches, plus the analysis of road products, to the development of guidelines and of a software tool that thanks to the direct involvement of CEN in the project, will motivate future EU-harmonized certification approaches for roads that would grant the implementation of the LCE4ROADS results. The LCE4ROADS project will contribute to the implementation of European policies and strategies, boosting the integration of transport in sustainable development promoting technologies and materials that reduce pollutant emissions and the use of natural and financial resources.
Maturity	TRL7
Link to REFINET high Level Service Infrastructure	GREEN
Key performance Indicators	CO2 emissions, energy consumption, environmental: %recycled materials, embedded CO2, embedded energy
Year of project ends	2016
Further information	http://ecolabelproject.eu/home/overview/

Catalogue of R&I projects 41_ CO2QUEST	
Field	**Description**
Technology title and keywords	Mathematical models determination of CO2 mixtures
Source of technology	Techno-economic Assessment of CO2 Quality Effect on its Storage and Transport / FP7-ENERGY / 309102
Lifecycle stage	Operation, maintenance

Type of infrastructure	ALL
Component of infrastructure	NA
Short Description	The CO2QUEST proposal addresses the fundamentally important issues regarding the impact of the typical impurities in the gas or dense phase CO2 stream captured from fossil fuel power plants on its safe and economic transportation and storage. The proposed work programme will focus on the development of state-of-the art mathematical models backed by laboratory and industrial-scale experimentation utilising unique EC funded test facilities to perform a comprehensive techno-economic, risk-based assessment of the impact of the CO2 stream impurities on phase behaviour and chemical reactions, and on pipeline and storage site integrities. The above involves the determination of the important CO2 mixtures that have the most profound impact on the pipeline pressure drop, compressor power requirements, pipeline propensity to ductile and brittle facture propagation, corrosion of the pipeline and wellbore materials, geochemical interactions within the wellbore and storage site, and the ensuing health and environmental hazards. Based on a cost/benefit analysis and whole system approach, the results will in turn be used to provide recommendations for tolerance levels, mixing protocols and control measures for pipeline networks and storage infrastructure. CO2QUEST addresses all the main themes of this Call in several ways. It involves the active participation of key players from the Carbon Capture Sequestration Forum, in particular China (partner), Canada and USA (Strategic Committee Members), and the world's leading steel producer representing a CO2 intensive industry. CO2QUEST involves the participation of leading academics with directly relevant fundamental and pre-normative research track records. A focus of attention will be maximising the project's impact by ensuring that its results are effectively exploited and actively disseminated, in particular, supporting the development of relevant design and operation standards for CCS infrastructure.
Maturity	NA
Link to REFINET high Level Service Infrastructure	GREEN
Key performance Indicators	
Year of project ends	2016
Further information	http://www.co2quest.eu/

Catalogue of R&I projects 42_ SWARM	
Field	**Description**
Technology title and keywords	Fuel cell passenger vehicle, hydrogen refuelling infrastructure
Source of technology	Demonstration of Small 4-Wheel fuel cell passenger vehicle Applications in Regional and Municipal transport / FP7-JTI / 303485
Lifecycle stage	Design

Type of infrastructure	Road
Component of infrastructure	Fuel cell passenger vehicle
Short Description	This project will establish a demonstration fleet of small passenger vehicles that builds on and expands existing hydrogen refuelling infrastructure. Three European regions will be participating in this effort: the UK (the Midlands and Plymouth), the Brussels area and Wallonia, and the Weser-Ems region in North6West Germany. Each of these regions will deploy a new hydrogen refuelling site to close the gaps in a continuous 'hydrogen highways' that leads from Scotland via the Midlands to London, connecting to Brussels and on to Cologne and Hamburg/Scandinavia/Berlin via Bremen. The vehicles employed are low-cost, high fuel-efficiency, hybridised, light-weight passenger cars specifically designed for city and regional transport. These vehicles provide a complementary pathway to commercialisation to the large Original Equipment Manufacturer (OEM) of hydrogen fuel cell options, by allowing near-term rollout on a commercial basis to a wide range of users – in parallel with the planned rollouts for large OEM vehicles from 2015. Their deployment regions will gain the infrastructure, public exposure and technological understanding to act as seed locations for future large scale OEM vehicle rollout. In view of the lower vehicle costs, this project will deploy an unprecedented number of road vehicles for a demonstration project, with three OEM's contributing 20, 10 and 20 vehicles respectively to the project. These will be put in the hands of users in a variety of real-life operating environments. An extensive data monitoring exercise will run throughout the demonstration phase, allowing the reliability of the vehicles tested by different users to be evaluated and leading to recommendations for the improvement of future, fully commercial vehicle designs. The three European regions will deploy several hydrogen refuelling stations, adding a total of 3 new stations to existing supply sites, contributing to some of the first regional hydrogen refuelling clusters in Europe. Each region will consequently either own a high-standard filling station with = high capacity (200 kg/day) and high performance (70 MPa) refuelling technology (Wallonia, Weser-Ems), or build on existing smaller stations of lower capacity and pressure (UK, Midlands and Plymouth). The project will be a near-commercial stepping stone and will include a reach-out activity timed to coincide with OEM's commercialisation plans in the post-2015 period, to attract further vehicles to the newly developed infrastructures - by offering cost effective and readily available focal points for additional hydrogen fleets developing around these regions. Therefore supplementing the SWARM fleet and infrastructure by more vehicles and hydrogen filling stations supplied through other projects and separate funding.
Maturity	TRL8
Link to REFINET high Level Service Infrastructure	GREEN, ENERGY EFFICIENT
Key performance Indicators	CO2 emissions, energy consumption
Year of project ends	2017

Further information	http://www.swarm-project.eu/

Catalogue of R&I projects 43_ ECOSSIAN	
Field	**Description**
Technology title and keywords	CIP (critical infrastructure protection),
Source of technology	European Control System Security Incident Analysis Network / FP7-SECURITY / 607577
Lifecycle stage	Operation
Type of infrastructure	Multi-modal
Component of infrastructure	Transportation system as Critical infrastructure (hubs, …)
Short Description	The protection of critical infrastructures increasingly demands solutions which support incident detection and management at the levels of individual CI, across CIs which are depending on each other, and across borders. An approach is required which integrates functionalities across all these levels. Cooperation of privately operated CIs and public bodies (governments and EU) is difficult but mandatory. After about 10 years of analysis and research on partial effects in CIP and for individual infrastructure sectors, ECOSSIAN is supposed to be the first attempt to develop this holistic system in the sense portrayed above. A prototype system will be developed which facilitates preventive functions like threat monitoring, early indicator and real threat detection, alerting, support of threat mitigation and disaster management. In the technical architecture with an operations centre and the interfaces to legacy systems (e.g., SCADA), advanced technologies need to be integrated, including fast data aggregation and fusion, visualization of the situation, planning and decision support, and flexible networks for information sharing and coordination support, and the connection of local operations centres. This system will only be successful, if the technical solutions will be complemented by an effective and agreed organizational concept and the implementation of novel rules and regulations. And finally, the large spectrum of economically intangible factors will have significant influence on the quality and acceptance of the system. These factors of societal perception and appreciation, the existing and required legal framework, questions of information security and implications on privacy will be analysed, assessed and regarded in the concept. The system will be tested, demonstrated and evaluated in realistic use cases. They will be developed with the community of stakeholders and cover the sectors energy, transportation and finance, and ICT sector.
Maturity	TRL7
Link to REFINET high Level Service Infrastructure	SAFE/SECURE
Key performance Indicators	Fatalities, economical losses €,
Year of project ends	2017

Further information	http://ecossian.eu/

Catalogue of R&I projects 44_ FABRIC	
Field	**Description**
Technology title and keywords	On road charging technologies, electromobility, electric vehicles
Source of technology	FeAsiBility analysis and development of on-Road chargIng solutions for future electric vehiCles / FP7-TRANSPORT / 605405
Lifecycle stage	Design
Type of infrastructure	Road
Component of infrastructure	Road
Short Description	FABRIC addresses directly the technological feasibility, economic viability and socio-environmental of dynamic on-road charging of electric vehicles. FABRIC responds to the need to assess the potential and feasibility of a more extensive integration of electric vehicles in the mobility and transportation system, focusing primarily on dynamic wireless charging which would allow practically all of the drawbacks of on-board battery packs to be avoided. On-road charging would also enable the direct link to renewable energy sources: Ultimately this is the only way to fully decarbonise road transport and hence provide true sustainability from the socio-environmental perspective. Specifically, by engaging a highly-qualified, expert and comprehensive group of key stakeholders within its consortium, FABRIC will determine and assess the end-user requirements that will determine the potential of success in various application sectors, the technology drivers and challenges that impact the widespread implementation of wireless charging technology, and the technology gaps to be bridged in order to provide rational and cost-effective solutions for the grid and road infrastructures. Advanced solutions, conceived to enable full integration in the grid and road infrastructure within urban- and extra-urban environments for a wide range of future electric vehicles, will be implemented and tested. Each key issue will be assessed directly and comprehensively, providing insights through experimental evaluations into the relevant technologies, investigating the present and future opportunities for such solutions, and identifying the future trends and requirements for research and development. The ultimate aim is to provide a pivotal contribution to the evolution of e-Mobility in Europe by identifying the benefits and costs in absolute terms so that the investments required in the coming years for widespread implementation and exploitation can be fully defined and quantified.
Maturity	Not applicable
Link to REFINET high Level Service Infrastructure	GREEN
Key performance Indicators	market share for Evs, CO2 emmisions

Year of project ends	2017
Further information	http://www.fabric-project.eu/

Catalogue of R&I projects 45_ IRUSAT	
Field	**Description**
Technology title and keywords	Resilience, transportation systems, natural hazards, buildings, bridges, disruptions, cascade effects
Source of technology	Improving Resilience of Urban Societies through Advanced Technologies / FP7-PEOPLE / 329871
Lifecycle stage	Design
Type of infrastructure	Multi-modal
Component of infrastructure	Urban Bridges, pipelines
Short Description	Urban societies depend heavily on the proper functioning of infrastructure systems such as electric power, gas, potable water, and transportation networks. Normally invisible, this reliance becomes painfully evident when infrastructure systems fail during disasters. Moreover, because of the network properties of infrastructures, damage in one location can disrupt service in an extensive geographic area. The societal disruption caused by infrastructure failures is therefore disproportionately high in relation to actual physical damage. As a result of the project, new retrofitting strategies will be developed to improve the resilience of infrastructures to withstand natural hazards. The project aims to improve the resiliency of buildings, bridges, and communities in general through new advanced technologies such as base isolations, viscous dampers, etc. Base isolation systems that can control the shape of the floor response spectrum will be analysed, in particular their behaviour under vertical excitations. Attention will be given to infrastructural systems' components and then it will be extended to performance of component assemblages (e.g., bridges, pipeline networks, etc.). The project will range from field work of specific lifeline damage in New Zealand, Japan and Italy after the earthquakes to laboratory simulations done in the laboratory of the University of California at Berkeley with scaled models and numerical analyses. Complexities of infrastructures, which include societal as well as technical issues will be addressed in the project. The project will try to answer through an interdisciplinary approach to the following questions: How, for instance, will the failure of one bridge affect businesses throughout the urban area that rely on the transportation system? How will the failure of one infrastructure system disrupt other infrastructure systems? How can repairs following a disaster be planned so they minimize social and economic losses?
Maturity	TRL4
Link to REFINET high Level Service Infrastructure	SAFE/SECURE
Key performance	Fatalities, economical losses €,

Indicators	
Year of project ends	2007
Further information	http://cordis.europa.eu/project/rcn/108725_en.html

Catalogue of R&I projects 46_ UDRIVE	
Field	**Description**
Technology title and keywords	Vulnerable users, ecodriving, accident causation
Source of technology	eUropean naturalistic Driving and Riding for Infrastructure & Vehicle safety and Environment / FP7-TRANSPORT / 314050
Lifecycle stage	Operation
Type of infrastructure	Road
Component of infrastructure	Drivers
Short Description	Road transport is indispensable for the exchange of goods and persons, but at the same time has severe negative consequences, among others related to road safety and environment. To meet EU targets, both the number of road crashes and vehicle emission levels need to be reduced substantially. For identifying the next generation of measures that will enable us to reach these targets, a far more in-depth understanding of road user behaviour is needed. The proposed UDRIVE project is building on the experiences of the PROLOGUE feasibility study and various Field Operational Tests (FOTs), and aims to contribute to developing this in-depth knowledge by: 1. Conducting a large-scale European Naturalistic Driving (ND) study; 2. Building one central database with the collected ND data; 3. Performing targeted analyses in the areas of: o crash causation factors and associated risks, o distraction and inattention, o vulnerable road users, o eco-driving; 4. Applying the findings in four specific area, notably: o the identification of new and promising countermeasures, o the potential of simple DAS for monitoring performance indicators over time, o the improvement of driver behaviour models for road transport simulation, o the possibilities for commercial applications of ND data; 5. Leaving behind the collected data to be used, subject to legal and ethical constraints, for additional analyses once UDRIVE is finished. During a 21-month data collection effort, UDRIVE will collect information on 210 vehicles, each for one year: 120 passenger cars, 50 trucks, and 40 powered two-wheelers. All data, including video data showing the forward view and the view of the driver as well as GIS data, will be collected continuously to enable knowledge in the various research areas to be brought well beyond the current state of the art. The UDRIVE consortium consists of 19 partners and represents a good balance between different EU regions and various stakeholders. The consortium also represents a good balance between expertise on the various research areas and expertise on huge data acquisition and storage.
Maturity	TRL6
Link to REFINET high	SAFE/SECURE,

Level Service Infrastructure	
Key performance Indicators	Number of car crashes, CO2 emissions
Year of project ends	2017
Further information	http://www.udrive.eu/

Catalogue of R&I projects 47_ MOWE-IT	
Field	**Description**
Technology title and keywords	Extreme weather, disaster, decision making, guidelines, policy making
Source of technology	Management of weather events in transport system / FP7-TRANSPORT / 314506
Lifecycle stage	Operation
Type of infrastructure	Multi-modal
Component of infrastructure	Transportation network
Short Description	The MOWE-IT project shall assess factors that prerequisite cross-modal transferability between the air and surface-based European transport systems in order to protect the passengers, shippers, European institutions and citizens against travel delays, cancellations and/or stoppages in freight transfer caused by extreme weather and/or other natural disasters. The on-going WEATHER and EWENT- projects have established how the different extreme weather events harm the safety and security of passengers and drivers, reduce the inter-urban and regional accessibility, disrupt logistics chains, delay cargo delivery, inflate supply costs for operators and consignees, and immobilise public infrastructure. However, there is still a need to find out how the air and surface transport systems may improve operational resilience by substituting each others' services when suffering from traffic curtailment, infrastructure shutdowns, and/or capacity shortages caused by emergencies. Therefore, the MOWE-IT project shall assess how the companies in passenger and freight transport comply with the European users rights protection legislation shielding theses parties against travel delays, cancellations and/or disruptions, and in case of gaps in conformity, propose new guidelines for cross-modal alignment of decision-making, capacity planning and reserve-building models at transport service and infrastructure providers in addition to incentive structures and policy instruments for more effective legislation enforcement. Such an assessment will also draw from the possibilities to use weather and other information technologies to aide the transport system and operators. The project will have 9 work packages, which focus on management and dissemination, transport-mode specific issues and cross-modal considerations and finally to short-term and long-term solutions and policy options for reducing the negative impacts of extreme weather and natural disasters.
Maturity	TRL7
Link to REFINET high	SAFE/SECURE, EFFICIENT

Level Service Infrastructure	
Key performance Indicators	Travel time, reliability
Year of project ends	2014
Further information	http://www.mowe-it.eu/

Catalogue of R&I projects 48_ MAXBE	
Field	**Description**
Technology title and keywords	Axle bearing damage, condition monitoring, early diagnosis
Source of technology	Interoperable monitoring, diagnosis and maintenance strategies for axle bearings / FP7-TRANSPORT / 314408
Lifecycle stage	Maintenance
Type of infrastructure	Rail
Component of infrastructure	Railway Axle Bearing
Short Description	The axle bearing damage process has safety and economic implications on the exploitation of railways systems, as proved by the selection of this topic for inclusion in the present call for research proposals of the FP7 of the EU. Axle bearing damage has been the object of intense attention by railway operators and transportation authorities, leading to a variety of approaches and systems currently in place to deal with the problem. However in Europe there is some lack of standardisation which justifies R&D work on condition monitoring and early diagnosis of axle bearings by technology integration. Moreover the current European documents do not present any guidelines for the maintenance management of the rolling stocks with regards to axle bearings, which make the association of monitoring, diagnosis and maintenance an interesting approach. The MAXBE project appears in this context and its strategic objective is to provide validated and demonstrated concepts, strategies and guidelines for the interoperable axle bearing monitoring and diagnosis that support the railway operators and managers dealing with the threats imposed by the existence of axle bearing defects. The consortium for the MAXBE project comprises 17 partners (industry, leading universities, end-users and a SME) from 8 member states, representing operators, axle bearing manufactures, key players in the railway community and experts in the field of monitoring, maintenance and rolling stock. The presence in the consortium of one axle bearing manufacturer, market leader in the field, and three operators and railway managers, as end-users, is decisive for the enhancement and optimisation of the axle bearing diagnosis and maintenance strategies and for the definition of the new proposed approaches for the interoperability. The MAXBE project will have impact for the reliability, availability, maintainability and safety (RAMS) of rolling stock and infrastructure, focused on the axle bearings.

