

THE ISSUE PROGRAMME OF INNOVATION IN SUSTAINABLE TRANSPORT AND INTELLIGENT MOBILITY:

The Application of ICT and Downstream Space Data Products & Services to Improve the Economic, Environmental & Social Health of Cities & Regions across Europe (2014-2020)



PREFACE

THE ISSUE Project was a Coordination and Support Action that received funding from the European Union's Seventh Framework Programme, under the 'Regions of Knowledge' initiative from December 2011 to November 2014. The Project was delivered by a Consortium of 13 core partners in four European regional 'triple'helix' research-driven clusters and supported by eight European associate regions.

The vision for THE ISSUE Project was to realise the potential for technology transfer from newly emerging and existing applications of ICT and Downstream Space Data Products & Services into the intelligent mobility and sustainable transport sectors to address key transport and urban mobility challenges impacting on the economic, environmental and social health of cities and regions. THE ISSUE's key output was its pioneering and state-of-the-art **Programme of Innovation in Sustainable Transport and Intelligent Mobility (2014-2020)**. This document provides a detailed description of the Programme.

THE ISSUE **Programme of Innovation in Sustainable Transport and Intelligent Mobility (2014 to 2020)** identifies a range of innovation actions that will deliver new economy-driving, environmentally-sensitive transport and urban mobility solutions that match both the vision and interest of markets and the key priorities of transport, urban mobility and environmental impact policy makers.

The Programme is structured into six challenge areas, which reflect the highest priorities in the transport and urban mobility sector where innovation and exploitation of newly-emerging and existing technologies could offer major advances towards the operational implementation and market growth of new innovations in intelligent traffic management and urban mobility. These challenge areas relate closely to Horizon 2020's Societal Challenges and its theme of 'Smart, Green and Integrated Transport'. They also respond to important external policy drivers from EU transport, air quality and climate change directives.

This Programme identifies 46 innovation action responses. Each innovation action is based on a strong evidence of need and capable of being supported through harnessing RTD activities and competencies found within THE ISSUE Consortium. Many of the innovation actions identified in the Programme are already sufficiently mature to be the subject of proposals for funding and have been highlighted as high priority projects. These actions have a pan-European perspective and will be taken forward in a collaborative approach by THE ISSUE Meta-Cluster through developing project consortia comprising of appropriate partners from within THE ISSUE Consortium. The recommended funding route for these priority actions is through European funding such as Horizon 2020.

The Programme will help support the modernisation of the transport sector through developing smart, upgraded and fully interconnected transport and urban mobility solutions. It will make a significant contribution towards the EU's "Smart, Green and Integrated Transport" agenda and deliver significant socio-economic impacts at regional and urban level, through stimulating supply chain development, business growth and the creation of new and better jobs. It will also offer programme planners for Horizon 2020 and other EU Programmes a clear evidence base for future work programme priorities. In particular, the expected impacts of the Programme are:

- *Exploiting space based applications from Galileo and Copernicus in areas such as traffic congestion and transport-related health and environmental impacts.*
- *Advancing the work on Trans-European transport networks*
- *Fostering cross-transport Intermodality and promoting modal shift*
- *Encouraging seamless travel*
- *Enabling existing road infrastructure to become more effective and efficient;*
- *Reducing greenhouse gas emissions from the transport sector*
- *Improving the safety and security of citizens*

THE ISSUE PROJECT OVERVIEW

THE ISSUE (*Transport, Health and Environment: Intelligent Solutions Sustaining Urban Economies*) Project was awarded €2.75 million over a three year period from the European Union's Seventh Framework Programme for research, technological development and demonstration under Grant Agreement No. 2011-287088. It was a "Coordination & Support Action" supported through the "Regions of Knowledge" Initiative. The Project was launched in December 2011 by a Consortium of 13 core partners in four European regional research-driven clusters. Eight associate regions joined the Project as part of a mentoring and knowledge exchange programme, bringing further expertise into the Project. The Project successfully completed its programme of work on 30 November 2014.

The Mission Statement for THE ISSUE Project was *"to identify opportunities to exploit newly-emerging and existing technologies, particularly in fields relating to ICT and Space Technologies, to deliver major advances towards the operational implementation and market growth of innovations in intelligent traffic management and urban mobility to improve the economic environmental and social health of cities & regions across Europe"*.

THE ISSUE created a vibrant network of 12 European regional research-driven clusters with common interests and expertise in the fields of Transport, Health and the Environment and a shared desire to identify intelligent solutions for sustaining urban environments. Each cluster is based on a "triple-helix" concept and includes representatives from industry, research institutions & local government, with active research and technological development (RTD) programmes that mapped on to their local and/or regional transport and urban mobility policy priorities.

Through a proactive knowledge exchange and dissemination programme, THE ISSUE Project brought together and coordinated already-existing and projected RTD programmes, particularly in fields relating to ICT and Downstream Space Data Products and Services. In parallel, consultations with participating regional and local authorities led to the identification of economic priorities, specific to the themes of Transport, Health and the Environment. This was followed by tensioning potential RTD actions against regional and local economic objectives to identify a coordinated programme of innovation action responses that exploited the RTD competencies within THE ISSUE Consortium and addressed six key transport and urban mobility challenge areas

The principle achievements of THE ISSUE Project were:

1. Developing *THE ISSUE Programme of Innovation in Sustainable Transport & Intelligent Mobility: The Application of ICT and Space Technologies to Improve the Economic, Environmental & Social Health of Cities & Regions* (2014-2020)
2. Defining a *Roadmap for Innovation in Transport and Urban Mobility through the application of ICT and Space Technologies* to improve the economic, environmental and social health of cities and regions
3. Championing a new dynamic for university-industry-government relationships in promoting innovation
4. Developing new perspectives on future patterns of urban mobility
5. Creating an extensive European network of collaborative partners
6. Expanding the "triple-helix" research-driven cluster concept into new European regions
7. Establishing a new legal entity, THE ISSUE Meta-Cluster, a new European Special Interest Group in transport-health-environment.
8. Delivering a major programme of mentoring and knowledge exchange
9. Producing a major new publication: "Space and ICT Applications Supporting Smart, Green, Integrated Transport and Urban Mobility"

THE ISSUE PROJECT

CORE PARTNERS

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5. Infoterra Limited/Airbus Defence and Space (Infoterra), East Midlands Region, UK
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8. Intergraph Polska Sp Zoo (Intergraph), Mazovia Region, Poland
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12. Aerospace Valley (AV), Midi-Pyrenees/Aquitaine Regions, France
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1. THE ISSUE PROJECT: PURPOSE, FOCUS AND STRUCTURE

1.1 Introduction

THE ISSUE (*Transport, Health and Environment: Intelligent Solutions Sustaining Urban Economies*) Project was awarded €2.75 million over a three year period from the European Union's Seventh Framework Programme for research, technological development and demonstration under Grant Agreement No. 2011-287088. It was a "Coordination & Support Action" supported through the "Regions of Knowledge" Initiative. The Project was launched in December 2011 by a Consortium of 13 core partners in four European regional research-driven clusters. The Project successfully completed its programme of activities on 30 November 2014. This chapter provides an overview of the purpose, focus and structure of THE ISSUE Project.

1.2 Project Overview and Key Achievements

THE ISSUE Project focussed on fostering cooperation, development and collaboration between European regional research-driven clusters to identify innovative new technological solutions to address some of the key challenges faced by urban and regional transport authorities in relation to the economic, environmental and social health of cities and regions. THE ISSUE's principle aim was to identify and harness relevant newly-emerging and existing Information & Communications Technologies and Downstream Space Data Products and Services found within THE ISSUE Consortium capable of supporting the development of new research-based or innovation-driven solutions that can deliver major advances towards the operational implementation and market growth of innovations in intelligent traffic management and urban mobility.

The primary achievement of THE ISSUE Project was the preparation of a pioneering and state-of-the-art **"Programme of Innovation in Sustainable Transport and Intelligent Mobility: The Application of ICT and Space Technologies to Improve the Economic, Environmental & Social Health of Cities & Regions (2014-2020)"**. This Programme identifies a range of innovation action responses that will deliver major advances towards the development of new and viable economy-driving, environmentally sensitive, transport and urban mobility solutions that match the vision and interest of markets and transport, urban mobility and environmental impact policy makers. The Programme will be implemented by THE ISSUE Consortium over the period to 2020 by securing appropriate EU and national funding to conduct pilot studies, demonstration programmes and pre-operational roll-out to demonstrate the market readiness of these new technological solutions.

Implementing the Programme will help support the modernisation of the transport sector through developing smart, upgraded and fully interconnected transport and urban mobility solutions. It will also make a major contribution to the EU's "Smart, Green and Integrated Transport" agenda and deliver significant socio-economic impacts at the regional and urban level, through stimulating supply chain development, business growth and the creation of new and better jobs.

In the process of developing its *"Programme of Innovation in Sustainable Transport and Intelligent Mobility"*, THE ISSUE Project also delivered a number of other important achievements, including:

1. Defining a *Roadmap for Innovation in Transport & Urban Mobility* to improve the economic, environmental & social health of cities & regions
2. Championing a new dynamic for university-industry-government relationships in promoting innovation
3. Developing new perspectives on future patterns of urban mobility

4. Creating an extensive European network of collaborative partners
5. Expanding the “triple-helix” research-driven cluster concept into new European regions
6. Establishing a New European Special Interest Group in Transport-Health-Environment: THE ISSUE Meta-Cluster
7. Delivering a major programme of mentoring and knowledge exchange
8. Producing a major new publication: “Space and ICT Applications Supporting Smart, Green, Integrated Transport and Urban Mobility”

1.3 Policy Context

An overriding principle of the European Union (EU) is the promotion of free movement of goods, services, people and capital. Transport and intelligent mobility are global urban issues with far reaching impacts on economic sustainability, mobility, citizens’ health and the environment. Economic costs attributable to urban traffic congestion are massive whilst ensuing traffic emissions are a substantial health risk to citizens. Reduced traffic congestion delivers economic gain and reduces risks to citizens’ health. Improvements to air quality follow from reduced traffic congestion through reduced air pollution and less adverse impacts on citizens’ health. Rising costs of hydrocarbon fuels and climate change concerns are creating demand for energy-efficient fuel technologies.

EU policy directives demand reductions in carbon emissions and a modal change in attitudes towards the use of public transport. In Europe 2020, the EU’s growth strategy for the period to 2020, the key priority is to deliver smart, sustainable and inclusive growth. Investing more in research, innovation and entrepreneurship is seen as an important factor in enhancing Europe’s capacity to deliver this priority. Europe 2020 identifies transport as a key component in delivering sustainable growth. The above principles and priorities in European strategy and policy in relation to transport and urban mobility had an important bearing on the way in which THE ISSUE Project was envisaged and developed.

1.4 THE ISSUE’s Vision and Focus

The development of transport technology and policy lies at the heart of achieving sustainable urban economies across Europe. In setting out its response to the EU’s invitation for proposals under the “Regions of Knowledge” Initiative, THE ISSUE Project recognised the tremendous potential of newly-emerging and existing technologies, particularly in the fields of Information and Communications Technologies (ICT) and Downstream Space Data Products and Services, to support the development of innovative new solutions that could address key transport and mobility challenges and contribute to the economic growth of cities and regions.

THE ISSUE Project was underpinned by the following **Vision**:

“To realise the potential for technology transfer from newly-emerging and existing applications of Information and Communications Technologies (ICT) and Downstream Space Data Products and Services into the intelligent mobility and sustainable transport sectors to address key transport and urban mobility challenges impacting on the economic, environmental and social health of cities and regions across Europe”.

In order to realise this Vision, THE ISSUE Consortium agreed the following **Mission Statement** as a way of making clear THE ISSUE Project's overriding core purpose and focus. Its Mission Statement was:

"To identify opportunities to exploit newly-emerging and existing technologies, particularly in fields relating to ICT and Space Technologies, to deliver major advances towards the operational implementation and market growth of innovations in intelligent traffic management and urban mobility to increase regional competitiveness and improve the economic, environmental and social health of cities and regions across Europe."

In setting out its Vision and Mission Statement, THE ISSUE Project recognised that the task of introducing new innovative solutions within cities and regions should not be underestimated. In view of this, THE ISSUE Project acknowledged that to successfully exploit newly-emerging and existing technologies and develop innovative new solutions that can deliver major advances towards the operational implementation and market growth of innovations in intelligent traffic management and urban mobility, THE ISSUE Project must identify innovative solutions that:

- a) Match the vision and interest of markets as well as the highest priority policy objectives of transport, urban mobility and environmental impact policy makers.
- b) Respond to key EU and national policy directives that relate to the impact of transport on the economic, environmental and social health of cities and regions.
- c) Align with key priorities in major European and national funding programmes, such as the EU's Horizon 2020 Research and Innovation Programme and the Structural and Investment Funds.

1.5 THE ISSUE's Key Aims and Objectives

At the outset of developing its proposal in response to the EU's invitation for projects under its **"Regions of Knowledge"** Initiative, THE ISSUE Consortium agreed a clear set of aims and objectives for the Project.

The overarching strategic aims of THE ISSUE Project were:

1. To achieve a more efficient use of existing transport infrastructures.
2. To promote innovation in the utilisation of transport infrastructures.

The overarching strategic objectives of THE ISSUE Project were:

1. *To identify a programme of priority innovation actions that, when implemented, will deliver new and viable economy-driving, environmentally sensitive, transport and urban mobility solutions that match the vision and interest of markets as well as the highest priority policy objectives of transport, urban mobility and environmental impact policy makers in cities and regions across Europe.*
2. *To harness newly-emerging and existing research and technological development (RTD) expertise within THE ISSUE Consortium, particularly in the fields of Information and Communication Technologies and Downstream Space Data and Services, that were capable of supporting the development of new research-based or innovation-driven solutions that have the capability to increase regional competitiveness and improve the economic, environmental and social health of cities and regions.*
3. *To foster trans-national cooperation, development and collaboration between innovative regional research-driven clusters in the areas of Transport-Health-Environment through the exchange of knowledge, best practice and mutual learning, in order to:*

- a) *Develop a framework for coordinating and exploiting Transport-Health-Environmental-related research RTD programmes to achieve intelligent solutions for sustaining urban economies.*
 - b) *Strengthen the capacity of regions to invest in and conduct research and technological development activities that have a strong practical application in cities and regions across Europe and contribute in a significant way to economic development, business growth and the creation of more and better jobs.*
 - c) *Achieve closer alignment between RTD priorities and actions and the operational priorities of regional and local transport end-users.*
 - d) *Develop joint action plans to realise the potential for technology transfer from newly-emerging and existing applications of Information and Communications Technologies (ICT) and Downstream Space Data Products and Services into the intelligent mobility and sustainable transport sectors.*
4. *To mentor regions with less well developed research profiles to support their capacity in setting up and developing regional research-driven clusters.*
 5. *To take steps to ensure the continuity and sustainability of the extensive European network of regional clusters focussed on transport-health-environment created by THE ISSUE Project.*

1.6 THE ISSUE's Project Consortium and "Triple-Helix" Approach

THE ISSUE Project was delivered through a Consortium of regional research-driven clusters. The Consortium comprised of 13 original core partners in four European regional research-driven clusters. The Consortium was expanded during the implementation of the Project as part of the Project's knowledge exchange and mentoring programme. This introduced 8 new associate regions into the Consortium. The four core European regional clusters regions included the East Midlands (UK), Midi-Pyrenees/Aquitaine Regions (France), Molise Region (Italy) and Mazovia Region (Poland). The eight European associate regions introduced a further 22 associate partners into the Project from Spain, Croatia, Greece, Romania, Finland, Italy and Northern Ireland. Figure 1 illustrates the geographical spread of the core and associate regions within THE ISSUE Consortium. Appendix 1 provides a more detailed breakdown of the 13 core partners and 22 associate partners that participated in the Project.

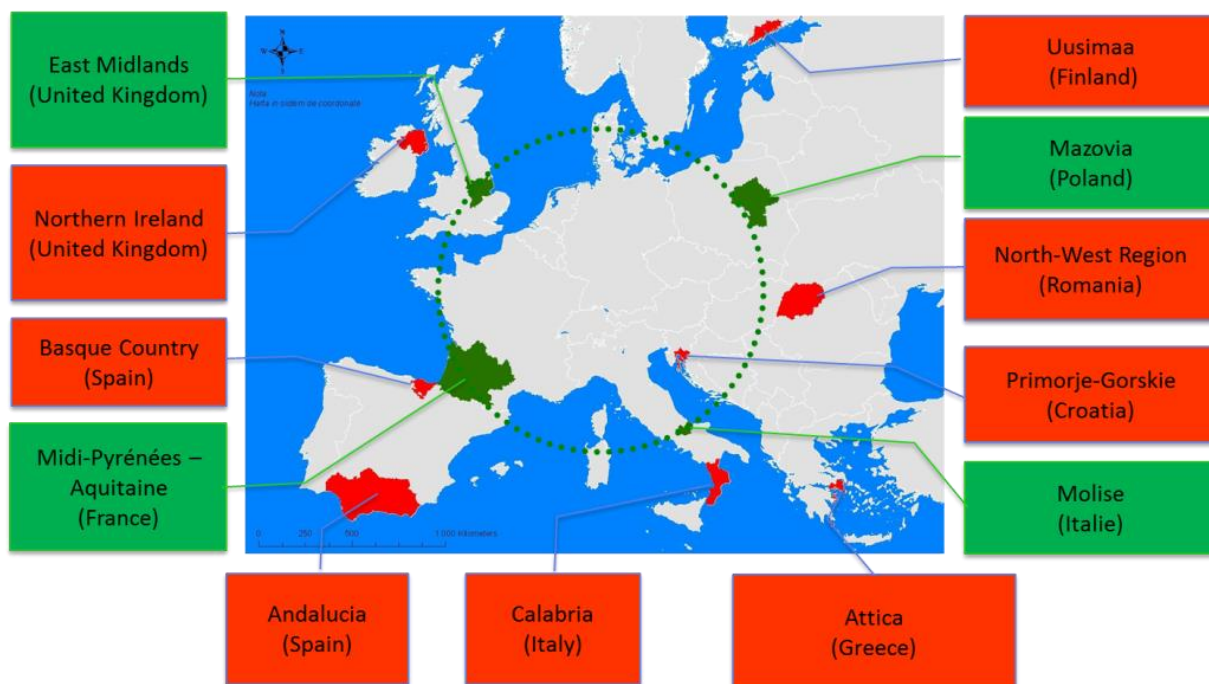


Figure 1. THE ISSUE Consortium of Four Core and Eight Associate Regional Clusters

Each regional cluster was based on a **“triple-helix”** structure and philosophy (see Figure 2). In terms of structure, the Consortium comprised of regional clusters, each of which included representatives from three distinct sectors: **industry**, **universities** and **local/regional government**. In terms of philosophy, the Consortium’s research partners were all actively involved in complementary state-of-the-art RTD programmes in three key areas relating to: **transport**, **health** and the **environment**. Each regional cluster demonstrated a willingness and commitment to work together in the sharing of knowledge gained from tackling similar challenges in the fields of transport-health-environment, against a backdrop of diverse local and regional contexts, and a desire to identify ways in which their RTD activities could be more closely aligned with local economic development priorities and the needs of business



Figure 2. THE ISSUE’s Triple-Helix Approach

2. PREPARING THE ISSUE PROJECT: PROGRAMME OF INNOVATION IN SUSTAINABLE TRANSPORT AND INTELLIGENT MOBILITY (2014-2020)

2.1 Introduction

The vision for THE ISSUE Project was to realise the potential for technology transfer from newly emerging and existing applications of ICT and Downstream Space Data Products & Services into the intelligent mobility and sustainable transport sectors to address key transport and urban mobility challenges impacting on the economic, environmental and social health of cities and regions. THE ISSUE's key output was its pioneering and state-of-the-art ***Programme of Innovation in Sustainable Transport and Intelligent Mobility (2014-2020)***.

The Programme identifies a range of innovation actions that will deliver new economy-driving, environmentally-sensitive transport and urban mobility solutions that match both the vision and interest of markets and the key priorities of transport, urban mobility and environmental impact policy makers. It is structured into six challenge areas, which reflect the highest priorities in the transport and urban mobility sector where innovation and exploitation of newly-emerging and existing technologies could offer major advances towards the operational implementation and market growth of new innovations in intelligent traffic management and urban mobility. These challenge areas relate closely to Horizon 2020's Societal Challenges and its theme of 'Smart, Green and Integrated Transport'. They also respond to important external policy drivers from EU transport, air quality and climate change directives.

This Programme identifies 46 innovation action responses. Each innovation action is based on a strong evidence of need and capable of being supported through harnessing RTD activities and competencies found within THE ISSUE Consortium. Many of the innovation actions identified in the Programme are already sufficiently mature to be the subject of proposals for funding and have been identified as priority innovation actions. The priority innovation actions have a pan-European perspective and will be taken forward in a collaborative approach by THE ISSUE Meta-Cluster through developing project consortia comprising of appropriate partners from within (and outside) THE ISSUE Consortium. The recommended funding route for these priority actions is through European funding such as Horizon 2020. A number of the priority innovation actions have already successfully attracted funding and are currently being delivered. Others are in the process of being developed into firm project proposals.

The Programme will help support the modernisation of the transport sector through developing smart, upgraded and fully interconnected transport and urban mobility solutions. It will make a significant contribution towards the EU's "Smart, Green and Integrated Transport" agenda and deliver significant socio-economic impacts at regional and urban level, through stimulating supply chain development, business growth and the creation of new and better jobs. It will also offer programme planners for Horizon 2020 and other EU Programmes a clear evidence base for future work programme priorities. In particular, the expected impacts of the Programme are highlighted in Table 1.

➤	<i>Exploiting space based applications from Galileo and Copernicus in areas such as traffic congestion and transport-related health and environmental impacts.</i>
➤	<i>Advancing the work on Trans-European transport networks</i>
➤	<i>Fostering cross-transport Intermodality and promoting modal shift</i>
➤	<i>Encouraging seamless travel</i>
➤	<i>Enabling existing road infrastructure to become more effective and efficient;</i>
➤	<i>Reducing greenhouse gas emissions from the transport sector</i>
➤	<i>Improving the safety and security of citizens</i>

Table 1. Key impacts of THE ISSUE's Programme of Innovation in Sustainable Transport and Intelligent Mobility

2.2 Programme Context

THE ISSUE's *Programme of Innovation Actions* draws on proven expertise and capacity within THE ISSUE's vibrant consortium of European regional research-driven clusters. Working through a proactive knowledge exchange and dissemination programme, THE ISSUE Project brought together and coordinated already-existing and projected RTD programmes identified within the Consortium that demonstrated potential synergies relevant to the fields of Transport, Health and the Environment. In parallel, consultations with participating regional and local authorities enabled the Project to develop a strong evidence base of priority operational needs of local and regional transport authorities with respect to their role in sustaining the economic, environmental and social health of their cities and regions. This was followed by tensioning potential RTD actions against regional and local economic, transport and urban mobility objectives to identify a coordinated programme of research, technological or development actions (innovation actions) that would deliver new research-based or innovation-driven solutions that match the vision and interest of markets as well as the highest priority policy objectives of transport, urban mobility and environmental impact policy makers in cities and regions across Europe.

2.3 Programme Structure

THE ISSUE's *Programme of Innovation Actions* is structured into six key **transport and urban mobility challenge areas**. Each challenge area is divided into a number of **strategic transport and urban mobility objectives** that reflect the highest operational problems faced by urban and regional transport authorities within the six challenge areas selected by the Project. A range of **innovation actions** are identified, supported by **core RTD competencies** within THE ISSUE Consortium, which will deliver new **research-based and innovation-driven solutions** to address each strategic objective. This structure is illustrated in Figure 3.

