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European Roadmap

Road User Behaviour and Expectations

Version May 9, 2011

ERTRAC Working Group on Urban Mobility

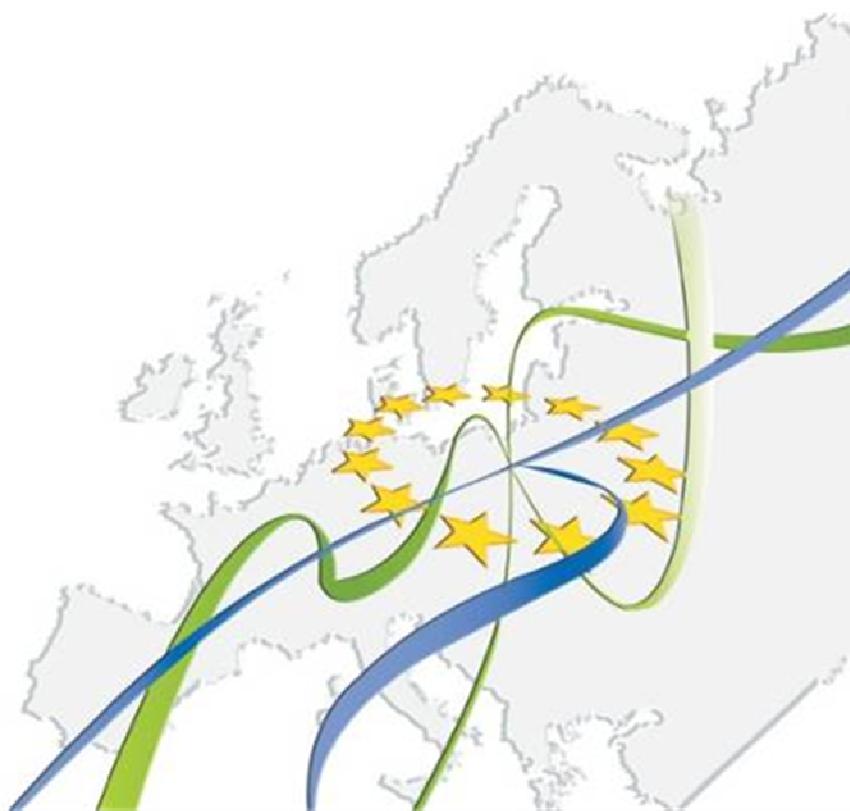


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1. Executive Summary

Road user is not only the direct consumer of entire transport network, but, above all, is the beneficiary (or the victim) of any plan, design, construct and maintain infrastructure in the future, which are determined by transportation decision maker. Therefore, road users need to be kept at the heart of transport policy in order to build a more efficient and safer road network system.

The consideration of road user behaviour and his or her expectations has virtually been the subject of transport planning activities. But, studying user behaviours and expectations has increasing difficulties and challenges because of the more complex travel patterns and social diversity. Therefore there is a need to improve researches on user behaviour. We focus on four research areas in terms of the contexts of SRA 2010: transport reliability, environmental concerns, co-modality and travel demand management vision of the road sector.

Therefore, the primary objective of this roadmap is to provide guidance to analyze road user behaviour in the vision of users' needs, preference and future expectations to build an improved road transport environment for passengers. The aim of this roadmap is to address road sustainable

mobility of long distance, in coordination with other transport modes to achieve optimal co-modality use of road network and its associated facilities.

All this analysis is more and more influenced by new technological developments. In fact, telecommunications technologies have a direct influence on driver behaviour. Besides that, they constitute a powerful tool to achieve a continuous communication among all actors: users, transport infrastructures and operators. Information flows allow to receive real time information on user behaviour and to react instantaneously. These changes open a new scenario of integration for the whole transport system.

2. Introduction

2.1 Background

Efficient, sustainable and safe road transport system is a great challenge for the European society and economy. User behaviour and expectations are the essential factor to build a more acceptable and efficient transport infrastructure and to manage the associated transport services.

This has been already the goal of a number of EU policy papers like the 2001 Transport White Paper and its mid-term review. Again the 2011 new White Paper also refers to the necessity to improve quality, accessibility and reliability of Transport Services.