Maturity	TRL7
Link to REFINET high Level Service Infrastructure	LOW COST, SAFE/SECURE
Key performance Indicators	Indicators according to the condition monitoring technology
Year of project ends	2015
Further information	https://web.fe.up.pt/~maxbe/index.html

Catalogue of R&I projects 49_ Polaris	
Field	**Description**
Technology title and keywords	Risks to space weather, mitigation measures, SW that performs collection and interpretation of data from many disparate sources
Source of technology	Project Title: Preventative OperationaL procedures for space weAtheR threats to CrItical InfraStructure; Funding Scheme (Ganº): Project ID: 312833 Funded under: FP7-INFRASTRUCTURES
Lifecycle stage	Operation
Type of infrastructure	Air
Component of infrastructure	operation
Short Description	SOLARIS SEEKS to improve critical infrastructure protection. EU-SOLARIS aims to create a new legal entity to explore and implement new and improved rules and procedures for Research Infrastructures (RI) for Concentrating Solar Thermal (CST) and Solar Chemistry technologies, to optimise RI development and Research and Technology Development (RTD) coordination. It is expected to be the first of its kind, where industrial needs will play a significant role and private funding will complement public funding. It intends to: - Become a unique distributed RI for CST technologies. - Optimize RI development and RTD coordination by creating a new legal entity to explore and implement new and improved rules and procedures for RI for CST technologies. - Ensure the alignment of the RI activities with the industry's needs. - Maintain Europe at the forefront of CST technologies development. EU-SOLARIS expects to provide the most complete, high quality scientific infrastructure portfolio at international level and to facilitate researchers´ access to highly specialised research infrastructure through a single access point. This will be accomplished by linking scientific communities, industry and universities involved in the CST sector. Moreover, it is expected to increase the efficient use of the economic and human resources required throughout the European research context. EU-SOLARIS will provide efficient resource management to complement research and to avoid unnecessary technological duplication and repetition.

Maturity	TRL 3
Link to REFINET high Level Service Infrastructure	SAFE/SECURE
Key performance Indicators	Secure -> Prevention Activity
Further information	year of projects end:2015 project website: www.eusolaris.eu

Catalogue of R&I projects 50_ ACEM Rail	
Field	**Description**
Technology title and keywords	Track inspection technologies, Predictive algorithms to estimate track defect evolution, optimization algorithms and techniques for the planning of maintenance tasks, algorithms and tools to monitor the execution of maintenance tasks
Source of technology	Project Title: Automated and cost effective maintenance for railway; Funding Scheme: Ganº SCP0-GA-2010- 265954
Lifecycle stage	Maintenance
Type of infrastructure	Rail
Component of infrastructure	Track
Short Description	Automated and Cost-Effective Maintenance for Railway (ACEM-Rail) is a collaborative research project funded by the Seventh Framework Programme (FP7) of the European Union. The goal of the project is to develop the technologies and systems to increase the automation level of railway infrastructure maintenance and to improve the cost-effectiveness of the maintenance process while enhancing the quality, the reliability and the competitiveness of railway services. The project focuses on the track including also track bed, subgrade and engineering structures (such as bridges, tunnels or retaining walls). It tackles the problem of track maintenance from a comprehensive perspective including the whole sequence of processes involved in it: since the monitoring of infrastructure (by means of automated technologies) up to the final execution of maintenance tasks and going through the evaluation of track condition and analysis of defects' degradation, optimization of maintenance scheduling (including preventive, predictive and corrective tasks) and assistance to the operator in field in the execution of maintenance tasks.
Maturity	TRL5
Link to REFINET high Level Service Infrastructure	COST-EFFICIENT

Key performance Indicators	Operations and Maintenance Performance Measure ->Maintenance Level of Service, Cost Efficiency, Asset Condition, Remaining Life/structural capacity
Further information	year of projects end: 2013; project website: http://www.acem-rail.eu

Catalogue of R&I projects 51_ Closer	
Field	**Description**
Technology title and keywords	Core indicators for the interconnection between short and long-distance transport networks, Decision Making Framework
Source of technology	Project Title: Connecting LOng and Short-distance networks for Efficient tRansport; Funding Scheme (Ganº: 234180)
Lifecycle stage	Renovation
Type of infrastructure	Multi-modal
Component of infrastructure	NA
Short Description	A set of seven case studies have been used to shed light on interconnections between short and long-distance transport networks: -Flughafen Leipzig-Halle, Germany (mainly freight) -Armentières station, France (passenger) -Oslo bus terminal Vaterland, Norway (passenger) -Port of Helsinki – Vuosaari, Finland (mainly freight) -Thessaloniki port, Greece (mainly freight) -Constantza port, Romania (freight) -Vilnius Airport, Lithuania (passenger)
Maturity	TRL1
Link to REFINET high Level Service Infrastructure	GREEN, COST-EFFICIENT, SOCIAL/INCLUSIVE
Key performance Indicators	Emissions, Customer Benefit or Disbenefit, Efficiency, Congestion, Delay, Travel Time, Travel Cost, Accessibility to different modes, Accessibility to destinations, Accessibility to facilities and services
Further information	year of project end: 2012; project website: http://www.closer-project.eu

Catalogue of R&I projects 52_ GreenRail	
Field	**Description**
Technology title and keywords	railroad sleeper composition, lower ballast pulverization
Source of technology	Project Title: Greenrail: sustainability, safety and saving in the the railroad sleeper of tomorrow
Lifecycle stage	Design/ Construction
Type of infrastructure	Rail
Component of infrastructure	Railroad sleeper
Short Description	Greenrail S.r.l., winner of SME Phase I and Seal of Excellence SME Phase II has designed an innovative composite railway sleeper. Greenrail

	Sleeper, patented in 122 countries, combines the advantages of concrete sleepers with the ones of composite sleepers. It is made of an inner core in concrete, covered by an elastic outer shell obtained from recycled plastic and ELT (End-of-Life Tyres), which reduces maintenance costs, vibrations and noise and allows to recover 35 tons of ELT and 35 tons of plastic from urban waste for each kilometer of line (1 km = 1670 sleepers). It is the sustainable substitute of pre-stressed concrete sleepers and it has a longer lifespan, estimated in 50 years from the first installation. Moreover, it is the only existing sleeper that can integrate sensors and systems for energy production and/or data transmission for safety and/or telecommunications. Besides the Greenrail Basic sleeper the company has planned further R&D for Greenrail Solar (a sleeper able to transform every km of line into a photovoltaic field producing from 150 kWh to 600 kWh), Greenrail LinkBox (a Greenrail Solar which also incorporates systems of data transmission for safety and telecommunications able to communicate with remote control rooms) and Greenrail Piezo (Greenrail Basic sleeper which incorporates piezoelectric systems and dynamometers that activate themselves at every train transition, producing energy able to power integrated systems for analysis and diagnostics of the railroad line). The goals of the project are: - obtain the homologation of Greenrail Basic sleeper through the pilot activity with RFI (Rete Ferroviaria Italiana), following the certification regulations; - R&D investments on Greenrail Solar, LinkBox and Piezo by 2018; - commercialisation and manufacturing plant.
Maturity	TRL 8
Link to REFINET high Level Service Infrastructure	GREEN, COST-EFFICIENT
Key performance Indicators	recycling, quality, noise impact, maintenance level of service
Further information	Year of projects end: 2015; Project website: http://www.greenrail.it

Catalogue of R&I projects 53_ NETTUN	
Field	**Description**
Technology title and keywords	multi-sensor ground prediction system, robotic maintenance system, cutter tools, modelling of global risks, Decision Support system for tunnel maintenance
Source of technology	Project Title: New Technologies for Tunnelling and Underground Works; Funding Scheme (Ganº 280712)
Lifecycle stage	Design/ Construction/Maintenance/Operation
Type of infrastructure	Road, Rail
Component of infrastructure	Tunnel
Short Description	The NeTTUN 54M project will enable ground-breaking change in the construction, management and maintenance of tunnels in pursuit of the goals of NMP.2011.4.0-2 via 9 focussed WPs addressing key scientific and technical challenges: (i) a multi-sensor ground prediction

	system for TBMs to enable effective look-ahead during boring; (ii) a robotic maintenance system that enables automation of inspection and exchange of drag bits and disc cutters; (iii) the design of cutter tools with increased lifetime; (iv) a system for modelling of global risks on tunnel projects in order to quantify and manage uncertainties; (v) systems for modelling and controlling the impact of tunnelling on surrounding structures; (vi) a Decision Support system for tunnel maintenance management. The improvements enabled by this work programme will enhance every aspect of the lifecycle of tunnelling: from design, to construction, and maintenance of Europe's extensive tunnel legacy. Each of the 23 partners in the NeTTUN Consortium – Industrial, Research and Development and SME – has been invited to participate because of unique scientific expertise and tunnelling sector experience. Ecole Centrale de Lyon, a French top-level engineering school involved in international research, will be the NeTTUN project coordinator. NFM, the French Tunnel Boring Machine manufacturer, will manage the scientific and technical aspects of the project. Both these organisations will work as a team. NeTTUN project results will impact the tunnelling industry by enlarging business perspectives, with productivity increase; delivering underground operations with zero impact on surroundings; answering societal needs by improving safety; and strengthening competitiveness of European industry. The Consortium will demonstrate project results on the site of Metro Line C construction under Rome's ancient monuments, as well as with OHL on the Guadalquivir, and Razel on the Fréjus Tunnels. Dissemination, Exploitation and Gender Equality Committees will ensure the Consortium's activities and successful project results are promoted to the target audiences of the general public, the tunnelling industry and education and academic sectors.
Maturity	TRL7
Link to REFINET high Level Service Infrastructure	COST-EFFICIENT
Key performance Indicators	asset condition, remaining life/structural capacity, capacity and availability, maintenance level of service
Further information	Year of projects end: 2017; Project website: www.nettun.org

Catalogue of R&I projects 54_ Pantura	
Field	**Description**
Technology title and keywords	Low Disturbance Urban Projects, Building Information Modelling (BIM), Urban Strategy
Source of technology	Project Title: "Flexible Processes and Improved Technologies for Urban Infrastructure Construction Sites" Funding Scheme (Ganº): 265172

Lifecycle stage	Construction/Maintenance/Renovation
Type of infrastructure	Road, Rail
Component of infrastructure	Bridge
Short Description	More than 50% of bridges in European cities are older than 40 years and bridges are a vital part of the infrastructure. Bridge managers are currently dealing with a large number of structurally deficient, obsolete bridges. The need to maintain, renew, strengthen and upgrade this part of the infrastructure will increase dramatically soon. PANTURA has bridges as its focal point. It is, however, important to stress that the approach proposed here can be applied to all infrastructure projects. The aims are to improve highly flexible off-site production processes, create resource-efficient construction sites, improve technologies and tools for bridge construction in densely populated areas and enhance communication between local authorities and construction companies. The main benefits of PANTURA are relevant to the Work Programme and are as follows: a) equip authorities, stakeholders and experts with a comprehensive instrument (methods, tools and techniques) to prepare and perform bridge construction, maintenance, repair and renovation processes in the most effective and efficient way, in the shortest possible time, with the most efficient, sustainable use of resources and with zero disturbance and disruption for the urban environment and urban life of the inhabitants, b) reduce lifecycle costs, i.e. the more efficient use of public funds by saving a significant amount of time and money, c) use new materials to increase off-site industrial production, technical innovations and new markets for SMEs and d) improve benchmarking systems to promote a performance-based, innovative, creative construction industry. PANTURA applies research based on a multidisciplinary, holistic approach and promotes innovative yet practical solutions, while covering the entire lifecycle process. PANTURA aims to realise these objectives by taking current research on construction processes, ICT tools and infrastructure technologies one step further.
Maturity	TRL5
Link to REFINET high Level Service Infrastructure	Selection among the five performances: GREEN, COST-EFFICIENT
Key performance Indicators	noise impact, bridge condition, cost efficiency, delay,
Further information	From 2011-01-01 to 2013-12-31, closed project Project website: http://www.pantura-project.eu

Catalogue of R&I projects 55_ SMARTRAIL	
Field	**Description**
Technology title and keywords	Monitoring and Inspection, Assessment and Models, New rehabilitation technologies, Whole Life-Cycle Cost Calculation Tools
Source of technology	Project Title: Smart Maintenance and Analysis of Transport Infrastructure; Funding Scheme (Ganº): 285683

Lifecycle stage	Maintenance
Type of infrastructure	Road, Rail
Component of infrastructure	Bridge, track, transition zone
Short Description	Europe needs a safe and cost effective transport network to encourage movement of goods and people within the EU and towards major markets in the East. This is central to European transport, economic and environmental policy. Many parts of Europe's rail network were constructed in the mid-19th century long before the advent of modern construction standards. Historic levels of low investment, poor maintenance strategies and the deleterious effects of climate change (for example scour of bridge foundations due to flooding and rainfall induced landslides) has resulted in critical elements of the rail network such as bridges, tunnels and earthworks being at significant risk of failure. The consequence of failures of major infrastructure elements is severe and can include loss of life, significant replacement costs (typically measured in millions of Euro's) and line closures which can often last for months. The SMART Rail project brings together experts in the areas of highway and railway infrastructure research, SME's and railway authorities who are responsible for the safety of national infrastructure, The goal of the project is to reduce replacement costs, delay and provide environmentally friendly maintenance solutions for ageing infrastructure networks. This will be achieved through the development of state of the art methods to analyse and monitor the existing infrastructure and make realistic scientific assessments of safety. These engineering assessments of current state will be used to design remediation strategies to prolong the life of existing infrastructure in a cost-effective manner with minimal environmental impact.
Maturity	TRL6
Link to REFINET high Level Service Infrastructure	COST-EFFICIENT
Key performance Indicators	Maintenance level of service
Further information	Year of projects end: 2014; Project website: http://smartrail.fehrl.org/

Catalogue of R&I projects 56_ APSE	
Field	**Description**
Technology title and keywords	green bitumen, bio-fluxing agent for pavements, separation of C&D waste
Source of technology	Project Title: Use of eco-friendly materials for a new concept of Asphalt Pavements for a Sustainable Environment; Funding Scheme (Ganº603862)
Lifecycle stage	Design
Type of infrastructure	Road
Component of infrastructure	asphalt pavements

Short Description	The construction of a new road has implications for the environment. Materials commonly used are petroleum derived and extracted from quarries, therefore energy consumption and emissions associated are considerable. The APSE project is a Seventh Framework Programme which emerges from the need of promoting a sustainable construction of asphalt roads. At present, potential measures with sound sustainability credentials are not widely implemented, regulated and harmonized within road construction and a wholesale shift to use of these types of materials has yet to occur. The APSE project will contribute to it, reducing the environmental impact associated to the construction of roads and increasing its competitiveness and cost-effectiveness during their whole life cycle. It will be done by placing emphasis on recycling technologies, use of waste and novel green binders, all integrated appropriately into optimal and eco-innovative designs of asphalt pavements. The concept of the APSE project is the design of an eco-innovative asphalt pavement designed through the substitution of asphalt mixtures by greener materials: reclaimed asphalt pavement (RAP), construction and demolition waste (C&DW), lignin (by-product of 2nd generation bioethanol processing) and bio-binder from vegetable oil. The main objective is to establish a new concept of asphalt pavement structures with ecologically oriented attributes, significantly reducing the asphalt pavement carbon footprint while achieving a level of long term performance comparable or greater than that of conventional pavement structures. This goal will be achieved by focusing on the two main components of asphalt mixture: bitumen and aggregates. In relation to bitumen, two types of greener binders will be addressed; the first investigates bio-fluxing bitumen, which enables part of the petro-chemical binder to be replaced with bio-based products (vegetable oils); the second uses lignin, also bio-derived, to replace the crude-oil derived polymer in modified bitumen. In relation to aggregates, two different approaches are also explored: the use of high rates of reclaimed asphalt pavement (RAP) in new hot asphalt mixtures, thanks to the addition of bio-fluxing agents which will allow working at lower temperatures, and the use of construction and demolition waste (C&DW). APSE project Scientific and Technological objectives are: • To demonstrate the technological performance of the green solutions proposed. • To provide a systematic approach for eco-innovative asphalt pavement design. • To validate the eco-innovative asphalt pavement designs through accelerated load testing at pilot scale. • To select the most suitable eco-innovative designs considering the demo cases (Madrid & Warsaw) specific requirements. • To scale up the production of the innovative solutions from lab scale

	to real industrial scale. • To validate the performance of the proposed eco-innovative asphalt pavement by means of the two real demo sites. • To demonstrate the environmental and economic value of the proposed practices, processes and products by means of LCA and LCC. Demonstration in two real road sections
Maturity	TRL6
Link to REFINET high Level Service Infrastructure	GREEN
Key performance Indicators	recycling
Further information	year of projects end: 2017; project website: http://apseproject.eu/

Catalogue of R&I projects 57_ INFRARISK	
Field	**Description**
Technology title and keywords	stress test structure, integrated approach to hazard assessment
Source of technology	Project Title: Novel Indicators for identifying critical INFRAstructure at RISK from natural hazards; Funding Scheme (Ganº 603960)
Lifecycle stage	Construction/Maintenance
Type of infrastructure	Road, Rail
Component of infrastructure	NA
Short Description	"The achievements of the European Union targets regarding energy and socio-economic sustainability are highly dependent on the way risks and vulnerabilities of European operating infrastructure networks and critical assets are minimised against natural extreme events. The INFRARISK project will develop reliable stress tests on European critical infrastructure using integrated modelling tools for decision-support. It will lead to higher infrastructure networks resilience to rare and low probability extreme events, known as “black swans”. INFRARISK will advance decision making approaches and lead to better protection of existing infrastructure while achieving more robust strategies for the development of new ones. INFRARISK proposes to expand existing stress test procedures and adapt them to critical land-based infrastructure which may be exposed to or threatened by natural hazards. Integrated risk mitigation scenarios and strategies will be employed, using local, national and pan-European infrastructure risk analysis methodologies. These will take into consideration multiple hazards and risks with cascading impact assessments. The INFRARISK approach will robustly model spatio-temporal processes with

	propagated dynamic uncertainties in multiple risk complexity scenarios of Known Unknowns and Unknown Unknowns. An operational framework with cascading hazards, impacts and dependent geospatial vulnerabilities will be developed. This framework will be a central driver to practical software tools and guidelines that provide greater support to the next generation of European infrastructure managers to analyse and handle scenarios of extreme events. The minimisation of the impact of such events by the supporting tools shall establish optimum mitigation measures and rapid response. INFRASRISK will deliver a collaborative integrated platform where risk management professionals access and share data, information and risk scenarios results efficiently and intuitively." 2 Scenario: Case Study 1: Italian Road Network; Case study 2: Croatian Rail Network
Maturity	TRL 5
Link to REFINET high Level Service Infrastructure	RESILIENT and SAFE/SECURE
Key performance Indicators	Sea Level rise, Precipitation, Wind, prevention activity
Further information	Year of project end: 2016; Project website: http://www.infrarisk-fp7.eu/

Catalogue of R&I projects 58_ DEMANES	
Field	**Description**
Technology title and keywords	Novel technologies to support the cost-effective and timely realisation of large-scale networked systems embedded in the physical world. CONTROL ENGINEERING. EMBEDDED SYSTEMS. SECURITY. PROTECTION. SMART TRANSPORT. SMART HOME.
Source of technology	**DEMANES:** ***Design, Monitoring and Operation of Adaptive Networked Embedded Systems.*** PF7-JTI JTI-CP-ARTEMIS Project Reference: 295372
Lifecycle stage	Design/ Monitoring / Operation /
Type of infrastructure	Road, Rail, Air, Water, Multi-modal
Component of infrastructure	Bridge, Tunnel, Airport, Smart home, etc.

