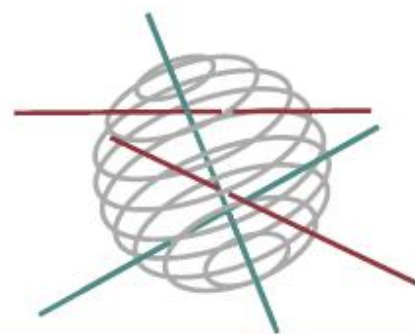


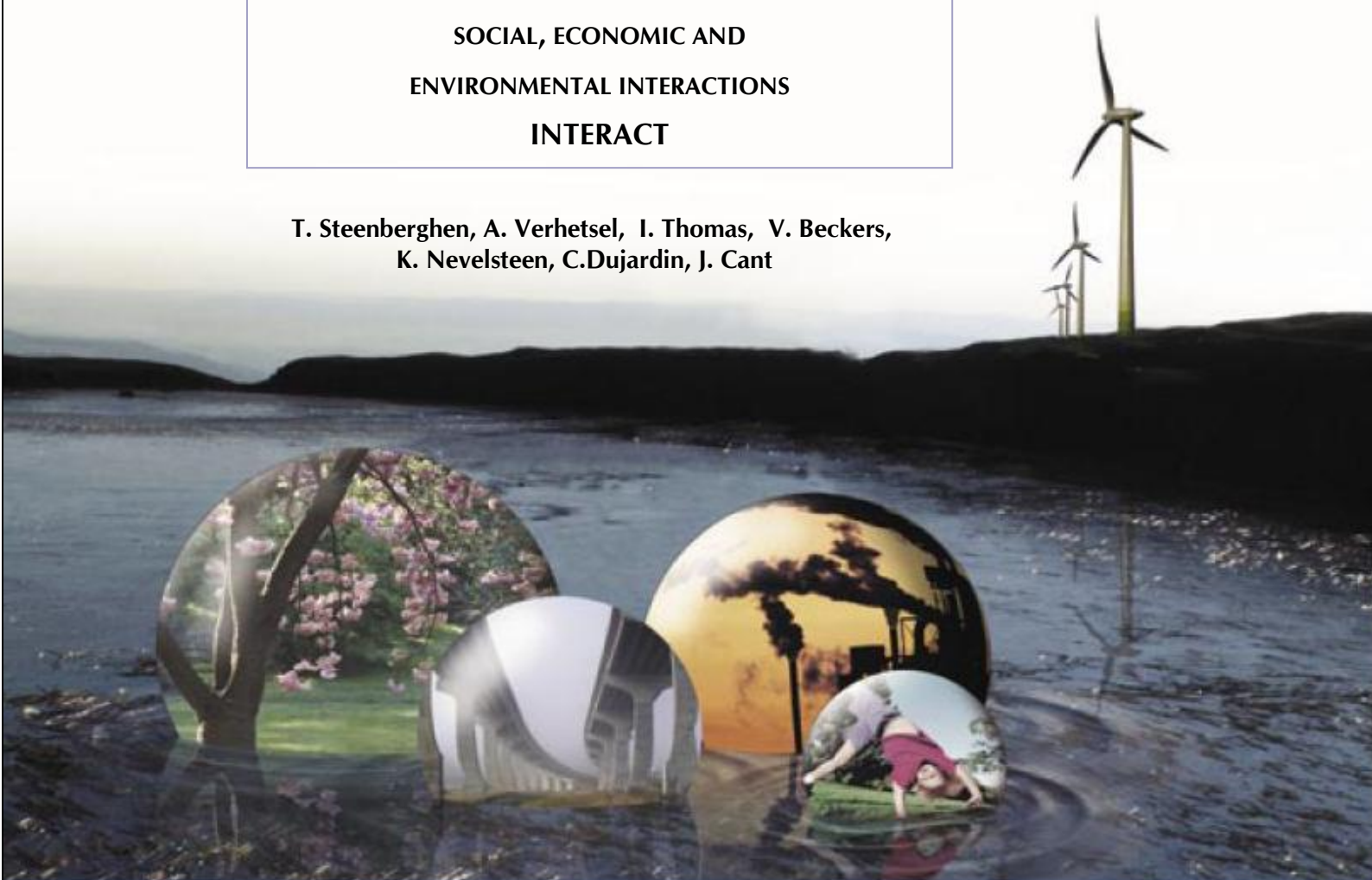
# SSD

SCIENCE FOR A SUSTAINABLE DEVELOPMENT



**ACCESSIBILITY TO PLACES AND TRANSPORT:  
SOCIAL, ECONOMIC AND  
ENVIRONMENTAL INTERACTIONS  
INTERACT**

**T. Steenberghen, A. Verhetsel, I. Thomas, V. Beckers,  
K. Nevelsteen, C. Dujardin, J. Cant**



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TRANSPORT AND MOBILITY

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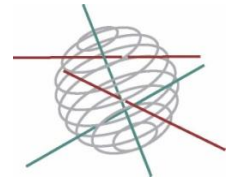
CLIMATE

BIODIVERSITY

ATMOSPHERE AND TERRESTRIAL AND MARINE ECOSYSTEMS

TRANSVERSAL ACTIONS

SCIENCE FOR A SUSTAINABLE DEVELOPMENT  
(SSD)



**Cluster**

FINAL REPORT

**ACCESSIBILITY TO PLACES AND TRANSPORT:  
SOCIAL, ECONOMIC AND ENVIRONMENTAL INTERACTIONS**

**INTERACT**

**SD/CL/07**

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## SUMMARY

INTERACT is a 2 year (2010-2011) cluster project involving 4 research units: the Spatial Applications Division Leuven (SADL, KU Leuven), the Centre for Operations Research and Econometrics (CORE, UCL), the 'Centre d'Etudes socio-économiques de la Santé' (SESA, UCL) and the 'Department of Transport and Regional Economics' (TRP, UA). The project consists of two parts. First, the integration of results from accessibility-related research projects financed by the Belgian Science Policy in the Science for Sustainable Development Programme (SSD), as a basis to formulate policy recommendations and guidelines. Second, focused analyses on specific locations (railway stations) and specific target groups (elderly people).

The teams previously performed accessibility-related research within social, economic, health and environmental domains. The purpose of INTERACT was to compare and deepen this knowledge and translate it to a new vision on accessibility in a context of sustainable development. This was done by reviewing results of previous research projects on the subject of accessibility in relation to sustainable development. The reviews were based on the application of two conceptual frameworks: the 'Traffic and transport markets framework' and the 'Driving forces – Pressures – State – Impact – Responses framework (DPSIR) framework'. The reviews were used to extract policy recommendations and measures, and group them into possible policy priorities. These were submitted to experts (civil servants, scientists, planners, politicians, interest groups) in an on-line questionnaire and discussed with a panel of experts during a workshop, to suggest policy solutions.

The policy priorities included: stimulation of public transport, stimulation of non-motorized transport, improvement of the efficiency of transport infrastructure, decreasing transport needs, preparing the system and public space for an ageing society and other measures. In general, balanced solutions were preferred, with a similar proportion on stimulation of public transport, stimulation of non-motorized transport, improvement of the efficiency of transport infrastructure and decreasing transport needs. There was less interest in measures for an ageing society. This seems to indicate that experts currently involved in transport and mobility are not very much aware of the challenges posed on the transport system by the increasing group of elderly people.

Efficient measures are often technically and financially unfeasible or have little public acceptance. The measure considered to be the most efficient and feasible is to simplify intermodal ticketing. Other measures that were found to be rather efficient and technically and financially feasible are the reduction of the benefit of company cars and the provision of dedicated lanes and priority at traffic signs for public transport. Both these measures however, have a low public acceptance. Especially the reduction of the benefits of company cars scores very low on public acceptance.

In the case study in the Brussels-Capital Region “Local environment, walkability and the health of the elderly in Brussels”, research was conducted to assess if the neighbourhood environment affects the health of the elderly. The lack of urban qualities was partly related to health characteristics of the elderly residents: poor sidewalks, poor public transport and low network connectivity have an inverse relation with health of elderly people in low income neighbourhoods. Lack of green spaces has an inverse relation with health of elderly people in high and middle income neighbourhoods. However, most often the health statistics are most related to the socio-economic structure. More research is needed on the life and residential trajectories of elderly people, and on the daily moves in relation to specific neighbourhood qualities.

The analysis of train station environments through video image analysis made it possible to identify zones with specific use of public space, to quantify movements and mixed use of the transport infrastructure, to assess flows, behaviour and conflicts between different types of road users.

# 1 THE INTERACT PROJECT

## 1.1 Motivation

INTERACT is a cluster project involving four research units from different disciplines and universities, financed by the Belgian Science Policy in the programme "Science for Sustainable Development" (SSD). The teams previously performed accessibility-related research within social, economic, health and environmental domains. The purpose of INTERACT is to compare and deepen this knowledge and translate it to a new vision on accessibility in a context of sustainable development.

The added value of the cluster includes:

- The dialogue between researchers from human and natural sciences;
- The dialogue between researchers, experts in public administrations and private companies, and policy makers;
- Tests of different approaches to answer scientific questions;
- Introduction of the SSD research in international initiatives and publications.

## 1.2 Project objectives

The objectives of INTERACT are:

1. To harmonize multidisciplinary research, data and analysis;
2. To improve the understanding of motivations, dynamics, interactions and effects of socio-economic and cultural human activities associated with mobility;
3. To formulate recommendations for policy makers, planners, engineers and other experts;
4. To develop of a toolbox for the evaluation of accessibility issues in urban planning, transport and mobility
5. To communicate research results nationally by means of workshops and internationally through participation in international research networks and publish in scientific journals.

The project has a dual perspective. The first consist of the application of a conceptual framework to integrate research results in terms of social, economic and environmental interactions, followed by a discussion as to how these relate to policy. The second examines cases: specific locations (railway stations), and specific target groups (the elderly).

## 1.3 Report overview

The dual perspective is reflected in the work package of the work plan (figure 1), and in the structure of this final report. In chapter 2, a number of results of previous research on the subject of accessibility related to sustainable development is

summarised and a conceptual framework concerning mobility is proposed. These results were submitted to experts in an on-line questionnaire and discussed with a panel of experts during a workshop, to suggest policy solutions. In chapter 3 the cases are further elaborated: what does the research imply for specific locations such as stations...., and for specific segments of the population (people 65 and over). For the study on the ageing population the focus is on objective and subjective health effects of mobility. The last chapter summarizes the communication of these results in the second workshop and in international networks and publications.

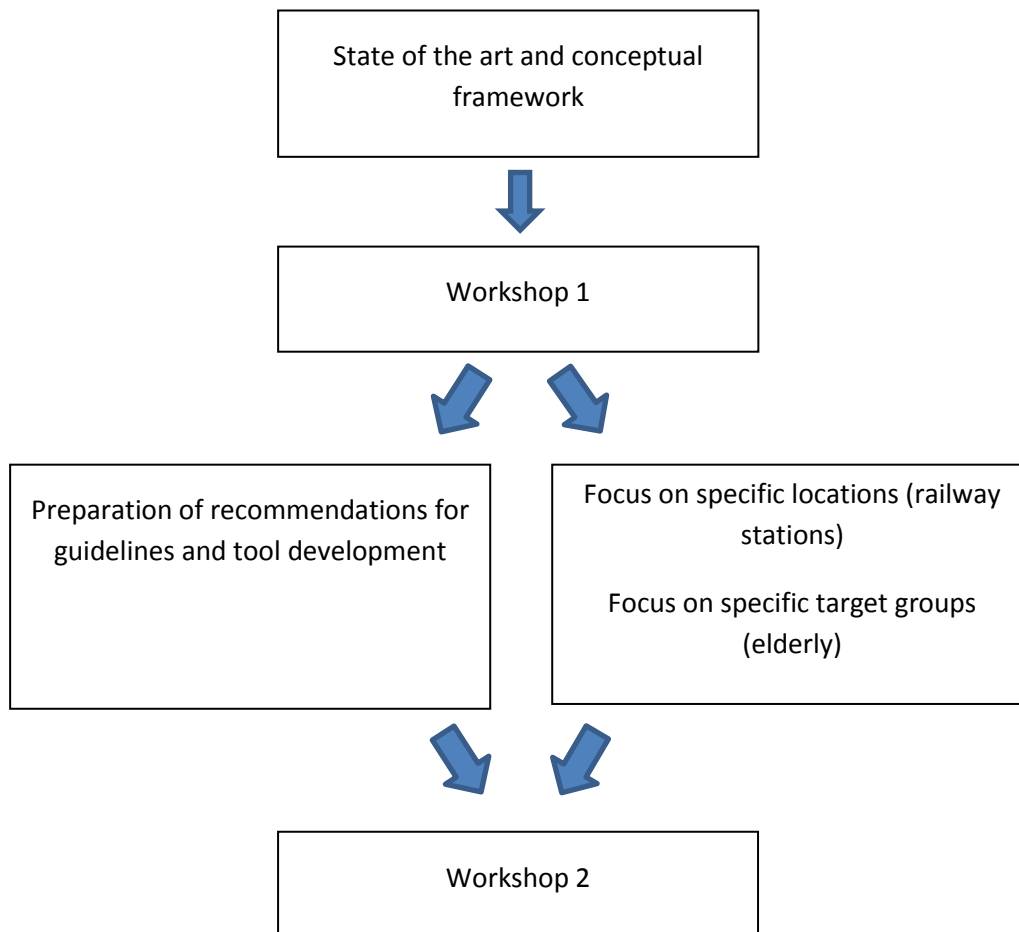


Figure 1. The INTERACT project work plan



## 2 ACCESSIBILITY IN A SUSTAINABLE DEVELOPMENT PERSPECTIVE: POLICY RECOMMENDATIONS

### 2.1 SSD studies related to accessibility

For the following selection of research projects conducted in the SSD programme the final reports were read with special attention to the objectives and the policy recommendations:

1. The project 'Towards sustainable mobility: **Economic and spatial effects of increasing goods traffic**' is an analysis of the impacts of freight transports in a spatial and multimodal framework. The objective was "to get a good grip on the complex relation between freight transport, external effects, infrastructure and economic growth" (Beuthe et al., 2001).
2. In 'Activités économique et ville européenne: **Les banlieues ont-elles besoin des centres?** – Economische activiteiten in de Europese stad: **Hebben de randgemeenten de stadscentra nodig?**' is a description and explanation of the Belgian urban spatial structure and the evolution in terms of localization of jobs and firms was made (Verhetsel and Thomas, 2004).
3. '**Determinants of modal choice in trip chains**' gives insight on the determinants of modal choice through a literature study and statistical analyses of data obtained through the mobility surveys and public transport data. The findings were used to propose some policy measures (Vleugels et al., 2005).
4. 'Spatial analysis and modelling based on activities' (**SAMBA**) focused on the spatial components in an activity-based approach to model travel behaviour (Thoint et al., 2005).
5. In 'Impact of "**free**" **public transport** on travel behaviour: a case study', the effect of the introduction of the third payer system for students in Brussels was analysed from a psycho-social, economic and geographical viewpoint. The multidisciplinary approach allowed an analysis of the range of effects that free public transport and, in general, price policies can entail" (Steenberghen, Lannoy and Macharis, 2006).
6. '**Commuting** in Belgium – The home-work and home-school trips' is derived from the socio-economic survey 2001 (SEE). Different aspects of the home-work and home school trips are analysed and compared to previous data. Different policy measures are suggested (Verhetsel et al, 2006)
7. In **Accessibility indicators** to places and transports', an extensive literature review was made of different methods to calculate accessibility, and their potential use was assessed and demonstrated. A selection of accessibility indicators was calculated at different scales, for both public transport and car, to

assess the impact of congestion on accessibility, and the spatial differences (Vandenbulcke, Steenberghen and Thomas, 2007).

8. '**Housing and housing environment** in Belgium' is derived from the socio-economic survey 2001 (SEE) focusing on the topic of housing, living, the housing stock and the housing environment. The results are compared with the previous SEE and explained in relation to different processes, externalities and pricing, whereafter policy measures are suggested (Vanneste, Thomas and Goossens, 2007).
9. In '**Time-space patterns of traffic accidents**: what we learn from comparing Brussels with QingDao City' techniques for identification of statistically significant accident concentrations (black zones) were tested in very different urban environments to examine the effects of the urban structure and network characteristics (Aerts et al., 2007).
10. The focus of '**Mobility and the elderly: successful ageing in a sustainable transport system (MESsAGE)**' was on the transportation autonomy of older people, and to increase the use of sustainable transport modes within this target group" (Christiaens, 2009).
11. In '**Systematic analysis of health risks and physical activity associated with cycling policies**' (**SHAPES**) data were collected and experimental measurements were performed to examine the major health risks and benefits associated with cycling as a mode of transport for commuting". (IntPanis et al., 2009).
12. In **SUSTAPARK**, '**Optimising price and location of parking in cities under a sustainability constraint**' a multi-agent urban parking model is developed based on experimental research of parking search strategies by drivers (Spitaels, 2009).
13. '**Assessing and developing initiatives of companies to control and reduce commuter traffic**' (**ADICCT**) is a study on the mobility of the commuters and the impact of the incentives on their behaviour, from the view point of the companies. (Witlox, 2009).
14. In '**Subclinical responses in healthy cyclists briefly exposed to traffic-related air pollution: an intervention study**' (**PM<sup>2</sup>TEN**) the effect on the lungs of a person making a bicycle journey along a busy commuting road is examined. The main objective was to determine whether cycling to work in a polluted urban environment should be encouraged or not (Jacobs et al, 2010).
15. '**Tackling health inequalities in Belgium**' (**TAHIB**) focuses on understanding the determinants of health inequalities in Belgium in order to propose effective entry points to reduce that inequality. In particular, interact focuses on the contextual determinants of health socio-economic and ethnic health inequalities as well as inequalities in providing informal care (Portet et al, 2010).

## 2.2 Conceptual frameworks for the integration transport studies

The term sustainable development was used for the first time by the Brundtland Commission in 1987. In the Brundtland Report 'Our Common Future' sustainable development was defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". In the beginning sustainable development was primarily used in the field of the environment and the use of natural resources. Later, the concept was broadened to the fields of environmental, economic and socio-political sustainability. Only sustainable development in all three fields would lead to a sustainable society (World Commission on Environment and Development, 1987). Sometimes other dimensions of sustainability are defined, but most of these are related to the above mentioned fields.

It is generally accepted that sustainable transport and mobility should, in the same way as sustainable development in general, find a proper balance between environmental, socio-political and economic qualities for the present and the future. There is however less agreement on which qualities should be guaranteed and balanced (Steg and Gifford, 2005). There have been attempts to list indicators that can be used to evaluate current and future sustainability (e.g. Gilbert and Tanguay, 2000; Gudmundsson, 2001; Litman, 2003). Examples of used indicators are energy use, emissions, land use, traffic safety, noise, health costs, welfare, accessibility, congestion delay, commuting speed, variety of transport, quality and comfort of transport...

Sometimes, specific goals are set to achieve sustainability in the long run. For example in Mobility 2030, a project of the World Business Council for Sustainable Development (WBCSD), seven goals are proposed which, if achieved, would improve the prospects for sustainable mobility:

1. Reduce conventional emissions from transport so that they do not constitute a significant public health concern anywhere in the world.
2. Limit gas (GHG) emissions from transport to sustainable levels.
3. Reduce significantly the number of transport-related deaths and injuries worldwide.
4. Reduce transport-related noise.
5. Mitigate traffic congestion.
6. Narrow "mobility divides" that exist within all countries and between the richest and poorest countries.
7. Improve mobility opportunities for the general population in developed and developing societies.

(WBCSD, 2004)

To harmonize the research, data and analyses of the above mentioned projects, two conceptual frameworks are proposed: the 'Traffic and transport market' framework (Egeter et al., 1998) and the 'Driving forces – pressures – state – impact – response' framework (DPSIR) framework (EEA, 1999).

### **2.2.1 Traffic and Transport Markets framework**

This framework is mainly used in passenger transport to provide support for defining policy measures.

Three markets on which supply and demand interact, can be delineated:

- Travel market: market where the demand and supply of activities in space and time lead to certain travel patterns. Interactions between geographically separated areas take place at certain times. The consumer weighs costs and benefits and decides whether or not to make the trip.
- Transport market: market where the requested travel pattern and the supply of possibilities in transport lead to a certain transport pattern where passengers and goods are allocated to certain means and services of transport. The travel patterns can be seen as the demand side of the transport market. On the supply side are the available means and services of transport and their perception (quality, availability, costs...). The outcome is a set of transport patterns.
- Traffic market: market where the transport patterns (demand) are being confronted with the supply in infrastructure and their traffic management systems, resulting in the effective use of the infrastructure, thus creating traffic patterns.

Policy measures can be implemented at different points in the scheme. Policies can try to influence the travel need in the travel market by acting upon the demand side (the activities) or the spatial location of the activities. In the transport market, policy can try to provoke changes by taking measures concerning the modal split, the travel efficiency and changing techniques. In the traffic market, measures affecting the traffic efficiency can change the prevailing patterns. Attitude affects all markets, thus changes in the attitude of consumers can have an overall impact on mobility. The attitude of people can affect for example: the travel market by their choice of home and/or employment location; the transport market by the choice for a certain transport mode; the traffic market by the choice for a particular route.

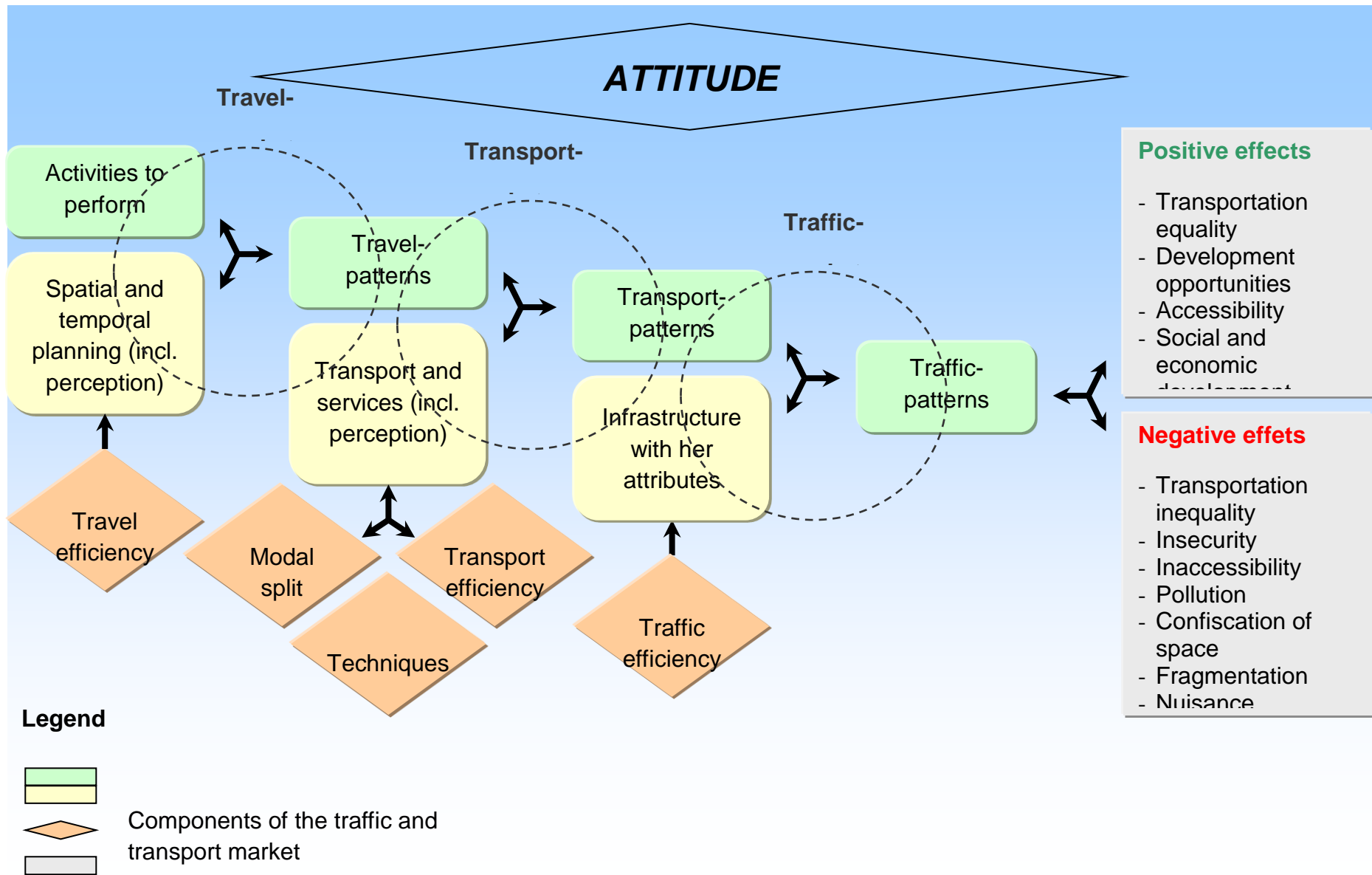


Figure 1: Three markets in traffic and transport (adapted from Mobiliteitsplan Vlaanderen, 2001)

## 2.2.2 The Driving forces – Pressures – State – Impact – Responses framework (DPSIR)

The DPSIR framework distinguishes driving forces, pressures, state, impacts and responses; this is an adaptation of the original PSR (pressure-state-response) framework, developed by the OECD (1993). The European Environment Agency (EEA) started using the DSPIR framework as a tool for the further development of a strategy for Integrated Environmental Assessment and it is now widely adopted as an instrument to report about the consequences of implemented or proposed policies (OECD, 1993; EEA, 1999; Pironne et al., 2003; Kristensen, 2004). At first, DPSIR models were only used in relation to the state of the environment, but nowadays they are also commonly used within the field of economics, social cohesion...