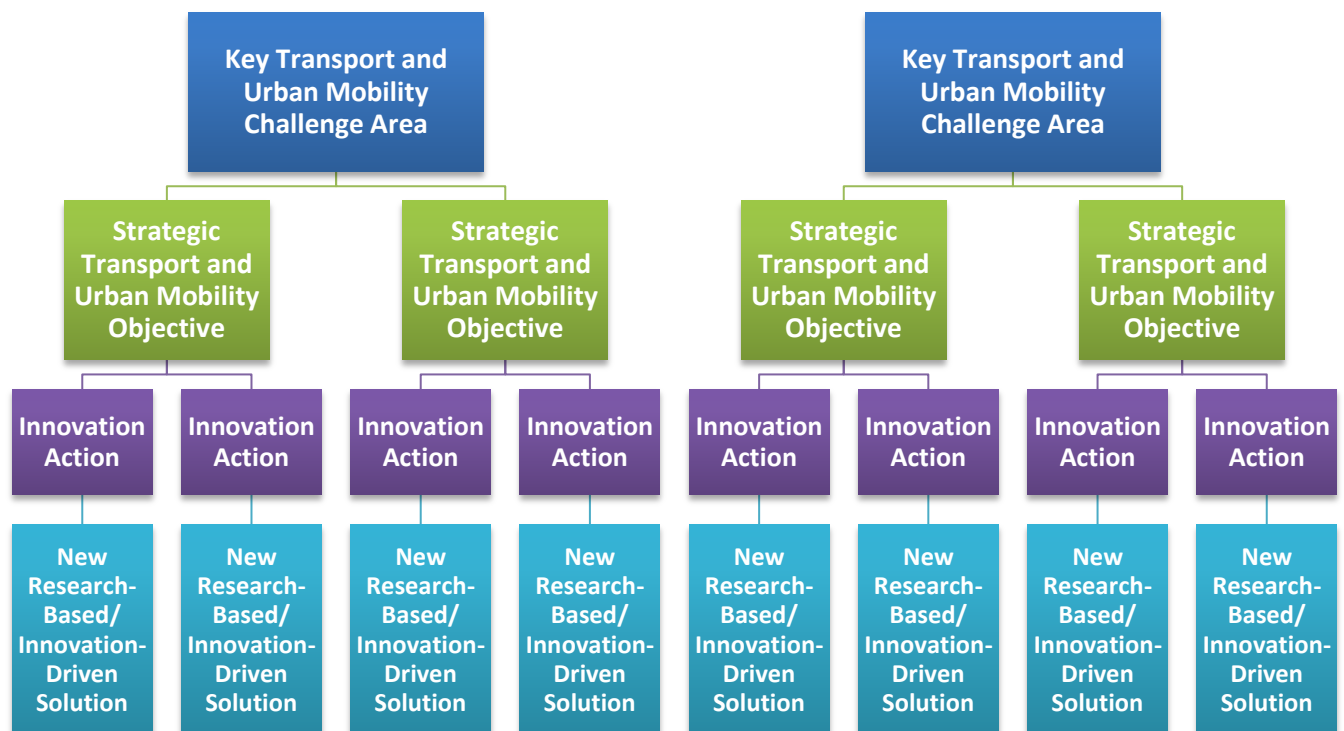


Figure 3. Generalised Structure of THE ISSUE Programme of Innovation Actions (2014-2020)

2.4 THE ISSUE's Key Transport and Urban Mobility Challenge Areas

THE ISSUE Programme of Innovation Actions is centred on six key transport and urban mobility challenge areas identified within THE ISSUE's Joint Action Plan. These are described in Figure 4 and Table 1. The six challenge areas represent the highest priorities in the transport and urban mobility sector where THE ISSUE Project believed that innovation and exploitation of core RTD capabilities identified in the industry and research sectors within THE ISSUE Consortium could offer major advances towards the operational implementation and market growth of new research-based and innovation-driven solutions to help increase regional competitiveness and improve the economic, environmental and social health of cities and regions. Close academic-industry partnerships will be developed in each challenge area and an alignment with the strategic operational priorities, plans and strategies of regional and local authority end-users will ensure a strong regional focus to the innovation actions identified within the Programme.

The six challenge areas selected by THE ISSUE Project were based on an in-depth analysis of the priority traffic management and urban mobility challenges facing urban and regional transport authorities across THE ISSUE Consortium in relation to tackling the impact of transport on the economic, environmental and social health of cities and regions. Each challenge area also responds to important external policy drivers coming from EU transport, air quality and climate change directives, as well as related national and regional transport and urban mobility policies and priorities.



Figure 4. THE ISSUE Project's "Six Key Transport and Urban Mobility Challenge Areas"

THE ISSUE's six challenge areas also relate closely with the Societal Challenges outlined within the Horizon 2020 theme of Smart, Green and Integrated Transport. As such, these six challenge areas represent the highest priority objectives through which THE ISSUE Project can make a major contribution to the EU "Smart, Green and Integrated Transport" agenda and its associated socio-economic impacts. Addressing these challenges will represent a major contribution to the EU "Smart, Green and Integrated Transport" agenda and deliver significant socio-economic impacts at regional and urban level, through stimulating supply chain development, business growth and the creation of new and better jobs.

2.5 THE ISSUE's Core RTD Competencies

A key objective of THE ISSUE Project was to harness newly-emerging and existing research and technological development (RTD) expertise within industry and academic sectors across THE ISSUE Consortium, particularly in the fields of Information and Communication Technologies and Downstream Space Data and Services, capable of supporting the development of new research-based or innovation-driven solutions that have the capability to increase regional competitiveness and improve the economic, environmental and social health of cities and regions.

THE ISSUE Project undertook a mapping exercise to identify the best fit between world-class RTD competencies within THE ISSUE Consortium and the strategic policies and priorities of urban and regional transport authorities in relation to transport and its impact on the economic, environmental and social health of cities and regions. This mapping exercise identified 10 core RTD competencies that could underpin and support the delivery of the innovation action responses outlined in its *Programme of Innovation in Sustainable Transport and Intelligent Mobility*. These are highlighted in Table 2.

Table 2. THE ISSUE Core Research & Technological Development (RTD) Competencies

	THE ISSUE CORE RESEARCH AND TECHNOLOGICAL COMPETENCIES RELATED TO THE FIELDS OF TRANSPORT-HEALTH-ENVIRONMENT
RTD1	Vehicle to vehicle and vehicle to infrastructure real-time communications technologies supporting advanced urban traffic management systems and rapid response capability (including freight)
RTD2	Advanced data sharing, data-fusion, collection and analysis infrastructure (including open data)
RTD3	Road surface and infrastructure management research and technologies
RTD4	Advanced sensor development for space, aerial and in-situ traffic management and control and air quality monitoring, analysis and evaluation
RTD5	ICT and Computational Intelligence supporting advanced urban traffic management systems
RTD6	Open GIS and crowd sourcing imagery augmenting mapping technologies
RTD7	Application of Downstream space data products and services (e.g. Copernicus/Galileo) to support urban traffic management systems to provide real-time positioning, tracking, incident location, velocity and timing information
RTD8	Specialised software for advanced management of multimodal transport network
RTD9	Ultra-low emission vehicle research and technologies
RTD10	Behavioural, societal, foresight and socio-economic research

The majority of the core RTD capabilities within THE ISSUE Consortium with the capacity to support the development of innovative new solutions were generally found to be already at high levels of technology readiness. This indicates a high potential for exploitation within the transport and urban mobility sector. However, in many cases barriers have existed to prevent market uptake in practice, such as resource limitations, lack of innovation and need for definitive demonstration of operational capability. A particular aim of this Programme is take forward actions that will break down these barriers and demonstrate the operational capability and market readiness of these core technologies through pilot studies, demonstration programmes and pre-operational roll-out at the regional level.

In addition to selecting the 10 core RTD competencies, THE ISSUE Project also identified examples of the potential practical application of each core RTD competency to highlight ways in which they could support the development of new research-based and innovation-driven solutions that could deliver major advances towards addressing the impact of transport on the economic, environmental and social health of cities and regions across Europe. These are set out in Appendix 3.

An additional output of this process was the collection of a wide range of case studies of research and technological development that had been carried out within THE ISSUE Consortium. These illustrated the emerging role of new technologies, particularly from the fields of ICT and Downstream Space Data Products and Services, in providing viable and sustainable solutions to many high priority problems currently faced by urban and regional transport authorities. These case studies were published jointly by THE ISSUE Project and NEREUS in October 2013 under the title “*Space and ICT Applications supporting Smart, Green, Integrated Transport and Urban Mobility*”.

2.6 THE ISSUE’s Strategic Transport and Urban Mobility Objectives

For each of the six challenge areas selected by THE ISSUE Project, a number of specific strategic objectives were identified in the *Programme of Innovation in Sustainable Transport and Intelligent Mobility*. These correlated directly to the highest operational needs of urban and regional transport authorities within THE ISSUE Consortium with respect to each challenge area. A total of 18 strategic objectives were selected across the six challenge areas following a thorough analysis by THE ISSUE Project of the key transport and urban mobility challenges impacting on the economic, environmental and social health of cities and regions within THE ISSUE Consortium Network. This included an extensive consultation within THE ISSUE Consortium to review the key priorities of end-users in terms of transport and urban mobility policies, strategies and implementation plans with respect to each of the six challenge areas. The strategic objectives identified for each challenge area are outlined in Table 3.

Table 3. THE ISSUE Strategic Transport and Urban Mobility Objectives

THE ISSUE’S KEY TRANSPORT AND URBAN MOBILITY CHALLENGE AREAS AND STRATEGIC TRANSPORT AND URBAN MOBILITY OBJECTIVES	
Challenge Area 1. Addressing Traffic Congestion and Associated impacts on the Urban Environment, through:	
SO1.	Achieving greater optimisation of the road network and improving local air quality
SO2.	Improving the efficiency of urban freight transport logistics
SO3.	Minimising congestion difficulties and impeding access for emergency services during incidents and extreme weather events
SO4.	Strengthening local transport and urban mobility planning
Challenge Area 2. Managing Urban Air Quality and Greenhouse Gas Emissions, through:	
SO5.	Improving the calibration & validation of the accuracy of air quality models & traffic simulations
SO6.	Improving sensor monitoring and model forecasting of emission levels
Challenge Area 3. Improving the Efficiency and Effectiveness of the Existing Urban and Regional Road Network, through:	
SO7.	Making the existing urban & regional road network more efficient, reliable, resilient & effective
SO8.	Improving the management and maintenance of the existing road infrastructure
SO9.	Improving the planning and development of the road infrastructure network
Challenge Area 4. Achieving Integrated and Seamless Travel and Modal Integration, through:	
SO10.	Promoting modal shift and offering more sustainable travel choices
SO11.	Improving the performance, reliability & affordability of public transport services
SO12.	Increasing the availability and interoperability of multi-modal transport data
SO13.	Promoting multimodal integrated travel information, journey planning & ticketing services

Challenge Area 5. Increasing Safety, Security and Health in Urban Communities, through
SO14. Developing advanced safety and security measures to help reduce accidents, make roads safer (especially for Vulnerable Road Users) and create a better urban environment
SO15. Improving security and information about the transporting of freight in urban areas
SO16. Improving the health of citizens
Challenge Area 6. Delivering a Step-Change in Sustainable Transport and Intelligent Mobility, through
SO17. Facilitating the increased uptake of Ultra-Low Emission Vehicles
SO18. Identifying future changes in patterns of urban mobility and potential RTD challenges

2.7 THE ISSUE's Priority Innovation Actions

For each of the strategic objectives, THE ISSUE Project identified a range of innovative action responses that will deliver new economy-driving, environmentally-sensitive transport and urban mobility solutions that will help improve the economic, environmental and social health of cities and regions across Europe. Each innovation action is based on a strong evidence of need and is capable of being supported through harnessing RTD activities and competencies found within THE ISSUE Consortium.

THE ISSUE *Programme of Innovation in Sustainable Transport and Intelligent Mobility* identified a total of 46 innovation action responses to address the 18 strategic objectives in the six challenge areas. THE ISSUE Project undertook a rigorous process to ensure that each innovation action selected satisfied six basic criteria, which were drawn up by the Project to make sure the Programme would be able to make a real difference on the ground. As a result, the Project sought to ensure that each innovation action selected was:

- a) **Credible** - in terms of being supported by a robust evidence base that justifies the need for such an action, in terms of real and identifiable transport and urban mobility operational priorities.
- b) **Relevant** - in terms of responding to key European and national policy drivers in relation to transport and urban mobility needs and their impact on the economic, environmental and social health of cities and regions.
- c) **Practical** - in terms of offering viable and appropriate solutions that match the vision and interest of markets as well as addressing the highest operational priorities of local & regional transport authorities.
- d) **Achievable** - in terms of its capacity to be supported through harnessing newly-emerging and existing RTD activities and competencies within THE ISSUE Consortium, particularly in the fields of ICT and Downstream Space Data Products and Services, to deliver new research-based or innovation-driven solutions that help improve the economic, environmental and social health of cities and regions across Europe.
- e) **Feasible** - in terms of its ability to access fund by ensuring it is closely aligned to priorities within relevant EU and national funding programmes, such as Horizon 2020.
- f) **Deliverable** - in terms of being capable of developing a viable proposal to demonstrate the market readiness of core technologies within THE ISSUE Consortium to deliver major advances towards the operational implementation and market growth of innovative new solutions that match the vision and interests of markets.
- g) **Sustainable** - in terms of being supported by a legacy body that was capable of coordinating its implementation after the end of THE ISSUE Project and facilitating the development of appropriate project partnerships and consortia.

The process adopted by THE ISSUE Project to select the innovation action responses that could address each strategic objective and to ensure the six criteria above were satisfied involved a four step process:

- i) Reviewing the broad range of potential innovation action responses capable of being taken forward within THE ISSUE Consortium.
- ii) Identifying those innovation actions most appropriate to address each of the strategic transport and urban mobility objectives selected for the Programme.
- iii) Clarifying the relevant core RTD competencies that could help support the development of each innovation action and in which regions these competencies were available.
- iv) Selecting the priority innovation action responses based on level of the maturity of the RTD competencies involved and the prospects for developing proposals for funding.

2.7.1 *Reviewing the Potential Range of Innovation Action Responses*

The first step taken by THE ISSUE Project was to review the range of potential innovation action responses that could be considered for inclusion in the Programme. To ensure this process led to the identification of a robust set of potential responses, THE ISSUE Project determined that all potential innovation actions must be able to satisfy the first three criteria outlined earlier, namely: it must be **credible** and **relevant**, in terms of being supported by a robust evidence base that justifies the need for such an action and its relevance to key European and national policy drivers. On this basis, an analysis was undertaken of the findings from the Technology Map, the Joint Action Plan and Business Plan, to identify:

- a) Best fit between world-class RTD competencies within THE ISSUE consortium and identified strategic objectives and priorities in Local/Regional Transport Plans.
- b) Newly-emerging and existing technologies that could have the greatest impact on European cities and regions in the near-term if incorporated into innovative new solutions to address key operational priorities in local or regional transport plans.
- c) Relevance to known European and national funding programmes.

As a result of this process, an initial long-list of **88 potential innovation action responses** were identified as being credible, relevant and capable of addressing the original long-list of 20 strategic objective options. The full list of 20 strategic objective options and the respective 88 potential innovation action responses are identified in Appendix 2.

2.7.2 *Identifying the Innovation Action Responses for Inclusion in the Programme*

The second step taken by THE ISSUE Project was to evaluate the initial long-list of 88 potential innovation action responses according to the criterion regarding “**practicality**”. This considered the relative viability and appropriateness of each potential innovation action to determine the extent to which they could offer viable and sustainable solutions that match the vision and interest of markets as well as addressing the highest operational priorities of local & regional transport authorities. The evaluation of the potential innovation actions was undertaken at the same time as the review of the initial long-list of 20 strategic objective options. Each core and associate region within THE ISSUE Consortium was asked to review the initial long-list of 20 strategic transport and urban mobility objectives and 88 potential innovation action responses and select the following:

- a) The top 10 strategic transport and urban mobility objectives that correlated most closely with the highest level operational problems faced by the urban and regional transport authorities in

their region with respect to the six transport and urban mobility challenge areas selected by THE ISSUE Project.

- b) Up to three potential innovation actions that were most appropriate for their region for each of their top 10 strategic transport and urban mobility objectives.

THE ISSUE Project analysed the results of this review and ranked the 20 strategic transport and urban mobility objectives and 88 innovation actions according to the responses received. In order to determine which strategic objectives and innovation actions should be included in the Programme, it was decided that only those strategic objectives that had been selected by four or more regions would qualify for inclusion in the Programme. As a result, 18 strategic transport and urban mobility objectives met this criterion. In terms of innovation actions, THE ISSUE Project then reviewed the rankings for those innovation actions relevant to the 18 strategic transport and urban mobility objectives that had been selected for the Programme. Again, THE ISSUE Project determined that only those actions that had been selected by a minimum of four regions would be included in the Programme. As a result, 46 innovation actions were selected for inclusion in the Programme.

2.7.3 Clarifying the Relevant Core RTD Competencies for each Innovation Action Response

Following the selection of the 18 strategic objectives and 46 innovation action responses, THE ISSUE Project determined the relative “**achievability**” of each innovation action, in terms of its capacity to be supported by newly-emerging and existing RTD activities and competencies from within THE ISSUE Consortium. As part of this process, THE ISSUE Project clarified the relevant core RTD competencies that existed within the Project Consortium and determined the specific ones that were capable of supporting each of the 46 innovation actions selected. Based on the 10 core competencies and 50 practical applications defined earlier, each core and associate region in THE ISSUE Consortium clarified their particular RTD competencies and how they could support the delivery of specific innovation actions.

2.7.4 Selecting the Priority Innovation Action Responses

The final step in the process was to determine the relative priority of each innovation action in terms of an implementation schedule for the Programme. This involved an assessment of how **feasible** and **deliverable** each action was in the short term, in terms of the likelihood of being able to access funding and the level of maturity of the core RTD competencies that would support its implementation, in terms of their current market readiness. Finally, this step also considered the relative **sustainability** of the action, in terms of the level of support that could be achieved for this action through the legacy body, THE ISSUE Meta-Cluster, in order to sustain its implementation after the end of THE ISSUE Project and facilitate the development of an appropriate project partnership and consortium.

This process was informed by the work carried out in Work Package 3 to produce the JAP Business Plan, which considered potential funding opportunities and the technology readiness levels of specific RTD competencies. THE ISSUE’s funding database provided further evidence of the potential scope for funding in the short to medium term. The assessment by the core and associate regions of the relevance of each potential innovation action against their regions priorities provided the evidence to determine the relative support for taking forward each action in the short to medium term.

The outcome of this assessment identified there were 21 innovation action responses covering 11 strategic objectives that were already sufficiently mature to be the subject of proposals for funding in the first two years of the Programme. These were identified as high priority projects in the Programme.

3. THE ISSUE PROJECT: PROGRAMME OF INNOVATION IN SUSTAINABLE TRANSPORT AND INTELLIGENT MOBILITY (2014-2020)

3.1 Introduction

This Chapter sets out in detail THE ISSUE's *Programme of Innovation in Sustainable Transport and Intelligent Mobility*. The Programme is structured into six challenge areas and identifies a total of 46 innovation action responses to address 18 specific strategic objectives identified by THE ISSUE Project across the six challenge areas. The 18 strategic objectives correlate very closely to the highest operational needs of urban and regional transport authorities, with respect to each challenge area, where technological solutions have the highest probability of developing viable and sustainable solutions that match the vision and needs of markets and users.

The strategic objectives for each challenge area were selected following a thorough analysis by THE ISSUE Project of the key transport and urban mobility challenges impacting on the economic, environmental and social health of cities and regions within THE ISSUE Consortium Network. This included an extensive consultation within THE ISSUE Consortium to review the key priorities of end-users in terms of transport and urban mobility policies, strategies and implementation plans with respect to each of the six challenge areas.

For each of the strategic objectives, THE ISSUE Project identified a range of innovative action responses that will deliver new economy-driving, environmentally-sensitive transport and urban mobility solutions that will help improve the economic, environmental and social health of cities and regions across Europe. Each innovation action is based on a strong evidence of need and is capable of being supported through harnessing RTD activities and competencies found within THE ISSUE Consortium.

Each innovation action response was assessed to identify its relative priority in terms of development and delivery in order to identify priority actions and longer-term actions. This assessment considered the relative strength of the evidence base for each action relating to impact and user-needs within each region and the level of maturity of the RTD competencies that would support the development of the innovative solution. A total of 21 innovation actions were identified as already sufficiently mature to be the subject of proposals for funding and these were highlighted as priority innovation actions within the Programme. These 21 priority innovation actions will be taken forward through THE ISSUE Meta-Cluster on the basis of a collaborative approach with a range of partners from within the Consortium forming appropriate project consortia to develop project proposals. The recommended funding route for these priority project areas is through European funding channels such as Horizon 2020.

In terms of those innovation actions responses identified as longer-term priorities, THE ISSUE Meta-Cluster will periodically review their relative standing in order to determine:

- a) If there is an increased policy priority around these areas
- b) If any new Meta-Cluster members have a policy priority in these areas.
- c) If there are capabilities that could influence regional policy priorities for example areas of air quality or the health impacts of pollution

CHALLENGE 1. ADDRESSING TRAFFIC CONGESTION AND ASSOCIATED IMPACTS ON THE URBAN ENVIRONMENT

THE CHALLENGE

Addressing traffic congestion and associated impacts on the urban environment was identified by THE ISSUE as the first challenge area in its Programme of Innovation in Sustainable Transport and Intelligent Mobility. Transport infrastructure in many cities and regions across Europe is reaching capacity; in some cities this has already been exceeded. Over 60% of European citizens live in urban areas of over 10,000 inhabitants. Urban mobility accounts for 40% of all CO₂ emissions of road transport and up to 70% of other pollutants from transport. European cities are increasingly facing problems caused by transport and traffic. Congestion in the EU costs nearly 100 billion Euro, or 1% of the EU's GDP, annually. The mitigation of congestion is the main challenge for transport policy at all levels and a priority of most infrastructure, traffic management and road charging measures.

A specific challenge is balancing the need to enhance mobility while at the same time reducing congestion, accidents and pollution. Traditional responses to rising demand have primarily centred on substantial capital investment in new roads, extra lanes and introducing more controlled junctions. However, economic pressures have meant that many transport authorities are no longer in a position to invest substantial capital resources to expand the infrastructure network. Environmental and health-related pressures have also demonstrated that continually expanding the road network in the future will no longer be a long term option.

Air quality and traffic management are currently considered in isolation from one another despite the clear linkages between traffic flow and air pollution from traffic emissions. Significant economic and health benefits can be realized from improving the efficiency of transport networks, particularly in highly congested urban areas. The challenge is for the delivery of integrated service solutions to the problems of urban and regional traffic congestion and air quality, across Europe.

In the future, the management of demand will require new long term sustainable solutions that deliver a more effective and efficient use of a city's or region's existing infrastructure network. Solutions that deliver positive environmental impacts and facilitate urban mobility for users will be of particular value.

THE ISSUE'S STRATEGIC OBJECTIVES

For this challenge area, THE ISSUE Programme identified four strategic objectives. These correlated most directly to the highest operational needs of urban and regional transport authorities, with respect to this challenge area. They were selected following a thorough analysis by THE ISSUE Project of the key challenges arising from the impact of traffic congestion on the economic, environmental and social health of cities and regions within THE ISSUE Consortium Network. This included an extensive consultation within THE ISSUE Consortium to review the key priorities of end-users in terms of transport and urban mobility policies, strategies and implementation plans with respect to reducing traffic congestion and the associated impacts on the urban environment. The four objectives were:

- SO1. Achieving greater optimisation of the road network and improving local air quality**
- SO2. Improving the efficiency of urban freight transport logistics**
- SO3. Minimising congestion difficulties and impeding access for emergency services during incidents and extreme weather events**
- SO4. Strengthening local transport and urban mobility planning**

Addressing these four strategic objectives through the exploitation of newly-emerging and existing research and technologies found within THE ISSUE Consortium, will deliver new research-based and innovation-driven solutions to help address congestion and traffic-induced air pollution and its impact on the urban environment and infrastructure.

THE ISSUE'S RESPONSE

For each of the four strategic objectives, THE ISSUE Project identified a range of innovative action responses that will deploy ITS solutions to better manage existing urban networks and balance the impact of increasing demand. THE ISSUE's innovation action responses have the potential to deliver new long term sustainable products and services that could help reduce traffic congestion and achieve a better balance between the impact of rising demand and the impact on the infrastructure, citizens' health and the urban environment. Each of these potential solutions is capable of being supported by core RTD competencies found within THE ISSUE Consortium Network.

Following a prioritisation exercise involving the core and associate regions within THE ISSUE Consortium, THE ISSUE Programme selected all the innovation action responses identified in Challenge Area 1 as high priority actions. Each action response had been assessed on the basis of the relative strength of the evidence base relating to user-needs within each region and the level of maturity of the RTD competencies that would support the development of the innovative solutions. The following high priority innovation action responses were identified to address the four strategic objectives in Challenge Area 1:

Strategic Objective 1: Achieving greater optimisation of the road network and improving local air quality, through:

Priority Innovation Action:

- IA01. *Enabling the integration of real-time management and control of urban traffic and air quality, by using ICT and Downstream Space Data Products and Services to develop advanced ITM&C systems that can achieve greater optimisation of the road network, leading to reductions in traffic delay while increasing traffic flow and optimising local air quality.*

Strategic Objective 2: Improving the efficiency of urban freight transport logistics, through:

Priority Innovation Actions:

- IA07. *Increasing urban road freight transport efficiency by developing dynamic, integrated ITS systems that improve road network route planning and help optimise delivery patterns, by exploiting new developments in EGNSS, cloud computing, air quality data collection and seamless, multi-modal communications technology, leading to reductions in congestion, lower emissions and noise pollution and improved safety and security associated with urban freight transport operations.*
- IA08. *Developing enhanced monitoring and tracking models and tools for integrated management of intermodal freight transport interface within Port Cities to deliver more efficient and sustainable onward movement of freight across urban areas.*

Strategic Objective 3: Minimising congestion difficulties and impeding access for emergency services during incidents and extreme weather events, through:

Priority Innovation Action:

- IA11. *Developing tools that can enhance the ability of ITM&C systems to provide a rapid response for emergency situations, including enabling controlled access to specific urban areas, automatically re-routing traffic or changing traffic light sequences to provide priority and prompt access to the transport infrastructure for emergency services without compromising the safety and security of other user, enabling emergency services to create a "cordon sanitaire" and clear emergency transit route, as well as the ability to respond to public transport priorities and providing relevant traffic information.*

Strategic Objective 4: Strengthening local transport and urban mobility planning, through:

Priority Innovation Actions:

- IA14. *Enabling the collection and analysis of detailed and accurate data outputs of user demand from ITM&C systems for use as a support mechanism for planning the transportation system in future urban transport strategies, as guiding planning decisions, supporting spatial planning and the simulation of land use development in the urban areas.*
- IA16. *Enhancing the knowledge and capacities of local authorities to successfully plan and implement innovative sustainable mobility measures, by developing new instruments and mechanisms to study, model and plan future scenarios for the sustainable movement of people and goods, based on the collection, analysis and exchange of reliable and relevant data from multiple sources, including geo-positioning information, environmental data, residents and visitors' behaviour.*
- IA15. *Developing new tools, instruments and mechanisms for information exchange to strengthen the knowledge and capacity of local authorities in their preparation of Sustainable Urban Mobility Plans.*

THE ISSUE'S PRIORITY INNOVATION ACTIONS

This section describes the priority innovation action responses identified by THE ISSUE Project for each of the strategic objectives identified in Challenge Area 1. Each of these innovation action responses were identified by THE ISSUE as being already sufficiently mature to be the subject of proposals for funding in the first two years of implementing the Programme. These projects have a pan-European perspective and will be taken forward through THE ISSUE Meta-Cluster on the basis of a collaborative approach with appropriate partners from within the Consortium. The recommended funding route for these priority project areas is through European funding channels such as Horizon 2020.