Short Description	Large scale societal challenges require large scale monitoring and control solutions. Technological developments will make it possible to design and build these large systems. A major obstacle in realizing these systems is the lack of a versatile methodology to design and implement adaptive monitoring and control systems taking into account intrinsic properties of system of systems (decentralization, dynamic requirements, continuous evolution and changing components). The goal of DEMANES is to provide component-based methods, framework and tools for development of runtime adaptive systems, making them capable of reacting to changes in themselves, in their environment (battery state, availability and throughput of the network connection, availability of external services, etc.) and in user needs (requirements). • to model the architecture and the operation of adaptive systems • to support the design process of such systems by providing simulation and evaluation environments and test-beds • to support the implementation of such system by providing services for self-organization, reconfiguration and self-optimization as parts of the execution environment • to verify and test adaptive systems • to monitor the internal and external operational conditions and manage adaptation at run time. In order to go beyond the state of the art DEMANES combines recent advances from systems and control engineering. The concept, methodology and tools developed in DEMANES will be validated and demonstrated in three use cases: smart urban transport, smart airport and smart home. To reach the ambitious goals of DEMANES in the spirit of the ARTEMIS programme a large consortium is necessary to cover the range of disciplines necessary. The partners in the DEMANES consortium are complementary in terms of technical competencies and organizational, business and market experience. Application Contexts: **Industrial Systems** (Industry for airports, urban transport, city logistics, urban safety and security). **Nomadic Environments** (PDAs, smart phones, body sensors, public transportation). **Private Space**s (home, smart TVs and sensors). **Public Infrastructure** (public urban spaces, transport stations and vehicles, airports).
Maturity	TRL 5-6
Link to REFINET high Level Service Infrastructure	COST-EFFICIENT SAFE/SECURE
Key performance Indicators	quantitative indicator according the definition of RMMTI model that help assess the efficiency of the technology
Further information	Project end: 2015 http://www.demanes.eu/

Catalogue of R&I projects 59_ MODULUSHCA	
Field	**Description**
Technology title and keywords	A logistics system modelled on the Web. MODULAR LOGISTIC UNITS. SHARED NETWORKS. PHYSICAL INTERNET.
Source of technology	**MODULUSHCA:** ***Modular Logistics Units in Shared Co-modal Networks*** FP7 Transport - CP-FP Small or medium-scale focused research project Project Reference: 314468
Lifecycle stage	Design / Operation
Type of infrastructure	Road, Rail, Air, Water, Multi-modal
Component of infrastructure	Bridge, Tunnel, Airport, Station, Port,…
Short Description	The objective of MODULUSHCA was to achieve the first genuine contribution to the development of interconnected logistics at the European level, in close coordination with North American partners and the international Physical Internet Initiative. The goal of the project was to enable operating with developed iso-modular logistics units of sizes adequate for real modal and co-modal flows of fast-moving consumer goods (FMCG), providing a basis for an interconnected logistics system for 2030. During the project life time, the main working areas and achievements have been: - Finalisation of a framework on how Physical Internet can enable an interconnected FMCG logistics system has been developed in several workshops with experts from industry partners, also explaining obstacles and success factors to a Physical Internet enabled system - Development of modular boxes in the FMCG sector in two versions, version 1 focusing on interlocking mechanism and version 2 made by panels - Algorithms for digital interconnectivity between different IT systems have been chosen and described as well as a sensoring and communication approach for modular logistics units - Recommendations have been developed for the standardisation of iso modular containers - Two implementation pilots have been carried out - Active promotion of the Physical Internet and MODULUSHCA has been made, accompanied by dedicated dissemination material (brochure, templates, website, internal working space to share information, mailing lists, etc.) - The Advisory board (Board of Directors) with experts from 13 industry and science institutions has been continued Potential Impact: Communication and Dissemination Strategy The dedicated Communication and Dissemination Strategy was presented as D7.1: Dissemination strategy. It outlines in detail which

	public and private target groups the project intends to reach, by means of which project communication tools and through which dissemination channels at the European, national and local level. This was used as an alive document and has therefore been constantly updated during the project lifetime. Development of a road map towards a fully interconnected logistics system in 2030. The road map will address the changes and necessary steps to change the logistics system gradually, exploiting progresses in digital, physical and operational interconnectivity, building on current players, assets and infrastructures.
Maturity	TRL 5
Link to REFINET high Level Service Infrastructure	COST-EFFICIENT
Key performance Indicators	quantitative indicator according the definition of RMMTI model that help assess the efficiency of the technology
Further information	Project end: 2016 http://www.modulushca.eu/

Catalogue of R&I projects 60_ NODES	
Field	**Description**
Technology title and keywords	A catalogue of integrated planning, design and management tools, based on the most advanced practices in urban and other related transport sectors. It allows practitioners to assess and benchmark their new or upgraded interchange and to improve performances. URBAN TRANSPORT INTERCHANGES.
Source of technology	**NODES: *New tOols for Design and OpEration of Urban Transport IntechangeS*** FP7-TRANSPORT - CP-FP - Small or medium-scale focused research project. Project Reference: 314618
Lifecycle stage	Design/ Operation
Type of infrastructure	Multi-modal
Component of infrastructure	Urban Transport Interchange
Short Description	"Urban mobility is of growing concern to citizens. To be more efficient urban mobility systems require a greater integration at urban level (city and its hinterland). Interchanges need to better integrate: - various urban transport modes, which can be urban, regional and long distance; - urban transport and land use; - urban transport networks; - transport and non transport related services. Not only will this provide a better management of transport and non-transport related services, it will also improve the functioning of the city in a global economy, as well as favour a greater use of environmentally

	friendly modes, and especially public transport. In order to support European cities in the design and operation of new or upgraded interchanges, NODES will produce Guidelines and a Toolbox on five topics which cover the key functions of interchanges: 1. Strategies for integrated land use planning with urban passenger infrastructure planning 2. Innovative approaches relating to the design of new or upgraded efficient transport interchanges 3. Intermodal operations and information provision 4. Management and business models: the interchange as business case for the local economy and in itself 5. Energy efficient and environmental friendly interchanges On the basis of the State of the art and analysis of User needs and requirements, these Guidelines and Toolbox will consist in Performance Criteria and Indicators, a selection of which will lead to a set of Key Performance Indicators. The guidelines and tools will be applied in reference sites where interchanges are being upgraded or built, which will validate the tools and their efficiency. Output: A Toolbox to support European cities in the design and operation of new or upgraded interchanges, as a way to provide greater support, services and satisfaction to the travellers and users, as well as to interchange operators, and those societal and economic actors depending on the efficiency of interchange operations.
Maturity	TRL 5
Link to REFINET high Level Service Infrastructure	SOCIAL/INCLUSIVE
Key performance Indicators	quantitative indicator according the definition of RMMTI model that help assess the efficiency of the technology
Further information	Project end: 2015 http://www.nodes-interchanges.eu/

Catalogue of R&I projects 61_ SPIDER PLUS	
Field	**Description**
Technology title and keywords	Sustainable Plan for Integrated Development through the European Rail network. Sustainable mobility. city logistics. high-speed rail. ICT technologies.
Source of technology	**SPIDER PLUS**: ***Sustainable Plan for Integrated Development through the European Rail network-Projecting Logistics & mobility for Urban Spatial design evolution***. FP7-TRANSPORT - CP-FP - Small or medium-scale focused research project. Project Reference: 314090

Lifecycle stage	Design
Type of infrastructure	Rail, Multi-modal
Component of infrastructure	High-Speed and Traditional Rail.
Short Description	"SPIDER PLUS objective is to provide a new 2050 mobility VISION through a Strategic Design & Plan, and a Road Map delivering Sustainable Solutions by then. In such Plan the electrified Rail has a central role both for passengers and freight. The productivity of the available resources supported by ICT and other technologies, is maximized by the combination of infrastructural nodes with spatial and urban planning integrating the missing links for sustainable mobility and city logistics. The combination of the Time with Space management generates seamless transport chains reducing aggravations and costs. E/Service, E/Freight, ICT technologies, satellite communications, Galileo are tools for achieving these objectives. Syncro-Mobility is the 2050 SPIDER PLUS MOBILITY motto."
Maturity	TLR 3
Link to REFINET high Level Service Infrastructure	GREEN, COST-EFFICIENT
Key performance Indicators	quantitative indicator according the definition of RMMTI model that help assess the efficiency of the technology
Further information	Project end: 2015 http://www.spiderplus-project.eu/

Catalogue of R&I projects 62_ OSIRIS	
Field	**Description**
Technology title and keywords	Reduction of energy consumption within Europe's urban rail systems of 10% compared to current levels by 2020. Reduction of energy consumption . Energy saving technologies. High-speed rail. Urban rail systems.
Source of technology	**OSIRIS *Optimal Strategy to Innovate and Reduce energy consumption In urban rail Systems.*** FP7 TRANSPORT - CP-IP - Large-scale integrating project. Project Reference: 284868
Lifecycle stage	Design/ Operation
Type of infrastructure	Rail
Component of infrastructure	Rail vehicles, Urban Rail infrastructure.
Short Description	"For many transport modes, energy reduction strategies can be effectively formulated at the level of the vehicle or vessel. New technologies can therefore be introduced to a vehicle and the direct energy savings can be readily quantified. However, such approach is not suitable to be employed for urban rail, where it is not sufficient to consider only the energy performance of vehicles; the energy associated with the infrastructure, as well as the influence of the mode

	of operation are to be considered too. In other words, urban rail systems are complex environments and their energy consumption is characterised by a wide range of inter-dependent factors. This means that it is often extremely difficult to assess the net benefits of introducing new energy saving technologies. For example, whilst a new technology might yield improvements in certain respects, it might also compromise other aspects of system performance. What is needed, and what has been lacking so far, is a holistic approach for the reduction of energy consumption for urban rail systems embracing vehicles, infrastructure and operation, as is proposed by OSIRIS. The project will start from the definition of Key Performance Indicators and Standard Duty Cycles to measure energy consumption in urban rail systems. Then, rather than focussing only on specific technologies, it will address the issue from the system-level ensuring that progresses on energy reduction are substantial. The effectiveness of solutions and their full potential will be proven by means of simulations and pilot tests. OSIRIS will introduce the entire discovered knowledge into a Decision Support Tool, for strategic decision making of companies (i.e., operators) and governments (i.e., public authorities). OSIRIS is fully aligned with the political ambitions of the Framework Program described in activity 7.2 - SUSTAINABLE SURFACE TRANSPORT of the FP7 4th call, topic "SST.2011.1.1-4: Energy consumption reduction in urban rail systems"." It is expected to bring positive benefits to the urban rail sector (operators and manufacturers), as well as to the community as a whole.
Maturity	TRL 5
Link to REFINET high Level Service Infrastructure	GREEN, COST-EFFICIENT, SOCIAL/INCLUSIVE
Key performance Indicators	quantitative indicator according the definition of RMMTI model that help assess the efficiency of the technology
Further information	Project end: 2015 http://www.osirisrail.eu/

Catalogue of R&I projects 63_ QUIET-TRACK	
Field	**Description**
Technology title and keywords	Quiet tracks for sustainable railway infrastructure. QUIET TRACKS. SUSTAINABLE RAILWAY. NOISE MITIGATION SYSTEMS.
Source of technology	**QUIET-TRACK:** ***Quiet Tracks for Sustainable Railway Infrastructures.*** FP7-TRANSPORT - CP-FP - Small or medium-scale focused research project. Project Reference: 604891
Lifecycle stage	Design/ Construction/Maintenance/

Type of infrastructure	Rail
Component of infrastructure	Track solutions, including embedded track systems. Monitoring systems.
Short Description	The Quiet-Track project deals with track based solutions for reducing railway rolling noise. Quiet-Track deals with situations where the track noise contribution is important in the global pass-by noise, i.e. surface rail transport with speeds between 20 and 200 km/h. In order to obtain the highest possible impact with the resources available, Quiet-Track focuses on very effective track based rolling noise mitigating solutions for trams, regional trains, surface metro and trains in an urban environment with direct application possibility to conventional railway tracks outside the city. The objective is to provide step changing track based noise mitigation systems and maintenance schemes, to provide reliable improved TSI based rolling noise calculation procedures with harmonized monitoring of the required input parameters and to provide track noise management tools, for use in noise mapping and hot spot action plans according to the END, for use as engineering tools and solutions in new railway projects and in refurbishment projects and for use by the track maintenance managers and track maintenance industry. The existing rolling noise models are enhanced with new fundamental features: the integration of the low frequency noise emission and of the actual wheel rail contact conditions for more accurate predictions of the noise emitted by the track. On-board monitoring systems based on noise measurements and location sensors are developed that continuously monitor rail roughness values, track decay rate values and wear to identify track locations where maintenance action is required or where mitigating solutions have to be applied. New track solutions, including embedded track systems, are developed which yield a noise reduction performance of at least 6 dB(A) in comparison with the global rolling noise measured on a well maintained standard track in the network of the participating infra managers. These new systems are applicable to tram, LRT and metro tracks as well as to conventional tracks. Attention is given to a good initial design with a procedure for selecting the best rail type and the best rail hardness in terms of minimising the noise related wear. Rail fixation systems are developed and validated exhibiting minimal rail roughness growth, avoiding corrugation in curves. A track maintenance tool is developed with a checking of the economic viability of the proposed maintenance activities. Holistic noise management tools for track maintenance and for track based noise mitigation solutions have been created. Recommendations have been drafted for updating the TSI Noise based upon relevant findings in the project. The solutions will be applicable to tram, LRT and metro tracks as well as to conventional tracks in the whole European Union.
Maturity	TRL 4
Link to REFINET high Level Service Infrastructure	GREEN, COST-EFFICIENT

Key performance Indicators	quantitative indicator according the definition of RMMTI model that help assess the efficiency of the technology
Further information	Project end: 2016 http://www.quiet-track.eu/

Catalogue of R&I projects 64_ FAULT-ADAPTIVE	
Field	**Description**
Technology title and keywords	Pioneering research to improve the performance and fault tolerance of *Critical Infrastructure Systems.* CONTROL ENGINEERING. CRITICAL INFRASTRUCTURES. SECURITY. PROTECTION.
Source of technology	**FAULT-ADAPTIVE** **Fault-Adaptive Monitoring and Control of Complex Distributed Dynamical Systems.** FP7-IDEAS-ERC - ERC-AG - ERC Advanced Grant. Started 2012 Project Reference: 291508
Lifecycle stage	Design/ Operation
Type of infrastructure	Road, Rail, Air, Water, Multi-modal
Component of infrastructure	Bridge, Tunnel, Airport, etc.
Short Description	Development of tools and design of methodologies that would facilitate early detection and accommodation of "small" faults or unexpected events, before they cause significant disruption or complete system failures in complex distributed dynamical systems. "The emergence of networked embedded systems and sensor/actuator networks has facilitated the development of advanced monitoring and control applications, where a large amount of sensor data is collected and processed in real-time in order to activate the appropriate actuators and achieve the desired control objectives. However, in situations where a fault arises in some of the components (e.g., sensors, actuators, communication links), or an unexpected event occurs in the environment, this may lead to a serious degradation in performance or, even worse, to an overall system failure. There is a need to develop a systematic framework to enhance the reliability, fault-tolerance and sustainability of complex distributed dynamical systems through the use of fault-adaptive monitoring and control methods. The work proposed here will contribute to the development of such a framework with emphasis on applications related to critical infrastructure systems (e.g., power, water, telecommunications and transportation systems). It will provide an innovative approach based on the use of networked intelligent agent systems, where the state of the infrastructure is monitored and controlled by a network of sensors and actuators with cooperating agents for fault diagnosis and fault tolerant control. A hierarchical fault diagnosis architecture will be developed, with

	neighbouring fault diagnosis agents cooperating at a local level, while transmitting their information, as needed, to a regional monitoring agent, responsible for integrating in real-time local information into a large-scale "picture" of the health of the infrastructure. A key motivation is to exploit spatial and temporal correlations between measured variables using learning methods, and to develop the tools and design methodologies that will prevent relatively "small" faults or unexpected events from causing significant disruption or complete system failures in complex distributed dynamical systems."
Maturity	TRL 5
Link to REFINET high Level Service Infrastructure	RESILIENT, and SAFE/SECURE
Key performance Indicators	quantitative indicator according the definition of RMMTI model that help assess the efficiency of the technology
Further information	Project end: 2018 http://www.kios.ucy.ac.cy/fault-adaptive/