The DPSIR framework (Figure 2) states that there is a chain of causal links starting with the '**driving forces**'. In transport, the driving forces are the needs of society. Primary driving forces for people are the need for shelter, food and water. Mobility is considered as a secondary driving force, along with entertainment, culture.... For companies, driving forces can be profit-making, while for a nation this can be the need of a balanced budget or to keep unemployment levels low. These driving forces lead to certain human activities as a result of the indicated needs generating certain '**pressures**' on the environment. These pressures are all direct stresses from the anthropogenic system on to the environment. These can for example be: changes in land use and pressures on public space, excessive use of environmental resources, emissions to air, water and soil... The pressures result in influencing or modifying the '**state**' of the environment. The state of the environment is the quality of the environmental resources in relation to the function they fulfil; it is the combination of the physical, chemical and biological conditions. Examples here are the air, water and soil quality, the soil use, the state of ecosystems... The state causes or provokes '**impacts**'. These impacts are the effects on the anthropogenic system (the life-supporting abilities of the environment, human health, social performance of society ...) caused by the changes in the state of the environment. The impacts stimulate or ask for '**responses**' by society and policy makers. The responses are all the measures taken by society or policy makers to avert, reduce or alter the negative consequence and impacts initially caused by the driving forces (EEA, 1999; Pironne et al., 2003; Kristensen, 2004).

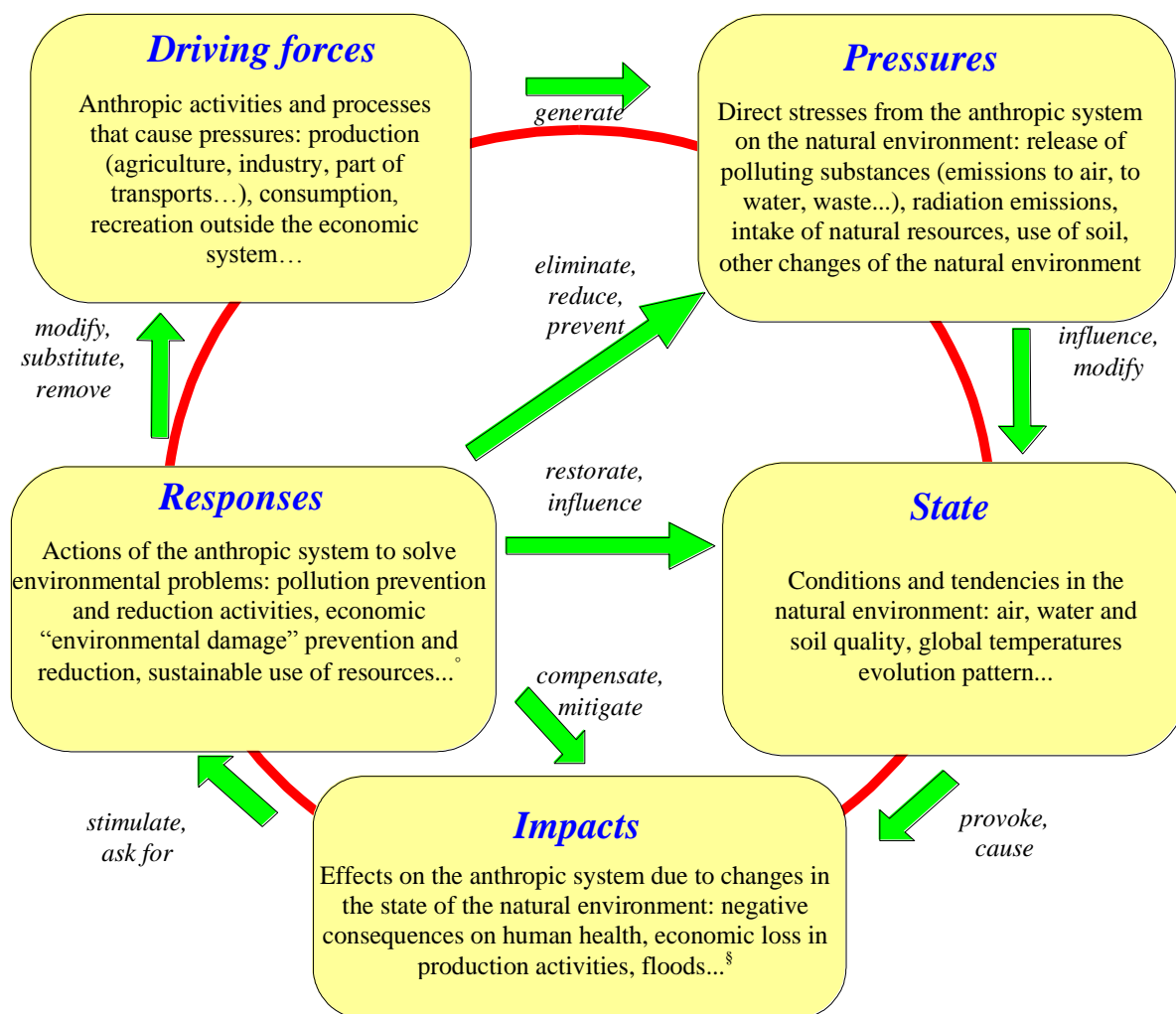


Figure 2: The DSPIR framework (Costantino and Falcitelli, 2003)

## 2.3 Application of the frameworks to the Belgian transport and mobility context

### 2.3.1 Policy measures in the Traffic and Transport Markets framework

#### a) Measures targeted at travel demand

A first possible point of intervention is in the travel market: measures to influence the travel needs. A possible measure, mentioned in the ADDICT project, that companies can take to reduce the demand for transport, is promotion of teleworking and telecommuting. Teleworking refers to all work-related substituted travels by telecommunication, including teleconferencing, emailing, online databases.... Telecommuting is more specific and defines the changes in the home-work commuting by either working at home or working at satellite or neighbourhood centres. These initiatives can reduce the number of trips made or at least make trips shorter (Witlox et al., 2009).

According to the SHAPES project and the project on Accessibility indicators, the needs for transport can also be influenced by focussing on proximity between residential areas and other activities during spatial planning. This proximity of different activities by encouragement of a concentration of houses and activities and a mixed land use decreases the travel need (IntPanis et al., 2009; Vandenbulcke, Steenberghen and Thomas, 2007), especially since, according to the SAMBA project, most residents seldom leave their city region (Thoïnt et al., 2005). The project of 'Economic activities within the European city: do suburbs need cities?' suggests that changes in planning should mainly focus on companies, since reversing the general trend of dispersion of residences will be much more difficult (Verhetsel and Thomas, 2004).

The time dimension of travel needs is another point at which measures can be considered. During peak hours the increase in demand leads to overload of the transport system, while at off-peak hours, networks are underutilized (Immers and Stada, 2011). The ADDICT project states that changes in the demand can be influenced by introducing compressed workweeks (work more hours in fewer days) and flexible work schedules. Contrary to compressed workweeks, flexible work schedules will however not affect the number of trips made, but they can reduce the concentration at peak hours by more dispersion of the demand over time leading to less congestion and overload (Witlox et al., 2009).

#### **b) Measures in the transport market**

The transport market can be influenced through: modal choice, transport efficiency and technological improvements.

Influencing the modal choice particularly means encouraging alternative traffic modes. For passenger transport this refers to walking or taking the bike, bus, tram or train, while for transport of goods encouraged modes are inland waterway and rail. In the reviewed research projects, little is said about how to encourage companies to change their mode of transport for goods. For passenger transport on the other hand, there are many ways mentioned to encourage consumers to take alternative modes of transport.

**Pull factors** are needed to make alternative modes of transport more interesting than travelling by car. Measures can be grants by companies (according to the ADDICT project) or government incentives for alternative modes of transport such as giving an allowance to be used for travel costs; when employees can keep their travel costs lower than their allowance, they can hold the difference. Also, the supply of infrastructure and service needs to be attractive. Improvement of infrastructure and safety on sidewalks and bicycle paths is important according to the MESsAGE and SHAPES projects; the quality of public transport in terms of reliability, missing



links and time spent waiting is considered important according to the project on 'Determinants of modal choice in trip chains' (Christiaens et al., 2009; IntPanis et al., 2009; Witlox et al., 2009; Vleugels et al., 2005). All measures can make alternatives more interesting. For elderly people, the MESsAGE project pointed out that the aspect of safety is important (Christiaens et al., 2009). For commuters time spent waiting is very important for their modal choice –more important than the actual travelling time– according to the project on 'Determinants of modal choice in trip chains'. It is mentioned being more (Vleugels et al., 2005).

At the same time **push factors** need to be implemented, according to the SUSTAPARK and the ADICCT projects this can be for example an efficient parking system with few and/or expensive parking lots for the city as well as for parking lots of companies. Limiting or cancelling the benefit of a company car can also be an important measure by companies according to the ADICCT project (Witlox et al., 2009).

According to the project on 'Accessibility indicators' spatial planners should incorporate the accessibility of the area in the planning process of residential and business areas, (Vandenbulcke, Steenberghen and Thomas, 2007). A high density and diversity of land use together with a good connectivity will not only reduce the travel demand (see earlier), the land use also influences the use of non-motorized modes of transport. Cycling and walking appear to be highly correlated with variables such as proximity and connectivity according to the SHAPES project (IntPanis et al., 2009).

Encouraging alternative modes of transportation should be geographically differentiated. It is easier to persuade people to choose for alternative modes of transportation, if alternatives are abundant like within cities. On the countryside the public transportation network for example, is less dense and often more transfers are needed to get to the place of destination. The SHAPES project also mentions the importance of geographical differentiation considering the encouragement of cycling: when there are many slopes to take and cycling distances are long (for example in the province of Luxembourg) it is hard or even impossible to persuade people to cycle. Other important environmental variables, according to the SHAPES project, are the cycling infrastructure, accident risks and traffic volume.

A part of the measures mentioned for influencing the modal choice of people are probably also useful for encouraging alternative modes for transport of goods, especially those involving grants and improvement of infrastructure.

Improving the **transport efficiency** implies a better use of the capacity of vehicles. For passenger transport this could be accomplished by encouraging carpooling as

mentioned in the SHAPES project. The problem with carpooling is that it is often mentioned as somewhat unreliable, so to encourage carpooling, companies can implement incentives like a free taxi home if let down by car share partner, financial incentives, preferential parking, etc and companies can also help with finding car share partners (Witlox et al., 2009).

Another set of measures to make mobility more sustainable is the application of new **technological developments**, such as cleaner engines, which can help diminish the negative effects of mobility. This is important, especially to encourage cycling, since the PM<sup>2</sup>TEN project proved that there is a significant impact of air pollution on cyclists when cycling (significantly more blood neutrophils than a comparable exercise in a clean room) (Jacobs et al., 2010). Although concentrations of PM10 are higher in a car than in the open air, the SHAPES project pointed out that cyclists have a higher intake of these particles because of an increased (3.3 times higher) ventilation due to the physical effort (IntPanis et al., 2009). Therefore there is a need in cleaner technologies for cars. Thereby the SHAPES project also states that cleaner techniques and noise reduction can also increase the liveability of cities (IntPanis et al., 2009)

#### **c) Measures in the traffic market**

The traffic market can be influenced by traffic efficiency improvement. Traffic efficiency determines to what extent the potential capacity of the existing transport system is being used. Examples of improving traffic efficiency are dynamic route information and ramp metering. Improvements to the design can also contribute to a more sustainable mobility and higher traffic efficiency. The design of roads should be adapted to the function and the relative importance of that road, misalignment can lead to congestion or less safety. Also a network of alternative routes should be foreseen to anticipate to road works or accidents. Furthermore specific infrastructure measures can be implemented to improve the local environment (sound barriers, ecoducts, necessary lightening, a safe infrastructure for walking and cycling ... ) (Immers and Stada, 2011).

#### **d) The importance of attitude**

Changing the general attitude of traffic consumers may be difficult but it can prove to be very beneficial. When consumers for example understand the necessity of sustainable mobility, they may try to change their demand for activities and influence the travel market. But if they are not able to change their demand, they might consider a more sustainable travel mode, leading to a more sustainable mobility system through the transport market. According to the project on 'Determinants of model choice in trip chains', once a certain attitude or habit has been formed, it is often hard to alter. This implies that it is important to develop a positive attitude and

habits towards sustainable mobility at young age, with children and adolescents. Traffic education should include learning responsibilities and consequences of a certain mobility behaviour. A crucial point, according to the same research, is the first job of youngsters: when they decide to use a car to go to work, a certain habit is formed, this doesn't easily change later on. Plus, this often comes with the purchase of a car, which is then also used for other purposes (shopping, recreation) instead of alternative modes of transport (Vleugels et al., 2005).