The Directive 2010 of Intelligent Transport Systems highlights the importance of ITS applications to provide useful information over travelling time and routing alternatives to ensure seamless door-to-door mobility services.

Emissions and energy efficiency are also elements of transport policy which clearly affect user behaviour. The energy and environmental policies have a clear impact on fuel prices, and they produce regulations and limits that reduce the performance for trips using different transport modes.

As a general statement the key idea on this regard is the target of placing citizens at the core of the transport policy and practice. This is why user behaviour and expectations have a great importance when developing the future European transport system.

However, there is still a long way to convert policy into current practice. Therefore the end of this roadmap is to settle the way forward to get a user oriented new transport scenario.

2.2 Scope

The roadmap of road user behaviour and expectations should address key challenges to achieve the objectives set in the SRA 2010 (Strategic Research Agenda, ERTRAC) and propose a process towards their achievement. For this purpose, research needs are identified, in cooperation with elements from the technology roadmaps developed by ERTRAC.

Firstly, the different categories of individual road users and organizational road users specified in this roadmap are:

- Individual road users
 - ✓ Long distance passengers
 - ✓ Travellers for all regional and metropolitan transport means, groups and individuals, motorised and non motorised
 - ✓ Car drivers
 - ✓ Professional drivers for freight and passenger road transport
- Organizational road users
 - ✓ Transport operators and companies for passenger and freight transport
 - ✓ Decision makers
 - ✓ Interchange operators

2.3 Complementarities with other ERTRAC Roadmaps

This roadmap follows a system approach, adopting the point of view of the user. That means that the road infrastructure should be not considered alone, but including also all the equipments and facilities which constitutes the basis for providing high level transport services.

This roadmap has been designed having in mind the content of other roadmaps. ***The Road User Behaviour and Expectations*** roadmap focuses on passenger travel because there is a dedicated roadmap on ***Green, safe and efficient freight corridors***. It does not deal with accidents either, which are addressed in the ***Safe road transport*** roadmap. The technological side is also avoided in what respects energy, for example eco-driving behaviour, because they are part of the ***Electromobility and Future Transport Energies*** roadmap. On the other hand, vehicles technologies are considered in the ***European Bus System of the Future*** roadmap.

Finally, there are many complementarities with the ***Towards an integrated urban mobility system*** roadmap. To avoid repetitions the *Road User Behaviour and Expectations* roadmap skips actions in the urban environment. However users should perceive a seamless transport chain and as a consequence “last mile” issues are tackled properly as part of the user behaviour. That means that integration between long distance and urban mobility services are also included in this roadmap.

2.4 Integrated system approach: the road system and the user

Although this roadmap is based on the road transport services, it tries to catch up all user needs which are multimodal by nature. Therefore we have to adopt a systemic approach to analyse road users' behaviour and their expectations about the combination with other modes of transport.

3. Benefits to Grand Societal Challenges

The grand societal challenges addressed by the ERTRAC Agenda are:

- 1) Decarbonization
- 2) Reliability
- 3) Safety

The following figure summarizes the guiding objectives (corresponding to the main areas and indicators) of ERTRAC’s “Strategic Research Agenda aiming at a 50% more efficient Road Transport System by 2030”.

| By 2030 Road Transport is 50% more efficient than Today | | |
|---|---|------------------------------------|
| | Indicator | Guiding objective for 2030 |
| Decarbonisation | Energy Efficiency: Urban Passenger | +80% |
| | Energy Efficiency: Long Distance Freight | +40% |
| | Share of Renewables | Biofuels: 25% Electricity: 5% |
| Reliability | Reliability of transport times | +50% |
| | Urban Accessibility | Preserve Improve where possible |
| Safety | Accidents with fatalities and severe injuries | -60% |
| | Cargo Lost to Theft and Damage | -70% |

Table 1. Clear guiding objectives for Decarbonisation, Reliability and Safety in Road Transport.
The mission of ‘50% more efficient Road Transport’ is articulated in leading indicators on Decarbonisation (3), Reliability (2) and Safety (2). Each indicator is furnished by a guiding objective for 2030 either indicating the improvement versus a 2010 baseline, indicated with ‘+’ or ‘-’ sign or an absolute level as is the case with ‘Share of Renewables’.