Catalogue of R&I projects 65_ CARONTE	
Field	**Description**
Technology title and keywords	The project will provide a future research agenda for security in land transport. LAND TRANSPORT. PUBLIC TRANSPORTATION. SECURITY.
Source of technology	**CARONTE Creating an Agenda for Research ON Transportation sEcurity.** FP7-SECURITY CSA-CA - Coordination (or networking) actions. Project Reference: 606967
Lifecycle stage	Design
Type of infrastructure	Road, Rail, Air, Water, Multi-modal
Component of infrastructure	Bridge, Tunnel, Terminal, Ports, etc.
Short Description	The project will cover existing and emerging threats and relevant work on security issues in all land transport modes (i.e., road, rail, air, maritime through ports and inland waterways). Easy, efficient, safe and secure transportation is a core factor for European growth, collaboration and employment and therefor an item in the Europe 2020 strategy. Land transportation has two main challenges concerning security: avoiding interrupts of transport itself to assure the flow of freight and passengers to guarantee supply of the population and avoiding that transportation modes themselves become a mean for attacks. The future research agenda for security in land transport which CARONTE will provide, focuses on core relevant gaps caused by emerging risks and will avoid doubling in research. For this CARONTE will provide answers to the question of what type of security related projects should be planned in the future, considering the current state of the art and existing research projects. It will cover all threats (including cyber-crime) and security aspects for all land transportation modes, respecting

	fundamental human rights and privacy. The step by step method includes analyzing the state of the art and emerging risks, identification of gaps, analyses and assessments of potential solutions and the research agenda. The CARONTE consortium consists of universities and research institutes, providing well experiences (research and consultancy) in transportation, logistics, infrastructure management and security. The partners are aware of practical needs and frames in land transport, and security as well as ethic, social and privacy aspects. As the partners come from neutral organizations, remaining neutrality concerning the project findings is guaranteed. Results which may mainly cover private interests are prohibited. This leads to a balanced and efficient research agenda. To ensure practical use and acceptance of the final recommendations, end-users (transportation companies, infrastructure managers, terminal operators, customs etc.) and the suppliers of security and transportation equipment will be integrated through a High Level Advisory Board.
Maturity	TRL 2
Link to REFINET high Level Service Infrastructure	RESILIENT, and SAFE/SECURE
Key performance Indicators	quantitative indicator according the definition of RMMTI model that help assess the efficiency of the technology
Further information	Project end: 2016 http://www.caronte-project.eu/

Catalogue of R&I projects 66_ IMPACTS	
Field	**Description**
Technology title and keywords	Quantifying fundamental properties of relevant CO2 mixtures (linked to CCS)
Source of technology	IMPACTS The impact of the quality of CO2 on transport and storage behaviour (106656)
Lifecycle stage	Operation
Type of infrastructure	Road / Rail
Component of infrastructure	N/A
Short Description	The goal of IMPACTS was to close identified knowledge gaps related to transport and storage of CO2-rich mixtures from various CO2 sources to enable realisation of safer and more cost-efficient solutions for Carbon Capture and Storage (CCS). IMPACTS is addressing the impact of impurities in captured CO2, from power plants and other CO2-intensive industries, on CO2 transport and storage. This encompasses fluid properties, phase behavior and chemical reactions in the infrastructure complex and at the storage sites. Results from IMPACTS will help to ensure safe and reliable design, construction and operation of CO2 pipelines and injection equipment, and safe long-term geological storage of CO2.
Maturity	TRL 4
Link to REFINET high Level Service Infrastructure	GREEN

Key performance Indicators	N/A
Further information	December 2015 completion http://www.sintef.no/impacts

Catalogue of R&I projects 67_ PRECYSE	
Field	**Description**
Technology title and keywords	PReSET: A Toolset for the Evaluation of Network Resilience Strategies
Source of technology	PRECYSE "Prevention, protection and REaction to CYber attackS to critical infrastructures" (102446)
Lifecycle stage	Design /Operation /Renovation
Type of infrastructure	Road, Rail, Air, Water, Multi-modal
Component of infrastructure	Signalling and other ICT equipment
Short Description	PRECYSE will define, develop and validate a methodology, an architecture and a set of technologies and tools to improve –by design– the security, reliability and resilience of the ICT systems supporting the Critical Infrastructures (CI). It will build on previous research and existing standards, and will pay due attention to performance demands of current CI systems, as well as to relevant privacy, legal and ethical issues. The solutions proposed by PRECYSE will be validated in two demonstrations in the domains of transport and energy. All the process will be strongly user-driven, with not only two high profile user organisations forming part of PRECYSE consortium, but also a powerful User Group which spans through multiple application domains –energy, transport, defence and police forces, utilities, public authorities, etc.- and all European regions, from Southern Europe to Scandinavia. The project will carry out a strong community building effort and activities aimed at preparing the large-scale adoption of the project results.
Maturity	TRL 4
Link to REFINET high Level Service Infrastructure	SAFE/SECURE
Key performance Indicators	Downtime of ICT equipment (hours)
Further information	February 2015 completion (http://precyse.eu/)

Catalogue of R&I projects 68_ VRUITS	
Field	**Description**
Technology title and	Architecture for integration of VRUs and Recommended practices for usability

keywords	and user acceptance.
Source of technology	VRUITS 'Improving the safety and mobility of vulnerable road users through its applications' (321586)
Lifecycle stage	Design/ Operation
Type of infrastructure	Road
Component of infrastructure	Intelligent Transport Systems - Intelligent Pedestrian Traffic Signal (IPT), Crossing Adaptive Lighting (CAL) and Information on Vacancy of Bicycle Racks (IVB)
Short Description	The EU has a target of halving road fatalities by 2020 and figures released by the European Commission show that there were 26 000 fatalities and 135 000 serious injuries on EU roads in 2015, with a combined cost of around EUR 100 billion (rehabilitation, healthcare, material damages, etc.). Between 2000 and 2012, fatalities among car occupants were reduced by 50% but similar reductions were not experienced by Vulnerable Road Users (VRUs), with fatalities amongst pedestrians reduced by 34 %, cyclists 31 %, and motorcyclists 17 %. Taken together, VRUs account for 68 % of the road fatalities in urban areas. Indeed, incidents involving VRUs are one of the reasons cited for the slowdown in EU road safety between 2015 and 2014. The three-year VRUITS project acknowledges that the Intelligent Transport System (ITS) approach to traffic management has contributed to the reduction in car fatalities by equipping vehicles and infrastructure with additional technology. However, the researchers argue it has given less emphasis to the safety, comfort and mobility needs of VRUs. The project sought to redress this balance by analysing different ITS, suggesting VRU-centric practices, which were then field tested and piloted. This enabled the researchers to make evidence-based recommendations for future policy and industrial development. Contributing factors such as market readiness, cost-benefit analysis, currently available infrastructure and societal impact were taken into account when making these recommendations. For infrastructure based ITS, the project looked at Intelligent Pedestrian Traffic Signal (IPT), Crossing Adaptive Lighting (CAL) and Information on Vacancy of Bicycle Racks (IVB). With vehicle based systems it focused on Blind Spot Detection (BSD), Pedestrian and Cyclist Detection System + Emergency Braking (PCDS+EBR) and VRU Beacon System (VBS). Finally, for user-centric systems it concentrated on Powered Two Wheeled on-coming Vehicle Information System (PTW2V), Bicycle to Vehicle Communications (B2V), Green Wave for Cyclists (GWC) and Intersection Safety (INS). Field trials of recommended practices were held in the Netherlands and Spain. In Valladolid, Spain, system tests were conducted into improvements to pedestrian mobility by sensor controlled traffic lights and to safety through increased visibility at zebra crossing. The trial found that as a result of the modifications 5 % fewer pedestrians crossed the road on a red light and pedestrians experienced 20 % less waiting time. The pilot study in Alcalá de Henares looked at intersection safety by using pedestrian detectors and driver notification, finding that the system held a lot of versatility but also the potential to be quite expensive to set-up, depending

	on the existing infrastructure. In Helmond in the Netherlands, researchers also looked at intersection safety but this time for cyclists by piloting a system which warned both car drivers and cyclists of potential collision danger, as well as instituting automatic car braking. Running these pilots enabled a more advanced technical understanding of the relative costs and benefits of each of the systems. Overall, the study of the 10 systems determined that seven returned benefits that outweighed the cost of implementation, improving the safety, mobility and comfort of VRUs. The study found that Pedestrian and Cyclist Detection System and Emergency Braking holds promise for the improvement of safety for VRUs but the researchers also acknowledge limitations in research methodology with the difficulty in designing tests which accurately replicate high risk scenarios. Therefore, the researchers suggest better accident data as one way towards creating optimum systems, as well as a system-wide rather than individual component strategy. The project also made a series of policy and industrial development recommendations. From a design stand-point they recommend the need for improved VRU detection accuracy and interfaces with designs optimised for users. Additionally, they call for devices that can adapt to environmental conditions and are enabled with multiple, cooperative functions. They also underline the need for better prediction of road user behaviour, proper procedures for data usage, standardised systems and legislation enforcement where necessary.
Maturity	TRL 4
Link to REFINET high Level Service Infrastructure	SOCIAL/INCLUSIVE, SAFE/SECURE
Key performance Indicators	Halving road fatalities by 2020 (EU target), including VRUs
Further information	March 2016 completion (http://www.vruits.eu/)

Catalogue of R&I projects 69_ ZEEUS	
Field	**Description**
Technology title and keywords	Electric charging infrastructure for buses
Source of technology	Zero Emission bUs Systems (186997)
Lifecycle stage	Design / Construction / Operation
Type of infrastructure	Road
Component of infrastructure	Electric charging infrastructure

Short Description	To create a competitive and sustainable transport system, the EU must look to alternative fuels to replace or complement petrol and diesel. Not only will this reduce transport emissions but it will also improve air quality and noise levels in urban areas. With this in mind, the ZEEUS ('Zero Emission Urban Bus System') project is working to make electric buses a core part of the urban bus network. Just one year after its launch, the ZEEUS project team has already begun testing electrification solutions for buses through live demonstrations. In mid October Barcelona hosted the launch of the first ZEEUS core demonstration which culminated in a short ride through the streets the city accompanied by Barcelona mayor, Xavier Trias. Local Spanish operator TMB (Transports Metropolitans de Barcelona) will now test four full electric buses: two standard i2e 12m IRIZAR buses and two 18m articulated SOLARIS buses. IRIZAR buses will charge at the depot, while the SOLARIS buses will charge at the end stations via opportunity charging. Barcelona is just one of eight such tests for the ZEEUS project, which runs until April 2017. The team is testing a wide range of different innovative electric bus technologies and charging infrastructure solutions in seven other demonstration sites – Bonn, Cagliari, Glasgow, London, Munster, Pilsen and Stockholm. The different sites will offer varying operational conditions to test the economic, environmental and social viability of the technologies in diverse locations. In late September, ZEEUS presented the first battery-powered electric bus Škoda Perun in Pilsen, although it is not in operation yet. And in spring 2015, the city will welcome two full electric, emission-free and quiet buses. These vehicles have a unique cooling and heating system that can re-use the heat generated during operation. Moreover, their battery can be fully recharged in as little as 12 minutes. Meanwhile, this week, the city of Stockholm is preparing to showcase its Volvo 12m plug-in hybrid buses to the citizens, city officials and local stakeholders. The Swedish capital will test eight plug-in hybrid buses with fast charging along route 73 in the city centre.
Maturity	TRL 8-10
Link to REFINET high Level Service Infrastructure	GREEN
Key performance Indicators	Extend the fully-electric solution to the core part of the urban bus network across Europe
Further information	April 2017 completion (http://zeeus.eu/)

Catalogue of R&I projects 70_ PLATINA II	
Field	**Description**
Technology title and keywords	CSA for quality inland waterway transport
Source of technology	PLATINA II "Platform for the implementation of NAIADES" (186985)
Lifecycle stage	Maintenance/Operation /Renovation

Type of infrastructure	Water
Component of infrastructure	Inland waterways
Short Description	PLATINA II is a Coordination Action aimed at the implementation of the NAIADES Action Areas. PLATINA II builds on the results of the FP7 project PLATINA (2008-2012) and is in line with the NAIADES action programme. It aims at bringing together key stakeholders in order to ensure a solid, multidisciplinary knowledge basis for the implementation of NAIADES actions. PLATINA II will, in close cooperation with the European Commission, set up a roadmap for the implementation of actions not yet started and support permanent-type actions. WP4 (INFRASTRUCTURE) will identify ways to close the data gaps on IWT infrastructure in Europe, provide tools for the integration of IWT into multimodal European corridors, monitor and support the implementation of River Information Services and identify future logistics applications as well as facilitate the exchange of good practices on efficient and effective inland waterway maintenance. The aim of this work package is to stimulate progress in three key fields of inland waterway infrastructure: integration into multimodal European transport corridors, further development of River Information Services and implementation of effective waterway infrastructure maintenance. In the first field, the objective is to support the development of the multimodal TEN-T corridor work plans from an IWT perspective, which has been the focus of the first project year. PLATINA 2 has come up with two extensive Information Packages for the project consortia which are elaborating the TEN-T corridor work plans. These contain practical guidance on which information needs to be considered for the work plans and how it can be retrieved. The support was well received by the addressees and will continue until end 2014. Furthermore, analytical work on available data sources to close the gaps between necessary and available IWT infrastructure data was performed and a first analysis of possible information architectures for this data pool was undertaken. In the field of River Information Services, the European portal www.ris.eu is maintained. In the coming year, ways on how to stimulate the use of River Information Services for logistics will be analyses and possible future European RIS identified. Related to waterway infrastructure maintenance, a pan-European group of experts was established, which will meet for its first workshop in October 2014. The group will steer the development of a “Good practices manual for inland waterway maintenance”, which shall provide practical guidance for waterway administrations focusing on a set of key issues. The Terms of Reference as well as provisional discussion topics have been elaborated.
Maturity	TRL 3
Link to REFINET high Level Service Infrastructure	GREEN, COST-EFFICIENT, RESILIENT
Key performance Indicators	None found

Further information	February 2016 completion (http://www.naiades.info/repository/public/documents/Downloads/14_Progress_report_PL2_2014-09-17.pdf)

Catalogue of R&I projects 71_ 2MOVE2	
Field	**Description**
Technology title and keywords	Integrated urban transport planning and ITS systems for public transport
Source of technology	2MOVE2 "New forms of sustainable urban transport and mobility" (107969)
Lifecycle stage	Design/ Operation
Type of infrastructure	Road, Rail, Air, Water, Multi-modal
Component of infrastructure	Roads, bike and footpaths
Short Description	2MOVE2 will further advance the knowledge of innovative, integrated urban transport systems, provide networking for cities to assimilate best practice, evaluate impacts and disseminate results. The official title 'New forms of sustainable urban transport and mobility' was abbreviated by 2MOVE2 in order to highlight the strong cooperation between leading and learning cities that will share and increase their knowledge and capacities in innovative urban transport systems. Strong focus will be laid on Sustainable Urban Mobility Plans. All city partners, which are Brno in the Czech Republic, Málaga in Spain, Stuttgart in Germany and Tel Aviv-Yafo in Israel, will benefit from the exchange of knowhow and the implementation of forward-looking transport measures.
Maturity	TRL 4 (tbc)
Link to REFINET high Level Service Infrastructure	GREEN, SOCIAL/INCLUSIVE, and SAFE/SECURE
Key performance Indicators	None found
Further information	November 2016 completion (http://www.civitas.eu/content/2move2)

Catalogue of R&I projects 72_ Future Sky Safety	
Field	**Description**
Technology title and keywords	Specific solutions for runway excursion accidents; Total system risk assessment; Mitigating the risk of fire, smoke and fumes
Source of technology	Future Sky Safety (193734)
Lifecycle stage	Design/ Construction/Maintenance/Operation /Renovation
Type of infrastructure	Road, Rail, Air, Water, Multi-modal
Component of infrastructure	Bridge, tunnel, pavement, etc.