The past has proven that understanding of the importance of sustainability isn't always enough. Most of the time, consumers need to be directed and encouraged into making certain choices. A possibility is a proper pricing system that includes the external costs of certain mobility choices made by consumers. These external costs are costs caused by a certain behaviour, not included in the effective cost for the consumer. Examples are public health, air pollution, congestion, noise, damage to thirds... and can be positive as well as negative. Internalizing these external costs into the prices of transport makes the price reflect the true costs of the behaviour and confronts consumers with those external costs. A problem with this measure is the estimation of those external costs because they are often difficult to quantify. The external effects and a correct quantification of them were examined for freight transport in the 'Economic and Spatial Effects of Increasing Goods Traffic' project, where they found that integrating the external costs for freight transport would lead to an increasing use of rail- and waterways (Beuthe et al., 2001). External costs were also mentioned in relation to parking prices in the SUSTAPARK project (Spitaels et al., 2009) and the expected reduction of negative external costs where quantified in a case study concerning free public transport (Steenberghen, Lannoy and Macharis, 2006).

Apart from a correct pricing, a more sustainable travel behaviour can be stimulated through provision of efficient alternatives for places difficult to reach by car due to congestion (Vandenbulcke, Steenberghen and Thomas, 2007). On top of that, a restrictive and expensive parking policy can be another reason to not use the car for travel according to the SUSTAPARK project (Spitaels et al., 2009).

Persuading people to change their mobility habits by changing their attitude however, also has a geographical component; people living in the city have more alternatives to choose from.

#### **e) Concluding remarks and evaluation**

Considering the general demand-supply setting of the mobility market, it is important to notice that the demand at every market originates from the necessity to travel for activities. The existing traffic patterns are a consequence of the combination

between the need for activities and the spatial arrangement of the implemented infrastructure.

To influence the mobility market at different points, different policy measures were mentioned.

Evaluating this framework, two missing issues can be mentioned. First, there is the absence of the **health topic** in the scheme. Indirectly, it can be linked to the framework, but it is not mentioned with the effects. Although it is mentioned in the PM<sup>2</sup>TEN and SHAPES projects, that traffic and transport have an important impact on health (Jacobs et al., 2010, IntPanis et al., 2009) and health also influences to what extent people can handle the negative effects resulting from certain traffic patterns. The TAHIB project indicated that for example smoking has a larger impact (for example on death rates) on the disadvantaged in society. This could mean that the negative impacts of traffic, like air pollution, could have a higher impact on groups with lower social status (Portet et al., 2010). Health can also be incorporated at another point in the framework. Except for the spatial and temporal planning, in a future society where 1/3 of the population is 65 and older, health becomes also an important issue in the travel market. Health issues will create other demands for activities and other places will become more important for example by the increasing demand for home nursing, meals on wheels... Given the importance of this topic within the perspective of the social pillar of sustainable development, it should not be ignored.

A second gap in the framework is the importance of **space and scale**. The different effects mentioned are not scale independent, nor are they spatially independent. They should be related to the carrying capacity and the specific characteristics of certain locations.

Both topics are important and are underexposed in the framework, which confirms the choice of the double focus in the second part of the INTERACT: elderly people, given their increasing number in our society, and specific sites given the importance of scale.

## 2.3.2 DPSIR

### a) Mobility in a DSPIR framework

The DPSIR framework is used to analyse the current mobility issues (Figure 3). The driving forces are interpreted as the demand for an efficient travel to access certain activities. As earlier stated, this demand for travel is a consequence of the scattering of activities and residences in space due to the land use pattern. The pressure generated by this demand is traffic, especially car traffic, with accompanying emissions, accidents and use of public space (roads and parking lots). These pressures lead to congestion, a decrease in safety, parking shortage and air pollution. The impacts provoked are economic losses, unhealthy environments, parking problems (illegal parking, long search times...) and a decrease in cyclists and pedestrians. These negative impacts require a response. Possible responses are the reduction in the number of movements, an alternation of the mode choice, a change in consumption habits and technical improvements.

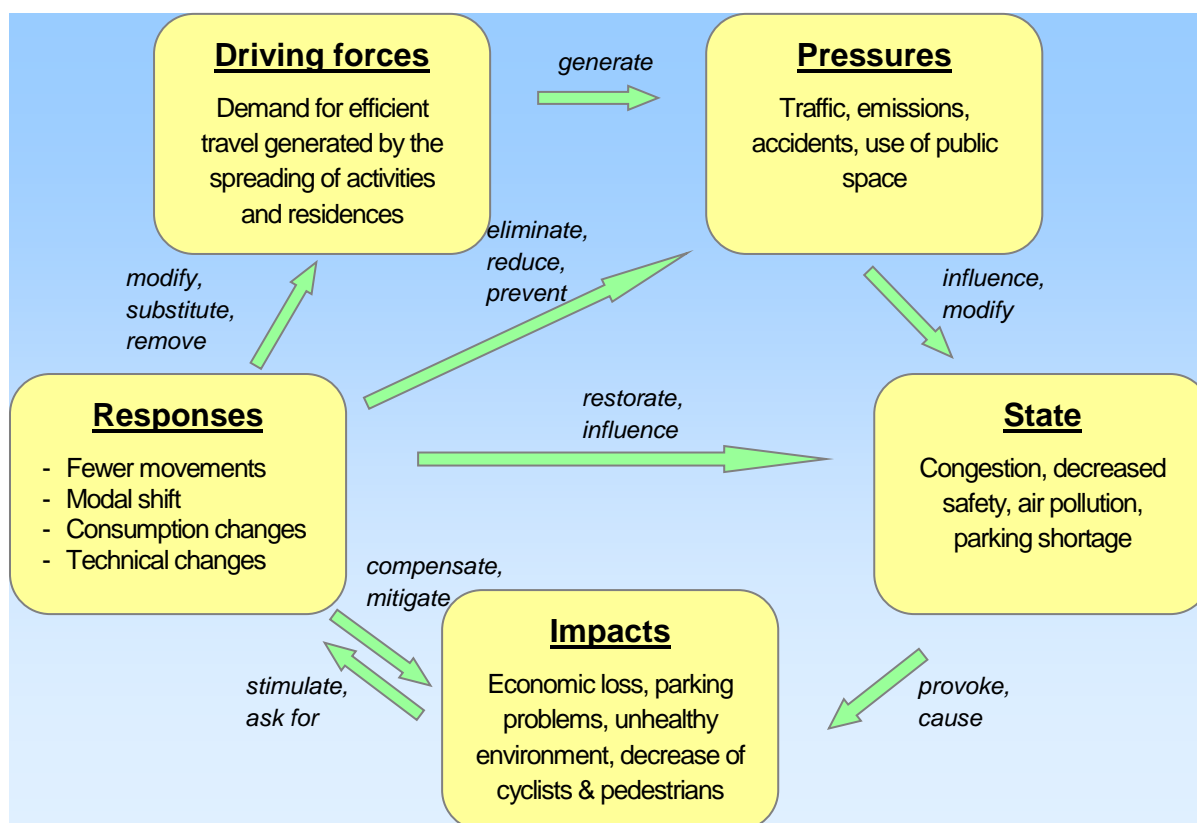


Figure 3: The DSPIR framework applied to the transport and mobility issue

Most projects describe the driving forces, pressures, state or impacts of the current mobility system after which they indicate possible responses for policy makers to deal with the mentioned problems. The 'Determinants of modal choice in trip chains' (Vleugels et al., 2005) and the 'Accessibility indicators to places and transports' (Vandenbulcke, Steenberghen and Thomas, 2007) projects examine the driving

forces and possible responses to it. The latter also points out at possibilities to describe the state of the system through the accessibility indicators. The project 'Economic activities within the European city: do suburbs need cities?' looks at what driving forces create the state of the current spatial layout (Verhetsel and Thomas, 2004). The SAMBA project also deals with the driving forces but doesn't really give possible policy responses (Thoint et al., 2005). The only project dealing with the analysis of a certain pressure and some policy recommendations to reduce the pressure is the SUSTAPARK project which deals with the problem of parking spaces (Spitaels et al., 2009). Many projects analyze the state of the system and possible ways to influence it, namely the ADICCT project (Witlox et al., 2009), the MESsAGE project (Christiaens et al., 2009), the SHAPES project (IntPanis et al., 2009), the TAHIB project (Portet et al., 2010), the two monographs based on the socio-economic survey of 2001 (Commuting and Housing and housing environment in Belgium) (Vanneste, Thomas and Goossens, 2007; Verhetsel et al., 2006). Also the project of 'Economic and spatial effects of increasing goods traffic' investigates the state of the system by looking at the infrastructure for transport of goods, after that, the project analyses the possible consequences of a policy that encourages goods traffic by rails and waterways (Beuthe et al., 2001). A last project that also deals with the state of the system is the project of 'Time-space patterns of traffic accidents' which looks at the current state of traffic accidents, but it doesn't give clear responses as how to deal with it (Aerts, Steenberghen and Thomas, 2007). The impact of air pollution on cycling is investigated in the PM<sup>2</sup>TEN project and the project also states certain responses (Jacobs et al., 2010). The 'Impact of "free" public transport on travel behaviour' project is unique in the way that it evaluates a response by policy makers to modify the driving forces.

A similar exercise can be carried out for traffic of goods. Again there is a need for transportation of goods due to a mismatch between the location of the production and the location of the consumption of goods. This demand for transport generates traffic by roads, waterways and rails, with the major part concentrated on road traffic. This leads to traffic jams, air pollution, decrease in safety..., again causing economic losses and unhealthy environments. Again, responses are needed and can be found in the decrease of the number of movements, a change in the mode of transport used and technical changes.

Since there is only one research project of the considered projects that deals with freight and since this research project (Economic and spatial effects of increasing goods traffic by Beuthe et al. (2001)) does not focus on responses, the possible responses (part 4.2.2) will only focus on passenger transport.

## **b) Possible responses**

### **➤ Reduce the number of trips**

Some initiatives to reduce the number of movements have been proposed by the ADICCT project. The encouragement of teleworking and telecommuting is a first possible measure. But only when it comes to working at home, telecommuting reduces the number of trips. Also the measures of compressed workweeks and ride sharing, earlier mentioned, are effective measures to reduce the number of movements. Flexible work schedules will not affect the number of trips, but they can reduce the number of movements at peak hour and thus reduce traffic congestion (Witlox et al., 2009).

### **➤ Changing the mode choice**

Changing the mode choice means encouraging public transport and private non-motorized transport for passenger transport, and encouraging the use of railroads and waterways for transporting freight. Measures should also be geographically differentiated given the differences in density and quality of infrastructure, differences in mean travel distance and differences in availability of public transport between cities, the outskirts and rural environments.

#### **1) To non-motorized travel modes**

According to the research in the ADICCT project, initiatives encouraging cycling, walking and other non-motorized travel methods, most of the time, don't persuade people to change their mode of transport. Measures will mostly perpetuate the current users of those travel modes since it is often the distance that withholds people from cycling. In order to reduce distances further urban sprawl and suburbanisation of activities should be prevented.

When users do change their mode of travel, it will mostly be between preferred modes, for example changes between public transport and cycling. The impact of stimulating modal choice to non-motorised modes on problems like congestion will be rather low since these measures usually affect bus users and short distance rides, but no movement on longer distances (Witlox et al., 2009).

The SHAPES project emphasizes the importance of cycling. When there are many cyclists, it encourages others to cycle, which could induce a mass effect. In the long-run this wouldn't just increase non-motorized movement, but it could also decrease noise and air pollution, improving the quality of life (IntPanis et al., 2009).

The MESsAGE project evaluates mobility of elderly. In 2050 one out of three Belgians will be 65 or older (this was one out of six in 2000) (Christiaens et al., 2009; Vanneste, Thomas and Goossens, 2007). Realizing the relative importance of this group in the total population now and in the future, specific focus on this part of the

population can't be neglected in a comprehensive mobility policy. For the elderly, mobility is an important precondition for a qualitative life. Measures for mobility of the elderly are however not that straightforward: the target group is heterogeneous and measures have to be adapted to this heterogeneity. The measures should acknowledge the differences in income among elderly, their differences in physical and cognitive capabilities, their age, where they live (city, outskirts, country side)...