Figure 1. Guiding objectives for 2030 (ERTRAC 2010)

This roadmap intends to place the road user in the centre of the RTR (Road Transport Research). Therefore, by principle it addresses all guiding objectives that ERTRAC has stated in its SRA 2010, both on the user side of the road transport system, as well as on maintaining and improving Europe’s competitive edge on the global market. None of those objectives is independent of user expectations and behaviour.

4. Research Lines

Through the consultation process there have been identified four longitudinal research areas (reliability, co-modality, environment and energy efficiency, and travel demand management) and two transversal research lines (travel demand estimation and technology responses) to be developed in this roadmap, as shown in Figure 2.

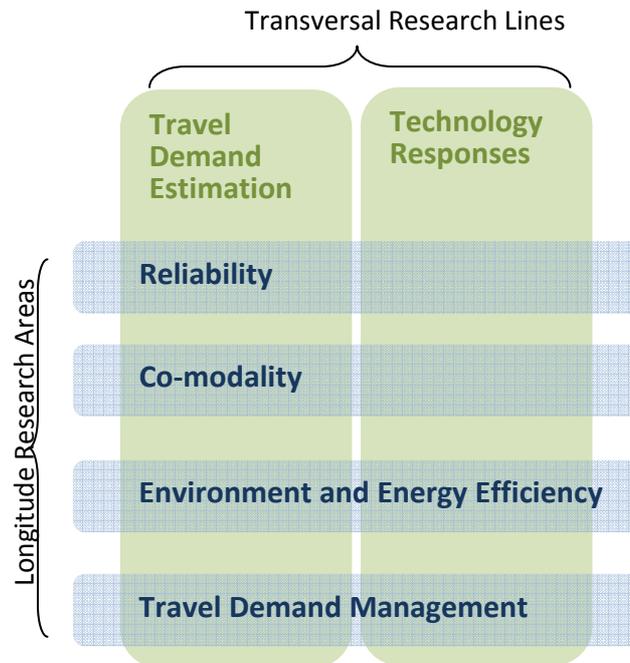


Figure 2. Research framework for The Road User Behaviour and Expectations Roadmap

4.1 A) Longitudinal Research Areas

The longitudinal research areas consider all the key elements and societal needs addressed in the ERTRAC SRA 2010. The explanation and development of research actions are given separately as below.

A1) Reliability

ERTRAC SRA focuses on improving the reliability of transport schedules and metropolitan or interurban accessibility. It aims at reducing congestion and it is strongly linked to economic growth and employment. Consequently, the research about road user behaviour and expectations includes reliability objectives, concentrating on two main fields, transport schedules and metropolitan or interurban accessibility. In this sense, it is needed to evaluate users' satisfaction for the existing services of transport schedule and accessibility levels to all destinations. This should start by analyzing travellers' needs and expectations in respect to these two fields, through standardized travel demand surveys and case study analysis.

The possible research actions developed in respect of reliability are shown as below:

- studying variables related to transport reliability
- carrying out surveys on users' satisfaction of transport schedule and territorial accessibility
- analysing the impact of reliability on user behaviour
- analyzing the accessibility for metropolitan areas

A2) Co-modality

The urban sprawl has characterized European cities by the last 20 years; it generates an increasing number of trips between metropolitan areas. In this context, the number of multimodal trips increases because of the longer distance travel. This research area focuses on road users' behaviour and expectations when they make a multimodal trip (such as car-long distance train, car-airplane, car-metropolitan train or car-long distance bus). Consequently, two main questions could be addressed. In the light of the complexity and breadth of the content on this studied area, two main questions are helped to address the researcher's target:

- 1) How do road users choose two or more modes to travel? It means that road user behaviour and expectations should be identified and analyzed.
- 2) What are the barriers and needs of users in a multimodal trip?

One way to study multimodal user behaviour is by realizing travel demand surveys (attitude questionnaire, stated preference or revealed preference) in different European areas.