STRATEGIC OBJECTIVE 1. ACHIEVING GREATER OPTIMISATION OF THE ROAD NETWORK AND IMPROVING LOCAL AIR QUALITY

THE ISSUE Rationale:

In tackling the challenge of reducing urban and regional traffic congestion and traffic-induced air pollution across Europe, a key priority identified by THE ISSUE Project is to deliver integrated service solutions that can address the problems of urban and regional traffic congestion and air quality in an integrated way. Air quality and traffic management are currently considered in isolation from one another despite the clear linkages between traffic flow and air pollution from traffic emissions. This priority innovation action offers new possibilities for responsive management of traffic congestion and air quality. It will deliver real-time Intelligent Traffic Management Systems (ITMS) that have access to innovative sensors, space and airborne based data and services, network technologies and analysis techniques.

These innovation actions will be delivered using the following technological competencies and emerging technologies:

- *Pro-active predictive systems, using computational intelligence, modelling and other mathematical techniques to derive near-future predictions of traffic conditions enabling ITMC systems to take account of both current and imminent road conditions.*
- *Innovative methodologies to achieve reliable values of pollutant emissions across wide urban networks, taking into account within-day variations of traffic conditions and parameters related to different categories of vehicles. Developing ITMC systems that deliver both congestion reduction and air quality enhancement.*
- *Cooperative and crowd-sourced systems, which use the vehicle as part of real-time data collection networks (floating car data), which provide aggregated data to central ITMC systems. These can be based on in-vehicle sensors, mobile phone apps augmenting in-situ systems provided by traffic management authorities.*
- *Increased use of space or airborne location (for ground navigation of vehicles), timing and navigation services (e.g. Galileo/EGNSS) and air quality data (Copernicus/RPAS) to supplement or replace expensive in-situ sensor arrays.*

THE ISSUE Priority Innovation Action 1:

IA01. Developing advanced ITM&C systems, using ICT and Downstream Space Data Products and Services, to enable the integrated real-time management and control of urban traffic and air quality, leading to a greater optimisation of the road network, resulting in reductions in traffic delay, increased traffic flow and more optimised local air quality

Expected Impacts of this Innovation Action:

- Increased traffic flow and reduced delays with associated improvements in air quality: lower NO₂ and CO₂ emissions.
- Improved reliability and predictability of journey times and ease of movement.
- Improved ability to manage recurrent/non-recurrent delays in the transport system and minimise disruption
- Health and environmental protection measures through reduced impact of traffic related emissions.
- Supporting decarbonization of urban areas by improving traffic conditions through traffic light adjustment.
- Empowering local authorities by giving more accurate information of the source of emissions and identifying zones and periods of time where emission levels exceed EU recommended limits.
- Potential to provide the public with accurate real-time air quality information, including areas and periods of high pollution levels.

Strong evidence of need for this innovation Action found in:

*East Midlands Region, UK
Mazovia Region, Poland*

*Midi-Pyrenees/Aquitaine Regions, France
Calabria Region, Italy*

Basque Country, Spain

Core RTD Competencies within THE ISSUE Consortium supporting this Innovation Action are:

- RTD1: Vehicle to vehicle and vehicle to infrastructure real-time communications technologies supporting advanced urban traffic management systems and rapid response capability
- RTD2: Advanced data sharing, data-fusion, collection and analysis infrastructure
- RTD4: Advanced sensor development for space, aerial and in-situ traffic management and control and air quality monitoring, analysis, evaluation.
- RTD5: ICT and Computational Intelligence supporting advanced urban traffic management systems
- RTD6: Open GIS and crowd sourcing imagery augmenting mapping technologies.
- RTD7: Application of Downstream space data products and services (e.g. Copernicus/Galileo) to support urban traffic management systems to provide real-time positioning, tracking, incident location, velocity and timing information.
- RTD8: Specialised software for advanced management of multimodal transport network

Core RTD Competencies identified in:

*East Midlands Region, UK
Mazovia Region, Poland
Northern Ireland, UK*

*Primorje-Gorskie Region, Croatia
Midi-Pyrenees/Aquitaine Regions, France
Calabria Region, Italy*

*Molise Region, Italy
Attica Region, Greece*

Relevance to Horizon 2020 - The Framework Programme for Research and Innovation:

- Transport Challenge “Smart Green Integrated Transport”: Call “Mobility for Growth”: Topics - Road, Urban Mobility, Intelligent Transport Systems
- Leadership in Enabling and Industrial Technologies “Space”:
 - a) Call “Applications in Satellite Navigation” - Topics: Galileo
 - b) Call “Earth Observation”: Topics – Space-Enabled Applications, Tools for Access to Space Data
- Energy Challenge “Secure, Clean and Efficient Energy”: Call “Smart Cities and Communities”

STRATEGIC OBJECTIVE 2. IMPROVING THE EFFICIENCY OF URBAN FREIGHT TRANSPORT LOGISTICS

THE ISSUE Rationale:

Enhanced monitoring of transported goods is an essential pre-condition for integrated freight transport services whether rail or combined rail-road. This is also important in terms of the quality of service and buyer experience and is particularly relevant to regions with less well developed road transport infrastructures.

Improvements in energy efficiency and reduced communication network costs could be achieved through improved machine to machine communications. The ability to provide continuity of tracking services would allow freight operators to combine road and rail services in integrated transport planning for goods.

Real-time monitoring of the location of goods would encourage road transport operators to consider rail transport for their goods. Furthermore, real-time monitoring would also enable rail carriers to be able to re-schedule deliveries in case of disruption and communicate the new schedules rapidly to the recipient.

Improving Machine to Machine communication offers real benefits in terms of energy efficiency and reduced communication network costs. The technology allows continuity of tracking services that would allow freight operators to combine road and rail services in integrated transport planning for goods. Geo-fencing for hazardous materials will be more accurate and cost effective.

Indeed, road transport operators will consider rail transport for their goods, only if their location information is available at all times. Real-time monitoring is also necessary to the rail carrier who must be able to re-schedule deliveries in case of disruption and communicate the new schedules rapidly to the recipient.

THE ISSUE Priority Innovation Action 2:

IA07. Increasing urban road freight transport efficiency by developing dynamic, integrated ITS systems that improve road network route planning and help optimise delivery patterns, by exploiting new developments in EGNSS, cloud computing, air quality data collection and seamless, multi-modal communications technology, leading to reductions in congestion, lower emissions and noise pollution and improved safety and security associated with urban freight transport operations

Expected Impacts of this Innovation Action:

- *Enhanced monitoring of transported goods as an essential pre-condition for integrated freight transport services whether rail or combined rail-road.*
- *Improved quality of service and buyer experience, particularly relevant to regions with less well developed road transport infrastructures.*
- *Reduced delay and increased traffic flow with associated improvements in air quality: lower NO₂ and CO₂ emissions.*
- *Economic benefits in terms of improved reliability and predictability of journey times and ease of movement, reduced congestion time, delays and stress – leading to increased transport efficiency and profitability.*
- *Health and environmental protection measures through reduced impact of traffic related emissions.*
- *Foster freight transport by improving ability to monitor, track and verify transport of goods.*
- *Innovative logistics systems to support dynamic routing, integrated freight transport services and alternatives to last mile freight deliveries.*

Strong evidence of need for this innovation Action found in:

Primorje-Gorskie Region, Croatia
Attica Region, Greece

Midi-Pyrenees/Aquitaine Regions, France

Basque Country, Spain

Core RTD Competencies within THE ISSUE Consortium supporting this Innovation Action:

- *RTD1: Vehicle to vehicle and vehicle to infrastructure real-time communications technologies supporting advanced urban traffic management systems and rapid response capability*
- *RTD2: Advanced data sharing, data-fusion, collection and analysis infrastructure*
- *RTD4: Advanced sensor development for space, aerial and in-situ traffic management and control and air quality monitoring, analysis, evaluation*
- *RTD5: ICT and Computational Intelligence supporting advanced urban traffic management systems*

- RTD6: Open GIS and crowd sourcing imagery augmenting mapping technologies
- RTD7: Application of Downstream space data products and services (e.g. Copernicus and Galileo) to support urban traffic management systems to provide real-time positioning, tracking, incident location, velocity and timing information
- RTD8: Specialised software for advanced management of multimodal transport network
- RTD9: Ultra-low emission vehicle research & technologies

Core RTD Competencies identified in:

East Midlands Region, UK
Mazovia Region, Poland
Northern Ireland, UK

Primorje-Gorskie Region, Croatia
Midi-Pyrenees/Aquitaine Regions, France
Calabria Region, Italy

Molise Region, Italy
Attica Region, Greece

Relevance to Horizon 2020 - The Framework Programme for Research and Innovation:

- Transport Challenge “Smart Green Integrated Transport”:
a) Call “Mobility for Growth”: Topics - Road, Urban Mobility, Logistics, Intelligent Transport Systems
- Leadership in Enabling and Industrial Technologies “Space”:
a) Call “Applications in Satellite Navigation” - Topics: Galileo
b) Call “Earth Observation”: Topics – Space-Enabled Applications, Tools for Access to Space Data
- Energy Challenge “Secure, Clean and Efficient Energy”:
a) Call “Smart Cities and Communities”

THE ISSUE Priority Innovation Action 3:

IA08. Developing enhanced monitoring and tracking models and tools for integrated management of intermodal freight transport interface within Port Cities to deliver more efficient and sustainable onward movement of freight across urban areas

Expected Impacts of this Innovation Action:

- Reduced delay and increased traffic flow with associated improvements in air quality: lower NO₂ and CO₂ emissions.
- Economic benefits in terms of improved reliability and predictability of journey times and ease of movement, reduced congestion time, delays and stress – leading to increased transport efficiency and profitability.
- Health and environmental protection measures through reduced impact of traffic related emissions.
- Foster freight transport by improving ability to monitor, track and verify transport of goods.
- Innovative logistics systems to support dynamic routing, integrated freight transport services and alternatives to last mile freight deliveries.

Strong evidence of need for this Innovation Action found in:

Calabria Region, Italy
Basque Country, Spain

Primorje-Gorskie Region, Croatia
Midi-Pyrenees/Aquitaine Regions, France

Attica Region, Greece

Core RTD Competencies within THE ISSUE Consortium supporting this Innovation Action are:

- RTD1: Vehicle to vehicle and vehicle to infrastructure real-time communications technologies supporting advanced urban traffic management systems and rapid response capability
- RTD2: Advanced data sharing, data-fusion, collection and analysis infrastructure
- RTD5: ICT and Computational Intelligence supporting advanced urban traffic management systems
- RTD6: Open GIS and crowd sourcing imagery augmenting mapping technologies

Core RTD Competencies identified in:

East Midlands Region, UK
Mazovia Region, Poland
Northern Ireland, UK

Primorje-Gorskie Region, Croatia
Midi-Pyrenees/Aquitaine Regions, France
Calabria Region, Italy

Molise Region, Italy
Attica Region, Greece

Relevance to Horizon 2020 - The Framework Programme for Research and Innovation:

- Transport Challenge “Smart Green Integrated Transport”:
a) Call “Mobility for Growth”: Topics - Road, Urban Mobility, Logistics, Intelligent Transport Systems
- Energy Challenge “Secure, Clean and Efficient Energy”:
a) Call “Smart Cities and Communities”

STRATEGIC OBJECTIVE 3. MINIMISING CONGESTION DIFFICULTIES AND IMPEDING ACCESS FOR EMERGENCY SERVICES DURING INCIDENTS AND EXTREME WEATHER EVENTS

THE ISSUE Rationale

Safety and incident management and maintaining the effective functioning of the road network during incidents and extreme weather events emerged as key priorities from THE ISSUE Project. THE ISSUE's response to these challenges focussed on providing ITS solutions for pro-active safety systems such as early warning of extreme weather events and other disturbances in the functioning of the road network to benefit vehicle occupants, other road users, infrastructure managers, emergency services and the general public.

GPS-based smartphones as well as vehicles equipped with Bluetooth devices or RFID transponders are examples of new sources of probe data (or floating car data). Attention has been focused on the fusion of data detected by different types of sensors in order to improve the forecast of traffic flow conditions. These innovations represent the starting point for the implementation of innovative solutions involving speed control (speed detector systems not based on fixed traffic sensors) and incident management systems (process of different activities from incident detection, verification, information, response and traffic management at network level and clearance). Technology solutions include:

- *ITS solutions for higher traffic safety*
- *Traffic incident management systems*
- *Innovative Tutor system for speed control*

THE ISSUE's innovation action response proposes innovative solutions for managing traffic on a real-time basis when incidents occur in urban environments in order to minimise congestion difficulties and impeding of access for emergency services. This includes developing advanced ITS systems that can automatically re-route traffic or change traffic light sequences to provide priority and prompt access to the transport infrastructure without compromising safety and other users. This includes the capacity to develop:

- *Specialist ITS systems for Informed Incident Management, offering emergency services the ability to create a "cordon sanitaire" and clear emergency transit routes.*
- *IIM systems extended to minimize the impact on the rest of the transport infrastructure that is not immediately affected by the incident.*
- *Automated detection and classification of incidents, using road-side sensors, telematics imaging, ad-hoc networks, providing data to a Pro-active Integrated Systems for Security Management by Technological, Institutional and Communication Assistance.*

THE ISSUE Priority Innovation Action 4:

IA11. *Developing tools that can enhance the ability of ITM&C systems to provide a rapid response for emergency situations, including enabling controlled access to specific urban areas, automatically re-routing traffic or changing traffic light sequences to provide priority and prompt access to the transport infrastructure for emergency services without compromising the safety and security of other user, enabling emergency services to create a "cordon sanitaire" and clear emergency transit route, as well as the ability to respond to public transport priorities and providing relevant traffic information*

Expected Impacts of this Innovation Action:

- Automated detection and classification of incidents
- Early warning of extreme weather events and other disturbances
- Automatic re-routing of traffic or changing traffic light sequences to provide priority and prompt access for emergency vehicles to the transport infrastructure without compromising safety and other users.
- Informed Incident Management (IIM) Systems that offer emergency services the ability to create a "cordon sanitaire" and clear emergency transit routes
- Reduction in incident impacts on urban congestion
- Reduced impact on transport infrastructure not immediately affected by an incident by extending IIM systems.
- Faster emergency vehicle response through clearer routes
- Rapid traffic system reaction times to incidents
- Improved reliability and predictability of journey times and ease of movement.
- Improved ability to manage non-recurrent delays in the transport system and minimise disruption

Strong evidence of need for this innovation Action found in:

East Midlands Region, UK
Mazovia Region, Poland

Midi-Pyrenees/Aquitaine Regions, France
Calabria Region, Italy

Basque Country, Spain

Core RTD Competencies within THE ISSUE Consortium supporting this Innovation Action:

- *RTD1: Vehicle to vehicle and vehicle to infrastructure real-time communications technologies supporting advanced urban traffic management systems and rapid response capability*
- *RTD2: Advanced data sharing, data-fusion, collection and analysis infrastructure*
- *RTD4: Advanced sensor development for space, aerial and in-situ traffic management and control and air quality monitoring, analysis, evaluation.*
- *RTD5: ICT and Computational Intelligence supporting advanced urban traffic management systems*
- *RTD6: Open GIS and crowd sourcing imagery augmenting mapping technologies*
- *RTD7: Application of Downstream space data products and services (e.g. Copernicus and Galileo) to support urban traffic management systems to provide real-time positioning, tracking, incident location, velocity and timing information*
- *RTD8: Specialised software for advanced management of multimodal transport network*

Core RTD Competencies identified in:

East Midlands Region, UK
Mazovia Region, Poland
Northern Ireland, UK

Primorje-Gorskie Region, Croatia
Midi-Pyrenees/Aquitaine Regions, France
Calabria Region, Italy

Molise Region, Italy
Attica Region, Greece

Relevance to Horizon 2020 - The Framework Programme for Research and Innovation:

- Transport Challenge “Smart Green Integrated Transport”:
 - a) Call “Mobility for Growth”: Topics - Road, Urban Mobility, Intelligent Transport Systems
- Leadership in Enabling and Industrial Technologies “Space”:
 - a) Call “Applications in Satellite Navigation” - Topics: Galileo
 - b) Call “Earth Observation”: Topics – Space-Enabled Applications, Tools for Access to Space Data
- Energy Challenge “Secure, Clean and Efficient Energy”:
 - a) Call “Smart Cities and Communities”

STRATEGIC OBJECTIVE 4. STRENGTHENING TRANSPORT AND URBAN MOBILITY PLANNING

THE ISSUE Rationale

Congested streets and lack of parking spaces in cities are often the result of an imbalance between supply and demand of the transportation system. In many cities and regions in Europe, the traditional solution to satisfying rising demand has usually involved expanding the capacity of the road network through building new roads, adding more lanes, or introducing more controlled junctions. Such activities often conflict with urban sustainability policies that strive to maintain a balance between transportation, economic, social and environmental objectives.

Adapting cities and metropolitan areas to changes in transport mobility requires the coordination of spatial and urban policy to manage transport services and balance demand between public, private and commercial transport needs. Spatial planning needs more support from modern technologies to incorporate the road network into intelligent management systems. Increasing traffic throughput in corridors well served by public transport, prioritising public transport, improving functional attractiveness of inner-city areas, are all important. Modern transport solutions need to provide controlled access to specific urban areas, manage traffic flow, and to provide traffic information and fast response for emergency situations.

THE ISSUE Project proposed innovative solutions that utilise ITS as a mechanism of planning the transportation system based on user demand. Demand management should be conducted in such a way as to fulfil the need of travel in the most economical way, but it does not exclude development incentives or increases in citizens’ mobility. Data outputs from ITS technologies can be used to guide planning decisions, as often data is very detailed and extremely accurate. Conversely, planning decisions should also ensure that implementation of different ITS systems is taken into full consideration as this will form a large part of future urban transport strategies. Examples of specific approaches might include:

- Spatial planning and simulation of land use development in the urban areas.

- Better management of existing resources.
- Reduction of individual transport and providing alternative ways of travelling.
- Using fiscal mechanisms.

THE ISSUE has considered the range of RTD capabilities within THE ISSUE Consortium and identified a range of innovative sustainable urban transport and mobility planning measures, technologies and tools that could improve the planning and management of the transportation system. The priority RTD actions that THE ISSUE has identified to help address this specific strategic objective, are:

THE ISSUE Priority Innovation Action 5:

IA14. *Enabling the collection and analysis of detailed and accurate data outputs of user demand from ITM&C systems for use as a support mechanism for planning the transportation system in future urban transport strategies, as guiding planning decisions, supporting spatial planning and the simulation of land use development in the urban areas*

Expected Impacts of this Innovation Action:

- Better informed planning decisions
- A more fit-for-purpose transport network
- Stronger data evidence-based approach to transport planning leading to an Improved ability to plan and design a fit-for-purpose transport network that is more accessible, integrated, affordable, efficient and viable, as well as meeting the future needs of business and citizens.
- Improved economic benefits as a result of a better-planned transport infrastructure
- Innovative use of information services and systems for planning and operating the transport network
- Optimisation of information within transport management systems.
- Re-assessment of conventional urban planning and technology implementation in the field of urban mobility
- Developing a strong data evidence based approach towards transport planning.
- Supporting solutions for physical planning

Strong evidence of need for this innovation Action found in:

Molise Region, Italy
Mazovia Region, Poland

Midi-Pyrenees/Aquitaine Regions, France
North West Region, Romania

Basque Country, Spain

Core RTD Competencies within THE ISSUE Consortium supporting this Innovation Action:

- RTD2: Advanced data sharing, data-fusion, collection and analysis infrastructure
- RTD3: Road surface and infrastructure management research & technologies
- RTD4: Advanced sensor development for space, aerial and in-situ traffic management and control and air quality monitoring, analysis, evaluation
- RTD5: ICT and Computational Intelligence supporting advanced urban traffic management systems
- RTD6: Open GIS and crowd sourcing imagery augmenting mapping technologies
- RTD8: Specialised software for advanced management of multimodal transport network
- RTD10: Behavioural, societal, foresight and socio-economic research

Core RTD Competencies identified in:

East Midlands Region, UK
Mazovia Region, Poland
Northern Ireland, UK

Primorje-Gorskie Region, Croatia
Midi-Pyrenees/Aquitaine Regions, France
Calabria Region, Italy

Molise Region, Italy
Attica Region, Greece

Relevance to Horizon 2020 - The Framework Programme for Research and Innovation:

- Transport Challenge “Smart Green Integrated Transport”:
 - a) Call “Mobility for Growth”: Topics - Road, Urban Mobility, Intelligent Transport Systems, Socio-Economic & Behavioural Research and Forward Looking Activities for Policy Making
- Energy Challenge “Secure, Clean and Efficient Energy”:
 - a) Call “Smart Cities and Communities”

THE ISSUE Priority Innovation Action 6:

IA15. Developing new tools, instruments and mechanisms for information exchange to strengthen the knowledge and capacity of local authorities in their preparation of Sustainable Urban Mobility Plans

Expected Impacts of this Innovation Action:

- Improved ability to plan and design a fit-for-purpose transport network that is more accessible, integrated, affordable, efficient and viable, as well as meeting the future needs of business and citizens.
- Improved reliability and predictability of journey times and ease of movement.
- Optimisation of information within transport management systems.
- Adapting the environment for safe planning of mass events.
- Better understanding of collective human movement in the urban environment.
- Design better exit routes for evacuation of large crowds from buildings
- Improved modelling of collective behaviour:
- Reduced congestion of pedestrian flow
- Socio-economic impacts, connecting and locating users everywhere in an urban environment, and potential creation and development of innovative services for citizens.

Strong evidence of need for this innovation Action found in:

East Midlands Region, UK
Attica Region, Greece

Molise Region, Italy
North West Region, Romania

Basque Country, Spain

Core RTD Competencies within THE ISSUE Consortium supporting this Innovation Action:

- RTD2: Advanced data sharing, data-fusion, collection and analysis infrastructure
- RTD3: Road surface and infrastructure management research & technologies
- RTD5: ICT and Computational Intelligence supporting advanced urban traffic management systems
- RTD6: Open GIS and crowd sourcing imagery augmenting mapping technologies

Core RTD Competencies identified in:

East Midlands Region, UK
Mazovia Region, Poland
Northern Ireland, UK

Primorje-Gorskie Region, Croatia
Midi-Pyrenees/Aquitaine Regions, France
Calabria Region, Italy

Molise Region, Italy
Attica Region, Greece

Relevance to Horizon 2020 - The Framework Programme for Research and Innovation:

- Transport Challenge “Smart Green Integrated Transport”:
a) Call “Mobility for Growth”: Topics - Road, Urban Mobility, Intelligent Transport Systems, Socio-Economic & Behavioural Research and Forward Looking Activities for Policy Making

THE ISSUE Priority Innovation Action 7:

IA16. Enhancing the knowledge and capacities of local authorities to successfully plan and implement innovative sustainable mobility measures, by developing new instruments and mechanisms to study, model and plan future scenarios for the sustainable movement of people and goods, based on the collection, analysis and exchange of reliable and relevant data from multiple sources, including geo-positioning information, environmental data, residents and visitors’ behaviour

Expected Impacts of this Innovation Action:

- Improved ability to plan and design a fit-for-purpose transport network that is more accessible, integrated, affordable, efficient and viable, as well as meeting the future needs of business and citizens.
- Improved reliability and predictability of journey times and ease of movement.
- Optimisation of information within transport management systems.
- Adapting the environment for safe planning of mass events.
- Better understanding of collective human movement in the urban environment.
- Design better exit routes for evacuation of large crowds from buildings
- Improved modelling of collective behaviour:

- *Reduced congestion of pedestrian flow*
- *Socio-economic impacts, connecting and locating users everywhere in an urban environment, and potential creation and development of innovative services for citizens.*

Strong evidence of need for this innovation Action found in:

Mazovia Region, Poland
Attica Region, Greece

Midi-Pyrenees/Aquitaine Regions, France
North West Region, Romania

Basque Country, Spain

Core RTD Competencies within THE ISSUE Consortium supporting this Innovation Action:

- *RTD2: Advanced data sharing, data-fusion, collection and analysis infrastructure*
- *RTD4: Advanced sensor development for space, aerial and in-situ traffic management and control and air quality monitoring, analysis, evaluation*
- *RTD5: ICT and Computational Intelligence supporting advanced urban traffic management systems*
- *RTD6: Open GIS and crowd sourcing imagery augmenting mapping technologies*
- *RTD7: Application of Downstream space data products and services (e.g. Copernicus and Galileo) to support urban traffic management systems to provide real-time positioning, tracking, incident location, velocity and timing information*
- *RTD8: Specialised software for advanced management of multimodal transport network*

Core RTD Competencies identified in:

East Midlands Region, UK
Mazovia Region, Poland
Northern Ireland, UK

Primorje-Gorskie Region, Croatia
Midi-Pyrenees/Aquitaine Regions, France
Calabria Region, Italy

Molise Region, Italy
Attica Region, Greece

Relevance to Horizon 2020 - The Framework Programme for Research and Innovation:

- *Transport Challenge “Smart Green Integrated Transport”:*
 - a) *Call “Mobility for Growth”: Topics - Road, Urban Mobility, Logistics, Intelligent Transport Systems, Socio-Economic & Behavioural Research and Forward Looking Activities for Policy Making*
- *Leadership in Enabling and Industrial Technologies “Space”:*
 - a) *Call “Applications in Satellite Navigation” - Topics: Galileo*
 - b) *Call “Earth Observation”: Topics – Space-Enabled Applications, Tools for Access to Space Data*

CHALLENGE 2. MANAGING URBAN AIR QUALITY AND GREENHOUSE GAS EMISSIONS

THE CHALLENGE

Managing urban air quality and greenhouse gas emissions was identified by THE ISSUE as the second challenge area in its Programme of Innovation in Sustainable Transport and Intelligent Mobility. Local management strategies and technological solutions are required to help local and regional authorities meet EU directives and government regulations for air quality standards and greenhouse gas emissions in Cities across Europe.