An important problem in mobility of the elderly is the substantial car use. A trend which is likely to increase since a higher part of future generations of elderly has a driving license. Considering the increasing share of elderly in society and their increasing car use, it is important to elaborate a well thought out policy concerning their mobility. For elderly people the most important issues in mobility by non-motorized travel methods are traffic safety and the design of public space (Christiaens et al., 2009). 57% of the Belgian population indicates that bicycle paths are in a poor state and 1/3 of the population indicates that sidewalks are in a bad state according to the monographs on 'Housing and housing environment' and 'Commuting'. A bad state of the public space is often more of a problem for elderly people (Vanneste, Thomas and Goossens, 2007; Verhetsel et al., 2006). An easy accessible public space is paramount in a comprehensive mobility policy.

The ADICCT project notices that the number of movements, or at least the number of movements by car, is much lower in areas with a high density and mixed land use, like in city centres (IntPanis et al., 2009). Shops, activities and residences are close to each other making them easily accessible without using the car. As such, the encouragement of mixed land use can cause a decrease in car usage. As mentioned before, cycling and walking are highly correlated with proximity and connectivity (IntPanis et al., 2009). But measures affecting land use take more time and are more difficult to implement.

## **2) To public transport**

To improve the use of public transport, the most important issues are the access to the system and the waiting time, according to the research on 'Determinants of modal choice in trip chains' (Vleugels et al., 2005). These issues are important to take into account during spatial planning. First of all, time spent walking and time spent waiting during a transfer, have a significant negative correlation with the use of public transport. The effect of the time spent waiting is hereby more important than the walking time or the total travel time. This problem can be addressed by a good network management. One proposed solution is a hierarchical structure of connections (from long distance to short distance) with an adapted infrastructure, lines and nodes. This can increase the travel speed and persuade travellers to



change their mode of transportation. However, shortening waiting times can only be obtained when there is an overall high punctuality (Vleugels et al., 2005).

Another important issue, according to the 'Determinants of modal choice in trip chains' research project, are 'missing links'. A missing link is a part of the transport chain for which there is no alternative in public transport. These are often in the beginning or at the end of the chain. The missing links are often an important reason for people to replace the entire chain by car, which makes it important in a context of changing the mode of transportation (Vleugels et al., 2005).

Considering the access to public transport, and especially busses, 82% of the Belgian population lives at less than 1km of a bus stop. These are high rates. But it is important to notice that this includes busses on demand (so called 'belbussen') and one can wonder if these busses are able to provide a service similar to regular busses (Vleugels et al., 2005). Plus, these numbers say nothing about the availability of public transport at both origin and destination; both are important for the modal choice of travellers.

It can therefore be said that when wanting to change the mode of transportation of people from private to public transport, accessibility, reliability and efficiency are critical. Extra pull and push factors to persuade people can be the, earlier mentioned, incentives by companies (considering home-work travel) or governments and restrictive and expensive parking policies (Christiaens et al., 2009; Vleugels et al., 2005; Witlox et al., 2009).

### **c) Consequences of responses**

Ideally, when policymakers are able to reduce the amount of traffic on roads (Figure 4), there is a release in pressure on the roads leading to a state of less congestion and air pollution. The impact will then be a reduced economic loss through traffic jams and a better health of the population through the reduction of air pollution. However, there will probably be no or only a small release in pressure on the roads since it is often the case that the vacant places on roads are quickly filled up with other cars and trucks. These drivers have noticed the decrease in congestion and therefore change their mode of transportation or they do not longer need to leave as early or as late as they used to (Steenberghen, Lannoy and Macharis, 2006). The same can be said for policies encouraging an increase in freight transport by rails and waterways. Again vacant places could get filled by other cars and trucks (Beuthe et al., 2001).

Bad experiences will bring people back from public transport to the car. If an increase in demand for public transport is not anticipated by policymakers and public transport gets too crowded so that passengers get frustrated, people will more likely

again start preferring their car. The same can be said when public transport proves to be unreliable. (Steenberghen, Lannoy and Macharis, 2006).

Risser and Ausserer (2010) found the same for walking. When people are persuaded to start walking and they have bad experiences through a lack of preconditions for walking such as unsafe walkways, unpleasant (noisy, smelly ...) environments... they will not likely do it again in the future.

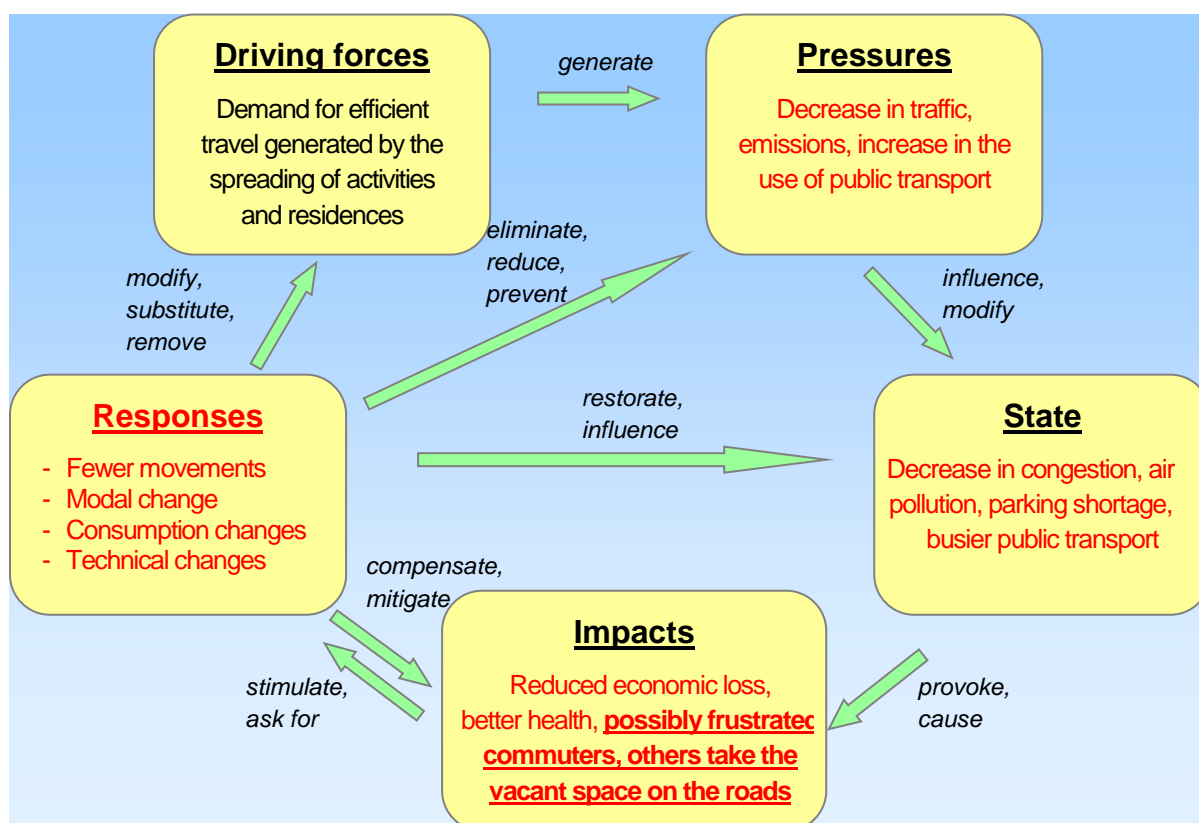


Figure 4: Possible consequences of responses in the DSPIR framework

A problem more related to freight transport is that, according to the research on 'Economic and spatial effects of increasing goods traffic', promotion of transport by railways and waterways could induce regional inequality in Belgium. The infrastructure of both railways and waterways is more developed in the Flemish region as in the Walloon region. As such promoting, for example through subsidy, those other modes lead to a disadvantage for the Walloon region (Beuthe et al., 2001).

The dynamics of the mobility system make it very difficult to obtain straightforward effects to policy measures, due to, i.e. the secondary effects described earlier of decrease of congestion stimulating car use or the boomerang effect making people return to their old habits after a bad experience.

#### **d) Concluding remarks**

The examined studies cover a wide range of driving forces, pressures, state or impacts of the current mobility system after which they indicate possible responses for policy makers to deal with the mentioned problems.

The critique on the framework can be a lack of differentiation within the driving forces: there is no **differentiation between the actors** (individuals, households, firms...) and there is no differentiation in the purpose of the trip (leisure, commuting, job related, tourism, education...). For every driving force, a new DPSIR cycle can be designed, each with their own (often different) responses. An in-depth analysis for a specific target group will allow us to introduce this differentiation.

As in the previous framework, **the scale and the geographical component** of processes are neglected. The pressures, state and impact can differ in different places and regions, or on different scales. Both frameworks allow the integration of different aspects of the mobility issue and show that any interference through policy can have an impact on the entire mobility system.

## **2.4 Policy recommendations for accessibility of places and transport**

The next step in the project is to propose solutions. These can be either aimed at specific domains, or specific locations, or be common to all. The objectives can be long-term, medium-term or short-term. Special considerations for implementation and the choice of measures, depend on the relevance from different points of view. These were obtained during a workshop where experts from different disciplines discussed and evaluated some proposed measures. Based on the findings of the workshop, a survey was carried out to prioritize the measures and estimate their efficiency and feasibility.

### **2.4.1 Survey response**

In total, 106 respondents filled out the entire survey. 56 of them were Flemish, 31 were Walloon and 18 were from Brussels. Most respondents work in a public administration (30), followed by scientists (24) and planners (14). Least represented were citizens and companies. 5 respondents indicated they did not belong in one of the proposed categories.

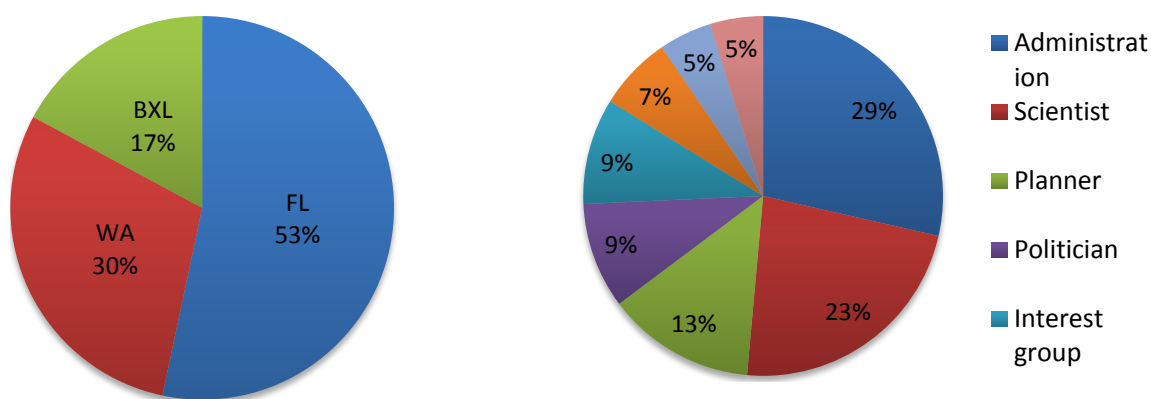


Figure 5. Survey response

## 2.4.2 Measures

### a) Balancing measures

The respondents were asked how a budget of 100(%) should be allocated in order to improve accessibility. On average 24.4% was allocated to the stimulation of public transport, closely followed by stimulation of non-motorized transport (21.3%), improvement of the efficiency of transport infrastructure (21.1%) and decreasing transport needs (19.4%). This distribution is an indication that the respondents are in favour of balanced policies, with combinations of measures in these four areas. Preparing the system and public space for an ageing society (7.7%) and other measures (5.3%) were considered less important. These answers also had the smallest standard deviation (SD), meaning most people had more or less the same idea on the importance of these measures. The highest SD can be found for 'Improve efficiency of transport infrastructure' meaning opinions differed: some respondents indicated this as an important measure (with allocations up to 100%) and some found it not important (allocation of 0%).

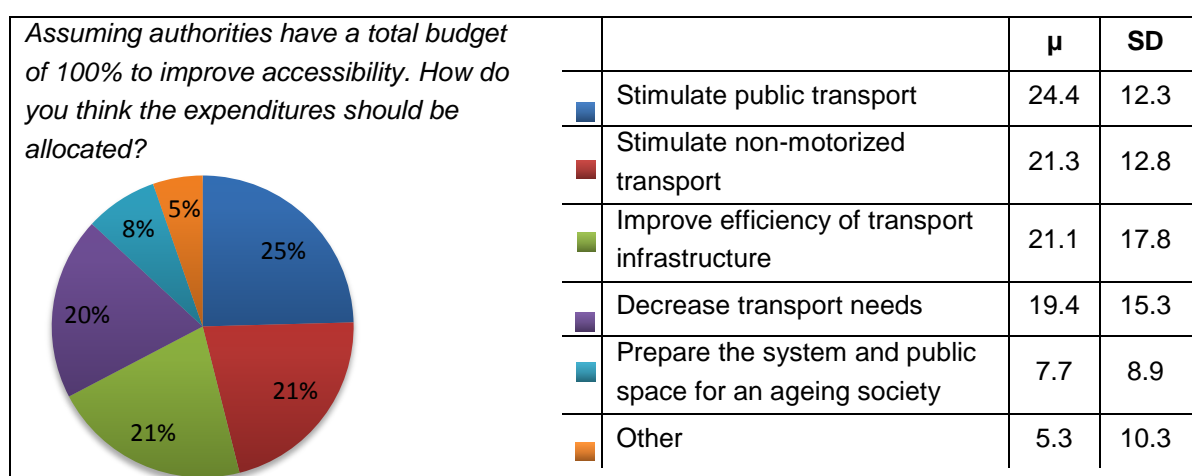


Figure 6. Priorities in terms of budget allocation

### b) Stimulate public transport

Within measures to stimulate public transport, all measures received on average a more or less equal share of the budget.