Short Description	Future Sky Safety is an EU-funded transport research programme in the field of European aviation safety, with an estimated initial budget of about € 30 million, which brings together 33 European partners to develop new tools and new approaches to aeronautics safety, initially over a four-year period starting in January 2015. The first phase of the Programme research focuses on four main topics: •Building ultra-resilient vehicles and improving the cabin safety •Reducing risk of accidents •Improving processes and technologies to achieve near-total control over the safety risks •Improving safety performance under unexpected circumstances Future Sky Safety, established under coordination of EREA, is built on European safety priorities around four main themes, each consisting of a small set of Projects: •Theme 1 (New solutions for today's accidents) aims for breakthrough research with the purpose of enabling a direct, specific, significant risk reduction in the medium term. •Theme 2 (Strengthening the capability to manage risk) conducts research on processes and technologies to enable the aviation system actors to achieve near-total control over the safety risk in the air transport system. •Theme 3 (Building ultra-resilient systems and operators) conducts research on the improvement of Systems and the Human Operator with the specific aim to improve safety performance under unanticipated circumstances. •Theme 4 (Building ultra-resilient vehicles) aims at reducing the effect of external hazards on the aerial vehicle integrity, as well as improving the safety of the cabin environment. Project #3 Specific solutions for runway excursion accidents The objective of P3 is to perform breakthrough safety research, in accordance with the European Action Plan for the Prevention of Runway Excursions (EAPPRE) priorities, to enable a significant reduction of runway excursion risk in the medium term. The EAPRRE has identified areas where non-ATM research is needed to further reduce runway excursion risk: •Flight mechanics of ground operations on slippery runways under crosswind conditions; •Impact of fluid contaminants of varying depth on aircraft stopping performance; •Advanced methods for analysis of flight data to monitor runway excursion risk factors. Project #4 Total system risk assessment P4 "Total system risk assessment" works to develop a prototype risk observatory to assess and monitor safety risks throughout the Total Aviation System and allow frequent update to the assessment of risks. This Technical Project builds on the progress made in five major programs (CATS in Netherlands, AIM in SESAR and EUROCONTROL, ISAM and ASIAS in the FAA,

	and the EC FP7 project ASCOS) and brings the results of these programs together to develop a permanent risk observatory for Europe. It thus relies on existing means for safety risk assessment and continuous safety performance monitoring, and will develop a next generation of safety assessment techniques. Project #7 Mitigating the risk of fire, smoke and fumes The objective of P7 is to develop solutions to mitigate risks of fire, smoke and fumes leading to possible health and safety issues. Important knowledge gaps exist around fire behaviour of Carbon Fibre Reinforced Plastics materials for primary structures, and around risks related to fire, smoke & fumes in the modern cabin environment. The Project will improve understanding of fire behaviour of composite materials and explore new generations of mitigating solutions. Possible risks associated with on-board (including cabin) air quality will also be studied by addressing knowledge about the thermo-chemical and thermo-physical decomposition (be it natural or accidental) of materials (incl. materials, fuel, oil, ...) in new generations of aircraft systems, and its measurement when for instance low contamination level or very fast changing ones are considered. Mainly: •Develop better methods to measure and assess material properties; •Analyse composite behaviours under various temperature, flame, and load conditions; •Evaluate numerical models and methods.
Maturity	TRL 4
Link to REFINET high Level Service Infrastructure	SAFE/SECURE
Key performance Indicators	Safety goal of an 80% reduction of accident rates (ACARE Vision 2020)
Further information	December 2018 completion (https://www.futuresky-safety.eu/)

Catalogue of R&I projects 73_BENEFIT	
Field	**Description**
Technology title and keywords	Business Models For Enhancing Funding and Enabling Financing of Infrastructure in Transport
Source of technology	BENEFIT "Business Models For Enhancing Funding and Enabling Financing of Infrastructure in Transport" (193363)
Lifecycle stage	Design/ Construction/Maintenance/Operation /Renovation
Type of infrastructure	Road, Rail, Air, Water, Multi-modal
Component of infrastructure	Bridge, tunnel, pavement, etc.
Short Description	BENEFIT takes an innovative approach by analysing funding schemes within an inter-related system. Funding schemes are successful (or not) depending on the Business Model that generates them. The performance of the Business Model is

	effected by the implementation and the transport mode context. It is matched successfully (or not) by a financing scheme. Relations between actors are described by a governance model (contracting arrangements). These are key elements in Transport Infrastructure Provision, Operation and Maintenance. Success is a measure of the appropriate matching of elements. Within BENEFIT funding and financing schemes are analysed in this respect. Describing these key elements through their characteristics and attributes and clustering each of them is the basis of, first, developing a generic framework. This allows for the transferability of findings with respect to "lessons learned", "limitations" and "the impact of the financial and economic crisis". Identifying best matches in their inter-relations and where to intervene, leads to move from a generic framework to a powerful decision policy tool, which can assess funding schemes for investments in modern infrastructure with smart pricing and funding in view of 2050 challenges and needs. The BENEFIT partnership takes stock of over twenty years of EC funded, national and international research. It receives direct input, with respect to study cases, from the OMEGA Centre and COST Action TU1001. It is set-up to share and exchange knowledge and debate. Its high level international advisory group and its consultation group demonstrate its ability to reach out to all stakeholders to share its innovative approach. Deliverable D4.2 lists findings to date, following review of PPPs and public projects across Europe. Most road projects in the BENEFIT database fulfilled transport goals as expected (23 out of 26 projects, or 88%). Within PPP cases, there are two projects exceeding expectations (Athens Ring road in Greece and E-39 in Norway), two projects below expectations (A23 - Beira Interior in Portugal and C-16 Terrassa-Manresa Toll Motorway in Spain) and one far below expectations (A22 – Algarve in Portugal). Within Public cases, there is one project exceeding expectations (A5 Maribor - Pince Motorway) and all other projects fulfilled transport goals as expected.
Maturity	TRL 4
Link to REFINET high Level Service Infrastructure	COST-EFFICIENT
Key performance Indicators	Cost performance (against budget) for projects (PPPs and public); Distribution of traffic forecast
Further information	August 2016 completion (http://www.benefit4transport.eu/)

Catalogue of R&I projects 74_ WEATHER	
Field	**Description**
Technology title and keywords	impacts and damages in infrastructures due to climate change, vulnerability, emergency management, adaptation

Source of technology	WEATHER - Weather Extremes: Assessment of impacts on Transport Systems and Hazards for European Regions / FP7-TRANSPORT / 233783
Lifecycle stage	Operation
Type of infrastructure	Applicable to all modes
Component of infrastructure	infrastructure network, vehicles, facilities, services
Short Description	The WEATHER project aims at adding to the current state of knowledge on the impacts of extreme weather events on economy and society in total and on European transport systems in particular. The project starts from the broad picture of climate scenarios and breaks them down to specific regions. Economic growth models are applied to study the impacts on economy and society and the inter-relations between transport and other sectors. The vulnerability of transport is assessed mode by mode including infrastructures, operations and intermodal issues. Best practices in emergency management are identified by studying the numerous damage cases worldwide and options for adapting to more frequent and / or more extreme weather events are assessed. A particular focal point of the project is to quantify expected damage, emergency and adaptation costs and the benefits of improved emergency management and adaptation. Moreover, the project will identify policy options to implement the recommended measures and demonstrate the competitive potential and the innovation power of a European lead market for adaptation and emergency management technologies and policies. The toolbox of the project consists of literature review, targeted interviews, workshops, cost accounting models and case studies. The project will last for 27 months. The team consists of 8 leading transportation research institutes all having well founded experience in the core research fields of the WEATHER project.
Maturity	TRL6 (TRL may not applicable since the output is not a technology, but artefacts such as models, case studies)
Link to REFINET high Level Service Infrastructure	RESILIENCE
Key performance Indicators	vulnerability to climate change, emergency management and adaptation measures
Year of project ends	2012
Further information	http://www.weather-project.eu/weather/index.php

Catalogue of R&I projects 75_ STAR-TRANS	
Field	**Description**
Technology title and keywords	risk assessment methodology interdependencies among transport infrastructure, emergency resources use
Source of technology	STAR-TRANS - Strategic Risk Assessment and Contingency Planning in Interconnected Transport Networks / FP7-SECURITY / 225594

Lifecycle stage	Operation
Type of infrastructure	Applicable to all modes
Component of infrastructure	Transport network
Short Description	STAR-TRANS aspires to develop a holistic risk assessment methodology for Critical Infrastructure and apply it to a wide panel of international transportation infrastructures to analyse and assess common issues for risks, threats and vulnerabilities and identify possible interdependencies assessing the impact of failures on interconnected transportation infrastructures. The successful project outcome will offer important aids for decision-makers to determine priorities among multiple contingency alternatives by evaluating the consequences (cost, timing, resources, etc.) of proposed actions. The improvement of the response and management capabilities regarding assessment of incidences / failures in critical transport infrastructures will be achieved through the identification and closure of relevant knowledge gaps and through the development, validation and usage of computational modelling tools. STAR-TRANS aims at developing a modelling formalism in which specification of the structure and associated assets of European transportation networks as well as the specification of the dependency types between the assets of interconnected and interdependent transportation networks is facilitated. This modelling formalism will consider a transportation 'network of networks' as consisting of nodes and links. In so doing, tools from network and graph theory and the systems area will be employed. A specialised software system will be developed that will support the end users, and network operators needs. The software tool will provide the technology to link together any relevant assets of interconnected and interdependent transport networks, such that risk managers, policy makers and others can, subsequently, be provided with the impact that a risk incident on an asset of a specific transportation network may have on the assets of other interconnected and interdependent transport networks.
Maturity	TRL7 (note: this TRL probably refers to Risk Assessment Tool)
Link to REFINET high Level Service Infrastructure	SECURE/SAFE
Key performance Indicators	response time improvement
Year of project ends	2012
Further information	http://www.startrans-project.eu/

Catalogue of R&I projects 76_ SECURESTATION	
Field	**Description**
Technology title and keywords	reduction the impact of blast, fire and the dispersion of toxic agents on passengers, staff and infrastructure.
Source of technology	SECURESTATION - "Passenger station and terminal design for safety, security and resilience to terrorist attack" / FP7-TRANSPORT / 266202

Lifecycle stage	Design
Type of infrastructure	Applicable to all modes
Component of infrastructure	station, terminals, hub
Short Description	The aim of the SECURESTATION project is to improve passenger station and terminal resilience to terrorist attacks and safety incidents through technologies and methodologies enabling design to reduce the impact of blast, fire and the dispersion of toxic agents on passengers, staff and infrastructure. Objectives: SecureStation will consider threats from terrorist attacks and safety incidents caused by blast, fire and accidental or deliberate particle dispersion. The four project objectives are: 1. To increase resilience of passenger stations and terminals through structural design, interior design, and building services design, realising everyday benefits while designing for security. 2. To ensure cost-effectiveness of countermeasures through application of risk analysis methodologies to prioritise actions taken in design and operation of passenger stations and terminals. 3. To deliver a Constructive Design Handbook addressing new build and retro-fit cases to serve as a powerful decision support tool for owners and operators to increase station security and safety from terrorist bomb blast, CBRN attacks involving particle dispersion, and fire events. 4. To create harmonization and the standardization of risk assessment methodologies, technologies and design solutions thereby supporting wide application by the numerous EC public transport organisations and associated key stakeholders. Therefore, the main focus of the SecureStation proposal will be to produce the necessary tools to build safer and more secure infrastructure whilst providing maximum operating resilience. The proposal covers the development of Risk Assessment Methodology (including simulation results), specifically focusing on passenger stations/ terminals (a scenario specific methodology) and the development of a Constructive Design Handbook. These two main outputs will be accompanied by dissemination activity at a transport security conference, and through an extensive End User group.
Maturity	TRL7 (this TRL refers to Advanced predictive tool for physical and functional resilience in critical scenarios)
Link to REFINET high Level Service Infrastructure	SECURE/SAFE
Key performance Indicators	reduction of the impact of the man-made hazards
Year of project ends	2014
Further information	http://www.securestation.eu/

Catalogue of R&I projects **77_ COMPASS**

Field	Description
Technology title and keywords	ICT data based traveller information to improve the co-modality
Source of technology	COMPASS - OPTIMISED CO-MODAL PASSENGER TRANSPORT FOR REDUCING CARBON EMISSIONS / FP7-TRANSPORT / 284722
Lifecycle stage	Operation
Type of infrastructure	Applicable to all modes
Component of infrastructure	ICT and ITS systems
Short Description	The work to be carried out in COMPASS can build on a substantial body of knowledge on co-modal and intermodal passenger transport already available from past and current projects, in particular KITE, LINK, INTERCONNECT, HERMES, CLOSER, ORIGAMI and USEmobility. From this basis, COMPASS's specific scientific and technological objectives are: *To identify key trends (demographic, societal, economical, policy etc.) that will affect mobility now and in the future; *To identify the mobility needs of current and future travellers; *To identify the potential role of ICT in promoting co-modality and data collection; *To identify the information that would be needed from data in order properly understand mobility, to optimise a future co-modal transport system and to assess the impact of new solutions; *To analyse existing surveys with regard to data available concerning long-distance, rural and urban travel; *To identify solutions to improving behavioural data (from ICT or elsewhere) and needs and opportunities for harmonisation of the data collected, in particular in the various national surveys (this also includes new definitions of accessibility indicators); *To identify and investigate ICT solutions to influence mobility patterns for long-distance, rural and urban travel towards increased co-modality; *To develop business models that enable and promote these solutions in practice; *To assess the potential impact of the solutions identified both on local and on European level, in particular with regard to carbon emissions; *To derive conclusions and recommendations for national and EU transport policy and actions; *To disseminate the findings widely amongst policy makers and other stakeholders as well as researchers and the transport industry. *The main outputs of COMPASS will be a 'Handbook of ICT solutions for improving co-modality in passenger transport' and 'An assessment of the potential impact of ICT solutions on a co-modal transport system'.
Maturity	TRL7 (the TRL refers to ICT solution handbook online)
Link to REFINET high Level Service Infrastructure	SOCIAL/INCLUSIVE GREEN
Key performance Indicators	carbon emissions reductions

Year of project ends	2013
Further information	http://www.fp7-compass.eu/

Catalogue of R&I projects 78_ EWENT	
Field	**Description**
Technology title and keywords	impacts and damages in infrastructures due to climate change, mitigation strategies
Source of technology	EWENT - Extreme Weather impacts on European Networks of Transport / FP7-TRANSPORT / 233919
Lifecycle stage	Operation
Type of infrastructure	Applicable to all modes
Component of infrastructure	infrastructure, operations and indirect impacts (elements of supply chain)
Short Description	The project addresses the EU policies and strategies on climate change with particular focus on extreme weather impacts on EU transportation system. The goal of EWENT is to estimate and monetise the disruptive effects of extreme weather events on the operation and performance of the EU transportation system. The methodological approach is based on generic risk management framework that follows a standardised process starting from the identification of hazardous extreme weather phenomena, followed by impact assessment and concluded by mitigation and risk control measures. In detail, the project will: - Identify and define the hazards on EU transportation systems caused by extreme weather phenomena and develop relevant scenarios. - Estimate the probabilities of harmful scenarios caused by extreme weather - Estimate the consequences of extreme weather events based on developed scenarios - first on EU transport infrastructure, then on operations and finally on supply chains and mobility. - Monetise the harmful consequences per transport mode both on infrastructure and operations (including mobility and supply chain impacts). - Evaluate measures and options for negative impact reduction, control and monitoring in short and long-term. The short-term viewpoint is focused on monitoring processes and forecasting and warning/alarm services on weather phenomena. The long-term view provides the starting point for planning and standard setting. - Analysis of different management and policy options and strategies. EWENT will cover most transport modes (including passenger & freight): road, rail, aviation, waterways and light (pedestrians, cycling). The transport system is viewed from three angles: infrastructure, operations, and indirect impacts to third parties. EWENT will evaluate the efficiency, applicability and finance needs for adaptation and mitigation measures which will minimise the costs of extreme weather impacts.

Maturity	TRL6 (the output of this project is information inside documents. TRL probably not applicable)
Link to REFINET high Level Service Infrastructure	RESILIENCE
Key performance Indicators	deterioration of physical infrastructure (material damages)
Year of project ends	2012
Further information	http://ewent.vtt.fi/

Catalogue of R&I projects 79_ GETAWAY	
Field	**Description**
Technology title and keywords	fire safety, emergency route modifications
Source of technology	GETAWAY - (Generating simulations to Enable Testing of Alternative routes to improve WAYinding in evacuation of over-ground and underground terminals) / FP7-TRANSPORT / 265717
Lifecycle stage	Operation
Type of infrastructure	Applicable to all modes
Component of infrastructure	terminals, hubs
Short Description	Efficient evacuation from transport terminals is usually constrained by a lack of detailed knowledge of the geometry. In most cases, the population attempts to evacuate via the way they entered, bypassing or ignoring emergency exits. In serious fires, the inability to locate emergency exits can lead to loss of life as in the Kings Cross Underground Station (1988) and Düsseldorf airport (1996) fires. While terminal staff attempt to direct passengers to the most appropriate exits, they cannot be everywhere throughout the station and they may not be able to reach the population quickly enough. Throughout the world, emergency signage has traditionally been used to address this problem. However, recent research has shown that only 38% of people 'see' evacuation signage, even if the sign is located directly in front of them and their vision is unobstructed. GETAWAY will tackle this problem through the design and development of an Intelligent Active Dynamic Signage System (IADSS). Through the introduction of lit, flashing and running signs, the traditional static emergency sign will transformed into a Dynamic Signage System. The increased affordance offered by the DSS will significantly increase the detectability of the emergency exit sign. By linking the DSS to the alarm system, the DSS will only be activated when needed, thereby overcoming the 'learnt irrelevance' of emergency signs. Finally, the Active Dynamic Signage System will be linked to an automated system utilising evacuation simulation, CCTV footage and Fire Detection System information to determine the optimal evacuation route as the fire develops, bringing Intelligence to the ADSS. IADSS enables the terminal Incident Manager to direct passengers to the optimal egress route by activating the appropriate signs within the ADSS. The IADSS will be tested and validated through trials in the London Underground and

	Barcelona Metro. GETAWAY will bring the humble emergency exit sign into the 21st Century.
Maturity	TRL7
Link to REFINET high Level Service Infrastructure	SAFE
Key performance Indicators	emergency awareness time, reduction on emergency all-distances
Year of project ends	2014
Further information	http://www.getaway-project.eu/

Catalogue of R&I projects 80_ INTERCONNECT	
Field	**Description**
Technology title and keywords	co-operation and interaction among authorities and private companies
Source of technology	INTERCONNECT - INTERCONNECTION BETWEEN SHORT AND LONG-DISTANCE TRANSPORT NETWORKS / FP7-TRANSPORT / 233846
Lifecycle stage	Operation
Type of infrastructure	Applicable to all modes
Component of infrastructure	short and long-distance transport network