The results of the surveys analysis would allow developing a comprehensive evaluation of multimodal mobility services, including production systems management. It determines the following research actions:

- Identifying road user expectations and behaviour in respect to the connection with other modes (railway, interurban bus, urban bus, vehicles, bicycle and walking) to realize an integrated mobility and to provide a high quality service
- Analysing the expectations and behaviour of users of intermodal services and multimodal transport. The aim of this analysis should be to identify key variables to influence positively the efficient use of multimodal services.
- Consider separately stakeholders, including operators, and then individual ordinary travellers
- Implementing door to door information and service
- Including the design requirements for achieving a more efficient transport service supply and for fulfilling travelers' needs and expectations.

A3) Environment and Energy Efficiency

A widely use of motor vehicle produces several environmental problems, such as CO₂ emission, pollution and noise, increasing the external costs for all the society.

Using the indicators of decarbonisation made by ERTRAC SRA 2010, several measures could be implemented, including new vehicle technologies application and “Travel Demand Management” policies. The most critical element is to understand users’ behaviour in respect to the environment, influence and convince them to adopt the recommended changes in their behaviour at long term.

The effects between road users and environment are double-sided, one is the effect of road user on the environment; another is the impact of the scheme pricing for internalizing environmental costs on users behaviour.

Consequently, research actions include:

- Calculation of individual footprint
- Energy consumption estimation per person and per trip option
- Social costs estimation including various externalities, including air quality
- Impact of information about environmental and health effects on user behaviour
- Health concerns evaluations: obesity, stroke etc

A4) Travel demand management (TDM)

TDM measures have become a necessary policy approach to restrict the use of vehicles in urban or interurban areas. Some TDM measures are congestion pricing, public transportation infrastructure improvement, bicycle-friendly facilities and environmental oriented developments. Each of these measures affects the performance of road users’ trip. Actually, road users are at the core of all the TDM measures. Only considering attitude, awareness and expectations of road users, the TDM measures can be efficient and acceptable.

This research area consists of two kinds of studies about road users’ behaviour. One is focused on the analysis of the impact of existing TDM policies on road users; another is to address the future (new) TDM polices considering the expectations of road users. In consequence, all of these measures should be included in an efficient design of transport infrastructures and services.

Research actions related with this area are:

- Analysis of users’ attitude, preference and acceptance of road pricing policies (such as parking restriction, congestion pricing).
- Evaluation of past TDM policy actions and criteria for improving their effectiveness
- Users’ expectations definition about public transport services (such as transit, park and ride)

4.2 B) Transversal Research Lines

Two transversal research lines are included in this roadmap: travel demand estimation and technology responses. The first one focuses on the analysis of travel demand in respect of four longitudinal research areas introduced before. The second one studies the specific response to each

advanced technology, such as information & communication technologies and saving energy technologies.

These two research lines have to be crossed with the longitudinal research areas.

B1) Travel demand estimation

It would allow developing an analysis on the characteristics of interurban users' behaviour and the expectations of different road users groups. Two main subjects are analyzed in this research line: the first one concerns the definition and the estimation of behaviour variables for forecasting the travel demand; the second one includes the re-orientation of expectations, preferences and needs of road user for future travelling. Both subjects aim to understand users' awareness, motivation and attitude towards different mobility options and address them.

The results of this action will serve to identify the potential and the design of the transport infrastructure or services for road transport users. It will also help decision makers to implement new policies to manage the increased interurban travel demand.

Several research actions are foreseen to achieve proper travel demand estimation:

- Aggregate & disaggregate travel surveys
- Estimation of macro/micro and static/ dynamic demand models
- Analysis of users' sensitivity to different TDM policies and other policies relevant for transport demand
- Identification of the impacts of different categories of road users by their age, travel mode or motive
- Analysis of the characteristics, attitudes and behaviours of road users with respect to road pricing schemes (cost internalization and acceptability)
- Study of user behaviour and its expectations about an integrated transport system. This action should be realized in collaboration with the roadmap of "Towards an integrated Urban Mobility System".