*Assuming authorities have a total budget of 100% to stimulate public transport. How do you think the expenditures should be allocated?*

	$\mu$	SD
Provide dedicated lanes and priority at traffic signs	15.8	11.3
Insure punctuality	9.4	6.9
Improve cooperation between different public transport companies	9.8	7.0
Reduce the benefits of company cars	13.0	7.7
Make public transport accessibility a precondition for new real estate developments	9.8	10.5
Provide correct real-time information	11.1	8.9
Implement a restrictive and expensive parking policy in cities	12.4	9.8
Simplify intermodal ticketing and payment systems	15.0	11.2
Other	3.6	13.0

Table 1: Mean and standard deviation of budget allocation for measures on stimulating public transport

Insuring punctuality received, on average, the lowest percentage (9.4). Most respondents felt this way, since SD (6.9) is rather low. Furthermore, this measure is considered highly efficient, with high public acceptance but with lower scores on technical and financial feasibility (Figure 7).

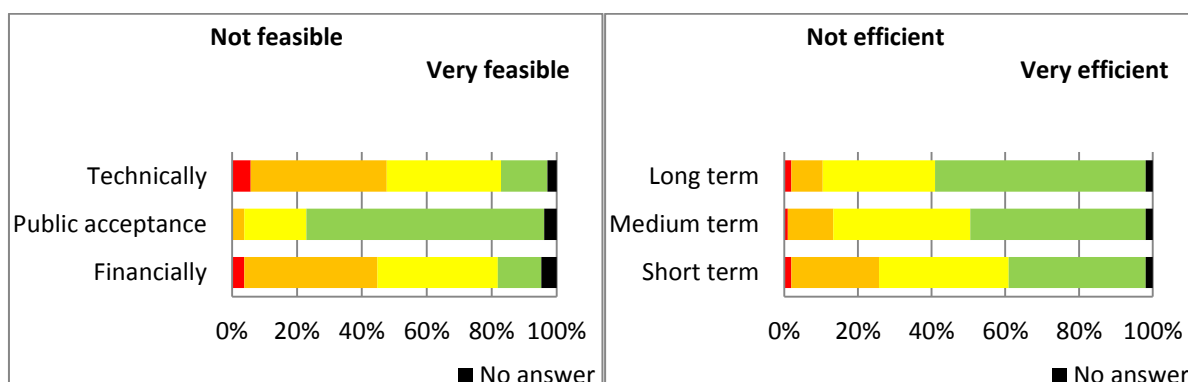


Figure 7: Efficiency and feasibility of the measure 'ensure punctuality of public transport'

The average scoring measure 'Implement a restrictive and expensive parking policy in cities' ( $\mu=12.4\%$ ) (8) shows a reversed graph with high technically and financially feasibility but with very low public acceptance. Thus, although this measure is perceived as efficient to very efficient, it will be hard to implement due to the very low public acceptance. 22 of the respondents indicated the measure as "not feasible" due to public acceptance.

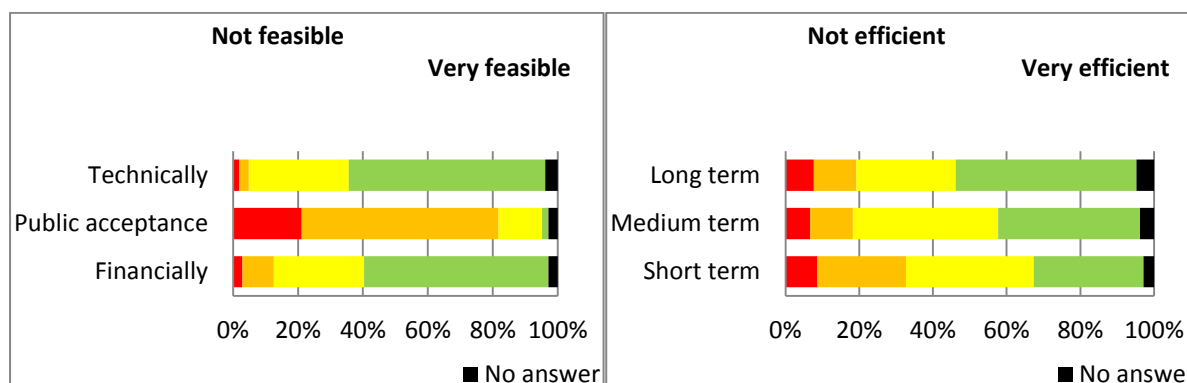


Figure 8: Efficiency and feasibility of the measure 'implementing a restrictive and expensive parking policy in cities'

The same can be said on the more or less equally scoring measure of reducing the benefits of company cars ( $\mu=13.0\%$ ) (Figure ). Again this is considered a technically and financially very feasible measure and perceived as efficient but with a very low public acceptance. Here, 16 respondents indicated this measure not being feasible due to public acceptance.

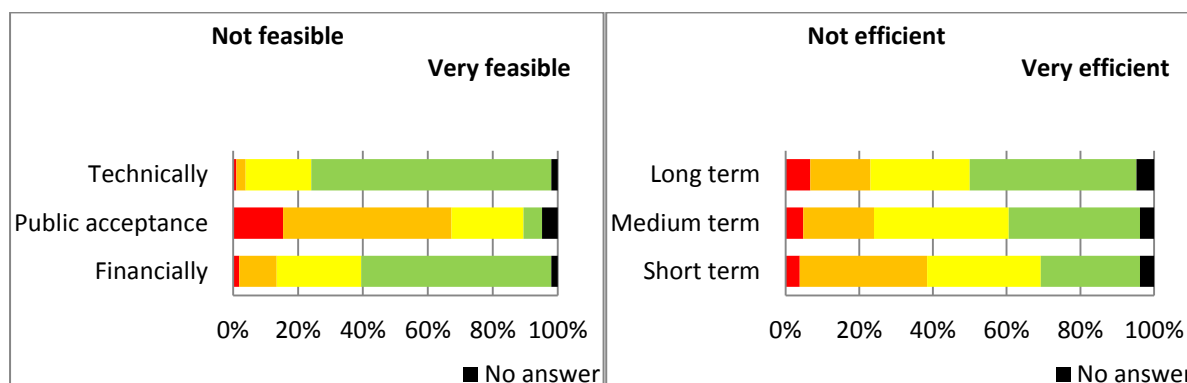


Figure 9: Efficiency and feasibility of the measure 'reducing the benefits of company cars'

Highest average (with highest SD) were allocated to 'Provide dedicated lanes and priority at traffic signs' ( $\mu=15.8\%$ ) and "Simplify intermodal ticketing and payment systems" ( $\mu=15.0\%$ ) (Figure & Figure 11). Both measures are considered to be efficient and both ought to be technically and financially feasible. With 'Simplify intermodal ticketing and payment systems' scoring somewhat higher on both themes. The measure difference however, can be found for public acceptance. While 'Provide dedicated lanes and priority at traffic lights' is considered to be somewhat

feasible to feasible on terms of public acceptance, 'Simplify intermodal ticketing and payment systems' scores very high for public acceptance. 83 respondents perceived the measure as very feasible in relation to public acceptance.

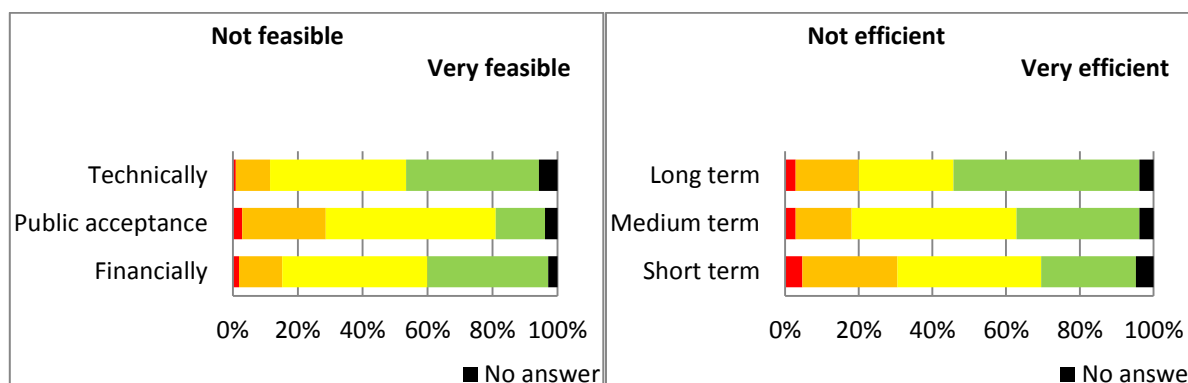


Figure 10: Efficiency and feasibility of the measure 'provide dedicated lanes and priority at traffic lights'

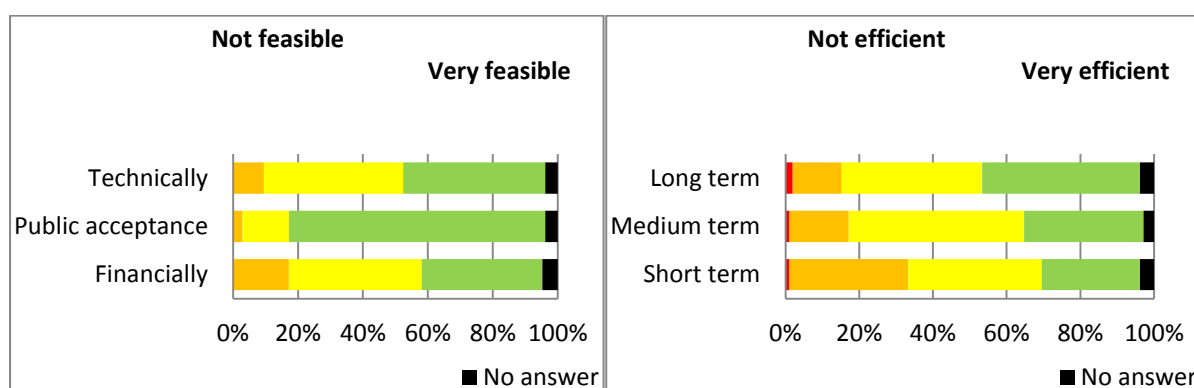


Figure 11: Efficiency and feasibility of the measure 'simplify intermodal ticketing and payment systems'

### c) Stimulate non-motorized transport modes

Allocation of a budget of 100% to stimulate public non-motorized transport modes was also rather balanced. There is one measure though that stands out, namely 'Aim at mixed land use to reduce travel distances', remarkably accompanied with a rather high SD. Also noteworthy is the relatively high score for "Other", meaning an important share of the respondents indicated that there are other measures more suitable to stimulate non-motorized transport modes.

*Assuming authorities have a total budget of 100% to stimulate non-motorized transport modes. How do you think the expenditures should be allocated?*

	$\mu$	SD
Reward walking and cycling financially	15.6	14.96
Increase public awareness of the benefits of walking	10.12	12.50
Aim at mixed land use to reduce travel distances	20.32	16.63
Redefine the hierarchy of roads for better balance between accessibility and integration with surroundings	15.41	11.34
Simplify guidelines for cycling and pedestrian facilities to encourage creative solutions	11.44	10.85
Increase inspections and audits during planning and construction of cycling and pedestrian facilities	11.80	11.62
Other	14.76	22.16
None of the above	0.57	4.12

Table 2: Mean and standard deviation of budget allocation for measures on stimulating non-motorized transport modes

The highest scoring ‘Aim at mixed land use to reduce travel distances’ (Figure ), is considered to be efficient on the long term yet not so much on the short term. It is neither considered to be very feasible, nor unfeasible; most respondents indicated “in between” values for technical and financial feasibility as well as for public acceptance.