Air pollution has very localised and adverse impacts on human health, as well as damaging flora and fauna ecosystems. Emissions from long distance HGV transport and urban traffic in congested towns and cities are major contributors of air pollution. The main impacts include high levels of NO_x and PM emissions, largely resulting from traffic congestion and represent significant health hazards. The latest analysis estimates that across the EU in 2004, over 420,000 premature deaths were as a result of air pollution.

Climate change is linked to atmospheric greenhouse gases (GHGs), including carbon dioxide (CO₂) and methane (CH₄). Traffic emissions account for 25% of GHG emissions across urban Europe. A reduction in traffic emissions is therefore a key area of importance if the EU is to achieve its 60% GHG reduction target by 2050.

Traditional approaches have seen responding to air pollution from traffic emissions as a local issue, presenting relatively short term problems tackled through short term mitigation strategies. Whereas, climate change impacts are generally perceived as a global issue with long term consequences requiring international action. However, climate change also impacts on urban and regional sustainability; therefore climate change adaptation measures must be considered the local, regional and national levels.

In the future, local management strategies and technological solutions must be capable of helping local and regional authorities meet EU directives and government regulations for air quality standards and greenhouse gas emissions in Cities across Europe.

THE ISSUE'S STRATEGIC OBJECTIVES

For this challenge area, THE ISSUE Programme identified two strategic objectives. These correlated most directly to the highest operational needs of urban and regional transport authorities, where the exploitation of newly-emerging and existing research and technologies, particularly in the fields of ICT and Space Technology, could deliver innovative new solutions to help improve the monitoring and management of urban air quality and Greenhouse Gas emissions. The two strategic objectives were:

SO5. Improving the calibration and validation of the accuracy of air quality models and traffic simulations

SO6. Improving Sensor Monitoring and Model Forecasting of Emission Levels

These objectives were selected following a thorough analysis by THE ISSUE Project of the key challenges arising from the impact of air pollution on the economic, environmental and social health of cities and regions within THE ISSUE Consortium Network. This included an extensive consultation within THE ISSUE Consortium to review the key priorities of end-users in terms of transport and urban mobility policies, strategies and implementation plans with respect to managing urban air quality and greenhouse gas emissions.

Addressing these two strategic objectives through the exploitation of newly-emerging and existing research and technologies found within THE ISSUE Consortium, will deliver new research-based and innovation-driven solutions to help improve the monitoring and management of urban air quality and Greenhouse Gas emissions.

THE ISSUE'S RESPONSE

For the two strategic objectives selected by THE ISSUE, the Project identified a range of innovative action responses that will deploy innovative solutions to deliver new long term sustainable products and services that will improve the monitoring and management of urban air quality and Greenhouse Gas emissions. Each of these potential solutions is capable of being supported by core RTD competencies found within THE ISSUE Consortium Network.

A key conclusion from THE ISSUE Project in terms of addressing Challenge Area 2 and the two specific strategic objectives is that different mitigation and adaptation solutions are required for these different problems. Research and innovation applied to existing monitoring systems are required to augment and sustain current sparsely populated networks of in-situ sensors and provide new data streams to support and validate the complex models of air quality and carbon emissions.

THE ISSUE proposes solutions that will integrate new technologies from space, airborne and in situ sensors in order to improve the identification of emission sources and provide new tools to support the regulation of emission levels. Health and economic benefits will follow from managing urban air quality and greenhouse gas emissions. The innovation actions proposed by THE ISSUE Project will deliver:

- Integrated systems to monitor air quality and identify sources of emissions in urban environments,
- Satellite technology to determine greenhouse gas emissions,
- Sensor monitoring and model forecasting of emission levels.

These solutions could provide new data streams to support and validate complex models of air quality and carbon emissions. Health and economic benefits could also follow from the improved monitoring and management urban air quality and greenhouse gas emissions.

Following a prioritisation exercise involving the core and associate regions within THE ISSUE Consortium, THE ISSUE Programme classified all the innovation action responses in Challenge Area 2 as longer-term actions. In response to an assessment of the relative strength of the evidence base relating to user-needs within each region and the level of maturity of the RTD competencies that would support the development of the innovative solutions, none of the action responses warranted being classified as high priority.

While it is clear that within THE ISSUE Consortium there are world-leading research capabilities in the field of air quality, this assessment also revealed that strict national legislation dictates that standardised monitoring equipment must be used to monitor air quality, thus reducing the autonomy of individual city authorities to innovate in terms of monitoring systems. In other cases, the real-time monitoring of Greenhouse Gas emissions is not currently identified as a statutory requirement in many regions within THE ISSUE Consortium. Nevertheless, THE ISSUE Project feels that the relative importance of monitoring and managing air quality will increase dramatically over the next five years, thus increasing demand for innovation in this field.

The following longer-term innovation action responses were identified to address the two strategic objectives in Challenge Area 2:

Strategic Objective 5. Improving the calibration and validation of the accuracy of air quality models and traffic simulations, through:

Long-Term Innovation Actions:

- IA21. Improving public information services and historical reporting by developing new systems for the measuring and monitoring of short-term carbon emissions and providing air quality forecasts.*

IA19. *Developing tools to promote the use of earth observation data sets to improve the quality of local air quality models.*

Strategic Objective 6. Improving sensor monitoring and model forecasting of emission levels, through:

Long-Term Innovation Actions:

- IA32. *Acquiring emissions data from urban and rural networks by public and commercial users of the road network, together with the expanded use of social networking technologies.*
- IA33. *Improving the measurement of height and spatial distribution of pollutants, using Unmanned Aerial Vehicles.*
- IA31. *Improving the calibration and validation of air quality estimations and traffic simulations, by integrating ground based sensors and remote sensing systems.*

THE ISSUE'S LONG-TERM INNOVATION ACTIONS

This section describes the longer-term innovation action responses identified by THE ISSUE Project for each of the strategic objectives identified in Challenge Area 2. Each of these innovation action responses will be taken forward through THE ISSUE Meta-Cluster on the basis of a collaborative approach with appropriate partners from within the Consortium. The recommended funding route for these priority project areas is through European funding channels such as Horizon 2020.

In terms of these innovation actions responses, THE ISSUE Meta-Cluster will periodically review their relative in order to determine:

- a) If there is an increased policy priority around these areas
- b) If other regions around Europe (new Meta-Cluster members), have a policy priority in these areas.
- c) If there are capabilities that could influence regional policy priorities for example areas of air quality or the health impacts of pollution

STRATEGIC OBJECTIVE 5. IMPROVING THE CALIBRATION AND VALIDATION OF THE ACCURACY OF AIR QUALITY MODELS AND TRAFFIC SIMULATIONS

THE ISSUE Rationale

To improve the identification of emission sources and provide new tools to support the regulation of emission levels, THE ISSUE identified that a key priority was to investigate ways in which to improve the calibration and validation of the accuracy of air quality models and traffic simulations. This would enable local authorities and organizations to assess localized management strategies or technology solutions for transport problems and air pollution and climate change resilience. It is widely recognised that measures to abate air pollution and GHG often target the same emission sources.

The integration of state-of-the-art remote sensing systems in combination with ground-based sensors will provide extensive valuable data of pollutant concentrations to calibrate and validate the accuracy of air quality models and traffic simulations. This challenge provides an excellent opportunity for local authorities and organizations to assess localized management strategies or technology solutions for transport problems and air pollution and climate change resilience. It is widely recognised that measures to abate air pollution and GHG often target the same emission sources.

The technology solutions we foresee are:

- The earth observation data sets from both monitoring and downstream services will provide the background levels of the main pollutants which can inform local air quality models.
- City-wide measurements of key pollutants that map the urban network and identify areas of poor air quality with high spatial and temporal resolution.
- GNSS -derived vehicle location data will improve congestion mapping processes with potential to improve emission management.
- Short-term carbon emissions and air quality forecasts for public information services and historical

reporting.

- Ground-based sensors (both traditional and innovative) to measure pollutants in real-time in urban locations with high traffic density.

THE ISSUE proposes to integrate state-of-the-art remote sensing systems with ground-based sensors to provide extensive valuable data of pollutant concentrations to improve the calibration and validation of the accuracy of air quality models and traffic simulations. In order to take this forward, THE ISSUE has identified the following priority RTD solutions that will help address this specific strategic objective.

THE ISSUE Long-Term Innovation Actions:

IA21. *Improving public information services and historical reporting by developing new systems for the measuring and monitoring of short-term carbon emissions and providing air quality forecasts.*

IA19. *Developing tools to promote the use of earth observation data sets to improve the quality of local air quality models.*

Expected impacts of these Innovation Actions:

- To be able to accurately assess real time levels of pollution and greenhouse gas emissions.
- To overcome data gaps in emission inventories validate models and identify zones where emission levels exceed EU recommended limits.
- To provide accurate information of areas and periods of high pollution levels to transport users, providers and local authorities.
- To provide accurate information about greenhouse gas emissions that will allow a more accurate assessment of any reductions.
- To evaluate the actual exposure of persons to ambient pollution via information on the spatial distribution of pollutant concentrations.
- To identify relative contributions of air pollutant emissions and GHGs at local and regional level to meet EU regulations (EEA, 2006; EEA, 2010a).

Core RTD Competencies within THE ISSUE Consortium supporting these Innovation Actions:

- Remote sensing using integrated satellite, aerial and in-situ real time data for air quality monitoring forecasting and management.
- Mapping levels and location of harmful and environmentally threatening anthropogenic emissions.
- Deployment of new environmental sensors from Europe's Copernicus and Galileo missions, and related in-situ and aerial sensor development programmes.

STRATEGIC OBJECTIVE 6. IMPROVING SENSOR MONITORING AND MODEL FORECASTING OF EMISSION LEVELS

THE ISSUE Rationale

Emission models set out to monitor and forecast variations in air pollution levels over the urban network and over time on daily, monthly and yearly timescales. The models need to be calibrated and validated using data from in-situ pollution sensors coupled with meteorological and air dispersion information to obtain distribution maps of the pollution levels. These models are used by local and regional authorities in health and environmental risk assessments to develop control strategies. Data from models also serve to inform local and regional authorities on options for air pollution control so as to meet EU air quality directives and avert the risk of fines.

In-situ pollution sensors are often either extensive but expensive to maintain or too sparsely distributed to provide accurate maps of air quality distributions. Other limitations in current models arise due to incomplete knowledge of the traffic variables that affect emissions, such as average vehicle speed, density, vehicle type, driving pattern (degree of acceleration/deceleration) and distance travelled. Data fed to models from urban traffic management systems is not sufficient to cover all these conditions.

Recently, distributions of air pollution species obtained from satellite imaging are being added to existing air quality models to augment the data from in-situ sensors, which are often sparsely distributed. Air quality maps are thus

being improved to help identify road traffic pollution hot spots. Other limitations in current models arise due to incomplete knowledge of the traffic variables that affect emissions, such as average vehicle speed, density, vehicle type, driving pattern (degree of acceleration/deceleration) and distance travelled. Data fed to models from urban traffic management systems is not sufficient to cover all these conditions.

Greenhouse gas (GHG) emissions are a driver of global climate change, arguably the most significant challenge of modern times, already with huge economic and social implications. As part of attempts to tackle this issue, countries around the world have set targets to reduce their GHG emissions. A key priority for THE ISSUE is to find ways to improve the ability to measure actual emissions of greenhouse gases beyond Greenhouse Gas Inventories.

The monitoring of GHG emissions targets has been achieved, to date, through 'budgeting systems' known as 'inventory methods', which allocate estimated emissions values to different activities such as transport, energy usage, burning of fossil fuels etc. In this way, a country's overall emissions profile is built up with very little or no actual measurements of emissions. The error in estimating emissions in this way can be very large. For example, it was found that uncertainty in China's overall emissions was as large as Japan's total emissions output, with Japan itself being one of the world's top 5 GHG emitters. Estimates are also based on historical information so that, at the time of reporting, information available to policy makers can already be out of date by up to two years.

Greenhouse gas (GHG) inventories allow assessment of progress towards national and international GHG reduction commitments. These commitments translate into sector and company-level obligations and responses that impact across a country. Fossil-fuel-derived carbon dioxide emissions can be estimated most accurately, but the uncertainty for other greenhouse gas sources is larger. Comparability of national inventories between industrialized countries is generally good, but may be less so for developing country inventories. France, Italy and UK's national inventories estimate GHG emissions within their borders.

To deliver radical changes to current monitoring methods and improve air quality models and maps, THE ISSUE proposes to use satellite imaging to more accurately identify road traffic pollution hot spots. Model reliability and accuracy could also be improved through access to new data sources from satellite imaging using new sensor technologies, which could identify distributions of air pollution species and augment the data from in-situ sensors.

THE ISSUE's response to this specific strategic objective is to propose solutions that could radically reduce the errors in estimations, by using direct measurements of CO₂, CH₄ and CO from the ground, aircraft and space. This includes assessing the emission sources and corroborate estimations with real measurements, by developing a methodology that will enable the standardization of actual determination of emissions for local, national and international procedures. Such measurements would allow closely monitoring the decarbonization of urban areas from changes towards low carbon vehicles or use of ITS to improve traffic conditions through traffic light adjustment (divert traffic) and increase fuel efficiency. De-carbonising the transport sector have been emphasized and prioritized in the latest Europe 2020 strategy. Urban and regional GHG emissions and climate change adaptation are important component of the global climate change scenario. Contribution to national carbon reduction targets.

Improvements to model reliability and accuracy are possible through access to new data sources and new sensor technologies. These technologies are potential enablers for radical change to the currently monitoring methods.

- Satellite monitoring of air quality is currently limited by low resolution and infrequent coverage. Spacecraft for atmospheric monitoring, such as the Copernicus Sentinel 4/5/SP satellites when operational, will greatly improve the spatial and temporal coverage of urban and regional areas and provide more comprehensive and continuous data sets for modelling and control of localized air pollution.
- New sensor technologies offer new capabilities and lower cost solutions in place of existing in situ sensor networks which may either be extensive but expensive to maintain or are too sparsely distributed to provide accurate maps of air quality distributions.
- New NO₂ imagers have been demonstrated offering 100m spatial resolution over several km sized urban networks, from roof top up to the boundary layer. Such systems have been demonstrated during the London Olympics and offer new operational approaches to air quality mapping.
- Airborne mapping of NO₂ over large urban areas provide a snap-shot of concentrations, which can be used to validate models.
- Integration of ground based sensors and remote sensing systems to calibrate and validate air quality estimations and traffic simulations.
- Acquisition of emissions data from urban and rural networks by public and commercial users of the road network organization coupled with the expanded use of social networking technologies (small sensors in vehicles, smartphones-cameras, GPS etc.).

- Remotely controlled aircraft have potential applications in the measurements of height and spatial distributions of pollutants, possibly at lower cost than conventional aerial survey aircrafts. This technology depends on new air safety regulations being introduced that allow operational use of remote controlled aircraft over urban zones.

THE ISSUE Long-Term Innovation Actions:

IA32. *Acquiring emissions data from urban and rural networks by public and commercial users of the road network, together with the expanded use of social networking technologies.*

IA33. *Improving the measurement of height and spatial distribution of pollutants, using Unmanned Aerial Vehicles.*

IA31. *Improving the calibration and validation of air quality estimations and traffic simulations, by integrating ground based sensors and remote sensing systems.*

Expected impacts of these Innovation Actions:

- Empower local authorities by giving information of the source of emissions.
- A strong data evidence based approach towards Transport Planning.
- Reduction of individual transport and providing alternative ways of travelling using estimations of high pollution periods and locations.
- Models that predict the emission situation at a local and national level.

Core RTD Competencies within THE ISSUE Consortium supporting these Innovation Actions:

- *Deployment of new environmental sensors from Europe's Copernicus and Galileo missions, and related in-situ and aerial sensor development programmes.*

CHALLENGE 3. IMPROVING THE EFFICIENCY AND EFFECTIVENESS OF THE EXISTING URBAN AND REGIONAL ROAD NETWORK

THE CHALLENGE

Improving the efficiency and effectiveness of the existing urban and regional road network was identified by THE ISSUE as the third challenge area in its Programme of Innovation in Sustainable Transport and Intelligent Mobility.

The European Environment Agency forecasts that by 2020, 80% of European citizens will live in urban areas. Such increases will create new problems of urban sprawl, traffic congestion, overloaded infrastructure, noise and air pollution. Chaotic and unplanned development of urban infrastructure offers very low economic and social effectiveness, unprofitable development and high cost of maintenance of public transport. These effects are serious barriers to sustainable development of many European cities.

Sustainable urban development requires coherent urban planning based on intelligent traffic management technology, data fusion from many separate sources, ease of access to data and information for planners, technology providers and public and commercial users. Transport system solutions directed at the sustainable development of existing and planned road networks can provide conditions for the safe and efficient transport of people and goods while ensuring the priority of public transport and to counterbalance the prevailing urban sprawl.

In the future, transport system solutions must be directed towards the sustainable development of existing and planned road networks that can provide conditions for safe and efficient transport of people and goods while at the same time ensure the priority of public transport and serve to counterbalance the prevailing urban sprawl.

THE ISSUE'S STRATEGIC OBJECTIVES

For this challenge area, THE ISSUE Programme identified three strategic objectives. These correlated most directly to the highest operational needs of urban and regional transport authorities, where the exploitation of newly-emerging and existing research and technologies, particularly in the fields of ICT and Space Technology, could deliver innovative new solutions to help Improve the efficiency and effectiveness of the existing urban and regional road network. The three strategic objectives were:

- SO7. Making the existing urban and regional road network more efficient, reliable, resilient and effective.**
- SO8. Improving the management and maintenance of the existing road infrastructure.**
- SO9. Improving the planning and development of the road infrastructure network**

These strategic objectives were selected following a thorough analysis by THE ISSUE Project of the key challenges arising from the increasing demands for travel and the impacts on the existing urban and regional road network. This included an extensive consultation within THE ISSUE Consortium to review the key priorities of end-users in terms of transport and urban mobility policies, strategies and implementation plans with respect to Improving the efficiency and effectiveness of the existing urban and regional road network.

Addressing these three strategic objectives through the exploitation of newly-emerging and existing research and technologies found within THE ISSUE Consortium, will deliver new research-based and innovation-driven solutions to help Improve the efficiency and effectiveness of the existing urban and regional road network.

THE ISSUE'S RESPONSE

For each of the three strategic objectives in Challenge Area 3, THE ISSUE Project identified a range of innovative action responses that will deploy innovative new solutions to better manage existing urban networks and balance the impact of increasing demand. THE ISSUE's innovation action responses have the potential to deliver new long term sustainable products and services that could help improve the efficiency and effectiveness of the existing urban and regional road network. Each of these potential solutions is capable of being supported by core RTD competencies found within THE ISSUE Consortium Network.

Following a prioritisation exercise involving the core and associate regions within THE ISSUE Consortium, THE ISSUE Programme includes a number of priority innovation actions and longer-term actions to address the three strategic objectives in Challenge Area 3. Each action response was assessed on the basis of the relative strength of the evidence base relating to user-needs within each region and the level of maturity of the RTD competencies that would support the development of the innovative solutions. The following high priority and longer-term innovation action responses were identified:

Strategic Objective 7. Making the existing urban and regional road network more efficient, reliable, resilient and effective, through:

Priority Innovation Actions:

- IA35. *Creating Open Data Platforms to improve the collection, assessment, fusion, trend monitoring, analysis and storage of transportation data from multiple sources, leading to a more efficient use of the existing infrastructure.*
- IA38. *Introducing advanced real-time information services for drivers and other road users to provide real-time traffic situation reports and options for choosing the best means of transport.*

Long-Term Innovation Actions:

- IA37. *Designing advanced road equipment systems (e.g. smart signs, intelligent crossings) that contribute towards improving the efficiency and effectiveness of the existing road network.*
- IA36. *Developing a real-time database of weather conditions, air pollution, traffic, road condition etc.*

Strategic Objective 8. Improving the management and maintenance of the existing road infrastructure, through:

Priority Innovation Actions:

- IA39. *Introducing more efficient and cost-effective ways of managing and maintaining the existing road infrastructure network by using ICT and Space technologies to develop new tools and mechanisms to gather and analyse information about the road infrastructure and its condition as well as the impacts on the environment and people's health.*
- IA42. *Developing tools that can improve the planning and management of road deviations during construction and maintenance works to maintain an efficient flow of traffic, especially in areas prone to congestion.*

Long-Term Innovation Action:

- IA43. *Developing a data, knowledge and information exchange panel (a dashboard) to improve communication between road infrastructure managers, road administrators and research institutions.*

Strategic Objective 9. Improving the planning and development of the road infrastructure network, through:

Priority Innovation Actions:

- IA45. *Developing real-time data collection networks that provide aggregated data to central ITM&C systems to enhance the ability to analyse multi-modal traffic and travel data from a range of data sources, including cooperative and crowd-sourced information, leading to improvements in transport system analysis and traffic model calibrations.*

IA46. Developing new models and tools to study, model and plan future scenarios for the movement of people and goods, taking into account multiple sources of information, including geo-positioning information, environmental data, residents and visitors' behaviour data.

Long-Term Innovation Action:

IA47. Introducing new user-behaviour models in info-mobility schemes taking into account the needs of pedestrians and bicycles in urban planning, also for transport mode interchange (e.g. Bike & Ride) and including ensuring safe and convenient access to public transport stops.

THE ISSUE'S PRIORITY INNOVATION ACTIONS

This section describes the priority innovation action responses identified by THE ISSUE Project for each of the strategic objectives identified in Challenge Area 3. Each of these innovation action responses were identified by THE ISSUE as being already sufficiently mature to be the subject of proposals for funding in the first two years of implementing the Programme. These projects have a pan-European perspective and will be taken forward through THE ISSUE Meta-Cluster on the basis of a collaborative approach with appropriate partners from within the Consortium. The recommended funding route for these priority project areas is through European funding channels such as Horizon 2020.

STRATEGIC OBJECTIVE 7. MAKING THE EXISTING URBAN AND REGIONAL ROAD NETWORK MORE EFFICIENT, RELIABLE, RESILIENT AND EFFECTIVE

THE ISSUE Rationale

Gathering, processing and sharing information will help to optimize the decision-making process. The aim is to provide geographical information for the knowledge of reality in a local context, optimized in terms of usability, to be readily used by policy makers and technicians. Particularly important is to provide geo-data (real-time positioning data of all means of transport; traffic data; all kind of databases linked to the knowledge of the territory and the transport infrastructures e.g. satellite images processed, Open Street Map, other maps; sociological and economic studies for transport management, environmental impacts of traffic flows) to the traveller and to the transport operator.

This topic covers mechanisms to mitigate the impact of increasing demand, and to deploy ITS solutions to better manage the existing network.