B2) Technology Responses

Technology response is a transversal research line considered in the *Road User behaviour and expectations roadmap*. It mainly analyzes users' responses to new technologies, including ITS (intelligent transportation system) and new energy sources for vehicles. Particularly, it is oriented to study the responses of road users to the rapid development of information technologies. In consequence, it will be necessary to develop some guidelines for testing how the ITS is able to fulfil expectations and needs of road user and to influence his behaviour.

The technology responses will address issues such as: co-modality, multimodal trip management, long-short distance trips integration, costs internalisation, accessibility, logistic and mobility services.

The research actions proposed to define the reactions to the new technologies are:

- Analysis of needs, expectations and responses of road user, in general
- Estimation of the behaviour of the specific groups of road users

5. Milestones

The objective of the next twenty years is to develop the following three milestones related to the focus of this document that is user behaviour and expectations.

- **Milestone 1: UNDERSTANDING** road user behaviour and expectations (2015):

The first milestone is oriented to understand the behaviours and expectations of different groups of road users. In consequence the foreseen actions will be:

- 1) Collecting the information about drivers' demand;
- 2) Defining the expectations of travellers on different levels of quality of services;
- 3) Analysing the attitude and the behaviour of user in respect to transport policies (infrastructures and services).

The results will serve to identify the potential and the design of infrastructure and services for road transport users. It will also define the way to organize a citizen oriented network of transport services. In this perspective, it is important to define the socio-economic and psycho-social variables like costs and revenue, social responsibility and fairness, for example, determining the road users' behaviour.

- **Milestone 2: To INFLUENCE & CONVINC** road user behaviour and expectations at mid- term (2020):

Once collected the data about the socio-economic and psycho-social variables influencing the road user behaviour, it is necessary to design the corresponding policy actions to influence the behaviour of road users. In other words, it is hopeful to define the TDM policy measures accompanied by awareness campaigns, marketing and their impact analysis.

Once obtained the results about road user behaviour and expectations, it is needed to identify

- Policy actions that influence user behaviour
- Best practices of management of transport infrastructures and facilities
- Co-modality and multimodal management
- Answers to targeted TDM policy actions

- **Milestone 3: To CHANGE** road user behaviour at long-term (2030)

The target of this roadmap is to change user behaviour to achieve the objectives of 50% efficiency improvement by identify and analyze their behaviour and expectations. In this last milestone, the research areas may focus on the long term objectives on changes of behaviour of road users after the implementation of new policies.

The following two tables (Table 1 and 2) summarise the detailed description of the three milestones with respect to the four longitudinal research areas and the two transversal research lines, respectively.

Table 1 – Milestones of longitudinal research areas

| | Milestone 1 (2015) | Milestone 2 (2020) | Milestone 3 (2030) |
|---------------------------------|---|--|---|
| | Understanding Road Users behaviour and expectations | Influence & Convince Road Users behaviour and expectations | Change Road Users behaviour and expectations |
| Reliability | - Collecting DATA on trip characteristics and user preferences | - Adaptation of regulation and transport services to the preferences and characteristics of road users | - Change of transport services and schedules in relationship with the characteristics and preferences of road users |
| Co-modality | - Obtaining variables characterizing users' behaviour in respect to co-modality - Analyzing different case studies among European cities | - Make co-modal transport services safer and more convenient to users | - Implementation of smart, seamless and friendly co-modality infrastructure and services. |
| Environment | - Collecting DATA about the economic and psycho-social attitudes of road users in respect to the environment | - Create incentives for the road users to economize fuel consumption and to reduce CO2 and other emissions | - Zero pollution and environment friendly policies for transport by a change of users behaviour |
| Travel demand management | - Including Comprehensive DATA about users' characteristics and preferences - Analysing the impact of TDM measures | - Define acceptable, easy and costless TDM measures | -Travel Demand Regulation to reduce the road congestion |