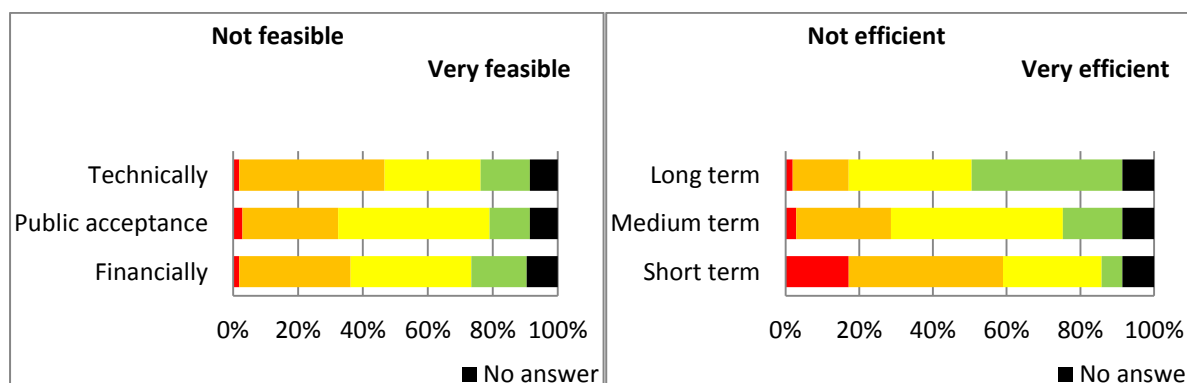


Figure 12: Efficiency and feasibility of the measure ‘aim at mixed land use to reduce travel distances’



All other measures have received more or less equal parts of the budget and had very similar results for feasibility and efficiency: the measures were considered to be feasible on all domains, but were not considered to be efficient. As an example, the graphs for “increase public awareness of the benefits of walking’ is given in Figure 13.

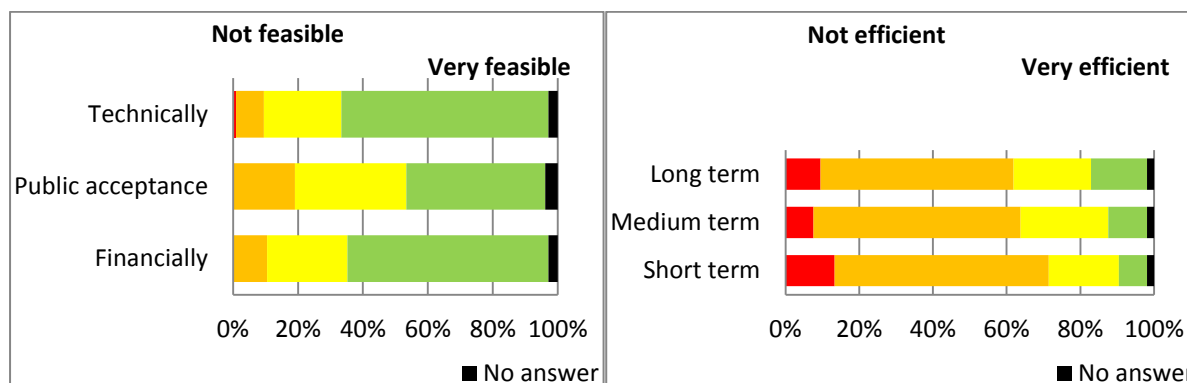


Figure 13: Efficiency and feasibility of the measure ‘increase public awareness of the benefits of walking’

**d) Improve efficiency of transport infrastructures**

For the allocation of a budget of 100% to improve the efficiency of transport infrastructure, three measures received a more or less equal score: ‘Add more public transport access points near employment concentrations’, ‘Ensure seamless door-to-door mobility through intermodal integration’ and ‘Increase public transport services beyond cities and interurban connections’. ‘Install dynamic traffic and parking management systems to reduce congestion in cities’ received a lower score and ‘Facilitate flexible work hours and compressed work weeks to decrease congestion’ received a much lower score’.

*Assuming authorities have a total budget of 100% to improve efficiency of transport infrastructure. How do you think the expenditures should be allocated?*

	$\mu$	SD
Add more public transport access points near employment concentrations	22.5	13.1
Ensure seamless door-to-door mobility through intermodal integration	20.9	13.5
Increase public transport services beyond cities and interurban connections	20.7	14.5
Install dynamic traffic and parking management systems to reduce congestion in cities	14.3	11.2
Facilitate flexible work hours and compressed work weeks to decrease congestion	10.7	11.2
Other	9.4	14.5

Table 3: Mean and standard deviation of budget allocation for measures to improve efficiency of transport infrastructures

The measure ‘Ensure seamless door-to-door mobility through intermodal integration’ was one of the measures that received a high score for the budget allocation question (20.9%). This measure is perceived by the respondents as a fairly efficient measure with high public acceptance. But it is considered as not very feasible on the technical and financial level (Figure ).

A similar result can be found for the measure ‘Add more public transport access points near employment concentrations’ which received on average 22.5% in the budget allocation question. Again the measure is considered to be efficient to very efficient and public acceptance is expected to be high (Figure ). But for this measure, technical and financial feasibility is higher. So the measure of increasing access points near employment concentrations receives on average the highest budget allocation, is considered to be efficient, acceptable for the public and rather feasible.

The third measure with a rather high score ( $\mu=20.7\%$ ) is the ‘Increase public transport beyond cities and interurban connections measure’-measure. Again the graphs show similar results as for the other high scoring measures (Figure ). Efficiency is somewhat lower than the previous two measures, but it is still considered as being an efficient measure. Also for this measure, public acceptance is rather high according to the respondents. Technically it is somewhat more feasible than the measure on public transport access points and more feasible than the

seamless door-to-door mobility measure. Financially however, this measure is considered to be less feasible than the previous two measures.

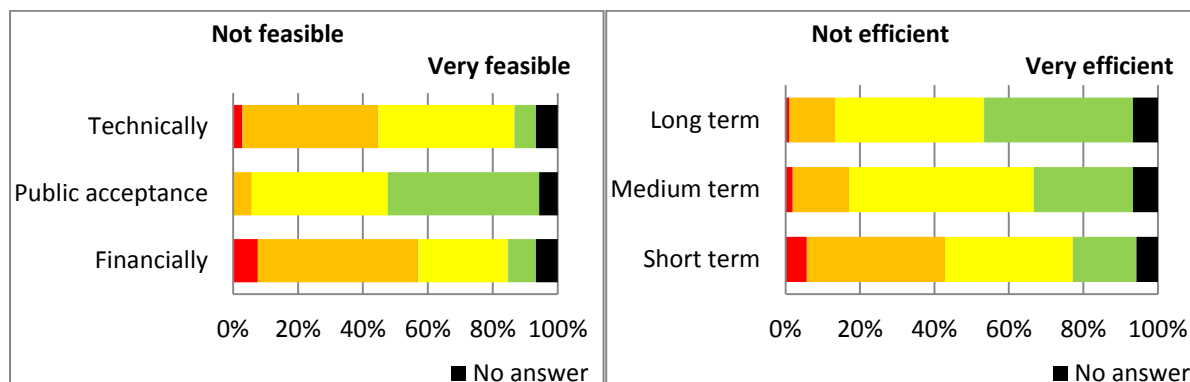


Figure 14: Efficiency and feasibility of the measure 'ensure seamless door-to-door mobility through intermodal integration'

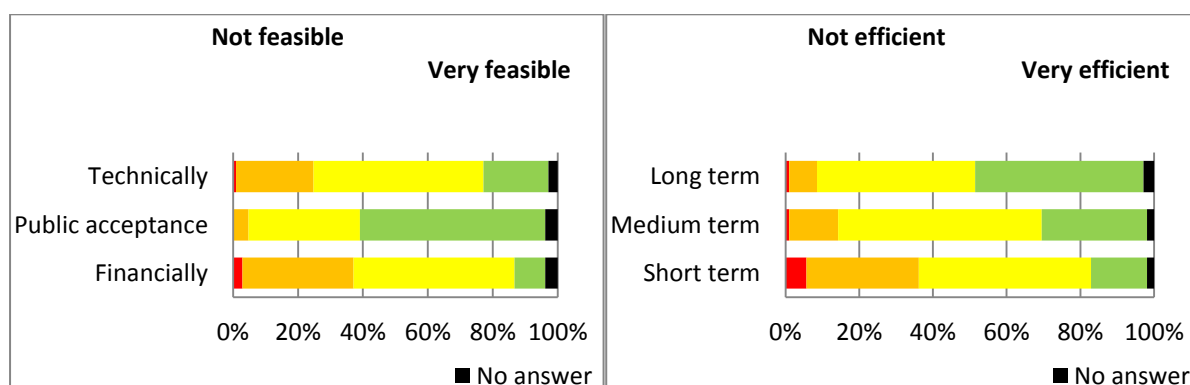


Figure 15: Efficiency and feasibility of the measure 'add more public transport access points near employment concentrations'

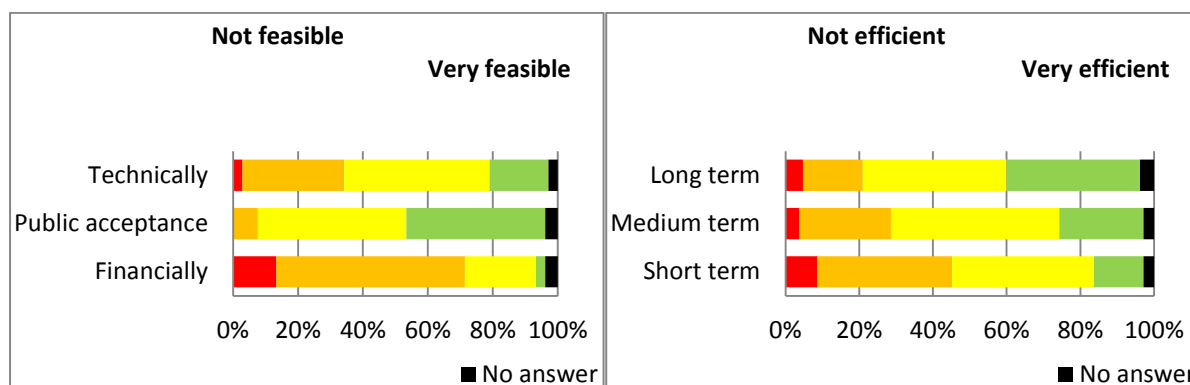


Figure 16: Efficiency and feasibility of the measure 'increase public transport services beyond cities and interurban connections'

Although having a low score, the measure 'Facilitating flexible work hours and compressed work weeks' is considered as being rather feasible and somewhat efficient (17). Still experts are not convinced resources should be used for this measure in order to improve the efficiency of transport infrastructures.

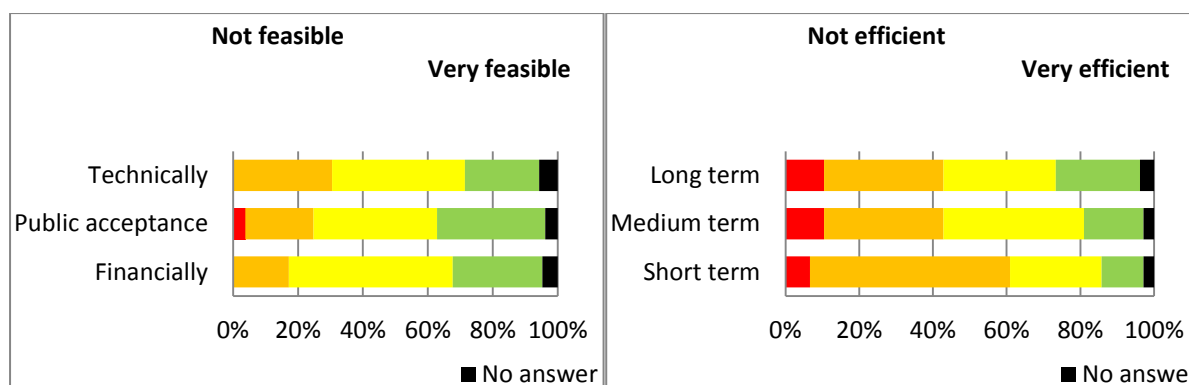


Figure 3: Efficiency and feasibility of the measure ‘Facilitate flexible work hours and compressed work-weeks to decrease congestion’

**e) Decreasing transport needs**

Allocating a budget of 100% tot decrease transport needs, respondents assigned on average a remarkable low budget to the abolishment of mobility subsidies. It can be assumed that this is partly caused by the fact that giving up subsidies isn’t a measure that is very costly.

*Assuming authorities have a total budget of 100% to decrease transport needs. How do you think the expenditures should be allocated?*

	$\mu$	SD
Aim at mixed land use in new urban developing projects	26.0	17.8
Provide tax benefits for building and living in cities	25.1	19.0
Promote teleworking	18.7	18.2
Other	16.6	18.0
Give up all mobility subsidies since it means subsidizing living further away from work	10.2	13.6

Table 4: Mean and standard deviation of budget allocation for measures to decrease transport needs

This is also obvious in the feasibility and efficiency graphs for the measure (Figure 4) which indicates the measure as being financially very feasible, also technically the measure is found to be very feasible. But, as can be expected, public acceptance would be very low. This is however not the full story, since it seems that respondents also indicated this measure as not efficient, which can be another part of the explanation for the low average in the budget allocation question. Since public

acceptance and efficiency is low, this can be considered as not being an interesting measure to decrease transport needs.