THE ISSUE has considered the range of RTD capabilities within THE ISSUE Consortium and identified a range of innovative sustainable urban transport and mobility planning measures, technologies and tools that could make the existing urban and regional road network more efficient, reliable, resilient and effective. The priority RTD solutions that THE ISSUE has identified to help address this specific strategic objective, are:

THE ISSUE Priority Innovation Action 8:

IA35. Creating Open Data Platforms to improve the collection, assessment, fusion, trend monitoring, analysis and storage of transportation data from multiple sources, leading to a more efficient use of the existing infrastructure

Expected Impacts of this Innovation Action:

- Transport network modernisation and improvements leading to a more accessible, integrated, affordable, efficient and viable transport network that meets the future needs of businesses and citizens.
- Better able to manage recurrent/non-recurrent delays in the transport system and minimise disruption
- Optimisation of information within transport management systems.
- Creation of a closer dialogue between the different decisional actors linked to the urban transport network.
- Innovative traffic management systems to maximize the capacity of the existing network

Strong evidence of need for this Innovation Action found in:

Mazovia Region, Poland
Basque Country, Spain

Primorje-Gorskie Region, Croatia
Midi-Pyrenees/Aquitaine Regions, France

East Midlands Region, UK

Core RTD Competencies within THE ISSUE Consortium supporting this Innovation Action are:

- RTD2: Advanced data sharing, data-fusion, collection and analysis infrastructure
- RTD5: ICT and Computational Intelligence supporting advanced urban traffic management systems
- RTD6: Open GIS and crowd sourcing imagery augmenting mapping technologies.
- RTD7: Application of Downstream space data products and services (e.g. Copernicus and Galileo) to support urban traffic management systems to provide real-time positioning, tracking, incident location, velocity and timing information

Core RTD Competencies identified in:

East Midlands Region, UK	Primorje-Gorskie Region, Croatia	Molise Region, Italy
Mazovia Region, Poland	Midi-Pyrenees/Aquitaine Regions, France	Attica Region, Greece
Northern Ireland, UK	Calabria Region, Italy	

Relevance to Horizon 2020 - The Framework Programme for Research and Innovation:

- Transport Challenge “Smart Green Integrated Transport”:
 - a) Call “Mobility for Growth”: Topics - Road, Urban Mobility, Intelligent Transport Systems
- Leadership in Enabling and Industrial Technologies “Space”:
 - a) Call “Applications in Satellite Navigation” - Topics: Galileo
 - b) Call “Earth Observation”: Topics – Space-Enabled Applications, Tools for Access to Space Data

THE ISSUE Priority Innovation Action 9:

IA38. Introducing advanced real-time information services for drivers and other road users to provide real-time traffic situation reports and options for choosing the best means of transport

Expected Impacts of this Innovation Action:

- Transport network modernisation and improvements leading to a more accessible, integrated, affordable, efficient and viable transport network that meets the future needs of businesses and citizens.
- Better able to manage recurrent/non-recurrent delays in the transport system and minimise disruption
- Optimisation of information within transport management systems.
- Creation of a closer dialogue between the different decisional actors linked to the urban transport network.
- Innovative traffic management systems to maximize the capacity of the existing network

Strong evidence of need for this Innovation Action found in:

East Midlands Region, UK	Midi-Pyrenees/Aquitaine Regions, France	Mazovia Region, Poland
Calabria Region, Italy	Primorje-Gorskie Region, Croatia	Calabria Region, Italy
Basque Country, Spain	North West Region, Romania	

Core RTD Competencies within THE ISSUE Consortium supporting this Innovation Action are:

- RTD1: Vehicle to vehicle and vehicle to infrastructure real-time communications technologies supporting advanced urban traffic management systems and rapid response capability
- RTD2: Advanced data sharing, data-fusion, collection and analysis infrastructure
- RTD5: ICT and Computational Intelligence supporting advanced urban traffic management systems
- RTD7: Application of Downstream space data products and services (e.g. Copernicus and Galileo) to support urban traffic management systems to provide real-time positioning, tracking, incident location, velocity and timing information
- RTD10: Behavioural, societal, foresight and socio-economic research

Core RTD Competencies identified in:

East Midlands Region, UK	Primorje-Gorskie Region, Croatia	Molise Region, Italy
Mazovia Region, Poland	Midi-Pyrenees/Aquitaine Regions, France	Attica Region, Greece
Northern Ireland, UK	Calabria Region, Italy	

Relevance to Horizon 2020 - The Framework Programme for Research and Innovation:

- Transport Challenge “Smart Green Integrated Transport”:
 - a) Call “Mobility for Growth”: Topics - Road, Urban Mobility, Intelligent Transport Systems
- Leadership in Enabling and Industrial Technologies “Space”:
 - a) Call “Applications in Satellite Navigation” - Topics: Galileo
 - b) Call “Earth Observation”: Topics – Space-Enabled Applications, Tools for Access to Space Data

STRATEGIC OBJECTIVE 8. IMPROVING THE MANAGEMENT AND MAINTENANCE OF THE EXISTING ROAD INFRASTRUCTURE

THE ISSUE Rationale

With rapidly reducing resource levels available to expand the road infrastructure, increasing pressure is being placed on increasing the capacity of the existing road infrastructure. On way of achieving this is through improving the way in which the infrastructure is managed and maintained. New satellite data sources from the European Sentinel missions or Galileo and the rules established by the INSPIRE directive provide spatial systems for implementation of a sound transport policy and to improve the management and maintenance of the existing road infrastructure. Additional sources of spatial information can found from real-time airborne monitoring. The key focus for THE ISSUE is producing intelligent GIS tools using satellite images and airborne sources for local authorities and other actors to:

- Plan the public transport networks, transport routes, stops, timetables;
- Study, model and plan the future scenarios for moving of people and goods;
- Help the densification of urban centre and control the urban sprawl;
- Develop and maintain airborne early warning and control systems;
- Gather all information: geo-positioning information, environmental data, residents and visitors behaviour data and information data to study/model different scenarios for present and future moving;
- Gather the information about the road infrastructure and its condition to better plan the maintenance and construction;
- Plan the road deviation during the construction and maintenance as well as caused by traffic accidents.

THE ISSUE has considered the range of RTD capabilities within THE ISSUE Consortium and identified a range of innovative sustainable urban transport and mobility planning measures, technologies and tools that could help improve the way in which the infrastructure is managed and maintained.

THE ISSUE Priority Innovation Action 10:

IA39. Introducing more efficient and cost-effective ways of managing and maintaining the existing road infrastructure network by using ICT and Space technologies to develop new tools and mechanisms to gather and analyse information about the road infrastructure and its condition

Expected Impacts of this Innovation Action:

- Innovative use of information services and systems for planning and operation.
- Innovative traffic management systems to maximize network use and improve transport security.
- Innovative logistics systems to support dynamic routing.
- Supporting solutions for physical planning
- More efficient and cost-effective methods of analysing and maintaining the condition of the existing infrastructure
- Ensuring the transport system and infrastructure is more resilient and adaptable to the impacts of climate change from heat and floods (damage to roads, bridges and other parts of the infrastructure)
- Innovative traffic management systems to maximize network use and improve transport security.
- Optimisation of information within transport management systems.

Strong evidence of need for this Innovation Action found in:

Mazovia Region, Poland
Molise Region, Italy

Mid-Pyrenees/Aquitaine Regions, France
North West Region, Romania

Attica Region, Greece

Core RTD Competencies within THE ISSUE Consortium supporting this Innovation Action are:

- RTD1: Vehicle to vehicle and vehicle to infrastructure real-time communications technologies supporting advanced urban traffic management systems and rapid response capability
- RTD2: Advanced data sharing, data-fusion, collection and analysis infrastructure
- RTD3: Road surface and infrastructure management research & technologies
- RTD5: Transport-related ICT and Computational Intelligence
- RTD6: Open GIS and crowd sourcing imagery augmenting mapping technologies.
- RTD7: Application of Downstream space data products and services (e.g. Copernicus and Galileo) to support urban traffic management systems to provide real-time positioning, tracking, incident location, velocity and timing information

Core RTD Competencies identified in:

East Midlands Region, UK
Mazovia Region, Poland
Northern Ireland, UK

Primorje-Gorskie Region, Croatia
Midi-Pyrenees/Aquitaine Regions, France
Calabria Region, Italy

Molise Region, Italy
Attica Region, Greece

Relevance to Horizon 2020 - The Framework Programme for Research and Innovation:

- Transport Challenge “Smart Green Integrated Transport”:
a) Call “Mobility for Growth”: Topics - Road, Urban Mobility, Intelligent Transport Systems
- Leadership in Enabling and Industrial Technologies “Space”:
a) Call “Applications in Satellite Navigation” - Topics: Galileo
b) Call “Earth Observation”: Topics – Space-Enabled Applications, Tools for Access to Space Data

THE ISSUE Priority Innovation Action 11:

IA42. Developing tools that can improve the planning and management of road deviations during construction and maintenance works to maintain an efficient flow of traffic, especially in areas prone to congestion

Expected Impacts of this Innovation Action:

- Reduced delay and increased traffic flow with associated improvements in air quality: lower NO₂ and CO₂ emissions.
- Improved reliability and predictability of journey times and ease of movement.
- Economic benefits in terms of reduced congestion time, shorter delays and reduction in stress.
- Innovative traffic management systems to maximize network use and improve transport security.
- Health and environmental protection measures through reduced impact of traffic related emissions.
- Supporting decarbonization of urban areas by improving traffic conditions through traffic light adjustment.

Strong evidence of need for this Innovation Action found in:

East Midlands Region, UK
Molise Region, Italy

Midi-Pyrenees/Aquitaine Regions, France
North West Region, Romania

Attica Region, Greece
Mazovia Region, Poland

Core RTD Competencies within THE ISSUE Consortium supporting this Innovation Action are:

- RTD1: Vehicle to vehicle and vehicle to infrastructure real-time communications technologies supporting advanced urban traffic management systems and rapid response capability
- RTD2: Advanced data sharing, data-fusion, collection and analysis infrastructure
- RTD6: Open GIS and crowd sourcing imagery augmenting mapping technologies
- RTD8: Specialised software for advanced management of multimodal transport network

Core RTD Competencies identified in:

East Midlands Region, UK
Mazovia Region, Poland
Northern Ireland, UK

Primorje-Gorskie Region, Croatia
Midi-Pyrenees/Aquitaine Regions, France
North West Region, Romania

Calabria Region, Italy
Attica Region, Greece

Relevance to Horizon 2020 - The Framework Programme for Research and Innovation:

- Transport Challenge “Smart Green Integrated Transport”:
a) Call “Mobility for Growth”: Topics - Road, Urban Mobility, Intelligent Transport Systems

STRATEGIC OBJECTIVE 9. IMPROVING THE PLANNING AND DEVELOPMENT OF THE ROAD INFRASTRUCTURE NETWORK

THE ISSUE Rationale

Adapting cities and metropolitan areas to changes in transport mobility requires the coordination of spatial and urban policy to manage transport services and balance demand between public, private and commercial transport needs.

Spatial planning requires more support from modern technologies to incorporate the road network into intelligent management systems. Increasing traffic throughput in corridors well served by public transport, prioritising public transport, improving functional attractiveness of inner-city areas, are all important.

From the transport user point of view, the consequence of transport network modernization will be decreased noise and air pollution levels, improved life quality and more efficient transport. Improvement to the transport network using new technologies will bring financial benefits in the long term by increasing the transport efficiency and profitability, subject to availability of the necessary capital investment.

It is worth noting that proper road networks as an element of transport system will function well if they are properly incorporated within the urban or regional transport system.

THE ISSUE has considered the range of RTD capabilities within THE ISSUE Consortium and identified a number of innovative sustainable urban transport and mobility planning measures, technologies and tools that could help improve the planning and development of the existing road infrastructure.

THE ISSUE Priority Innovation Action 12:

IA45. Developing real-time data collection networks that provide aggregated data to central ITM&C systems to enhance the ability to analyse multi-modal traffic and travel data from a range of data sources, including cooperative and crowd-sourced information, leading to improvements in transport system analysis and traffic model calibrations

Expected Impacts of this Innovation Action:

- Increased ability to design a fit-for-purpose transport network that meets the needs of business and citizens
- Improved accessibility to public transport, footways and public rights of way for mobility impaired and disadvantaged groups.
- Better able to manage recurrent/non-recurrent delays in the transport system and minimise disruption
- Economic impacts as a result of a well-planned transport infrastructure.
- Innovative traffic management systems to maximize network use and improve transport security
- Innovative use of information services and systems for planning and development of the road network
- Optimisation of information within transport management systems.
- Re-assessment of conventional urban planning and technology implementation in the field of urban mobility.

Strong evidence of need for this Innovation Action found in:

Calabria Region, Italy
Molise Region, Italy
Basque Country, Spain

East Midlands Region, UK
Mazovia Region, Poland

Attica Region, Greece
North West Region, Romania

Core RTD Competencies within THE ISSUE Consortium supporting this Innovation Action are:

- RTD2: Advanced data sharing, data-fusion, collection and analysis infrastructure
- RTD3: Road surface and infrastructure management research & technologies
- RTD4: Advanced sensor development for space, aerial and in-situ traffic management and control and air quality monitoring, analysis, evaluation
- RTD5: Transport-related ICT and Computational Intelligence.
- RTD6: Open GIS and crowd sourcing imagery augmenting mapping technologies

Core RTD Competencies identified in:

East Midlands Region, UK
Mazovia Region, Poland
Northern Ireland, UK

Primorje-Gorskie Region, Croatia
Midi-Pyrenees/Aquitaine Regions, France
Calabria Region, Italy

Molise Region, Italy
Attica Region, Greece

Relevance to Horizon 2020 - The Framework Programme for Research and Innovation:

- Transport Challenge “Smart Green Integrated Transport”:
 - a) Call “Mobility for Growth”: Topics - *Road, Urban Mobility, Intelligent Transport Systems*
- Energy Challenge “Secure, Clean and Efficient Energy”:
 - a) Call “Smart Cities and Communities”

THE ISSUE Priority Innovation Action 13:

IA46. *Developing new models and tools to study, model and plan future scenarios for the movement of people and goods, taking into account multiple sources of information, including geo-positioning information, environmental data, residents and visitors’ behaviour data*

Expected Impacts of this Innovation Action:

- Increased ability to design a fit-for-purpose transport network that meets the needs of business and citizens
- Improved accessibility to public transport, footways and public rights of way for mobility impaired and disadvantaged groups.
- Better able to manage recurrent/non-recurrent delays in the transport system and minimise disruption
- Economic impacts as a result of a well-planned transport infrastructure.
- Innovative traffic management systems to maximize network use and improve transport security
- Innovative use of information services and systems for planning and development of the road network
- Optimisation of information within transport management systems.
- Re-assessment of conventional urban planning and technology implementation in the field of urban mobility.

Strong evidence of need for this Innovation Action found in:

Calabria Region, Italy	East Midlands Region, UK	Attica Region, Greece
Basque Country, Spain	Molise Region, Italy	

Core RTD Competencies within THE ISSUE Consortium supporting this Innovation Action are:

- RTD2: Advanced data sharing, data-fusion, collection and analysis infrastructure
- RTD3: Road surface and infrastructure management research & technologies
- RTD4: Advanced sensor development for space, aerial and in-situ traffic management and control and air quality monitoring, analysis, evaluation
- RTD5: Transport-related ICT and Computational Intelligence.
- RTD6: Open GIS and crowd sourcing imagery augmenting mapping technologies

Core RTD Competencies identified in:

East Midlands Region, UK	Primorje-Gorskie Region, Croatia	Molise Region, Italy
Mazovia Region, Poland	Midi-Pyrenees/Aquitaine Regions, France	Attica Region, Greece
Northern Ireland, UK	Calabria Region, Italy	

Relevance to Horizon 2020 - The Framework Programme for Research and Innovation:

- Transport Challenge “Smart Green Integrated Transport”:
 - a) Call “Mobility for Growth”: Topics - *Road, Urban Mobility, Intelligent Transport Systems*
- Energy Challenge “Secure, Clean and Efficient Energy”:
 - a) Call “Smart Cities and Communities”

CHALLENGE 4. ACHIEVING INTEGRATED AND SEAMLESS TRAVEL AND MODAL INTEGRATION

THE CHALLENGE

Achieving integrated and seamless travel and modal integration was identified by THE ISSUE as the fourth challenge area in its Programme of Innovation in Sustainable Transport and Intelligent Mobility. Demand for travel is continually rising – whether for business or personal travel, driven by the needs of the global economy, a growing population, easier access to mobility and increasing availability of transport services. At the same time, the travelling experience is becoming increasingly more complex as transport options and services increase and the range of information available increases exponentially year on year.

To achieve optimised door-to-door mobility, higher safety, less environmental impact and lower operations costs, new innovative solutions are required to establish an integrated and seamless connection between people, transport means, infrastructure, businesses and goods.

Modal shift, congestion management and related regional and local authority transport policy objectives will oblige citizens to shift from cars to other forms of transport; either through choice or in response to regulatory process such as road pricing or taxation. More effective and coordinated public transport systems are needed to offer competitive and attractive alternatives to car use. But citizens then require systems that deliver quality, real-time, trustworthy data focussed on travellers' personal needs such that public transport becomes their preferred choice through informed decisions making.

Developing integrated transport system require giving people good information before and during their journeys; making sure that the interchanges between different public transport services do not act as a barrier; providing good walking and cycling access and facilities; getting transport services to connect with each other; and having tickets that allow services to join up in a simple and transparent way.

ITS technology already has capabilities to aggregate real-time data related to bus, train, tram, plane & boat positions, together with congestion data, and deliver this information to users. Web based services or public information boards can be delivered to personal devices such as mobile phones. Real-time information systems are available to alert travellers to incidents, delays and congestion to allow for an appropriate change in behaviour.

Available technologies include:

- Live information systems to encourage driver behaviour change during the journey.
- Location based services, using GNSS, city Wi-Fi and others to deliver real-time position data for public transport.
- Data mining, fusion and systems to analyse real-time data and deliver optimized journey plans.
- Presentation and display systems to support personalized dynamic journey management.

Regulatory barriers and user resistance to change stand in the way of exploitation and systematic implementation. Disruptive innovation is required for ITS technologies to make any impact on core regional transport policy objectives of modal shift and interoperability between transport modes.

Improvements in the cost effectiveness and attractiveness of public and soft transport modes (e.g. cycles) are necessary for providing efficient seamless travel in the urban environment for all categories of persons, especially young people, elderly, disadvantaged and less able persons. Modal shift towards public and soft transport modes benefits citizens by reducing stress and journey time and contributes to reduction of carbon footprint, noise, and congestion, thereby enhancing the quality of urban life. Wide-scale deployment of innovative technologies in the area of mobility management is anticipated through the Commission's "Smart Cities" European Innovation Partnerships leading to massive contributions to local economic development. The economic implications of such programmes are considerable.

In the future, achieving seamless transport and promoting modal shift will require integrated multi-modal transport information systems that can deliver quality, real-time, trustworthy data focussed on travellers'

personal needs as well as provide travellers with easy, one-stop-shop access to online booking, payment and ticketing services. For a significant group of travellers more sustainable forms of transport could become the default mode, particularly for shorter trips.

THE ISSUE'S STRATEGIC OBJECTIVES

For this challenge area, THE ISSUE Programme identified four strategic objectives. These correlated most directly to the highest operational needs of urban and regional transport authorities, where the exploitation of newly-emerging and existing research and technologies, particularly in the fields of ICT and Space Technology, could deliver innovative new solutions to help achieve integrated and seamless travel and modal integration. The four strategic objectives were:

SO10. Improving the competitiveness, performance, reliability and affordability of public transport services.

SO11. Increasing the availability and interoperability of multi-modal transport data

SO12. Promoting multimodal integrated travel information, journey planning and ticketing services

SO13. Promoting modal shift and offering more sustainable travel choices.

These strategic objectives were selected following a thorough analysis by THE ISSUE Project of the key challenges arising from the increasing demands for travel and the impacts on the existing urban and regional road network. This included an extensive consultation within THE ISSUE Consortium to review the key priorities of end-users in terms of transport and urban mobility policies, strategies and implementation plans with respect to integrated and seamless travel and modal integration.

Addressing these four strategic objectives through the exploitation of newly-emerging and existing research and technologies found within THE ISSUE Consortium, will deliver new research-based and innovation-driven solutions to help achieve integrated and seamless travel and modal integration.

THE ISSUE'S RESPONSE

For each of the four strategic objectives in Challenge Area 4, THE ISSUE Project identified a range of innovative action responses that will deploy innovative new solutions to help achieve integrated and seamless travel and modal integration. Each of these potential solutions is capable of being supported by core RTD competencies found within THE ISSUE Consortium Network.

THE ISSUE's response to this challenge area focusses on how mobile technologies, innovative data processing and new information systems can help to optimize travel experience. High priority RTD solutions, that are within the proven capabilities of THE ISSUE team, are proposed for:

- Localization based services for mobile citizens,
- Tracking services for freight transport,
- Predicting and managing the behaviours of crowds,
- Innovative travel planning tools based on GIS Technologies,
- Smart ticketing.

Following a prioritisation exercise involving the core and associate regions within THE ISSUE Consortium, THE ISSUE Programme includes a number of priority innovation actions and longer-term actions to address the four strategic objectives in Challenge Area 4. Each action response was assessed on the basis of the relative strength of the evidence base relating to user-needs within each region and the level of maturity of the RTD competencies that would support the development of the innovative solutions. The following high priority and longer-term innovation action responses were identified:

Strategic Objective 10. Improving the competitiveness, performance, reliability and affordability of public transport services, through:

Priority Innovation Action:

- IA57. *Enabling public transport operators to increase reliability, accessibility, affordability and safety of public transport service, by developing and improving models and tools that enhance the collection, analysis and monitoring of relevant traffic and travel data from a range of sources to facilitate more optimised, coordinated and efficient service network planning.*

Strategic Objective 11. Promoting modal shift and offering more sustainable travel choices, through:

Priority Innovation Actions:

- IA51. *Developing advanced real-time multi-modal routing, information and journey decision support systems for drivers and other road users, including intelligent road equipment systems, to provide real-time traffic situation reports and options for choosing the best means of transport*
- IA53. *Providing innovative forms of travel information that focus on travellers' personnel needs by creating new innovative tools and mechanisms, including GIS-based tools, which enable the collection, analysis and dissemination of quality, real-time, interactive and trustworthy multi-modal transport information to improve the capacity of travellers to make informed decisions about proposed journeys*

Long-Term Innovation Action:

- IA55. *Developing advanced positioning technologies and delivering location-based services that provide continuity and reliability of user positioning services for both indoor and outdoor environments and the interface between the two, to support transport users, emergency communications, personal guidance in multimodal interfaces and social applications to create a more comfortable mobility experience; using services provided by Galileo and EGNOS signals, including data and signal fusion with 4G-5G networks, open geographical data, social networks, video processing, and machine-machine technologies.*

Strategic Objective 12. Increasing the availability and interoperability of multi-modal transport data, through:

Priority Innovation Action:

- IA63. *Developing standards of collective and multimodal data to allow better integration, comparison and accessibility between different users.*

Long-Term Innovation Actions:

- IA62. *Developing GIS-based tools to localize, validate, visualize, modify, share and manage real-time multimodal data with spatial information for different kind of transport providers.*
- IA65. *Improving the understanding of urban mobility and achieving further advances in intelligent mobility by developing new applications and tools that can unlock and exploit the potential of vast amounts of transport-related positioning, tracking and timing information available arising from the increasing connectivity of people and devices, the availability of GNSS location based services, advances in cloud computing, big, linked and open data and data crowd sourcing.*

Strategic Objective 13. Promoting multimodal integrated travel information, journey planning and ticketing services, through:

Priority Innovation Action:

- IA66. *Implementing smart, multi-modal integrated ticketing systems to promote seamless mobility and ease of use of public transport in urban areas.*
- IA68. *Developing real-time multi-modal personalised transport and travel information services, delivered through a fully integrated one-stop-shop user interface for travellers, which offers interactive on-line door-to-door multi modal journey comparison of real-time travel information including true financial costs, timings, and health and environmental impacts, as well as ticket purchase and redemption and interactive real-time notifications of incidents and delays.*

Long-Term Innovation Actions:

- IA69. *Promoting Smart Ticketing for larger territories and different local and regional transport authorities.*

THE ISSUE'S PRIORITY INNOVATION ACTIONS

This section describes the priority innovation action responses identified by THE ISSUE Project for each of the strategic objectives identified in Challenge Area 4. Each of these innovation action responses were identified by THE ISSUE as being already sufficiently mature to be the subject of proposals for funding in the first two years of implementing the Programme. These projects have a pan-European perspective and will be taken forward through THE ISSUE Meta-Cluster on the basis of a collaborative approach with appropriate partners from within the Consortium. The recommended funding route for these priority project areas is through European funding channels such as Horizon 2020.

STRATEGIC OBJECTIVE 10. IMPROVING THE COMPETITIVENESS, PERFORMANCE, RELIABILITY AND AFFORDABILITY OF PUBLIC TRANSPORT SERVICES

THE ISSUE Rationale

As cities across Europe continue to expand, keeping their citizens mobile is becoming a major challenge for local and regional authorities. Road traffic continues to increase, which is leading to growing congestion and pollution in city centres. Public transport is one of the most economical and environment friendly policies for solving congestion problems in urban areas. The challenge is to improve the global quality of public transport. By making it more punctual, safer, more comfortable and more attractive, it will help to increase its use and in this contribute to creating cleaner and less congested cities.

Increasing the efficiency and effectiveness of public transport will increase the satisfaction of existing passengers and attract new ones in greater numbers. It will also enable public transport operators to be able to provide better services that are competitive in price and reliability.

THE ISSUE has considered the range of RTD capabilities within THE ISSUE Consortium and identified a number of innovative sustainable urban transport and mobility planning measures, technologies and tools that could help increase the efficiency and improve the effectiveness of public transport services..