Short Description	INTERCONNECT is concerned with the role of local and regional connections in the context of growing importance of interregional passenger journeys in the European Union. Poor interconnectivity among different transport networks and among different scales of modal networks might compromise the objectives of integration of the TEN-T network investments and policy measures. The proposal addresses the potential for greater efficiency and reduced environmental impact of passenger transport by judicious encouragement of integration, co-operation and, where appropriate, competition in the provision of local connections, paying attention to land, air and maritime modes. Building on the attributes of a well-connected transport system identified in past research and policy documents, as well as on the review of available evidence on the extent and nature of problems affecting local connectivity for longer distance journeys, INTERCONNECT will develop an analytical approach to provide effective recommendations to national and European policy makers. The applicability of mechanisms for improving interconnectivity between the different network scales and between road, rail, maritime and air passenger modes of transport will be explored through a combination of literature reviews, interviews with key stakeholders and - above all - detailed investigation of selected case studies. The range and applicability of specified solutions, which will be tested in the project case studies, will take into account legal and institutional issues and will make use of policy measures like integrated pricing, and ticketing, improved links and interchanges, infrastructure pricing, strategic planning, information and marketing. While promoting take-up of organisational, administrative and technical best practice and coordination among policy makers, INTERCONNECT will also make a contribution to the wider use of analytical tools that are appropriate to this field at both European and local level.
Maturity	TRL4
Link to REFINET high Level Service Infrastructure	COST-EFFICIENT GREEN
Key performance Indicators	interconnectivity indicators, from economy and environmental perspective
Year of project ends	2011
Further information	http://www.interconnect-project.eu/

Catalogue of R&I projects 81_ OPTIMISM	
Field	**Description**
Technology title and keywords	Passenger new challenges, ICT solutions, strategies and recommendations for interconnectivity
Source of technology	OPTIMISM - Optimising Passenger Transport Information to Materialize Insights for Sustainable Mobility / FP7-TRANSPORT / 284892

Lifecycle stage	Design
Type of infrastructure	Multi-modal
Component of infrastructure	passenger transport behaviour
Short Description	OPTIMISM's main outcomes is the creation and development of different sets of strategies and methodologies for optimising passenger transport systems based on co-modality ICT solutions. OPTIMISM also takes into consideration the passenger needs and the carbon-neutral objective. The main scope is to provide a scientifically documented insight of the transport system and people's travel choices via the study of social behaviour, mobility patterns and business models. This will also allow to define future changes in the passenger's travel system that would lead to more sustainable method/mode(s) of travelling. OPTIMISM will base its operating principles in three main blocks of activities: 1. Identifying the gaps and harmonisation of data in travel behaviour. This will lead to a unified set of data that will serve as reference material for future exploitation of existing studies and baseline information (or data) 2. Definition of the demand and supply factors that shape the transportation system and mobility patterns. This will aim to give an outlook on future development(s) by modelling and scenario simulation and 3. Defining the potential decarbonisation of the passenger transport system and ensuring the sustainability of the system. The decarbonisation potential and co-benefits of best practice(s)/solutions will be based upon an analysis of ICT and co-modality options with an impact assessment of the research results The OPTIMISM partners will combine and utilise multidisciplinary skills, expertise, and on-going work in the fields of climate friendly transport, foresight, modelling, socio-economics, mobility behaviour, ITS and transport policy development. A network with Pan-European and beyond coverage, has been appointed to lead the dissemination relevant tasks in order to ensure the widespread dissemination of results but also to allow access to various information sources relating to national surveys.
Maturity	NA (no technology but methodology and strategy)
Link to REFINET high Level Service Infrastructure	SOCIAL/INCLUSIVE
Key performance Indicators	interconnectivity indicators
Year of project ends	2013
Further information	http://www.optimismtransport.eu/

Catalogue of R&I projects 82_SECCRIT	
Field	**Description**
Technology title and keywords	Cloud computing technologies, data protection
Source of technology	SEcure Cloud computing for CRitical infrastructure IT/ FP7-SECURITY/312758

Lifecycle stage	Operation
Type of infrastructure	Applicable to all modes
Component of infrastructure	passenger transport behaviour, ICT services
Short Description	Cloud Computing is a style of computing where elastic IT-related capabilities are provided as optimized, cost-effective, and on-demand utility-like services to customers using Internet technologies. Being one of the major trends in the IT industry recently, it has gained tremendous momentum and started to revolutionize the way enterprises create and deliver IT solutions. As more sectors adopt cloud services in their computing environment, the trend will also reach ICT services operating critical infrastructures (CI), such as transportation systems or infrastructure surveillance. Hosting CI services in the cloud brings with it security and resilience requirements that existing cloud offerings are not well placed to address. Due to the opacity and elasticity of cloud environments, the risks of deploying CI services in the cloud are difficult to assess – specifically on the technical level, but also from legal or business perspectives. Traditional IT security measures cannot fully tackle the issues (e.g. risk, trust, and resilience) arising from this paradigm shift, especially for operators and manufacturers of CI IT systems. Therefore, the mission of the SECCRIT project is to analyse and evaluate cloud computing technologies with respect to security risks in sensitive environments, and to develop methodologies, technologies, and best practices for creating a secure, trustworthy, and high assurance cloud computing environment for CI. In order to accomplish this mission, the objectives of the SECCRIT project are: identification of the relevant legal framework and establishment of respective guidelines, provision of evidence and data protection for cloud services; understanding and managing risk associated with cloud environments; understanding cloud behaviour in the face of challenges; establishment of best practice for secure cloud service implementations; and the demonstration of SECCRIT research and development results in real-world application scenarios.
Maturity	NA
Link to REFINET high Level Service Infrastructure	Safety/Security
Key performance Indicators	
Year of project ends	2015
Further information	https://www.seccrit.eu/

Catalogue of R&I projects 83_BRIDGE SMS	
Field	**Description**
Technology title and keywords	Climate, resilient, Bridge,

Source of technology	Bridge SMS - Intelligent Bridge Assessment Maintenance and Management System/ FP7-PEOPLE/612517
Lifecycle stage	Operation/maintenance/inspection
Type of infrastructure	Road/rail
Component of infrastructure	hydraulic vulnerability of bridges over water
Short Description	Government agencies, the public and private sectors and professional engineering sectors across Europe need to come together and proactively meet the challenge of creating a climate resilient infrastructure system. Managing National Infrastructure requires collaboration, planning and sharing of information between multiple sectors. This will reduce the risk of economic disruption to Europe and enable opportunities from well-managed infrastructure to be maximised. Adapting to climate change is not all about managing risks, it is about taking the opportunities it presents to develop innovative systems and services which are robust, efficient and valuable. The continual inspection, assessment and maintenance of bridges requires a multidisciplinary approach. Bridge inspection systems must have a knowledge and appreciation of structural engineering, geotechnics, hydraulics, hydrology, materials and transport management. BRIDGE-SMS will couple state-of-the art scientific knowledge in hydrology and river engineering with industrial knowledge in infrastructure management and web based bridge management systems to develop an open source cloud based intelligent decision support system for the assessment and management of the hydraulic vulnerability of bridges over water. This will be achieved through the secondment of staff and transfer of knowledge and skills between experts from UCC and UNIZAG (internationally renowned experts in the areas of hydrology and river engineering), NIVAS (experts in IT Systems Integration). Investing in engineering efforts to develop a system like BRIDGE-SMS to protect infrastructure is essential both to minimise risks to valuable assets, the public and the economy and to maximise opportunities to develop cost-effective and marketable solutions which can be applied to multiple sectors.
Maturity	NA
Link to REFINET high Level Service Infrastructure	Resilient, Security, Safety, cost effective
Key performance Indicators	Minimise risks to valuable assets, the public and the economy and to maximise opportunities to develop cost-effective and marketable solutions which can be applied to multiple sectors.
Year of project ends	2018
Further information	http://www.bridgesms.eu/

Catalogue of R&I projects 84_PROS	
Field	**Description**

Technology title and keywords	Road safety, post-crash safety
Source of technology	TROS - Priorities for Road Safety Research in Europe/FP7-TRANSPORT/314427
Lifecycle stage	Design/Operation
Type of infrastructure	Road
Component of infrastructure	Passenger transport behaviour, road
Short Description	In spite of all improvements in European road safety, almost 100 people are killed and about 40,000 get injured on European roads each day. The progress made so far is to a large extent based on intensive, publicly funded road safety research activities. While many "low-hanging fruits" in road safety have already been picked, a multitude of more specific research issues remains. With ICT opening up an enormous potential for new integrated safety applications, the research area of road safety is becoming broader and broader with the risk of diluting efforts. As a result of the political focus on the greening and electrification of road transport, the focus of European road transport research funding has moved away from safety topics increasing the need to identify those safety research topics which public money will be invested in most efficiently. Therefore, PROS is to establish a pan-European network to develop commonly agreed priorities in road safety research and overcome the current fragmentation in relevant stakeholder groups. This network will follow an integrated approach covering human, vehicle and infrastructure aspects and all phases from preventive to post-crash safety. The PROS concept starts from the identification of future safety research needs based on a review of future societal scenarios as well as existing research activities, agendas and roadmaps. These research needs will be subject to a transparent prioritisation and roadmapping process with maximum involvement of key stakeholders. The outcomes will be widely disseminated together with identified success stories to all interested parties. Following an iterative optimisation, the whole process will be ready for the long-term continuation of activities in a pan-European multi-stakeholder network. Due to maximum stakeholder involvement, PROS will achieve a substantial impact in increasing the return on investment in road safety research by providing commonly-agreed priorities to focus on.
Maturity	NA
Link to REFINET high Level Service Infrastructure	GREEN, Safety
Key performance Indicators	Prevent post-crash safety, improve road safety
Year of project ends	2014
Further information	http://www.pros-project.eu/

Catalogue of R&I projects 85_I-C-EU	
Field	**Description**
Technology title and keywords	Transport infrastructure
Source of technology	I-C-EU - Impact of Transport Infrastructure on International Competitiveness of Europe/FP7-TRANSPORT/314395
Lifecycle stage	Operation
Type of infrastructure	Multimodal
Component of infrastructure	passenger transport behaviour
Short Description	The transition process between the Lisbon Agenda and the Europe 2000 strategy plans happens exactly in the time when Europe is undergoing its hardest economic crisis since its formation. The objective of getting out of the crisis together with the urgent need to remains performance in the context of fiercer world economic competition especially against the new emerging economies has made Europe's competitiveness and economic performance fundamental issues. White Paper 2011 has summarized the main objective of European transport strategy which is to help establish a system that underpins European economic progress, enhances competitiveness and offers high quality mobility services while using resources more efficiently. In this sense, it is essential then first to clarify the relationship between the transport sector, economic growth and competitiveness and second, to elaborate a working framework so that transport policy intervention can effectively improve European economic growth and competitiveness. The I-C-EU will be a project that clarifies the relationship between transport infrastructure investment and its wider economic impacts, namely competitiveness and economic growth. This clarification will be made possible by exploring the state-of-the-art of the theoretical methodology of the assessment tools, analysing current and future situation of Europe while considering European strategy on growth and competitiveness. Using this triad of concept will allow I-C-EU to provide recommendations to the European Commission on making political intervention to enhance competitiveness of Europe.
Maturity	NA
Link to REFINET high Level Service Infrastructure	SOCIAL/INCLUSIVE
Key performance Indicators	interconnectivity indicators
Year of project ends	2014
Further information	http://www.i-c-eu.eu/

Catalogue of R&I projects 86_NEAR2

Field	Description
Technology title and keywords	Railway, Rail Research Network
Source of technology	NEAR2 - Network of European Asian Rail Research capacities/FP7-TRANSPORT/314254
Lifecycle stage	Operation
Type of infrastructure	Applicable to all modes
Component of infrastructure	infrastructure, passenger transport behaviour, freight
Short Description	The rapid development of Asian economies, particularly China, India and Russia has dramatically increased the trade volumes between Europe and Asia, with the largest trading partners of Europe actually being located in Asia. Nowadays, the most important trade loads are being transported between the two continents by sea. Railway transport, using the existing and new land routes for the Trans-Eurasian land bridge presents a viable alternative to the maritime routes, which is gaining significant momentum. Due to the origins and current nature of this rail land bridge, numerous issues need to be resolved to bring the system to a modern state of infrastructure, services and operations. Furthermore, to build the capacity to fully exploit the systems potential adaptation of new technologies, interoperability solutions and optimized operations should be considered. To support this objective, NEAR2 proposed the development of a Rail Research Network, drawing knowledge and expertise form leading institutions and researchers from both continents. The project capitalizes upon the existing structure and leverages the achievements of the existing European Rail Research Network and builds upon the reservoir of expertise of the proposed project partners gleaned from the most relevant past and on going research projects and other activities. The Network aims to become the resource arm of the relevant industry. NEAR2 will establish a unique, international, interdisciplinary research capacity with the goal of contributing in advancing a major sector of the regions' economy, as well as broaden the knowledge basis of the railway research and practice.
Maturity	NA
Link to REFINET high Level Service Infrastructure	SOCIAL/INCLUSIVE
Key performance Indicators	Broaden the knowledge bases of railway, improve railway network in Europe
Year of project ends	2014
Further information	http://cordis.europa.eu/project/rcn/105909_en.html

Catalogue of R&I projects 87_OPTIRAIL	
Field	**Description**
Technology title and keywords	Railway, safety, intelligence techniques, European railway corridors

Source of technology	Development of a smart framework based on knowledge to support infrastructure maintenance decisions in railway corridors/fp7-transport/314031
Lifecycle stage	Operation
Type of infrastructure	Rail
Component of infrastructure	railway corridors
Short Description	"In a context of wide use of transport, it is necessary to increase efficiency of the different transport modes as well as their interaction. To that effect, rail transport will play an important role in the future by increasing its capacity. Thus, it would be necessary to strength the competitiveness of railway ensuring a sustainable, efficient and safe service. In that sense, it is essential to improve the interoperability and safety of national networks in order to promote a single European Rail Market. Nevertheless, there are still several barriers to overcome as a consequence of the lack of a common definition of standards at European level. Within this framework, the main objective targeted by the OPTIRAIL project aims at developing a new tool, based on Fuzzy and Computational Intelligence techniques and validated through two case studies, that will enable the better cross-border coordination for decision making of railway infrastructure maintenance across the European railway corridors.
Maturity	NA
Link to REFINET high Level Service Infrastructure	Safety/Maintenance
Key performance Indicators	Improve the interoperability and safety of national networks, increase rail transport capacity
Year of project ends	2015
Further information	http://cordis.europa.eu/project/rcn/104890_en.html

Catalogue of R&I projects 88_NEWS	
Field	**Description**
Technology title and keywords	Water, logistics system, Waterway ship
Source of technology	NEWS - Development of a Next generation European Inland Waterway Ship and logistics system/ FP7-TRANSPORT/314005
Lifecycle stage	Operation
Type of infrastructure	Water
Component of infrastructure	Waterway

Short Description	"The proposed project "Development of a Next generation European Inland Waterway Ship and Logistics System" aims at: 1. developing and validating a novel container ship (hull) which will include the following TECHNICAL INNOVATIONS. 2. tailoring a special-designed and integrated logistics system which will include the complying LOGISTICAL INNOVATIONS. Concluding, the novel container ship will be able to meet operator's targeted costs, optimize time-management (reliability), answer to inland shipping-specific bottlenecks (e.g. low bridges, shallow waters), improve carbon footprints and thus successfully compete with road and railway transport. A significant modal shift is aspired, especially to the Danube and its hinterland. One of the main results will be a finance and business plan to bring the novel ship AND the required logistical concepts to the market, designed to reach EU 2011 White Paper and to strengthen the Danube region.
Maturity	NA
Link to REFINET high Level Service Infrastructure	Green, cost efficient
Key performance Indicators	increase transport efficiency, decrease of emissions, optimize time-management (reliability)
Year of project ends	2015
Further information	http://cordis.europa.eu/project/rcn/107662_en.html

Catalogue of R&I projects 89_ LAMPRE	
Field	**Description**
Technology title and keywords	Landslide events, innovative research, map landslide, modelling, recovery management
Source of technology	LAMPRE - LAndslide Modelling and tools for vulnerability assessment Preparedness and REcovery management/FP7-SPACE/312384
Lifecycle stage	Operation
Type of infrastructure	Multimodal
Component of infrastructure	passenger transport behaviour
Short Description	LAMPRE proposes to execute innovative research and technological developments to increase GMES limited operational capacity to cope with triggered landslide events and their consequences, in Europe and elsewhere. LAMPRE will enhance landslide risk mitigation/preparedness efforts and post-event-landslide recovery and reconstruction activities, in highly vulnerable geographic and geologic regions. The project improves the ability to detect/map landslides, assess/forecast the impact of triggered landslide events on vulnerable elements, and model landscape changes caused by slope failures. These goals are achieved by (i) researching and developing new techniques and products to dynamically integrate satellite/airborne imagery, (ii) designing and using intelligent image

	processing techniques, (iii) modelling landslide-infrastructure interactions using advanced numerical modelling and ground based thematic information, and (iv) proposing standards for landslide mapping, susceptibility zonation and image processing. Products of LAMPRE, including geo-processing tools, landslide inventory/susceptibility maps, vulnerability/impact assessments, and standards and best practices, will be beneficial to Civil Protection authorities, environmental, agricultural and forestry agencies, organizations managing transportation networks, and Emergency Response and Land Monitoring GMES services. Results of LAMPRE will be relevant to the EU strategy for the prevention, preparedness and response to natural hazards, and the protection of people, property, infrastructures and the environment, to implement the EU Soil Thematic Strategy, and to the design of novel GMES landslide services based on images taken by the ESA Sentinel-2 satellites. To facilitate up take by users and cross boundary cooperation, LAMPRE will test products and services in a range of physiographical and geographical regions, and will use the advice of a specific international stakeholder user group.
Maturity	NA
Link to REFINET high Level Service Infrastructure	SOCIAL/INCLUSIVE
Key performance Indicators	To improve the ability to detect/map landslides, assess/forecast the impact of triggered landslide events on vulnerable elements, and model landscape changes caused by slope failures
Year of project ends	2015
Further information	http://cordis.europa.eu/project/rcn/106788_en.html

Annex 4 - REFINET Geo-Clustering Platform Storyboards

To illustrate the use of the REFINET platform, two storyboards have been developed, as follows:

- **Story board #1: Profile**: stakeholder in the road sector; **aim** is to check the technologies developed in the European Project in the road sector, with particular focus on "Energy Management" topic
- **Story board #2: Profile**: Public Officer; Aim is to study national strategic plans for transport infrastructure development, verify national funding priorities and check previously funded projects at european level.