Table 2 – Milestones of transversal research lines

| | Milestone 1 (2015) | Milestone 2 (2020) | Milestone 3 (2030) |
|---------------------------------|---|---|--|
| | Understanding Road Users behaviour and Expectations | Influencing & Convincing Road Users behaviour and Expectations | Changing Road Users behaviour and Expectations |
| Travel demand estimation | - Obtaining data about the travel demand of road user | - Estimating and forecasting the travel behaviour of road user | - Use the results of Milestone 1 and 2 to define new transport demand policies to change road user behaviour |
| Technology Responses | - Defining a common database on users' preference and needs | - Improving transport technologies innovations among the most popular road transport modes. | - Incorporate new transport technologies to make road modes more friendly and convenient for road users. |

6. Roadmap phases and their milestones

Following the definition of milestones, this section defines the roadmap corresponding to the two types of research (longitudinal and transversal) in order to achieve the stated objectives.

The roadmap indicates the main tasks towards a better understanding of road user expectations and behaviour.

The framework document of the roadmap elaborated in the ERTRAC Strategic Research Agenda (2010) defines four steps for the implementation of the actions for each roadmap. The following arrows synthesize these steps that have been use for the action diagram below:



A) Longitudinal Research Areas

A1) Reliability

- Studying variables related to transport reliability including intermodality
- Carrying out surveys on satisfaction of transport schedule and territorial accessibility
- Analysing the impact of reliability on user behaviour
- Analysing accessibility for metropolitan areas

A2) Co-modality

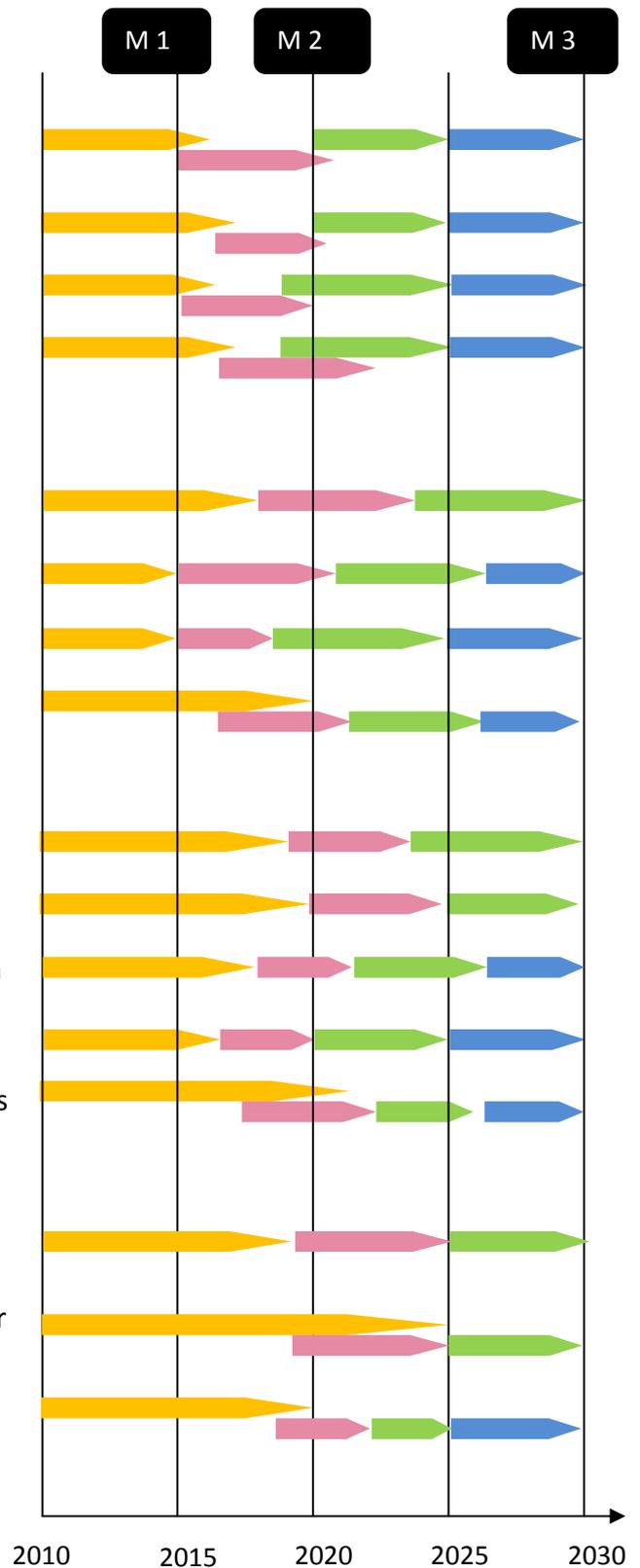
- Identifying road user behaviour and expectations in respect to the connection with other modes
- Analysis of expectations and behaviour of users of intermodal services and multimodal transport
- Implementing door to door information and service
- Making easier, better and friendlier interchanges