THE ISSUE Priority Innovation Action 14:

IA48. Enabling public transport operators to increase reliability, accessibility, affordability and safety of public transport service, by developing and improving models and tools that enhance the collection, analysis and monitoring of relevant traffic and travel data from a range of sources to facilitate more optimised, coordinated and efficient service network planning

Expected Impacts of this Innovation Action:

- Better information for public transport providers to enable them to provide a better quality local bus services.
- Increased public transport efficiency and profitability.
- Promoting an improved continuity of service and creating a more comfortable mobility experience, thereby improving the willingness of citizens to make positive choices to use public transport, with related impacts, such as reduction in congestion, air pollution and noise
- Many more residents using the bus for longer journeys within the urban area, instead of using the car
- Improved accessibility to public transport services for mobility impaired and disadvantaged groups
- Creation of a dialogue between the different decisional actors linked to public transport service provision.
- Improved image of public transport

Strong evidence of need for this Innovation Action found in:

Calabria Region, Italy
Molise Region, Italy
Basque Country, Spain

East Midlands Region, UK
Mazovia Region, Poland

Attica Region, Greece
North West Region, Romania

Core RTD Competencies within THE ISSUE Consortium supporting this Innovation Action are:

- RTD2: Advanced data sharing, data-fusion, collection and analysis infrastructure
- RTD3: Road surface and infrastructure management research & technologies
- RTD5: ICT and Computational Intelligence supporting advanced urban traffic management systems
- RTD6: Open GIS and crowd sourcing imagery augmenting mapping technologies.
- RTD10: Behavioural, societal, foresight and socio-economic research

Core RTD Competencies identified in:

East Midlands Region, UK
Mazovia Region, Poland
Northern Ireland, UK

Primorje-Gorskie Region, Croatia
Midi-Pyrenees/Aquitaine Regions, France
Calabria Region, Italy

Molise Region, Italy
Attica Region, Greece

Relevance to Horizon 2020 - The Framework Programme for Research and Innovation:

- Transport Challenge “Smart Green Integrated Transport”:
 - a) Call “Mobility for Growth”: Topics - *Road, Urban Mobility, Intelligent Transport Systems, Socio-Economic & Behavioural Research and Forward Looking Activities for Policy Making*

STRATEGIC OBJECTIVE 11. PROMOTING MODAL SHIFT AND OFFERING MORE SUSTAINABLE TRAVEL CHOICES

THE ISSUE Rationale

Providing alternative, more sustainable modes of transport to the motor car will play a role in improving the economies, health and environment in cities and regions across Europe. A key priority for THE ISSUE is to ensure alternative modes of transport are attractive, accessible, affordable, safe and reliable. Another key priority for THE ISSUE is encouraging greater usage of these alternative modes of transport. There are a number of social, cultural and economic barriers slowing the shift towards the use of more sustainable modes of transport.

The development of standards of collective and multimodal data will allow a better integration, comparison and accessibility between the different users. The development of standards must be in coherence and complementary with the existing standards (NEPTUNE, for the theoretical multimodal supply, SIRI for the real time information).

More reliable data, especially concerning multimodal information, will provide better information for transport providers. This will result in simplified and more reliable journeys for the traveller. Consequently, modal shifts can be expected, with related impacts, such as reduction in congestion, air pollution and noise.

With the extension of urban areas and the multiplication of transport modes the need for continuity and reliability of positioning services (for both indoor and outdoor environments) is emerging. In outdoor positioning, urban canyons limit access to the satellite constellation and cause multipath errors and loss of precision. In parallel, indoor positioning technologies are not precise enough and difficult to access for users. The challenge becomes complex: how to ensure the precision and access to positioning and guarantee a continuity of a user service switching from outdoor to indoor environment?

The focus proposed in the framework of THE ISSUE consists of studying and benchmarking emerging technologies and their potential hybridization with the advanced positioning technologies provided by Galileo and EGNOS signals. These emerging technologies include data and signal fusion with 4G-5G networks, open geographical data, social networks, video processing, and machine-machine (M2M) technologies.

The potential creation and development of innovative services for citizens that could connect and locate users everywhere in an urban environment could provide support to transport users, emergency communications, personal guidance in multimodal interfaces and social applications. This continuity of services would then improve the willingness of citizens to use public transport since it would create a more comfortable mobility experience.

THE ISSUE has considered the range of RTD capabilities within THE ISSUE Consortium and identified a number of innovative sustainable urban transport and mobility planning measures, technologies and tools that could help improve modal shift.

THE ISSUE Priority Innovation Action 15:

IA51. Developing advanced real-time multi-modal routing, information and journey decision support systems for drivers and other road users, including intelligent road equipment systems, to provide real-time traffic situation reports and options for choosing the best means of transport

Expected Impacts of this Innovation Action:

- More reliable multi-modal information and better informed travel decisions.
- Improved reliability and predictability of journey times and ease of movement around the urban area
- Reduced congestion due to advanced notice of incidents and delays, leading to increased traffic flow with associated improvements in air quality and lower CO₂ emissions from better and more efficient driving.
- Supporting transport users, emergency communications, personal guidance in multimodal interfaces and social applications.
- Innovative traffic management systems to maximize network use, an increased use of spare capacity and improved transport safety and security
- Simplified and more reliable journeys for the traveller.
- Reduction of stress, shorter delays and economic gain due to reduced congestion time

Strong evidence of need for this Innovation Action found in:

Calabria Region, Italy
East Midlands Region, UK
Basque Country, Spain

Midi-Pyrenees/Aquitaine Regions, France
Primorje-Gorskie Region, Croatia

Mazovia Region, Poland
North West Region, Romania

Core RTD Competencies within THE ISSUE Consortium supporting this Innovation Action are:

- RTD1: Vehicle to vehicle and vehicle to infrastructure real-time communications technologies supporting advanced urban traffic management systems and rapid response capability
- RTD2: Advanced data sharing, data-fusion, collection and analysis infrastructure
- RTD5: ICT and Computational Intelligence supporting advanced urban traffic management systems
- RTD7: Application of Downstream space data products and services (e.g. Copernicus and Galileo) to support urban traffic management systems to provide real-time positioning, tracking, incident location, velocity and timing information.
- RTD10: Behavioural, societal, foresight and socio-economic research

Core RTD Competencies identified in:

East Midlands Region, UK
Mazovia Region, Poland
Northern Ireland, UK

Primorje-Gorskie Region, Croatia
Midi-Pyrenees/Aquitaine Regions, France
Calabria Region, Italy

Molise Region, Italy
Attica Region, Greece

Relevance to Horizon 2020 - The Framework Programme for Research and Innovation:

- Transport Challenge “Smart Green Integrated Transport”:
 - a) Call “Mobility for Growth”: Topics - Road, Urban Mobility, Intelligent Transport Systems, Socio-Economic & Behavioural Research and Forward Looking Activities for Policy Making
- Leadership in Enabling and Industrial Technologies “Space”:
 - a) Call “Applications in Satellite Navigation” - Topics: Galileo
 - b) Call “Earth Observation”: Topics – Space-Enabled Applications, Tools for Access to Space Data

THE ISSUE Priority Innovation Action 16:

IA53. *Providing innovative forms of travel information that focus on travellers' personnel needs by creating new innovative tools and mechanisms, including GIS-based tools, which enable the collection, analysis and dissemination of quality, real-time, interactive and trustworthy multi-modal transport information to improve the capacity of travellers to make informed decisions about proposed journeys*

Expected Impacts of this Innovation Action:

- Improving the provision of information on public transport, walking and cycling opportunities.
- Increased support to transport users, emergency communications, personal guidance in multimodal interfaces and social applications
- Promoting a continuity of service, thereby improving the willingness of citizens to use public transport since it would create a more comfortable mobility experience.
- Modal shift arising from positive choices by travellers to use public transport, with related impacts, such as reduction in congestion, air pollution and noise.
- More reliable multi-modal information and better informed decisions about proposed journeys.
- Socio-economic impacts, connecting and locating users everywhere in an urban environment, and potential creation and development of innovative new travel and transport services for citizens.

Strong evidence of need for this Innovation Action found in:

Calabria Region, Italy
Molise Region, Italy
Basque Country, Spain

Midi-Pyrenees/Aquitaine Regions, France
Primorje-Gorskie Region, Croatia
North West Region, Romania

East Midlands Region, UK
Mazovia Region, Poland

Core RTD Competencies within THE ISSUE Consortium supporting this Innovation Action are:

- RTD2: Advanced data sharing, data-fusion, collection and analysis infrastructure
- RTD3: Road surface and infrastructure management research & technologies
- RTD5: ICT and Computational Intelligence supporting advanced urban traffic management systems
- RTD6: Open GIS and crowd sourcing imagery augmenting mapping technologies
- RTD7: Application of Downstream space data products and services (e.g. Copernicus and Galileo) to support urban traffic management systems to provide real-time positioning, tracking, incident location, velocity and timing information.
- RTD8: Specialised software for advanced management of multimodal transport network

Core RTD Competencies identified in:

East Midlands Region, UK
Mazovia Region, Poland
Northern Ireland, UK

Primorje-Gorskie Region, Croatia
Midi-Pyrenees/Aquitaine Regions, France
Calabria Region, Italy

Molise Region, Italy
Attica Region, Greece

Relevance to Horizon 2020 - The Framework Programme for Research and Innovation:

- Transport Challenge "Smart Green Integrated Transport":
 - a) Call "Mobility for Growth": Topics - Road, Urban Mobility, Intelligent Transport Systems, Socio-Economic & Behavioural Research and Forward Looking Activities for Policy Making
- Leadership in Enabling and Industrial Technologies "Space":
 - a) Call "Applications in Satellite Navigation" - Topics: Galileo
 - b) Call "Earth Observation": Topics – Space-Enabled Applications, Tools for Access to Space Data
- Energy Challenge "Secure, Clean and Efficient Energy":
 - a) Call "Smart Cities and Communities"

STRATEGIC OBJECTIVE 12. INCREASING THE AVAILABILITY AND INTEROPERABILITY OF MULTI-MODAL TRANSPORT DATA

THE ISSUE Rationale

Intelligent Transport Systems (ITS) are at the heart of achieving seamless mobility for passengers across Europe. However, there is currently a fragmented approach to the deployment of ITS across Europe. A key priority is to meet the mobility needs of passengers across Europe by developing innovative solutions that ensure there is a wider choice of transport services available to European citizens and that they are able to move more easily across transport modes and across countries. It will also allow European citizens to make better use of the existing infrastructure when travelling and may lead to a shift to more environmentally friendly modes of transport.

The use open source and high quality transport data will provide the means for achieving substantial improvements in the performance of transport networks by raising their efficiency, facilitating visibility, resilience and facilitating collaboration.

Whether travelling within a city, between cities or between countries, passengers across Europe have never had as many travel options and services available to choose as they do today when deciding to plan a journey. Thanks to the internet, travellers also have access to a huge amount of travel data to help them plan their journeys. However, the irony is that at the same time the multiple travel options and array of information is making planning a journey becoming ever more challenging and stressful.

The travel experience for individuals is becoming increasingly more complex with multiple travel options and services being provided and more and more travel information is available, particularly on line, but from a bewildering array of sources. This has created difficulties for the passenger to understand, analyse and make choices over these options and services as well as being able to access the right information at the right time.

The challenge is to come up with new, efficient, affordable, safe, secure and accessible solutions taking advantage of the ever growing connectivity of people and objects, the availability of European GNSS based location, the advances in cloud computing, big, linked and open data and the propagation of Internet and social media, that will help solve the mobility problems European citizens and businesses are facing today. Indeed, 'Big Data' management (availability, collection, storage, distribution and use) will progressively become a major challenge in intelligent transport communications as will the wider issues related to data ownership, user acceptance and privacy concerns.

At the heart of this is the need to improve and maximise the availability and (cross-border/cross-system) interoperability of transport data and provide solutions for real-time information exchange; that delivers deliver high-quality traffic and travel information as well as business services to support travellers.

The integration of social media for data crowd sourcing and increasing user engagement and acceptance has to be a fundamental consideration. A key priority is to develop solutions that will help unlock the potential of vast amounts of transport data and resolve problems relating to the transmission, interoperability, storage, processing and security of transport data.

THE ISSUE has considered the range of RTD capabilities within THE ISSUE Consortium and identified a number of innovative sustainable measures, technologies and tools that could help improve the interoperability of transport data.

THE ISSUE Priority Innovation Action 17:

IA63. Developing standards of collective and multimodal data to allow better integration, comparison and accessibility between different users

Expected Impacts of this Innovation Action:

- Creation of a dialogue between the different decisional actors linked to urban transport
- Improvements to the transport network using new technologies.
- More reliable multi-modal information
- Optimization of information within management systems.
- Strong data evidence based approach towards Transport Planning

Strong evidence of need for this Innovation Action found in:

East Midlands Region, UK
Molise Region, Italy

Midi-Pyrenees/Aquitaine Regions, France

Primorje-Gorskie Region, Croatia

Core RTD Competencies within THE ISSUE Consortium supporting this Innovation Action are:

- RTD2: Advanced data sharing, data-fusion, collection and analysis infrastructure.
- RTD3: Road surface and infrastructure management research & technologies.
- RTD5: ICT and Computational Intelligence supporting advanced urban traffic management systems.
- RTD6: Open GIS and crowd sourcing imagery augmenting mapping technologies.
- RTD7: Application of Downstream space data products and services (e.g. Copernicus and Galileo) to support urban traffic management systems to provide real-time positioning, tracking, incident location, velocity and timing information.
- RTD10: Behavioural, societal, foresight and socio-economic research.

Core RTD Competencies identified in:

East Midlands Region, UK
Mazovia Region, Poland
Northern Ireland, UK

Primorje-Gorskie Region, Croatia
Midi-Pyrenees/Aquitaine Regions, France
Calabria Region, Italy

Molise Region, Italy
Attica Region, Greece

Relevance to Horizon 2020 - The Framework Programme for Research and Innovation:

- Transport Challenge “Smart Green Integrated Transport”:
 - a) Call “Mobility for Growth”: Topics - Road, Urban Mobility, Intelligent Transport Systems, Socio-Economic & Behavioural Research and Forward Looking Activities for Policy Making
- Leadership in Enabling and Industrial Technologies “Space”:
 - a) Call “Applications in Satellite Navigation” - Topics: Galileo
 - b) Call “Earth Observation”: Topics – Space-Enabled Applications, Tools for Access to Space Data
- Energy Challenge “Secure, Clean and Efficient Energy”:
 - a) Call “Smart Cities and Communities”

STRATEGIC OBJECTIVE 13. PROMOTING MULTIMODAL INTEGRATED TRAVEL INFORMATION, PLANNING AND TICKETING SERVICES

THE ISSUE Rationale

Development of standards of collective and multimodal data will allow a better integration, comparison and accessibility between the different users. The development of standards must be in coherence and complementary with the existing standards (NEPTUNE, for the theoretical multimodal supply, SIRI for the real time information). GIS based tools offer capabilities to localize, validate, visualize, modify, share and manage real-time multimodal data with spatial information for different kind of transport providers. This kind of tool could be a common environment where transport providers and public authorities can share real time information, and collaborative methods with the potential intervention of all users, traffic modelling for the calculation of multimodal journey times or provision of open data and open services from the transport operators.

The last point is the development of practical tools and guidance for the user multimodal transportation planning and decision-making process, for instance, smartphone applications that update in real time the multimodal journey planning (Mobiville project).

Smart ticketing can be divided in two complementary themes: the smart organization of ticketing at a large scale and for different means of transport (unique ticketing), and the smart technology to pay for a transport service. In both cases, universal use and maximum simplification of ticket management can have a real social and environment impact.

After positive local experiences in various European regions (the Pastel card in Midi Pyrénées for instance can be used for buses, tram, metro and trains with the same equipment), THE ISSUE aims at promoting the study of these solutions at a larger scale.

The smart ticketing can make multimodal travel easier for users (no need to buy different tickets at each step of the travel, global vision of the cost of the complete travel), improved image of public transport, improved modal shift from individual car to cleaner means for transportation. It may also impact on tariff policy and harmonize the costs between the different transport providers. The treatment of unique ticketing data allows access to global usage statistics that are of value to transport authorities.

Specific areas for focus include:

- Smart ticketing for different means of transport (a common system of pay for different transport services, such as bikes, parking, toll-roads, etc.),
- Smart ticketing for larger territories and different local and regional transport authorities,
- Generalization of the existing technologies for the development of alternative tickets: smartphones applications, QR codes, smartcards, NFC (Near Field Communication), car-sharing vehicles via contactless smartphone interactions (*Autopartage* project),
- Adapting the technological and organizational solutions to the local context,
- Establishing local acceptability by ensuring user needs are fully catered for,
- Providing a ticketing system that is comprehensible and ergonomic,
- Combining ticketing with other elements related to the activity of citizens (a common system to pay for different services, not only transport).

THE ISSUE has considered the range of RTD capabilities within THE ISSUE Consortium and identified a number of innovative sustainable measures, technologies and tools that could help promote multimodal integrated travel information, planning and ticketing services.

THE ISSUE Priority Innovation Action 18:

IA66. Implementing smart, multi-modal integrated ticketing systems to promote seamless mobility and ease of use of public transport in urban areas

Expected Impacts of this Innovation Action:

- Multimodal travel easier for users, including removing the need to buy different tickets at each step of a journey.
- Socio-economic impacts, connecting and locating users everywhere in an urban environment, potential creation and development of innovative new services for citizens.
- Improved quality of local bus services: through coordinated implementation of smart & integrated ticketing, real time bus passenger information, enforcement of bus lanes, etc.
- Reduction in barriers inhibiting people from changing their travel behaviour to more sustainable modes (reliability, cost, convenience of public transport, issues of personal safety and security).
- Simplified and more reliable journeys for the traveller.
- Increased use of more sustainable methods of travel.
- Many more residents using the bus for longer journeys within the urban area, instead of using the car

Strong evidence of need for this Innovation Action found in:

Calabria Region, Italy	Primorje-Gorskie Region, Croatia	Attica Region, Greece
East Midlands Region, UK	Mazovia Region, Poland	North West Region, Romania
Basque Country, Spain		

Core RTD Competencies within THE ISSUE Consortium supporting this Innovation Action are:

- *RTD1: Vehicle to vehicle and vehicle to infrastructure real-time communications technologies supporting advanced urban traffic management systems and rapid response capability*
- *RTD2: Advanced data sharing, data-fusion, collection and analysis infrastructure*
- *RTD3: Road surface and infrastructure management research & technologies*
- *RTD5: ICT and Computational Intelligence supporting advanced urban traffic management systems*
- *RTD6: Open GIS and crowd sourcing imagery augmenting mapping technologies.*
- *RTD7: Application of Downstream space data products and services (e.g. Copernicus and Galileo) to support urban traffic management systems to provide real-time positioning, tracking, incident location, velocity and timing information*

Core RTD Competencies identified in:

East Midlands Region, UK	Primorje-Gorskie Region, Croatia	North West Region, Romania
Basque Country, Spain	Midi-Pyrenees/Aquitaine Regions, France	Attica Region, Greece
Northern Ireland, UK	Calabria Region, Italy	

Relevance to Horizon 2020 - The Framework Programme for Research and Innovation:

- Transport Challenge “Smart Green Integrated Transport”:
 - a) Call “Mobility for Growth”: Topics - Road, Urban Mobility, Intelligent Transport Systems, Socio-Economic & Behavioural Research and Forward Looking Activities for Policy Making
- Leadership in Enabling and Industrial Technologies “Space”:
 - a) Call “Applications in Satellite Navigation” - Topics: Galileo
 - b) Call “Earth Observation”: Topics – Space-Enabled Applications, Tools for Access to Space Data
- Energy Challenge “Secure, Clean and Efficient Energy”:
 - a) Call “Smart Cities and Communities”

THE ISSUE Priority Innovation Action 19:

IA68. Developing real-time multi-modal personalised transport and travel information services, delivered through a fully integrated one-stop-shop user interface for travellers, which offers interactive on-line door-to-door multi modal journey comparison of real-time travel information including true financial costs, timings, and health and environmental impacts, as well as ticket purchase and redemption and interactive real-time notifications of incidents and delays

Expected Impacts of this Innovation Action:

- Reduction in barriers inhibiting people from changing their travel behaviour to more sustainable modes.
- Simplified and more reliable journeys for the traveller.
- Increased use of more sustainable methods of travel.
- Many more residents walking and/or cycling the shorter journeys in and around the urban area
- Many more residents using the bus for longer journeys within the urban area, instead of using the car
- Increased support to transport users, emergency communications, personal guidance in multimodal interfaces and social applications.
- Socio-economic impacts, connecting and locating users everywhere in an urban environment, potential creation and development of innovative new services for citizens.

Strong evidence of need for this Innovation Action found in:

Calabria Region, Italy
Molise Region, Italy
Basque Country, Spain

Primorje-Gorskie Region, Croatia
North West Region, Romania

Mazovia Region, Poland
East Midlands Region, UK

Core RTD Competencies within THE ISSUE Consortium supporting this Innovation Action are:

- RTD2: Advanced data sharing, data-fusion, collection and analysis infrastructure
- RTD3: Road surface and infrastructure management research & technologies
- RTD7: Application of Downstream space data products and services (e.g. Copernicus and Galileo) to support urban traffic management systems to provide real-time positioning, tracking, incident location, velocity and timing information
- RTD5: ICT and Computational Intelligence supporting advanced urban traffic management systems
- RTD6: Open GIS and crowd sourcing imagery augmenting mapping technologies.

Core RTD Competencies identified in:

East Midlands Region, UK
Mazovia Region, Poland
Northern Ireland, UK

Primorje-Gorskie Region, Croatia
Midi-Pyrenees/Aquitaine Regions, France
Calabria Region, Italy

Molise Region, Italy
Attica Region, Greece

Relevance to Horizon 2020 - The Framework Programme for Research and Innovation:

- Transport Challenge “Smart Green Integrated Transport”:
 - a) Call “Mobility for Growth”: Topics - Road, Urban Mobility, Intelligent Transport Systems, Socio-Economic & Behavioural Research and Forward Looking Activities for Policy Making
- Leadership in Enabling and Industrial Technologies “Space”:
 - a) Call “Applications in Satellite Navigation” - Topics: Galileo
 - b) Call “Earth Observation”: Topics – Space-Enabled Applications, Tools for Access to Space Data
- Energy Challenge “Secure, Clean and Efficient Energy”:
 - a) Call “Smart Cities and Communities”

THE ISSUE'S LONG-TERM INNOVATION ACTIONS

This section describes the longer-term innovation action responses identified by THE ISSUE Project for each of the strategic objectives identified in Challenge Area 4. Each of these innovation action responses will be taken forward through THE ISSUE Meta-Cluster on the basis of a collaborative approach with appropriate partners from within the Consortium. The recommended funding route for these priority project areas is through European funding channels such as Horizon 2020.

In terms of these innovation actions responses, THE ISSUE Meta-Cluster will periodically review their relative in order to determine:

- a) If there is an increased policy priority around these areas
- b) If other regions around Europe (new Meta-Cluster members), have a policy priority in these areas.
- c) If there are capabilities that could influence regional policy priorities for example areas of air quality or the health impacts of pollution

STRATEGIC OBJECTIVE 11. PROMOTING MODAL SHIFT AND OFFERING MORE SUSTAINABLE TRAVEL CHOICES

THE ISSUE Rationale

With the extension of urban areas and the multiplication of transport modes the need for continuity and reliability of positioning services (for both indoor and outdoor environments) is emerging. In outdoor positioning, urban canyons limit access to the satellite constellation and cause multipath errors and loss of precision. In parallel, indoor positioning technologies are not precise enough and difficult to access for users. The challenge becomes complex: how to ensure the precision and access to positioning and guarantee a continuity of a user service switching from outdoor to indoor environment?

The focus proposed in the framework of THE ISSUE consists of studying and benchmarking emerging technologies and their potential hybridization with the advanced positioning technologies provided by Galileo and EGNOS signals. These emerging technologies include data and signal fusion with 4G-5G networks, open geographical data, social networks, video processing, and machine-machine (M2M) technologies.

The project concept is to take a precise user-case of service using outdoor / indoor positioning, and to use this example as a benchmark of different technologies or solutions to select the most relevant technology based on the experiences of a group of typical users. This example could follow the experience lead in the framework of the BINAUR project which deals with positioning and guidance of blind people in urban (indoor/outdoor) environments.

THE ISSUE Long-Term Innovation Actions:

IA55. *Developing advanced positioning technologies and delivering location-based services that provide continuity and reliability of user positioning services for both indoor and outdoor environments and the interface between the two, to support transport users, emergency communications, personal guidance in multimodal interfaces and social applications to create a more comfortable mobility experience; using services provided by Galileo and EGNOS signals, including data and signal fusion with 4G-5G networks, open geographical data, social networks, video processing, and machine-machine technologies.*

Expected impacts of these Innovation Actions:

- In terms of socio-economic consequences, the impact could be considerable since it aims at connecting and locating users everywhere in an urban environment. The potential creation and development of innovative services for citizens would then be greatly increased: support to transport users, emergency communications, personal guidance in multimodal interfaces and social applications are examples of actions that would potentially benefit from this research topic. This continuity of services would then

improve the willingness of citizens to use public transport since it would create a more comfortable mobility experience.

Core RTD Competencies within THE ISSUE Consortium supporting these Innovation Actions:

- *Vehicle-vehicle and vehicle-infrastructure real time communication and rapid response capability.*
- *Satellite provided vehicle and incident location supporting autonomous navigation services.*
- *Data sharing and data fusion infrastructure.*

STRATEGIC OBJECTIVE 12. INCREASING THE AVAILABILITY AND INTEROPERABILITY OF MULTI-MODAL TRANSPORT DATA

THE ISSUE Rationale

As illustrated by the crowd disaster in Duisburg during the Love Parade in 2010, the understanding of pedestrian behaviour and crowd dynamics has become important research areas. Much fundamental research undertaken in this area is aiming to analyse the collective motion of crowds and their congestion formation mechanisms. The objective is then to design better exit routes for evacuation of large crowds and to adapt the environment for safe planning of mass events.