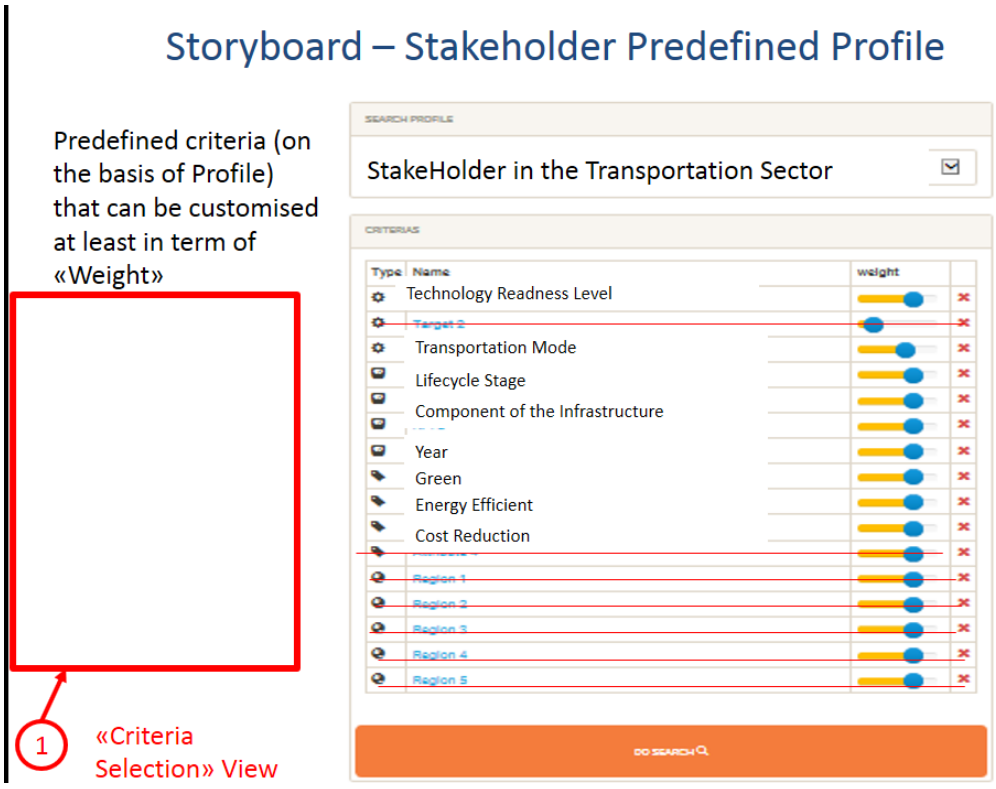
Story board #1

Profile: A private Stakeholder in the road sector

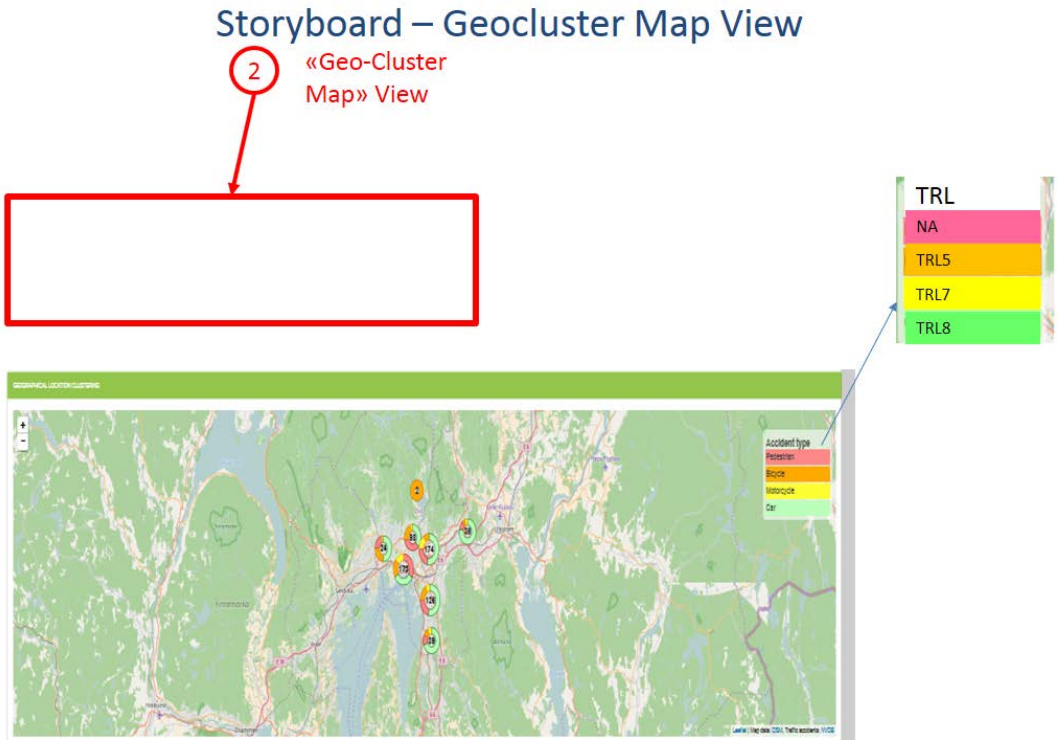
The **aim** of the stakeholder is to check the technologies developed in European Projects in the road sector, with particular focus on "Energy Management" topic

Step by step process:

1. Since the TRL parameter is a very important piece of information to understand the possibility of the transfer of the research results to the industrial/operational phase, the Stakeholder assigns in his/her predetermined profile a "High" importance to the "TRL" criterion.



2. The Geographical map view shows to the stakeholder the geographical distribution of Use Case Scenario put in place to test the technologies with different TRL. For all the project related to the "Road" Transportation Mode



3. These are the project coming from the Platform selecting the "Road Transport" mode. A "Use Case Scenario Location" search criterion is also available to understand the location of the demonstration phase:

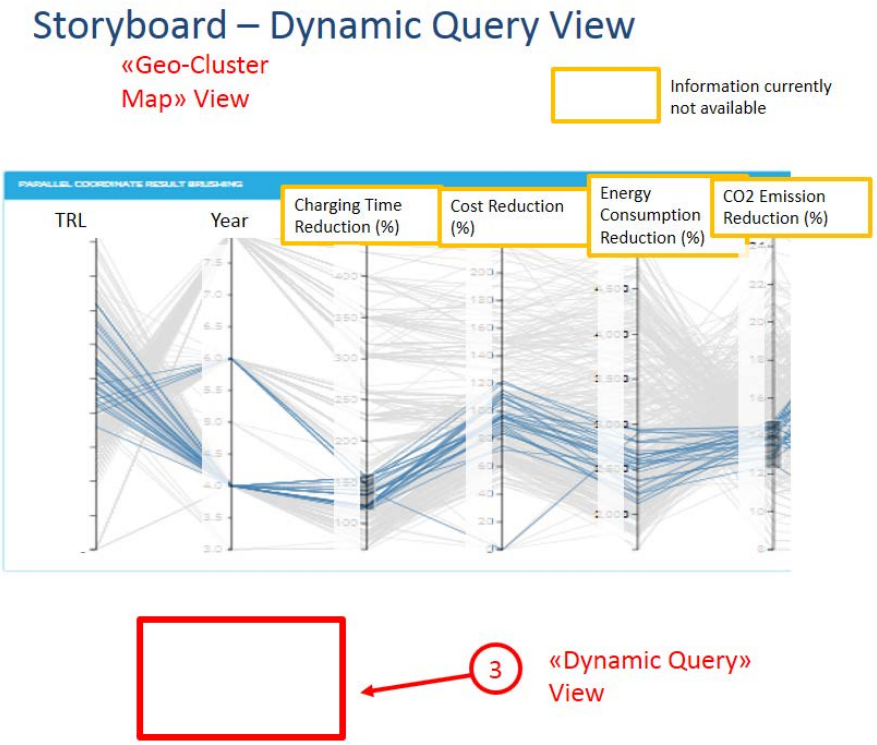
Acronym	Title	Transport mode	Lifecycle stage	Component of infrastructure / comments	TRL	Use Case Scenario Location
VRA	Support action for Vehicle and Road Automation network	Road	Operation	automation of vehicle driving	N/A	SE-Gothenburg, Yvelines, France, A9 Corridor Germany, A270 and N270 roads between the cities of Helmond and Eindhoven
HERMES	Innovative, Highly Efficient Road Surface Measurement and Control System	Road	Operation	pavement	8	Estonia
Local4Global	SYSTEM-OF-SYSTEMS THAT ACT LOCALLY FOR OPTIMIZING GLOBALLY	Road	Operation	Traffic management	NA	A test bed in the north of Munich, Germany was defined to introduce the Local4Global Traffic Use Case into practice. The road section of the arterial road B 13 between the

Acronym	Title	Transport mode	Lifecycle stage	Component of infrastructure / comments	TRL	Use Case Scenario Location
						highway junction Unterschleissheim in the north and the junction of the federal roads B 13 and B 471 in the south has two lanes per driving direction and consists of 7 signalized intersections.
MOBINCITY	SMART MOBILITY IN SMART CITY	Road	Operation	Fully electric vehicle - communication among vehicle, traffic and transport infrastructure to improve the autonomy range of FEV	5	Ljubljana, Rome
eCo-FEV	efficient Cooperative infrastructure for Fully Electric Vehicles	Road	Construction	Fully Electric Vehicle integration	6	Grenoble in the county of Isère, A32 motorway near Susa in the North of Italy
EMERALD	Energy ManagEment and RechArging for efficient eLectric car Driving	Road	Operation	ITS & Management	6	Lucca (Tuscany, Italy), interurban region between Bilbao, Vitoria-Gasteiz and Donostia-San Sebastian (Basque Country, Spain),
FastInCharge	Innovative fast inductive charging solution for electric vehicles	Road	Design	Electric vehicle charging infrastructure	7	Douai (France)
UNPLUGGED	Wireless charging for Electric Vehicles	Road	Design	EV, charging infrastructure	7	London, Barcelona
LCE4ROADS	Life Cycle Engineering approach to develop a novel EU-harmonized sustainability certification system for cost-effective, safer and greener road infrastructures	Road	Design	pavement	7	NA
SWARM	Demonstration of Small 4-Wheel fuel cell passenger vehicle Applications in Regional and Municipal transport	Road	Design	Fuel cell passenger vehicle	8	UK: Midlands, Plymouth; Brussel Area and Wallonia; Weser-ems region in north-west Germany

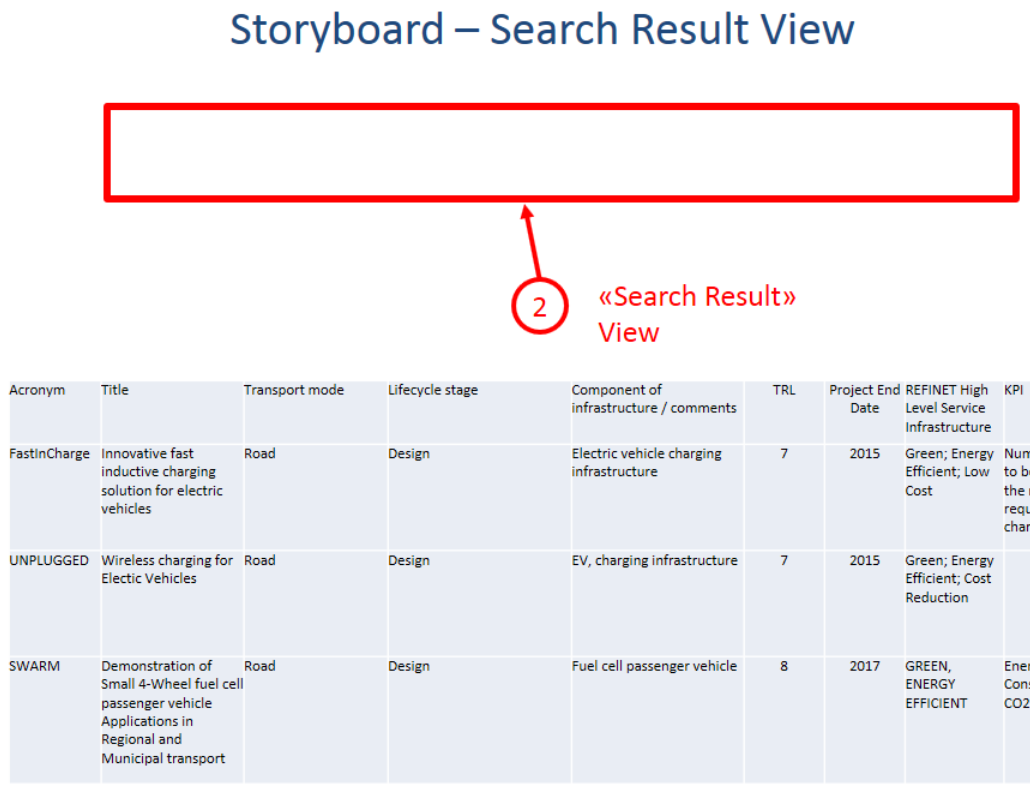
4. The Stakeholder is interested in the "Energy Management" topic related to the design of vehicles. Selecting the **"Design"** *Lifecycle stage* and the "**Vehicle"** as keyword associated to the "Component of infrastructure", the following project are the results of the search process:

Acronym	Title	Transport mode	Lifecycle stage	Component of infrastructure / comments	TRL	Project End Date	Use Case Scenario Location	REFINET High Level Service Infrastructure	KPI
FastInCharge	Innovative fast inductive charging solution for electric vehicles	Road	Design	Electric vehicle charging infrastructure	7	2015	Douai (france)	Green; Energy Efficient; Low Cost	Number of cars to be charged on the roads; Time required for charging
UNPLUGGED	Wireless charging for Electic Vehicles	Road	Design	EV, charging infrastructure	7	2015	London, Barcellona	Green; Energy Efficient; Cost Reduction	
SWARM	Demonstration of Small 4-Wheel fuel cell passenger vehicle Applications in Regional and Municipal transport	Road	Design	Fuel cell passenger vehicle	8	2017	UK:Midlards,Plymouth; Brussel Area and Wallonia; weser-ems region in north-west Germany	GREEN, ENERGY EFFICIENT	Energy Consumption; CO2 Emission

5. The “dynamic query view” uses the criteria with high importance (see “criteria selection” view) that can be in some quantify at least in term of % of reduction (e.g. % of noise reduction) or improvement (e.g. % of enhanced availability). Example of such kind of criteria are the Key Performance Indicator associated to the technologies.



6. Eventually the search provides the Stakeholder with a list of three projects most relevant to his/her initial search. Next steps – including for example getting in touch with the project coordinator and/or technology owner to get further information – can take place offline.



Acronym	Title	Transport mode	Lifecycle stage	Component of infrastructure / comments	TRL	Project End Date	REFINET High Level Service Infrastructure	KPI
FastinCharge	Innovative fast inductive charging solution for electric vehicles	Road	Design	Electric vehicle charging infrastructure	7	2015	Green; Energy Efficient; Low Cost	Number of cars to be charged on the roads; Time required for charghing
UNPLUGGED	Wireless charging for Electic Vehicles	Road	Design	EV, charging infrastructure	7	2015	Green; Energy Efficient; Cost Reduction	
SWARM	Demonstration of Small 4-Wheel fuel cell passenger vehicle Applications in Regional and Municipal transport	Road	Design	Fuel cell passenger vehicle	8	2017	GREEN, ENERGY EFFICIENT	Energy Consumption; CO2 Emission

Story board #2

Profile: Public Officer

Aim of the search: Public Officer is interested in analyzing the strategic plan of few countries related to transportation infrastructures development, verifying national funding priorities and checking the funded projects at European level

Step by step process:

1. Prior to start his/her search, the Public Officer will have detailed his/her priorities in a predefined profile

2. The Public Officer starts the search with the REFINET Platform by analysing the EU and national documents describing the status of EU and national transportation infrastructure. The data includes the following documents (more will be added an on-going basis):

TITLE	TYPE	COMMENTS	YEAR
1. Corridor studies	EU STUDY	State of play and the development needs of the TEN-T core network corridors. Identification of critical issues and corridor development objectives. 9 reports	2015
2. 2015 EU Transport Scoreboard	EU STUDY	The scoreboard can be consulted either by country and/or by one of the following categories: people, Internal Market: invest and infrastructure and Energy Union and innovation	2015
3. Infrastructure in the EU	EU STUDY	First chapter describes the evolution of physical infrastructures in inland transport in Member States. It also assesses the improvement in the quality of infrastructures in Member States.	2014
4. EU road surfaces	EU STUDY	This study looks at the condition and the quality of road surfaces in the EU and at the trends registered in the national budgets on the road maintenance activities in recent years, with the aim of reviewing the economic and safety consequences of the lack of regular road maintenance. The authors investigate the key causes behind the registered variations identified and the consequent impacts on road safety; they recommend therefore a series of actions and best practices to help preserve the safety and quality of the EU road surfaces	2014
5. White Paper on transport	EU STUDY		2011
6. ERF Yearbook 2014-	European Road	Road Network, Infrastructure Financing and Road	2015