A3) Environment

- Calculation of individual carbon footprint
- Energy consumption estimation per person and per trip option
- Impact of information about environment and health effects on user behaviour
- Health concerns evaluation: obesity, stroke etc.
- Social costs estimation including various externalities

A4) Travel Demand Management

- Analysis of users' attitude, preference and acceptance of road pricing policies
- Evaluation of past TDM policy actions and criteria for improving their effectiveness
- Users' expectations definition about public and private transport services



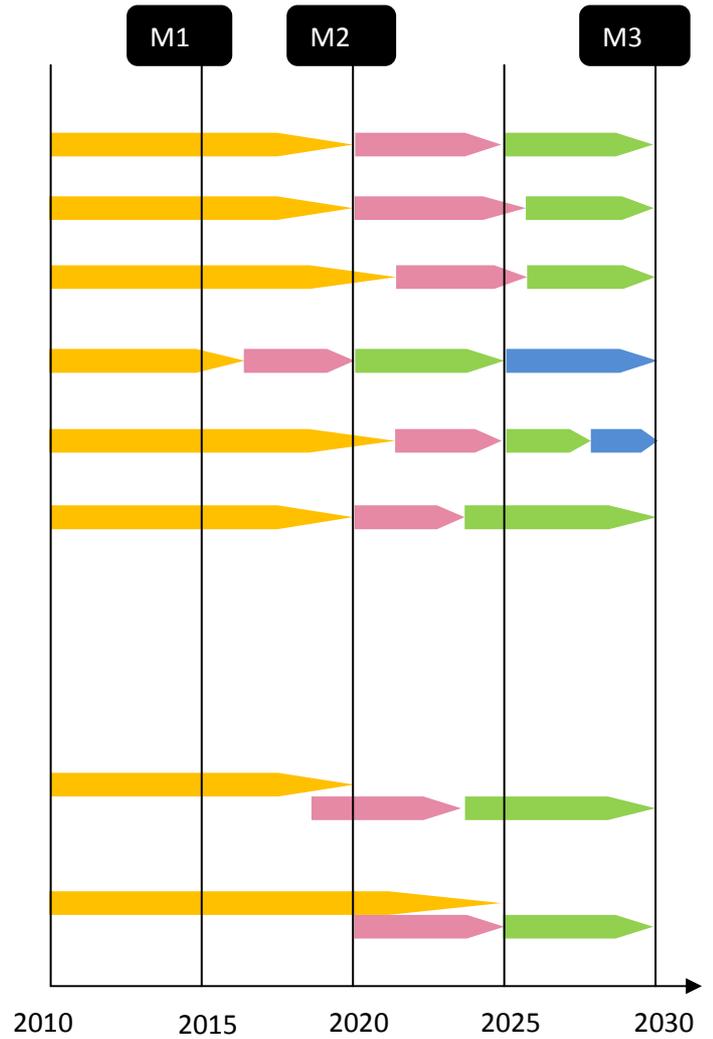
B) Transversal Research Lines

B1) Travel Demand Estimation

- Implement aggregate & disaggregate surveys
- Estimate demand models
- Analyze sensitivity to TDM policies
- Identify impacts of different categories of road users
- Analyze the characteristics and attitudes of road users with respect to road pricing schemes
- Study traveller behaviour and expectations related with future integrated transport system

B2) Technology Response

- Identification of general road user needs, expectations and responses related with new technologies
- Estimation of specific impacts of new technologies on future road users' behaviour



ERTRAC Research and Innovation Roadmaps

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