A new approach at the crossroads of social ethology and statistical physics seeks to understand the behavioural rules and interactions that govern collective behaviours in human crowds. The approach consists of developing an understanding of the behaviour of animal groups (ant colonies, sheep flocks etc.) and their interactions with their environment whilst moving. The ambition is then to develop models that reproduce the patterns that govern these collective movements and then adapting these models to collective human behaviour. Reducing pedestrian congestion in metro stations or optimizing the use of road networks are typical applications under consideration.

THE ISSUE Long-Term Innovation Actions:

- IA62.** *Developing GIS-based tools to localize, validate, visualize, modify, share and manage real-time multimodal data with spatial information for different kind of transport providers.*
- IA65.** *Improving the understanding of urban mobility and achieving further advances in intelligent mobility by developing new applications and tools that can unlock and exploit the potential of vast amounts of transport-related positioning, tracking and timing information available arising from the increasing connectivity of people and devices, the availability of GNSS location based services, advances in cloud computing, big, linked and open data and data crowd sourcing.*

Expected impacts of these Innovation Actions:

- This work opens the way for the elaboration of reliable risk management tools but also to a better understanding of collective human movement in the urban environment. Modelling of collective behaviour could help urban planners to design better exit routes for evacuation of large crowds from buildings, to reduce congestion of pedestrian flow and to adapt the environment for safe planning of mass events. *The consequences will be reduction of stress, shorter delays and economic gain due to reduced congestion time.*

Core RTD Competencies within THE ISSUE Consortium supporting these Innovation Actions:

CHALLENGE 5. INCREASING SAFETY, SECURITY AND HEALTH IN URBAN COMMUNITIES

THE CHALLENGE

Increasing safety, security and health in urban communities was identified by THE ISSUE as the fifth challenge area in its Programme of Innovation in Sustainable Transport and Intelligent Mobility. Safety, security & health are at the heart of European policies and the Horizon 2020 pillars. Particular emphasis is given to transport policies and projects that generate improvement to the quality of life of citizens and communities. Working on these themes can improve the planning, the design and the use of the transport network.

Reducing accidents saves lives, makes the streets safer, reduces congestion and creates a better urban environment. Safer streets aid social inclusion and improve pedestrian safety. Economic benefits accrue from reduction in workloads in health services in accident and emergency centres and reductions in traffic congestion arising from incidents.

In the future, new monitoring and mapping systems must be capable of extending the amount and type of information that can be collected and measured as inputs for road safety enhancement tools. New technologies and monitoring systems are also needed to improve the control and management of the road network before, during and after incidents.

THE ISSUE'S STRATEGIC OBJECTIVES

For this challenge area, THE ISSUE Programme identified three strategic objectives. These correlated most directly to the highest operational needs of urban and regional transport authorities, where the exploitation of newly-emerging and existing research and technologies, particularly in the fields of ICT and Space Technology, could deliver innovative new solutions to help increase safety, security and health in urban communities. The three strategic objectives were:

- SO14. Developing advanced safety and security measures to help reduce accidents, make roads safer (especially for Vulnerable Road Users) and create a better urban environment.**
- SO15. Improving Security and Information about the Transporting of Freight in Urban Areas.**
- SO16. Improving the Health of Citizens**

These strategic objectives were selected following a thorough analysis by THE ISSUE Project of the key challenges arising from the increasing demands for travel and the impacts on safety, security and health in urban communities. This included an extensive consultation within THE ISSUE Consortium to review the key priorities of end-users in terms of transport and urban mobility policies, strategies and implementation plans with respect to increase safety, security and health in urban communities.

Addressing these three strategic objectives through the exploitation of newly-emerging and existing research and technologies found within THE ISSUE Consortium, will deliver new research-based and innovation-driven solutions to help increase safety, security and health in urban communities.

THE ISSUE'S RESPONSE

For each of the three strategic objectives in Challenge Area 5, THE ISSUE Project identified a range of innovative action responses that will deploy innovative new solutions to better manage existing urban

networks and balance the impact of increasing demand. THE ISSUE's innovation action responses have the potential to deliver new long term sustainable products and services that could help improve the efficiency and effectiveness of the existing urban and regional road network. Each of these potential solutions is capable of being supported by core RTD competencies found within THE ISSUE Consortium Network.

The availability of new monitoring and mapping systems has largely extended the amount and type of information that can be collected as input for road safety enhancement tools. New technologies and monitoring systems have extended the amount and type of traffic measurements. High priority RTD actions, that lie within the proven capabilities of THE ISSUE, are proposed for:

- Design and quality of network to enhance road safety;
- Systems to control and manage the road network before, during and after incidents;
- Health of citizens;
- Security and information about freight road traffic.

Following a prioritisation exercise involving the core and associate regions within THE ISSUE Consortium, THE ISSUE Programme includes a number of priority innovation actions and longer-term actions to address the three strategic objectives in Challenge Area 5. Each action response was assessed on the basis of the relative strength of the evidence base relating to user-needs within each region and the level of maturity of the RTD competencies that would support the development of the innovative solutions. The following high priority and longer-term innovation action responses were identified:

Strategic Objective 14. Developing advanced safety and security measures to help reduce accidents, make roads safer (especially for Vulnerable Road Users) and create a better urban environment, through:

Priority Innovation Actions:

- IA72. Improving traveller safety and security by developing new automatic data collection and monitoring systems that provide a more in-depth understanding of user behaviour, accident causation and possible countermeasures and impacts.*
- IA71. Developing innovative, low cost, flexible and mobile speed control systems that improve the monitoring, mapping and control of the speed of vehicles in urban and rural areas and improves road safety.*

Long-Term Innovation Actions:

- IA73. Developing innovative tools to improve the design & quality of road networks to enhance road safety.*

Strategic Objective 15. Improving security and information about the transporting of freight in urban areas, through:

Long-Term Innovation Actions:

- IA78. Developing specific tools (software and hardware) for road safety enhancement relating to the transport of goods.*
- IA76. Developing location-based service solutions for improvement of freight transport functioning.*
- IA77. Developing automatic tracking systems for the transport of goods.*
- IA75. Developing a Trans-European freight transport information hub, with the aim of collecting and disseminating information from all possible users and providers*

Strategic Objective 16. Improving the health of citizens, through:

Long-Term Innovation Actions:

- IA79. Increasing the level of information available, directly or indirectly related to transport systems, about the presence of pollutants and noise levels, especially at local and regional levels.*
- IA81. Analysing the inter-linkages between currently used and newly identified parameters relating to health related air pollution or the impact of vehicle noise regulations.*
- IA82. Identifying, piloting and evaluating the most efficient and cost-effective measures to reduce exposure to pollutants and noise, and to help decision makers to find specific solutions.*

THE ISSUE'S PRIORITY INNOVATION ACTIONS

This section describes the priority innovation action responses identified by THE ISSUE Project for each of the strategic objectives identified in Challenge Area 5. Each of these innovation action responses were identified by THE ISSUE as being already sufficiently mature to be the subject of proposals for funding in the first two years of implementing the Programme. These projects have a pan-European perspective and will be taken forward through THE ISSUE Meta-Cluster on the basis of a collaborative approach with appropriate partners from within the Consortium. The recommended funding route for these priority project areas is through European funding channels such as Horizon 2020.

SO14. DEVELOPING ADVANCED SAFETY AND SECURITY MEASURES TO HELP REDUCE ACCIDENTS, MAKE ROADS SAFER (ESPECIALLY FOR VULNERABLE ROAD USERS) AND CREATE A BETTER URBAN ENVIRONMENT.

THE ISSUE Rationale

The implementation of innovative tools for the road safety impact assessment and the road safety audit involving the use of new automatic data collection systems represents an advanced solution for this sector, usually based on the use of few data, generally reduced to incident statistics. Specific topics are related to the data collection involving the road network (conditions and topology), the user behaviour and, last but not least, the environmental conditions.

The crowd disaster in Duisburg during the Love Parade in 2010, highlighted the importance of understanding pedestrian behaviour and crowd dynamics. Much fundamental research undertaken in this area is aiming to analyse the collective motion of crowds and their congestion formation mechanisms. The objective is then to design better exit routes for evacuation of large crowds and to adapt the environment for safe planning of mass events. This work opens the way for the elaboration of reliable risk management tools but also to a better understanding of collective human movement in the urban environment. Modelling of collective behaviour could help urban planners to design better exit routes for evacuation of large crowds from buildings, to reduce congestion of pedestrian flow and to adapt the environment for safe planning of mass events. The consequences will be reduction of stress, shorter delays and economic gain due to reduced congestion time.

GPS-based smartphones as well as vehicles equipped with Bluetooth devices or RFID transponders are examples of new sources of probe data (or floating car data). Attention has been focused on the fusion of data detected by different types of sensors in order to improve the forecast of traffic flow conditions. These innovations represent the starting point for the implementation of innovative solutions involving speed control (speed detector systems not based on fixed traffic sensors) and incident management systems (process of different activities from incident detection, verification, information, response and traffic management at network level and clearance).

THE ISSUE has considered the range of RTD capabilities within THE ISSUE Consortium and identified a number of innovative sustainable measures, technologies and tools that could help developing advanced safety and security measures to help reduce accidents, make roads safer (especially for vulnerable road users) and create a better urban environment.

THE ISSUE Priority Innovation Action 20:

IA72. Improving traveller safety and security by developing new automatic data collection and monitoring systems that provide a more in-depth understanding of user behaviour, accident causation and possible countermeasures and their impacts

Expected Impacts of this Innovation Action:

- Improved road safety and a reduction in the number of people killed or injured in road accidents.
- Reduction in the number of accidents.
- Reduction in barriers inhibiting people from changing their travel behaviour to more sustainable modes (reliability, cost, convenience of public transport, issues of personal safety and security).
- Innovative traffic management systems to maximize network use and improve transport safety and security.
- Innovative use of information services and systems for planning and management of the road network.

- Reduction in safety and security threats in the traffic accident area.
- Reduction in the impact of accidents on traffic conditions and congestion.
- Strong data evidence based approach towards Transport Planning.

Strong evidence of need for this Innovation Action found in:

Calabria Region, Italy
Molise Region, Italy
Mazovia Region, Poland

Primorje-Gorskie Region, Croatia
North West Region, Romania

Attica Region, Greece
East Midlands Region, UK

Core RTD Competencies within THE ISSUE Consortium supporting this Innovation Action are:

- RTD1: Vehicle to vehicle and vehicle to infrastructure real-time communications technologies supporting advanced urban traffic management systems and rapid response capability
- RTD2: Advanced data sharing, data-fusion, collection and analysis infrastructure
- RTD3: Road surface and infrastructure management research & technologies
- RTD5: ICT and Computational Intelligence supporting advanced urban traffic management systems
- RTD6: Open GIS and crowd sourcing imagery augmenting mapping technologies.
- RTD10: Behavioural, societal, foresight and socio-economic research

Core RTD Competencies identified in:

East Midlands Region, UK
Mazovia Region, Poland
Northern Ireland, UK

Primorje-Gorskie Region, Croatia
Midi-Pyrenees/Aquitaine Regions, France
Calabria Region, Italy

Molise Region, Italy
Attica Region, Greece

Relevance to Horizon 2020 - The Framework Programme for Research and Innovation:

- Transport Challenge “Smart Green Integrated Transport”:
a) Call “Mobility for Growth”: Topics - Road, Urban Mobility, Intelligent Transport Systems, Socio-Economic & Behavioural Research and Forward Looking Activities for Policy Making

THE ISSUE Priority Innovation Action 21:

IA71. Developing innovative, low cost, flexible and mobile speed control systems that improve the monitoring, mapping and control of the speed of vehicles in urban and rural areas and improves road safety

Expected Impacts of this Innovation Action:

- Improved road safety and a reduction in the number of people killed or injured in road accidents.
- Reduction in the number of accidents.
- Reduction in barriers inhibiting people from changing their travel behaviour to more sustainable modes (reliability, cost, convenience of public transport, issues of personal safety and security)
- Innovative traffic management systems to improve transport safety and security.
- Reduction in safety and security threats in the traffic accident area.
- Reduction in the impact of accidents on traffic conditions and congestion.
- Strong data evidence based approach towards Transport Planning.

Strong evidence of need for this Innovation Action found in:

Calabria Region, Italy
Molise Region, Italy
East Midlands Region, UK

Primorje-Gorskie Region, Croatia
Mazovia Region, Poland

Attica Region, Greece
North West Region, Romania

Core RTD Competencies within THE ISSUE Consortium supporting this Innovation Action are:

- RTD1: Vehicle to vehicle and vehicle to infrastructure real-time communications technologies supporting advanced urban traffic management systems and rapid response capability
- RTD2: Advanced data sharing, data-fusion, collection and analysis infrastructure
- RTD3: Road surface and infrastructure management research & technologies
- RTD5: ICT and Computational Intelligence supporting advanced urban traffic management systems
- RTD6: Open GIS and crowd sourcing imagery augmenting mapping technologies.
- RTD10: Behavioural, societal, foresight and socio-economic research

Core RTD Competencies identified in:

East Midlands Region, UK
Mazovia Region, Poland
Northern Ireland, UK

Primorje-Gorskie Region, Croatia
Midi-Pyrenees/Aquitaine Regions, France
Calabria Region, Italy

Molise Region, Italy
Attica Region, Greece

Relevance to Horizon 2020 - The Framework Programme for Research and Innovation:

- Transport Challenge “Smart Green Integrated Transport”:
 - a) Call “Mobility for Growth”: Topics - *Road, Urban Mobility, Intelligent Transport Systems, Socio-Economic & Behavioural Research and Forward Looking Activities for Policy Making*

THE ISSUE’S LONG-TERM INNOVATION ACTIONS

This section describes the longer-term innovation action responses identified by THE ISSUE Project for each of the strategic objectives identified in Challenge Area 5. Each of these innovation action responses will be taken forward through THE ISSUE Meta-Cluster on the basis of a collaborative approach with appropriate partners from within the Consortium. The recommended funding route for these priority project areas is through European funding channels such as Horizon 2020.

In terms of these innovation actions responses, THE ISSUE Meta-Cluster will periodically review their relative in order to determine:

- a) If there is an increased policy priority around these areas
- b) If other regions around Europe (new Meta-Cluster members), have a policy priority in these areas.
- c) If there are capabilities that could influence regional policy priorities for example areas of air quality or the health impacts of pollution

STRATEGIC OBJECTIVE 14. DEVELOPING ADVANCED SAFETY AND SECURITY MEASURES TO HELP REDUCE ACCIDENTS, MAKE ROADS SAFER (ESPECIALLY FOR VULNERABLE ROAD USERS) AND CREATE A BETTER URBAN ENVIRONMENT

THE ISSUE Rationale

The implementation of innovative tools for the road safety impact assessment and the road safety audit involving the use of new automatic data collection systems represents an advanced solution for this sector, usually based on the use of few data, generally reduced to incident statistics. Specific topics are related to the data collection involving the road network (conditions and topology), the user behaviour and, last but not least, the environmental conditions.

THE ISSUE Long-Term Innovation Actions:

IA73. *Developing innovative tools to improve the design and quality of road networks in order to enhance road safety.*

Expected impacts of this Innovation Action:

- Optimization of information within management systems.
- Better management of networks (road, infrastructure).
- Faster emergency vehicle response through clearer routes.

Core RTD Competencies within THE ISSUE Consortium supporting this Innovation Action:

- Acquisition and automatic processing of CCTV and crowd sourced images for safety and security enhancement.
- Vehicle-vehicle and vehicle-infrastructure real time communication and rapid response capability.
- Satellite provided vehicle and incident location supporting autonomous navigation services.
- Data sharing and data fusion infrastructure.
- Road infrastructure databases.
- Analysis and evaluation of road surface condition.
- Specialized software for the management of road infrastructure.

SO15. IMPROVING SECURITY AND INFORMATION ABOUT THE TRANSPORTING OF FREIGHT IN URBAN AREAS

THE ISSUE Rationale

The analysis of actual systems of tracking freight, often based on mobile telecommunication, reveals weak points in terms of continuity of service. Another important aspect is related to the lack of exchange of data and information among different subjects involved in the sector of freight transport with negative impacts in terms of security. The implementation of modern Location Based Service (LBS) also using telecommunication technology with dedicated network can significantly affect the use of an effective real-time goods tracking. By providing integrated security systems based on the monitoring of vehicle movements and parking areas, the exchange of information about traffic and accidents along the road network will improve security. In addition, the development of a Trans-European information hub, with the aim of collecting and disseminating information from all possible users and providers, is a desirable perspective.

Technology solutions include:

- Location-based service solutions for improvement of transport functioning
- Goods automatic tracking systems
- A specific tool (software and hardware) for road safety enhancement

THE ISSUE has considered the range of RTD capabilities within THE ISSUE Consortium and identified a number of innovative sustainable measures, technologies and tools that could help developing advanced safety and security measures to help improve security and information about the transporting of freight in urban areas.

THE ISSUE Longer-Term Innovation Actions:

- IA78. *Developing specific tools (software and hardware) for road safety enhancement relating to the transport of goods.***
- IA76. *Developing location-based service solutions for improvement of freight transport functioning.***
- IA77. *Developing automatic tracking systems for the transport of goods.***
- IA75. *Developing a Trans-European freight transport information hub, with the aim of collecting and disseminating information from all possible users and providers***

Expected impacts of this Innovation Action:

- Foster freight transport by improving goods tracking and verification
- Improved security and integrity along the transport chain
- Speed up the process of service delivery.

Core RTD Competencies within THE ISSUE Consortium supporting this Innovation Action:

- Acquisition and automatic processing of CCTV and crowd sourced images for safety and security enhancement.
- Vehicle-vehicle and vehicle-infrastructure real time communication and rapid response capability.
- Improving the data collection, trend monitoring and the use of innovative planning and management for the public transport system.
- Satellite provided vehicle and incident location supporting autonomous navigation services.
- Data sharing and data fusion infrastructure.
- Road infrastructure databases.
- Analysis and evaluation of road surface condition.
- Specialized software for the management of road infrastructure.

SO16. IMPROVING THE HEALTH OF CITIZENS

THE ISSUE Rationale

It is generally recognized that there is lack of information, directly or indirectly related to transport systems, about the presence of pollutants and noise levels especially at local and regional levels. In terms of health, this issue represents an important obstacle for a clear understanding of the impact of abatement measures proposed or already implemented. Spatial distributions are key inputs to potential solutions that gather information from different locations and merge the data into an available centre. This will allow for analysis of the interlink between currently used and newly identified parameters relating to health related air pollution or impact of vehicle noise regulation. The final aim is to identify, pilot and evaluate the most efficient and cost-effective measures to reduce exposure to pollutants and noise, and to help decision makers to find specific solutions.

Technology solutions include:

- innovative solutions to reduce harmful traffic-related factors (air pollution and noise mitigation)'
- introducing the low carbon economy,
- GIS and satellite technology for mapping road networks and their nearby environment.

THE ISSUE has considered the range of RTD capabilities within THE ISSUE Consortium and identified a number of innovative sustainable measures, technologies and tools that could help improve the health of citizens.

THE ISSUE Longer-Term Innovation Actions:

- IA79. *Increasing the level of information available, directly or indirectly related to transport systems, about the presence of pollutants and noise levels, especially at local and regional levels.***
- IA81. *Analysing the inter-linkages between currently used and newly identified parameters relating to health related air pollution or the impact of vehicle noise regulations.***
- IA82. *Identifying, piloting and evaluating the most efficient and cost-effective measures to reduce exposure to pollutants and noise, and to help decision makers to find specific solutions.***

Expected impacts of these Innovation Actions:

- Reduce exposure to pollutants and noise relevant to health.
- Prevent disease.
- Help decision makers to find specific solutions.
- Protect the environment.

Core RTD Competencies within THE ISSUE Consortium supporting these Innovation Actions:

- Remote sensing using integrated satellite, aerial and in-situ real time data for air quality monitoring forecasting and management.
- Mapping levels and location of harmful and environmentally threatening anthropogenic emissions.
- Vehicle-vehicle and vehicle-infrastructure real time communication and rapid response capability.

CHALLENGE 6. DELIVERING A STEP-CHANGE IN SUSTAINABLE TRANSPORT AND INTELLIGENT MOBILITY

THE CHALLENGE

Delivering a step-change in sustainable transport and intelligent mobility was identified by THE ISSUE as the sixth challenge area in its Programme of Innovation in Sustainable Transport and Intelligent Mobility. In many cities and regions implementing efficient and integrated urban transport systems has been a challenge for local authorities and transport organisations. For as long as urban transportation decisions are made vertically, without transverse collaboration between political decision makers, users and system providers, or where consultation between stakeholders is ineffective, transport planning will continue to suffer from technical incompatibility and compartmentalization of the different transport modes.

In the future, methodologies for policy and planning for sustainable urban transport need a radical shift towards horizontal connectivity between stakeholders.

THE ISSUE'S STRATEGIC OBJECTIVES

For this challenge area, THE ISSUE Programme identified two strategic objectives. These correlated most directly to the highest operational needs of urban and regional transport authorities, where the exploitation of newly-emerging and existing research and technologies, particularly in the fields of ICT and Space Technology, could help deliver a step-change in sustainable transport and intelligent mobility. The two strategic objectives were:

SO17. Facilitating the Increased Uptake of Ultra-Low Emission Vehicles.

SO18. Identifying Future Changes in Patterns of Urban Mobility and Potential RTD Challenges.

These strategic objectives were selected following a thorough analysis by THE ISSUE Project of the key challenges arising from the increasing demands for travel and the impacts on the existing urban and regional road network. This included an extensive consultation within THE ISSUE Consortium to review the key priorities of end-users in terms of transport and urban mobility policies, strategies and implementation plans with respect to sustainable transport and intelligent mobility.

Addressing these two strategic objectives through the exploitation of newly-emerging and existing research and technologies found within THE ISSUE Consortium, will deliver new research-based and innovation-driven solutions to help deliver a step-change in sustainable transport and intelligent mobility.

THE ISSUE'S RESPONSE

For the two strategic objectives in Challenge Area 3, THE ISSUE Project identified a number of innovative action responses that will deploy innovative new solutions to help deliver a step-change in sustainable transport and intelligent mobility. THE ISSUE's innovation action responses have the potential to deliver new long term sustainable products and services that could help promote sustainable urban mobility. Each of these potential solutions is capable of being supported by core RTD competencies found within THE ISSUE Consortium Network.

In other fields, disruptive innovations have managed to displace existing markets and value networks. This project seeks to understand what characterizes successful disruptive innovations and how the conditions

can be created to enable such disruptions to be introduced in the field of urban mobility to achieve sustainability.

Disruptive technologies could impact significantly on current approaches to urban sustainability. High priority RTD solutions, that lie within the proven capabilities of THE ISSUE team, are proposed for:

- Foresight scenario analysis and socio-economic evaluation of disruptive technology impact on urban mobility;
- Triple helix actors fostering organizational collaborations;
- ITS for Changing User Behaviour;
- Uptake of Low Carbon Vehicle Technology.

A disruptive innovation initially offers a lower performance according to what the mainstream market has historically demanded. At the same time it provides some new performance attributes, which in turn makes it prosper in a different market. As its performance progresses it eventually displaces the former technology.

Following a prioritisation exercise involving the core and associate regions within THE ISSUE Consortium, THE ISSUE Programme classified all the innovation action responses in Challenge Area 6 as longer-term actions. In response to an assessment of the relative strength of the evidence base relating to user-needs within each region and the level of maturity of the RTD competencies that would support the development of the innovative solutions, none of the action responses warranted being classified as high priority.

While it is clear that within THE ISSUE Consortium there are world-leading research capabilities that could help deliver a step-change in urban mobility, this assessment identified that there were still a number of barriers that have to be addressed before these technologies can be accepted.

Nevertheless, THE ISSUE Project feels that the challenge of delivering a step-change in urban mobility will become increasingly important over the next five years, thus increasing demand for innovation in this field.

Strategic Objective 17. Facilitating the increased uptake of Ultra-Low Emission Vehicles, through:

Long-Term Innovation Actions:

- IA84. Undertaking social studies to better understand lack of take-up of Ultra-Low Emission Vehicles (ULEVs).*
- IA85. Implementing pilot studies deploying ULEVs to stimulate modal shift, evaluate barriers to uptake and evaluate new vehicles ownership and usage models.*
- IA86. Developing innovation in techniques to substantially increase the range of ULEVs (particularly electric vehicles).*

Strategic Objective 18. Identifying future changes in patterns of urban mobility and potential RTD Challenges, through:

Long-Term Innovation Actions:

- IA88. Implementing a foresight-driven research programme involving science and technology, computer science, physical and human geography, social science and economics to assess how disruptive innovation can change resource allocations and distribution chains by creating new markets and replacing old ones.*

THE ISSUE'S LONG-TERM INNOVATION ACTIONS

This section describes the longer-term innovation action responses identified by THE ISSUE Project for each of the strategic objectives identified in Challenge Area 6 . Each of these innovation action responses will be taken forward through THE ISSUE Meta-Cluster on the basis of a collaborative approach with

appropriate partners from within the Consortium. The recommended funding route for these priority project areas is through European funding channels such as Horizon 2020.