TITLE	TYPE	COMMENTS	YEAR
2015	Federation Statistics Handbook	Maintenance and Investment data	
7. Operational Programme "Transport and Transport Infrastructure" 2014-2020. Bulgaria	Structural Funds. Bulgaria	Countries that include financing priorities related to Transport infrastructures	2014
8. Partnership agreement for the European structural and investment funds in the eu financial period 2014-2020	Structural Funds. Croatia		2014
9. Partnership agreement for the programming period 2014–2020	Structural Funds. Czech Republic		2014
10. Investment Funds Partnership Agreement for the use of European Structural and Investment Funds 2014-2020	Structural Funds. Estonia		2014
11. Spain-EC PARTNERSHIP AGREEMENT FOR THE PROGRAMMING PERIOD 2014–2020 (Spanish language)	Structural Funds. Spain		2014
12. Operational Programme: Fostering a competitive and sustainable economy to meet our challenges Financed through the ERDF and the Cohesion Fund	Structural Funds. Malta		2014
13. Operational Program 2014-2020 (Portuguese language)	Structural Funds. Portugal		2014
14. Romanian partnership agreement for the 2014-2020 programming period	Structural Funds. Romania		2014
15. Transport and infrastructure in Poland: the current state and projects for the future	Department of Regional Economics, University of Economics, Cracow, Poland		2005
16. Report about the state of infrastructures in Italy (Italian language)	Union trasporti report		2011

TITLE	TYPE	COMMENTS	YEAR
17. National Infrastructure Delivery Plan 2016 to 2021	UK Policy paper	This document sets out in detail how the government will support the delivery of key infrastructure projects and programmes to the end of this Parliament.	2016
18. Strategic Plan of Infrastructures and transport 2005-2020	Spain	Chapter DIAGNOSIS OF THE TRANSPORT SYSTEM: THE NEED FOR A CHANGE OF HEADING Available English version	2005
19. Strategia nazionale di specializzazione intelligente	Italy		2014

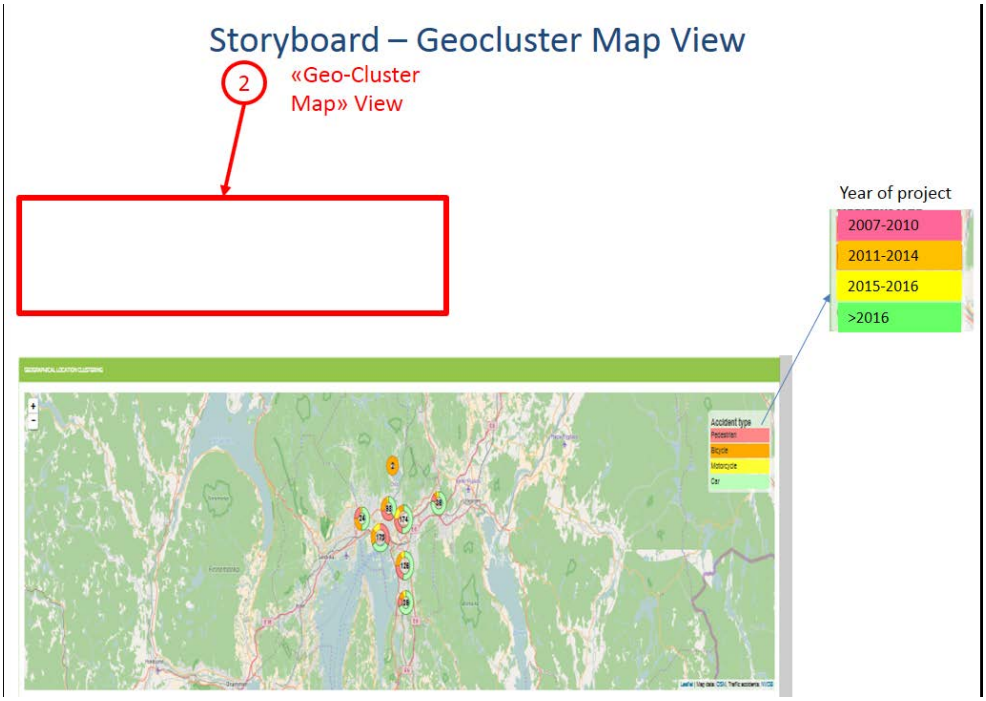
3. The Public Officer selects the Italian Strategic Plan (row#19) and verifies past Italian investments in Research and Development; she/he gets access to useful statistical information regarding the investments in the country: "*Gli investimenti in R&S sono particolarmente rilevanti per l'area Mobilità sostenibile. Secondo le indagini più recenti rappresentano per il complesso del settore circa il 2,6% del fatturato industriale, incidenza che aumenta sensibilmente per alcuni specifici comparti (ad esempio è superiore al 3% per il settore automotive e ferroviario). In sintesi, i parametri nazionali degli investimenti in R&S dell'ambito mobilità sostenibile sono allineati con la media dei valori europei. Con riferimento al posizionamento della produzione scientifica italiana, si rileva un buon posizionamento del Paese nel settore. In Italia la produzione scientifica si attesta su circa 31.000 pubblicazioni nel settore con una crescita del 57.2% rispetto al 2001 in leggero calo con la media europea (63.6%).*"

4. Then the Public Officer looks for Italian funds available for future research projects:

Purpose	Funding priorities	Funds	Expected impacts (relevant to REFINET)	Managing authorities
OP on "Infrastructures and Networks" (PON Infrastrutture e Reti 2014-2020): re-balance the Italian transport system, currently characterised by a predominance of road traffic, by modernising and extending sustainable transport modes for passengers and freight, along the Trans-European core transport network TEN-T in less developed regions. The programme will focus on actions in three sectors: railways, port infrastructure and intelligent transport systems. The competitiveness of key ports and multimodal logistic platforms will be improved through appropriate intermodal connections with inland transport. Highways and road	01) Supporting a multimodal Single European Transport Area by investing in the TEN-T network (total funding: EUR 1,095m, 62%) 02) Developing and improving environmentally-friendly (including low-noise) and low-carbon transport systems, including inland waterways and maritime transport, ports, multimodal links and airport infrastructure, to promote	ERDF & National funds: Fondo di rotazione nazionale (€ 460.933.334)	01) Supporting a multimodal Single European Transport Area by investing in the TEN-T network (total funding: EUR 1,095m, 62%) (02) Developing and improving environmentally-friendly (including low-noise) and low-carbon transport systems, including inland waterways and maritime transport, ports, multimodal links and airport infrastructure, in order to promote sustainable regional and local mobility (total funding EUR 684.2 million, 38%)	Ministero delle Infrastrutture e dei Trasporti - Direzione Generale per lo Sviluppo del territorio, Sistemi informativi e statistici: Divisione II - Programmi europei e nazionali per le reti e la mobilità Via Nomentana, 2 00161 Roma

arteries will not be co-financed by this programme. Focus regions: Basilicata, Calabria, Campania, Puglia and Sicilia; will invest in 3 sectors: railway and port infrastructure and intelligent transport systems.	sustainable regional and local mobility (total funding EUR 684.2 million, 38%)			

5. Then, thanks to the Geographical map view, the Public Officer can check the geographical distribution of past European Project funded in different years:

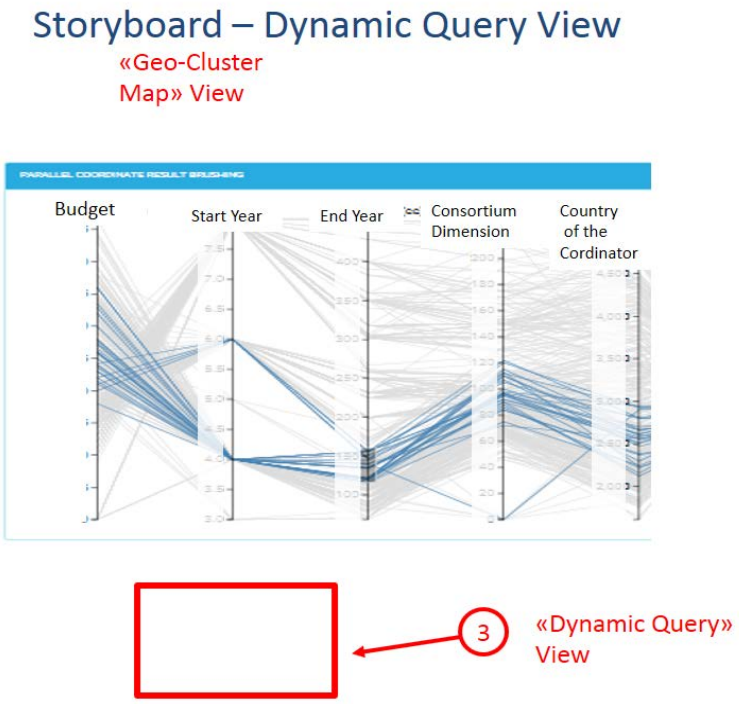


6. The Public Officer selects all past European Projects with an Italian Coordinator:

Acronym	Title	Programme	Start date	End date	EU Contribution to Coordinator
INTER-TRUST	Interoperable Trust Assurance Infrastructure	FP7-ICT	01/11/2012	30/04/2015	€552,266
ICSI	Intelligent Cooperative Sensing for Improved traffic efficiency	FP7-ICT	01/11/2012	31/12/2015	€483,858
EMERALD	Energy ManagEment and RechArging for efficient eLectric car Driving	FP7-ICT	01/10/2012	30/06/2016	€598,430
AIRTN-NextGen	Air Transport Network – Next Generation	FP7-TRANSPORT	01/12/2013	30/09/2016	€68,095
STRUCTURES	Strategies for the Improvement of Critical infrastructure Resilience to Electromagnetic Attacks	FP7-SECURITY	01/07/2012	31/10/2015	€456 440
IRUSAT	Improving Resilience of Urban Societies through Advanced	FP7-PEOPLE	01/07/2014	30/06/2017	€351,295.60

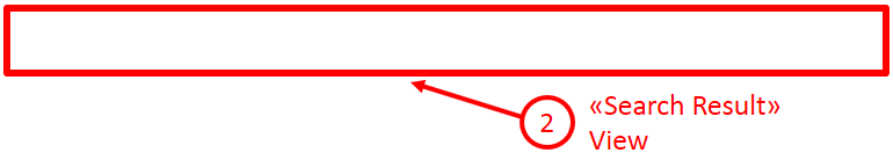
	Technologies				
LAMPRE	LAndslide Modelling and tools for vulnerability assessment Preparedness and REcovery management	FP7-SPACE	01/03/2013	28/02/2015	€625,541
GREENRAIL	Greenrail: sustainability, safety and saving in the railroad sleeper of tomorrow	H2020-EU.3.4	01/02/2015	01/08/2015	€50,000

7. The "dynamic query view" can be used to refine the search by Budget, Start Year, end year consortium dimension and country of the coordinator. The Public Officer selects "completed project", "year <2016" with an "EU contribution for the coordinator >€400,000":



8. Four projects are highlighted as most relevant to the Public Officer's search. Next steps – such as contacting the project coordinator to get further information about the Technology, etc. – will take place offline.

Storyboard – Search Result View



Acronym	Title	Programme	Start date	End date	Eu Contribution to Coordinator	URL
INTER-TRUST	Interoperable Trust Assurance Infrastructure	FP7-ICT	01/11/2012	30/04/2015	552 266 eur	http://cordis.europa.eu/project/rcn/105295_en.html
ICSI	Intelligent Cooperative Sensing for Improved traffic efficiency	FP7-ICT	01/11/2012	31/12/2015	483 858 eur	http://cordis.europa.eu/project/rcn/105540_en.html
STRUCTURES	Strategies for the Improvement of Critical infrastructure Resilience to Electromagnetic Attacks	FP7-SECURITY	01/07/2012	31/10/2015	456 440 eur	http://cordis.europa.eu/project/rcn/104107_en.html
LAMPRE	LAndslide Modelling and tools for vulnerability assessment Preparedness and REcovery management	FP7-SPACE	01/03/2013	28/02/2015	625 541 EUR	http://cordis.europa.eu/project/rcn/106788_en.html

Annex 5 - EU28 Transport Scoreboard – Analysis performed within REFINET

To complement what presented in Section 1.2, more information of data/ranking (taking as source the Transport Scoreboard) are reported in what follows.

Country	Quality of railroad infrastructure	Ranking
ES	5,98	1
FI	5,92	2
FR	5,89	3
DE	5,66	4
NL	5,62	5
AT	5,29	6
LU	5,03	7
BE	4,92	8
UK	4,89	9
SE	4,54	10
DK	4,51	11
CZ	4,51	11
LT	4,5	13
PT	4,44	14
SK	4,4	15
IT	4,14	16
IE	4,1	17
LV	4,1	17
HU	3,78	19
EE	3,71	20
SI	3,36	21
BG	3,03	22
PL	2,93	23
EL	2,87	24
HR	2,86	25
RO	2,86	25
CY	-1	27
MT	-1	27

Country	Quality of port infrastructure	Ranking
NL	6,81	1
FI	6,38	2
BE	6,37	3
ES	5,82	4
DK	5,79	5

DE	5,67	6
UK	5,61	7
SE	5,6	8
EE	5,6	8
MT	5,54	10
PT	5,42	11
IE	5,32	12
LV	5,22	13
FR	5,2	14
SI	4,99	15
CY	4,87	16
LT	4,85	17
EL	4,72	18
HR	4,6	19
IT	4,47	20
BG	4,18	21
PL	3,97	22
RO	3,39	23
AT	-1	24
LU	-1	24
CZ	-1	24
HU	-1	24
SK	-1	24

Country	Quality of Air transport infrastructure	Ranking
NL	6,45	1
FI	6,17	2
ES	6	3
DE	5,94	4
BE	5,9	5
FR	5,81	6
PT	5,7	7
SE	5,67	8
IE	5,58	9
DK	5,56	10
CZ	5,55	11
UK	5,52	12
MT	5,48	13
LU	5,42	14
AT	5,41	15
LV	5,35	16

EL	5,16	17
CY	5,06	18
SI	4,45	19
BG	4,32	20
IT	4,29	21
LT	4,19	22
HR	4,19	22
HU	4,11	24
PL	4,02	25
EE	3,78	26
RO	3,62	27
SK	3,37	28

Country	Quality of roads	Ranking
PT	6,34	1
AT	6,27	2
FR	6,17	3
NL	6,14	4
ES	5,91	5
DE	5,88	6
FI	5,87	7
LU	5,71	8
HR	5,62	9
SE	5,5	10
DK	5,43	11
CY	5,31	12
IE	5,27	13
BE	5,25	14
UK	5,18	15
LT	4,94	16
SI	4,9	17
EE	4,39	18
EL	4,32	19
IT	4,26	20
HU	4,25	21
CZ	3,7	22
SK	3,69	23
MT	3,65	24
PL	3,55	25
BG	3,14	26
LV	3,09	27

RO	2,75	28

Country	Top performers	Medium performers	Low performers
NL	3	1	0
FI	4	0	0
ES	4	0	0
DE	4	0	0
FR	3	1	0
AT	1	2	0
BE	2	2	0
PT	2	2	0
LU	1	2	0
SE	1	3	0
DK	1	3	0
UK	0	4	0
CY	0	3	0
IE	0	4	0
MT	0	2	1
LT	0	4	0
CZ	0	2	1
LV	0	3	1
SI	0	3	1
EE	0	3	1
HR	0	3	1
IT	0	4	0
EL	0	3	1
HU	0	3	0
SK	0	1	2
BG	0	2	2
PL	0	2	2
RO	0	0	4

REFERENCES

A number of REFINET Deliverables are referenced in this document, as follows:

D3.2 Best Practice in design, building and maintenance of transport infrastructure

D3.3 Catalogue of technologies for multi-modal transport infrastructure

D3.4 REFINET Strategic Implementation Plan (SIP)

Other source of information used to create this report:

European Commission, European Semester Thematic Fiche Transport http://ec.europa.eu/europe2020/pdf/themes/2016/transport_201605.pdf, May 2016

Internazionale, http://www.internazionale.it/, July 2016

McKinsey, "Using 'asset genetics' to unlock hidden capital", By Janna de Groot and Ashay Prabhu, http://www.mckinsey.com/industries/infrastructure/our-insights/using-asset-genetics-to-unlock-hidden-capital?cid=other-soc-lkn-mip-mck-oth-1607&kui=IDn5kwzg83LVR1keZHYk3Q, July 2016

Transportation Research Forum, Multimodal Infrastructure Investment Decision Making: An Institutional and Funding Perspective by Travis P. Dunn and Joseph M. Sussman, http://www.trforum.org/journal/downloads/2011v50n2_02_MultimodalInfrastructure.pdf, summer 2011

Federal Highway Administration (US) "Best Practices in GIS-Based Transportation Asset Management", https://www.gis.fhwa.dot.gov/documents/gis_assetmgmt.pdf, January 2012

European Transport Scoreboard, http://ec.europa.eu/transport/facts-fundings/scoreboard/index_en.htm
Infrastructure - TEN-T - Connecting Europe Multi-Annual Work Programmes available at: http://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/project-funding/work-programmes_en.htm

European Social and Investment Funds (ESIF), http://ec.europa.eu/contracts_grants/funds_en.htm

European Regional Development Fund (ERDF) http://ec.europa.eu/regional_policy/en/funding/erdf/

European Social Fund (ESF), http://ec.europa.eu/regional_policy/en/funding/social-fund/
Cohesion Fund (CF), http://ec.europa.eu/regional_policy/en/funding/cohesion-fund/

Interreg Europe http://www.interregeurope.eu

Research and Innovation Observatory Country reports, Italy https://rio.jrc.ec.europa.eu/en/country-analysis/Italy/country-report and Romania https://rio.jrc.ec.europa.eu/en/country-analysis/Romania/country-report, 2015

Romania General Transport Master Plan and Rail System, http://www.europarl.europa.eu/RegData/etudes/IDAN/2015/540376/IPOL_IDA(2015)540376_EN.pdf, 2015

Climate Change Post, http://www.climatechangepost.com/romania/transport-infrastructure-and-building/, 2016