In terms of these innovation actions responses, THE ISSUE Meta-Cluster will periodically review their relative in order to determine:

- a) If there is an increased policy priority around these areas
- b) If other regions around Europe (new Meta-Cluster members), have a policy priority in these areas.
- c) If there are capabilities that could influence regional policy priorities for example areas of air quality or the health impacts of pollution

STRATEGIC OBJECTIVE 17. FACILITATING THE INCREASED UPTAKE OF ULTRA-LOW EMISSION VEHICLES

THE ISSUE Rationale

Ultra-Low Emission Vehicles (ULEVs) are a mature technology. The key problem is a market failure – the low level of ULEVs on the road means that there is a poor support infrastructure. This lack of infrastructure results in low sales. Electrification of road vehicles is available in the current form (Battery EVs). Hydrogen technologies are behind. The EU has invested in the Hydrogen Highway, which has good coverage in Scandinavia, Denmark and Germany, and is now linked to the UK.

The challenge is to overcome the poor market take-up of these emerging technologies, which is often due to the high cost of the vehicles, and the lack of available infrastructure. Improving the infrastructure will help to break down market barriers to wide-scale commercialization, which in turn will help promote investment into new RTD programmes to advance RTD technologies.

Research and disruptive innovation are required in the following areas:

- Social studies to better understand lack of take-up of ULEVs.
- Pilot studies deploying ULEVs to stimulate modal shift, evaluate barriers to uptake and evaluate new vehicles ownership and usage models.
- Innovation in techniques to substantially increase the range of ULEVs (particularly electric vehicles).

THE ISSUE Long-Term Innovation Actions:

- IA84. Undertaking social studies to better understand lack of take-up of Ultra-Low Emission Vehicles (ULEVs).**
- IA85. Implementing pilot studies deploying ULEVs to stimulate modal shift, evaluate barriers to uptake and evaluate new vehicles ownership and usage models.**
- IA86. Developing innovation in techniques to substantially increase the range of ULEVs (particularly electric vehicles).**

Expected impacts of these Innovation Actions:

- Health protection measures through reduced impact of traffic related emissions.
- Reduced transport related carbon emissions.
- A movement towards greater use of ULEV vehicles.

Core RTD Competencies within THE ISSUE Consortium supporting these Innovation Actions:

- Use of ICT technologies to provide data and information.
- Data sharing and data fusion infrastructure.
- Road Traffic Management, Air quality and carbon emissions, Traffic safety, Public transport services

STRATEGIC OBJECTIVE 18. IDENTIFYING FUTURE CHANGES IN PATTERNS OF URBAN MOBILITY AND POTENTIAL RTD CHALLENGES

THE ISSUE Rationale

THE ISSUE identified a need for an over-arching foresight-driven research programme involving science and technology, computer science, physical and human geography, social science and economics to assess how disruptive innovation changes the resource allocation and distribution chains by creating new markets and replacing old ones. This action would identify important lessons from historic events of disruptive innovation and how they have shaped the world we live in today with the aim to create knowledge as to how such innovations can be stimulated to lead to more sustainable living.

The research would study different resource allocation models relevant to urban mobility, giving due regard to global distribution networks, supply/demand patterns, poverty/wealth, access/power, and the market economy/international politics.

How to 'live differently' is not just a question of persuading people to change their lifestyle, but has to have a strong foundation in the disruption of current unsustainable value networks. Disruptive technology needs to meet a basic need in the first instance, but in a sustainable way.

Questions to be addressed:

- How can the main unsustainable global markets and value networks be restructured by disruptive innovations to lead to more sustainable living?
- What characterizes disruptive innovations and which main themes of unsustainable behaviour (including economic and political decision making) need disruption?
- What can we learn from historic disruptive innovations?
- What are the implications of expanding cities and how can sustainable cities, rural spaces and transport networks look like in 20-50 years' time?

Future themes for disruptive innovations and development pathways need to support these innovation processes and have to be examined, including the candidate themes of:

- Wise use of renewable and environmentally friendly energy resources;
- Efficient forms of green transport meeting the needs of consumers;
- Infrastructures in cities;
- Future of rural communities;
- Geographies of materials, energy and transport flows;
- Geographic shifts in natural resource availability and supply/demand networks.

THE ISSUE Long-Term Innovation Action:

IA88. *Implementing a foresight-driven research programme involving science and technology, computer science, physical and human geography, social science and economics to assess how disruptive innovation can change resource allocations and distribution chains by creating new markets and replacing old ones.*

Expected impacts of this Innovation Action:

- Re-assessment of conventional urban planning and technology implementation in the field of urban mobility.
- Increasing focus of technology developments on sustainable living.
- Emergence of new disruptive innovative technologies supporting economic sustainability and quality of life.

Core RTD Competencies within THE ISSUE Consortium supporting this Innovation Action:

- Use of ICT technologies to provide data and information.
- Data sharing and data fusion infrastructure.

THE ISSUE PROJECT FINAL REPORT - APPENDICES

APPENDIX 1. THE ISSUE PROJECT CONSORTIUM

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APPENDIX 2. THE ISSUE PROJECT'S STRATEGIC OBJECTIVES AND POTENTIAL INNOVATION ACTION AREAS

CHALLENGE AREA 1. ADDRESSING TRAFFIC CONGESTION AND ASSOCIATED IMPACTS ON THE URBAN ENVIRONMENT			
Strategic Objectives		Potential Innovation Action Areas	
SO1	Addressing congestion and traffic-induced air pollution	IA1	Enhancing ITMC systems and promoting active demand management measures; leading to a sustainable decrease in urban traffic congestion and its impacts on air quality and other urban challenges.
		IA2	Developing real-time data collection networks that provide aggregated data to central ITMC systems, including cooperative and crowd-sourced information
		IA3	Developing models and tools for improving the ground navigation of vehicles and monitoring of air quality data.
		IA4	Developing multi-modal routing and journey decision support systems Aiding reduction in traffic congestion
		IA5	Improving the availability of real-time information in strategic locations and enhancing availability of positioning tracking and timing information to promote informed travel planning
		IA6	Introducing environmental quality assessment and real-time information services to avoid or limit access in risky areas.
SO2	Improving the Efficiency of Urban Freight Transport Logistics	IA7	Developing dynamic, integrated ITS systems that improve road network route planning, reduce congestion and reduce emissions for urban freight transport, using new developments in EGNSS, cloud computing, air quality data collection and seamless, multi-modal communications technology.
		IA8	Developing enhanced monitoring and tracking models and tools for the integrated management of the multi-modal (Maritime/Port/Urban/Inter-Urban) freight interface for the movement of freight within Port Cities.
SO3	Minimising congestion difficulties and impeding access for emergency services during incidents and extreme weather events	IA9	Developing models and tools to enable the early warning of extreme weather events and other disturbances
		IA10	Developing models and tools to enable the automated detection and classification of incidents to provide data to a Pro-active Integrated Systems for Security Management.
		IA11	Developing models and tools to enable the automatic re-routing of traffic or changing traffic light sequences to provide priority and prompt access to the transport infrastructure without compromising safety and other users.
		IA12	Developing Informed Incident Management systems that offers emergency services the ability to create a “cordon sanitaire” and clear emergency transit routes
		IA13	Reducing the impact of an incident on the transport infrastructure that is not immediately affected by the incident by extending IIM systems.
SO4	Strengthening Transport and Urban Mobility Planning	IA14	Enabling the collection and analysis of detailed and accurate data outputs to inform planning decisions.
		IA15	Developing new tools, instruments and mechanisms for information exchange to strengthen the knowledge and capacity of local authorities in their preparation of Sustainable Urban Mobility Plans (SUMP)
		IA16	Developing tools and mechanisms to enhance the capacities of local authorities to successfully plan and implement innovative sustainable urban mobility measures
		IA17	Developing the capacity to use a range of ITS systems to evaluate priorities in future urban transport strategies.
		IA18	Developing new tools for spatial planning and the simulation of land use development in urban areas.

CHALLENGE AREA 2. MANAGING URBAN AIR QUALITY AND GREENHOUSE GAS EMISSIONS			
Strategic Objectives		Potential Innovation Action Areas	
SO5	Improving the calibration and validation of the accuracy of air quality models and traffic simulations	IA19	Developing tools and measures to promote the use of earth observation data sets to improve the quality of local air quality models.
		IA20	Improving the city-wide identification and mapping of areas of poor air quality against the urban network using high spatial and temporal resolution measurements of key pollutants.
		IA21	Improving public information services and historical reporting by developing new systems for the measuring and monitoring of short-term carbon emissions and providing air quality forecasts.
		IA22	Developing new innovative ground-based sensors to measure pollutants in real-time in urban locations with high traffic density.
SO6	Improving the Ability to Measure Greenhouse Gas Emission	IA23	Improving the modelling of atmospheric transport of GHGs using direct measurements of CO ₂ , CH ₄ and CO from the ground, aircraft and space to provide information on all distance scales.
		IA24	Developing tools and measures that enable the use of databases of real measurements service to complement current inventory methods of compiling emissions.
		IA25	Increasing the ability to monitor greenhouse gases from cities, to regions, to nations and eventually globally using satellite measurements.
		IA26	Developing carbon footprint calculator to support environmentally friendly transport choices amongst individual, public and freight transport journeys
SO7	Improving Sensor Monitoring and Model Forecasting of Emission Levels	IA27	Providing more comprehensive, higher resolution and continuous data sets for modelling and controlling localised air pollution.
		IA28	Creating more accurate maps of air quality distributions that offer new capabilities and lower cost solutions than existing in-situ sensor networks.
		IA29	Providing new operational approaches to air quality mapping, using NO ₂ imagers, over several km sized urban networks.
		IA30	Developing the ability to undertake airborne mapping of NO ₂ over large urban areas to provide a snap-shot of concentrations, which can be used to validate models.
		IA31	Improving the calibration and validation of air quality estimations and traffic simulations, by integrating ground based sensors and remote sensing systems.
		IA32	Acquiring emissions data from urban and rural networks by public and commercial users of the road network, together with the expanded use of social networking technologies.
		IA33	Improving the measurement of height and spatial distribution of pollutants, using remotely controlled aircraft.

CHALLENGE AREA 3. IMPROVING THE UTILIZATION, PLANNING AND OPTIMIZATION OF URBAN AND REGIONAL ROAD NETWORKS			
Strategic Objectives		Potential Innovation Action Areas	
SO8	Making the Existing Urban and Regional Road Network More Efficient, Reliable, Resilient and Effective	IA34	Developing advanced ITMC systems to provide controlled access to specific urban areas, manage traffic flow, respond to priorities for public transport, and provide traffic information and fast response for emergency situations.
		IA35	Developing Open Data Platforms for the collection, assessment, fusion, trend monitoring, analysis and storage of transportation data from multiple sources to support a more efficient use of the existing infrastructure.
		IA36	Developing a real-time database of weather conditions, air pollution, traffic, road condition etc.
		IA37	Introducing modern road equipment systems (e.g. smart signs, intelligent crossings).
		IA38	Introducing advanced real-time information services for drivers and other road users to provide real-time traffic situation reports and options for choosing the best means of transport.
SO9	Improving the Management and Maintenance of the Existing Road Infrastructure	IA39	Developing new tools to gather information about the road infrastructure and its condition.
		IA40	Providing new methods and tools for the analysis and optimization of the transport infrastructure with particular emphasis on environmental and health issues.
		IA41	Developing multi-dimensional analytical methods and tools to analyse the environmental status of the road infrastructure by integrating and sharing real-time data and data from road infrastructure archives.
		IA42	Developing new models and tools to improve the planning of road deviations during construction and maintenance works as well as disruption caused by traffic incidents.
		IA43	Establishing a data, knowledge and information exchange panel (a dashboard) to improve communication between road infrastructure managers and road administrations and research institutions.
SO10	Improving the Planning and Development of the Road Infrastructure Network	IA44	Developing new models and tools to improve the planning of public transport networks, transport routes, stops, timetables, etc.
		IA45	Improving transport system analysis and traffic model calibrations by developing tools and measures to acquire, integrate, access and share traffic data and travel data information (for all modes of transport), allowing data fusion from separate data sources.
		IA46	Developing new models and tools to study, model and plan future scenarios for the movement of people and goods, taking into account multiple sources of information, including geo-positioning information, environmental data, residents and visitors' behaviour data and information data.
		IA47	Improving recognition and implementation of user-behaviour models in info-mobility schemes taking into account the needs of pedestrians and bicycles in urban planning, also for transport mode interchange (e.g. Bike & Ride) and including ensuring safe and convenient access to public transport stops.

CHALLENGE AREA 4. PROMOTING SEAMLESS MOBILITY, INTERMODALITY AND INTEROPERABILITY			
Strategic Objectives		Potential Innovation Action Areas	
SO11	Promoting Modal Shift and Offering More Sustainable Travel Choices	IA48	Improving the competitiveness, performance, reliability and affordability of public transport options
		IA49	Improving the cost effectiveness and attractiveness of soft transport modes (walking and cycling)
		IA50	Facilitating increased cycling through improved cycle routes across the city and possible cycle-hire schemes
		IA51	Introducing advanced real-time information services for drivers and other road users to provide real-time traffic situation reports and options for choosing the best means of transport.
		IA52	Developing innovative approaches to behavioural change, travel demand management and integration.
		IA53	Developing real-time personalised information systems to support modal shift, interactive journey planning and assistance and transit management.
		IA54	Increasing understanding of social and economic barriers preventing urban mobility amongst all socio-economic income groups
		IA55	Developing localisation-based services for mobile citizens
		IA56	Developing innovative models and tools for predicting and managing the behaviour of pedestrians and crowds.
SO12	Increasing Efficiency and Improving the Effectiveness of Public Transport Services	IA57	Developing new models and tools to provide public transport operators with improved data collection, trend monitoring and service planning to increase the reliability, punctuality, accessibility and usage of public transport services.
		IA58	Increasing the effectiveness of public transport services by improving travel times and accessibility of services
		IA59	Redefining the role of railway networks and rail passenger services
		IA60	Improving the data collection and trend monitoring to provide information to public transport operators to improve reliability, punctuality, accessibility and usage of public transport
		IA61	Promoting safer travel as a means to enhance public transport use and improve health of the population
SO13	Improving the Interoperability of Transport Data	IA62	Developing GIS-based tools to localize, validate, visualize, modify, share and manage real-time multimodal data with spatial information for different kind of transport providers.
		IA63	Developing standards of collective and multimodal data to allow better integration, comparison and accessibility between different users.
		IA64	Developing practical tools and guidance for the user, multimodal transportation planning and decision-making process.
		IA65	Developing new applications and systems to further understand and improve urban mobility.
SO14	Promoting Multimodal Integrated Travel Information, Planning and Ticketing Services	IA66	Supporting the implementation of smart, multi-modal integrated ticketing systems to promote seamless mobility and ease of use in urban areas.
		IA67	Developing innovative forms of travel information e.g. interactive end-to-end journey planning and assistance through online tools/personalised travel planning; real-time journey advice; pay-as-you-go car clubs and sharing schemes; online and SMS messaging travel information services.
		IA68	Developing a fully integrated one-stop-shop user interface for travellers, offering true door-to-door multi modal journey comparison of real-time travel information including true financial costs, timings, and health and environmental impacts, as well as ticket purchase and redemption and interactive real-time notifications of incidents and delays.
		IA69	Promoting Smart Ticketing for larger territories and different local and regional transport authorities.
		IA70	Promoting the generalization of the existing technologies for the development of alternative tickets: smartphones applications, QR codes, smartcards, NFC (Near Field Communication), car-sharing vehicles via contactless smartphone interactions,

CHALLENGE AREA 5. INCREASING SAFETY, SECURITY AND HEALTH IN URBAN COMMUNITIES			
Strategic Objectives		Potential Innovation Action Areas	
SO15	Developing advanced safety and security measures to help reduce accidents, make roads safer (especially for Vulnerable Road Users) and create a better urban environment.	IA71	Developing innovative, low cost, flexible and mobile speed control systems based on the integration of different sources of ICT technologies to monitor, map and control the speed of vehicles using the road network in urban and rural areas.
		IA72	Developing new automatic data collection and monitoring systems, using integrated data sources about user behaviour regarding speed and other related elements, to provide a more in-depth understanding of accident causation, together with increasing the knowledge base regarding possible countermeasures and their impacts, with a strong link to improving transport policy plan making, road safety impact assessment and road safety audits.
		IA73	Improving the design and quality of road networks to enhance road safety.
SO16	Improving Security and Information about the Transporting of Freight in Urban Areas	IA74	Developing integrated security systems, based on the monitoring of freight vehicle movements and parking areas, to promote the exchange of information about traffic and accidents along the road network and improve security.
		IA75	Developing a Trans-European freight transport information hub, with the aim of collecting and disseminating information from all possible users and providers.
		IA76	Developing location-based service solutions for improvement of freight transport functioning.
		IA77	Developing automatic tracking systems for the transport of goods.
		IA78	Developing specific tools (software and hardware) for road safety enhancement relating to the transport of goods.
SO17	Improving the Health of Citizens	IA79	Increasing the level of information available, directly or indirectly related to transport systems, about the presence of pollutants and noise levels, especially at local and regional levels
		IA80	Developing models and tools to provide a clear understanding of the impact of abatement measures proposed or already implemented.
		IA81	Analysing the inter-linkages between currently used and newly identified parameters relating to health related air pollution or the impact of vehicle noise regulations.
		IA82	Identifying, piloting and evaluating the most efficient and cost-effective measures to reduce exposure to pollutants and noise, and to help decision makers to find specific solutions

CHALLENGE AREA 6. DELIVERING A STEP-CHANGE IN SUSTAINABLE TRANSPORT AND INTELLIGENT MOBILITY			
Strategic Objectives		Potential Innovation Action Areas	
SO18	Fostering more effective organisational collaborations	IA83	Developing local or regional triple-helix partnerships or clusters to overcome transport challenges
SO19	Facilitating the Increased Uptake of Low Carbon Vehicles	IA84	Undertaking social studies to better understand lack of take-up of low carbon vehicles
		IA85	Implementing pilot studies deploying low carbon vehicles to stimulate modal shift, evaluate barriers to uptake and evaluate new vehicles ownership and usage models.
		IA86	Developing innovation in techniques to substantially increase the range of low carbon vehicles (particularly electric vehicles).
		IA87	Developing the required infrastructure for low carbon vehicles.
SO20	Identifying Future Changes in Patterns of Urban Mobility and Potential RTD Challenges	IA88	Implementing a foresight-driven research programme involving science and technology, computer science, physical and human geography, social science and economics to assess how disruptive innovation can change resource allocations and distribution chains by creating new markets and replacing old ones.

APPENDIX 3. THE ISSUE PROJECT'S CORE RESEARCH & TECHNOLOGICAL DEVELOPMENT (RTD) COMPETENCIES AND PRACTICAL APPLICATIONS WITHIN THE INTELLIGENT MOBILITY & SUSTAINABLE TRANSPORT SECTORS

THE ISSUE CORE RTD COMPETENCIES AND PRACTICAL APPLICATIONS WITHIN THE INTELLIGENT MOBILITY & SUSTAINABLE TRANSPORT SECTORS	
RTD1. Vehicle to vehicle and vehicle to infrastructure real-time communications technologies supporting advanced urban traffic management systems and rapid response capability (including freight), with the following practical applications:	
a) Improving vehicle-to-vehicle (V2V) real time communication b) Improving vehicle-to-infrastructure (V2I) communication c) Developing social networks for car sharing e.g. professional; occasional travel; long distance travel etc.	
RTD2. Advanced data sharing, data-fusion, collection and analysis infrastructure (including open data), with the following practical applications:	
a) Facilitating knowledge transfer from the aeronautics industry to the urban transport domain b) Introducing collaborative, multi user data platforms where users are sources of information c) Developing real-time data collection networks d) Providing real time information in various forms and locations e) Improving data collection and trend monitoring for public transport systems f) Improving the acquisition and automatic processing of CCTV and crowd sourced images. g) Developing automated detection and classification of incidents	
RTD3. Road surface and infrastructure management research and technologies, with the following practical applications:	
a) Developing specialised software to improve management, maintenance & development of road infrastructure b) Developing models and tools to improve the analysis and evaluation of the condition of road surfaces and the wider transport infrastructure. c) Developing models and tools to improve pavement monitoring, road works location information	
RTD4. Advanced sensor development for space, aerial and in-situ traffic management and control and air quality monitoring, analysis and evaluation, with the following practical applications:	
a) Developing new space and ICT technologies in intelligent traffic management to control air quality and carbon emissions b) Developing, trialling and bringing to the market ultra-low-carbon vehicles and technologies. c) Developing state of the art in-vehicle guidance systems for low emission public transport vehicles. d) Developing a carbon footprint calculator to support climate friendly decisions in daily travel e) Developing new systems for the measuring and monitoring short-term carbon emissions and providing air quality forecasts. f) Improving the city-wide identification and mapping of areas of poor air quality against the urban network using high spatial and temporal resolution measurements of key pollutants. g) Improving the modelling of atmospheric transport of GHGs using direct measurements of CO₂, CH₄ and CO from the ground (mobile and fix sensors), aircraft and space to provide information on all distance scales. h) Developing new, more accurate air quality sensor technologies i) Developing tools and models for improving the measurement of the height and spatial distribution of pollutants j) Developing tools and models to improve the collection of emissions data from urban and rural networks by public and commercial users of the road network	
RTD5. ICT and Computational Intelligence supporting advanced urban traffic management systems, with the following practical applications:	
a) Developing new tools and models to enhance existing traffic management systems b) Developing tools for road safety enhancement c) Developing techniques to provide real time data and information to the public d) Developing advanced real-time information services for drivers, other road users and traffic managers e) Developing techniques to use traffic data and information to improve reliability; punctuality; accessibility and use of public transport. f) Developing traffic management and control systems that are capable of responding to priorities for public transport and traffic reduction in defined areas of a city.	

THE ISSUE CORE RTD COMPETENCIES AND PRACTICAL APPLICATIONS WITHIN THE INTELLIGENT MOBILITY & SUSTAINABLE TRANSPORT SECTORS (CONT.)	
RTD6. Open GIS and crowd sourcing imagery augmenting mapping technologies, with the following practical applications:	
a) <i>Using GIS and mapping techniques to monitor air quality and pollution levels</i> b) <i>Developing indoor GIS and navigation and positioning technologies</i> c) <i>GIS, crowd source imagery and live mapping techniques to view road conditions and congestion</i> d) <i>Developing and maintaining airborne (e.g. drones) early warning and control systems.</i> e) <i>Gathering geo-positioning information and data to develop future models</i> f) <i>Developing common location-based platforms based on Crowd-Sourced & Open Data to underpin services for smart cities</i> g) <i>Developing innovative methodologies to achieve interoperability of data & services based on Geospatial Standards.</i> h) <i>Increasing use of crowd sourced data sources to supplement or replace expensive traditional data sources.</i>	
RTD7. Application of Downstream space data products and services (e.g. Copernicus/Galileo) to support urban traffic management systems to provide real-time positioning, tracking, incident location, velocity and timing information, with the following practical applications:	
a) <i>Developing techniques for the ground navigation of vehicles by using space navigation services (e.g. Galileo/EGNSS)</i> b) <i>Using earth observation data sets from both monitoring and downstream services to improve local air quality models and provide background levels of the main pollutants.</i> c) <i>Research into applications of GNSS/GPS/Navigation derived vehicle location</i> d) <i>Developing remote sensing using integrated satellite, aerial and in-situ real time data for air quality monitoring forecasting and management.</i> e) <i>Developing new tools to improve spatial planning and simulation of land use development in urban areas.</i> f) <i>Utilising advanced outdoor/indoor positioning technologies, provided by Galileo and EGNOS signals, to develop innovative new services</i> g) <i>Developing and applying Remotely Piloted Aircraft Systems (RPAS) and High Altitude Long Endurance (HALE) platforms to provide continuous monitoring capabilities over large urban areas.</i>	
RTD8. Specialised software for advanced management of multimodal transport network, with the following practical applications:	
a) <i>Developing active traffic management measures</i> b) <i>Developing smart, multi-modal integrated ticketing systems to encourage multi modal transport and improve traffic management</i> c) <i>Methods to optimise current networks without adding additional infrastructure</i> d) <i>Developing real-time personalised information systems to support modal shift, journey planning and transit management</i> e) <i>Developing innovative ITS and logistics solutions</i> f) <i>Developing presentation and display systems to support personalized dynamic journey management.</i>	
RTD9. Ultra-low emission vehicle research and technologies, with the following practical applications:	
a) <i>Developing, trialling and bringing-to-the-market of ultra-low emission vehicles and technologies.</i> b) <i>Developing ultra-low emission public transport</i>	
RTD10. Behavioural, Societal, Foresight and Socio-Economic Research competencies, with the following practical applications:	
a) <i>Research into key societal drivers (values, needs and expectations) and transport user needs, mobility patterns, mobility choices, aspirations and behaviours.</i> b) <i>Knowledge and understanding of the major societal trends (e.g. aging, urbanisation, family composition, working and living patterns) and how these impact on transport</i> c) <i>Knowledge and understanding of the complex interactions between societal trends and user behaviour and their influence on the development of innovative transport products and services and urban mobility policy making.</i> d) <i>Knowledge and understanding of the key characteristics and mobility needs of specific transport user groups (e.g. elderly, young, single parents, women, employed and unemployed, immigrants, etc.)</i> e) <i>Developing new ICT tools and models for collecting data on user behaviour, mobility patterns</i> f) <i>Understanding societal resistance and barriers to accepting emerging transport technologies and services.</i> g) <i>Research into the impact new forms of mobility and transport can have on users, the environment, society as a whole and policy makers.</i> h) <i>Foresight-driven research capabilities</i>	

Further Information

For further information on THE ISSUE Project visit www.theissue.eu, or contact:

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