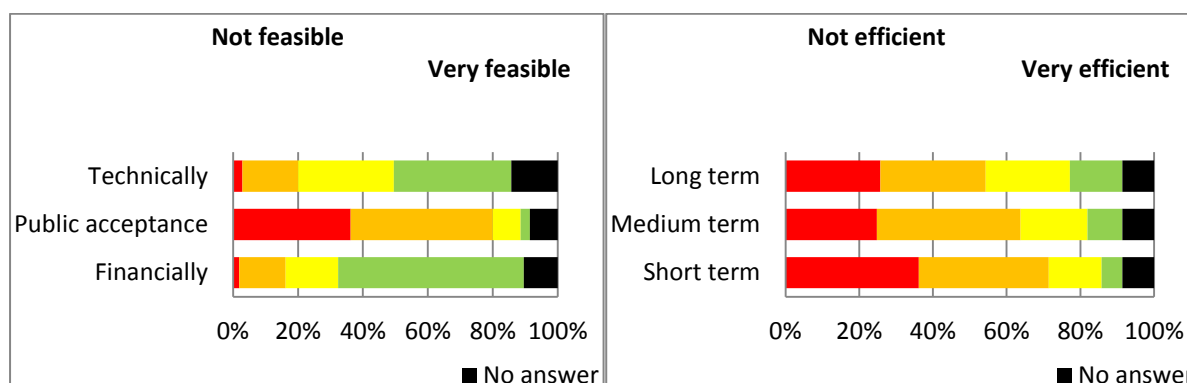


Figure 4: Efficiency and feasibility of the measure 'give up all mobility subsidies since they subsidize living further away from work'

The measure of providing tax benefits for building and living in cities ( $\mu=25.1\%$ ) is not so much considered to be efficient in the short term, yet very efficient for the medium and long term (Figure ). The measure is also considered to be technically feasible and can count on public acceptance. According to the experts, the financial feasibility, however, is problematic.

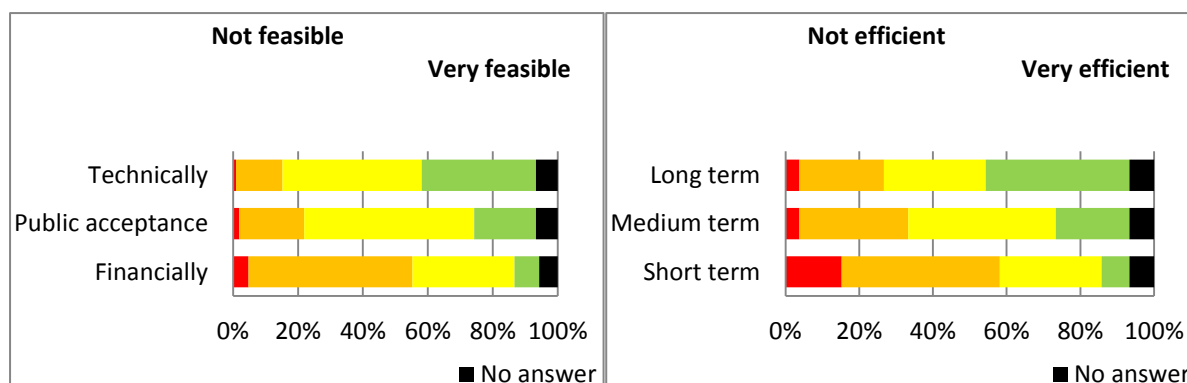


Figure 19: Efficiency and feasibility of the measure 'provide tax benefits for building and living in cities'

The other high scoring measure to decrease transport needs 'Aim for mixed land use in new urban development projects' ( $\mu=26.0\%$ ) has more or less the same results for efficiency, technical feasibility and public acceptance. The respondents give it a good score for financially feasibility as well (Figure).

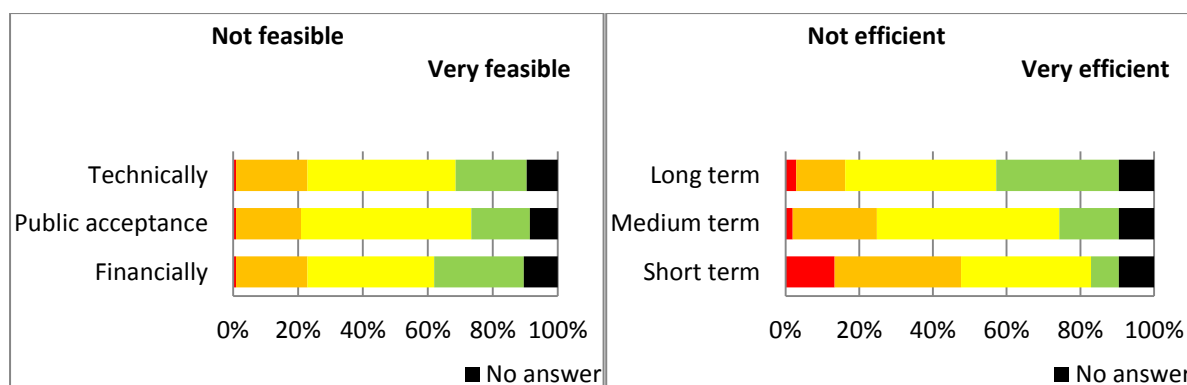


Figure 20: Efficiency and feasibility of the measure 'aim for mixed land use in new urban development projects'

**f) Adapting the transport system and public space for the ageing society**

'Adapting the transport system and public space for the ageing society', scores low (7.7%) in the general 'Improving accessibility'-question, and the response on the different measures show little preference for specific measures. The measure 'Increasing safety in public space', received a little less than the other two measures. The three measures within this theme all had more or less the same graphs for efficiency and feasibility: they are rather efficient with an increase from short to long term, they have high public acceptance and they are technically and financially quite feasible.

*Assuming authorities have a total budget of 100% to adapt the transport system and public space for the ageing society. How do you think the expenditures should be allocated?*

	$\mu$	SD
Ensure, for elderly people, the proximity of residential areas to different services	29.7	15.8
Adapt access to places and to transport services	29.3	14.3
Increase safety in public space	22.7	16.2
Other	13.5	17.4

Table 5: Mean and standard deviation of budget allocation for measures to adapt the transport system and public space for the ageing society

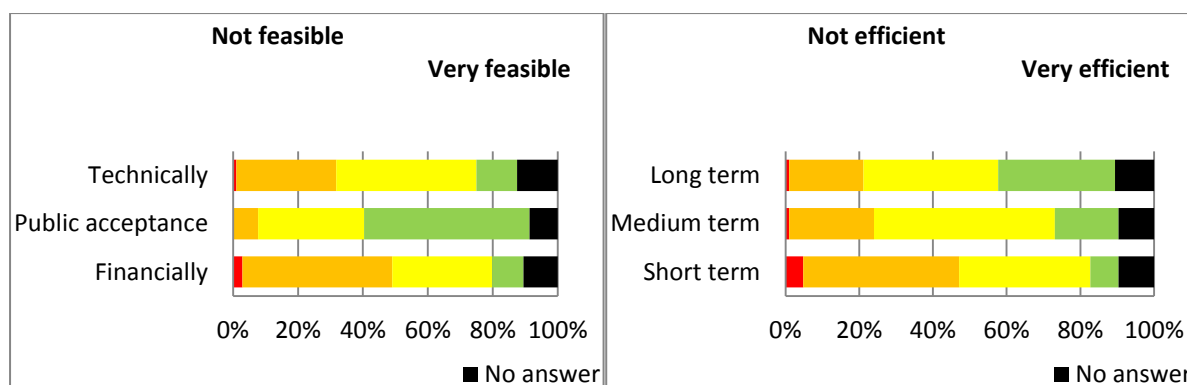


Figure 21: Efficiency and feasibility of the measure 'Ensure the proximity of residential areas to important services for elderly people'

### 2.4.3 Additional comments and suggestions

#### a) General comments on the survey

- "For feasibility, one should maybe include the political feasibility apart from technical and financial feasibility and public acceptance";
- "The allocation of a budget doesn't incorporate the consequences of choosing for money making measures";
- "The questions are very oriented (ed. "biased") and too "positive", furthermore they are too much based on technical measures and not enough on other types of measures to influence behaviour";
- "In the parts on "public transport" and on "non-motorised transport" and "ageing" there is no question on more flexible solutions";
- "The list of measures is limited and rather "public transport" oriented";
- "The answers on the budget questions are importantly influenced by the knowledge of the respondents on the cost ratios between the proposed measures";
- "The first part on the investment measures is very ambiguous because some measures don't require much (or any) investments, others are very expensive";
- Ok for the analysis of mobility and displacements but beware of depopulation of the rural areas and of the mentality of people.

#### b) Additional measures

- "For elderly and handicapped persons: instead of subsidizing the supply, subsidize the demand";
- "Limiting free care use during leisure time (company car) would make a difference. There is no such thing as free mobility";
- "Internalisation of the real (=external) costs of transport is a very efficient tool to influence modal choice";

- *“Important measure missing: increase taxes on the use of cars and freeways”;*
- *“For the development of more non-motorized mobility, creating an appropriate infrastructure is not in the proposals although this is crucial”;*
- *“The policy priorities are reflected in the public spending more than in the discourses. Massive investments are needed to meet the increasing demand for public transport”*
- *“To improve mobility :*
  - *discourage the use of cars in the city through increased parking prices and reduced space for cars*
  - *bus priority lanes*
  - *reduce the cost of public transport*
  - *more punctual public transport*
  - *develop teleworking”.*

### **c) Interesting examples, cases and websites**

#### **Examples and cases**

- *“In many ways Bordeaux can be considered as a 'best practice'. A qualitative tram without a negative impact on the historic environment (no electricity and cables, piles etc. in the street). A quay aimed at an active experience with emphasis on the active road user. A large pedestrian zone and consistent qualitative street furniture, bike passes throughout the city, the use of shared bicycles, electrical busses etc.”*
- *“I continue to be amazed that projects like Houten (NL) or Freiburg/Tübingen (D) are not being implemented in Belgium. I also believe that the standards of the RSV (Ruimtelijk Structuurplan Vlaanderen) are too low with its 25 homes per hectare in urban areas. A little Dutch town goes to 60 or 80 homes per hectare without affecting the quality of life. There is no better way to encourage public transport, biking and walking than living compact.”*
- *“The development of a slow road network can in rural and urban contexts lead to a dense transportation network for non-motorized trips. The cost of construction and maintenance are significant but relatively low compared to other infrastructure related solutions.”*
- *“Bad practise examples such as taxi stands often too far away from train stations, makes one wonder if there is lack of awareness or lack of competence concerning accessibility in the urban planning field.”*

#### **Websites**

- [www.toegankelijkeomgeving.be](http://www.toegankelijkeomgeving.be): Website of the Flemish government with policy, DOD-principal (Doorgangen-Oppervlak-Drempels), Vademecum and different projects related to the accessibility of the public domain.



- [www.bleu-bike.be](http://www.bleu-bike.be): Website for using shared bikes at station environments.
- [www.tragewegen.be](http://www.tragewegen.be): Trage wegen is a thematic environmental association to support the development and revaluation of roads mainly or only used by non-motorized traffic.
- [www.komimo.be](http://www.komimo.be): Komimo is the umbrella organization of nine Flemish mobility groups which strive together for a more sustainable mobility.
- <http://www.iewonline.be/spip.php?article3823>: Article on budgets of Walloon mobility by the Inter-Environment Federation of Wallonia.
- [www.are.admin.ch](http://www.are.admin.ch): Federal Office for Spatial Development ARE of the Swiss Confederation:
  - <http://www.are.admin.ch/themen/verkehr/00256/04271/>: Description of the methodology used to determine classes in Switzerland's public transport service (Desserte et accessibilité en Suisse p.8-12).
  - <http://www.are.admin.ch/dienstleistungen/00904/01393/01932/>: The Web-GIS with the cartography of the classes and the population density
  - <http://www.are.admin.ch/themen/raumplanung/00228/00274/03672/>: Statistics on the relation between the standards and the effective supply of transport in all Swiss cantons (Statistique suisse des zones à bâtir 2007, p.61-67)
  - <http://www.are.admin.ch/themen/agglomeration/00626/01680/>: Recommendations of ARE on the relationship between transport service and urbanization (Concept pour un développement urbain vers l'intérieur).

## 2.5 Discussion during the first workshop and conclusions

First of all it can be noticed that there is little or no interest in measures for an ageing society. One could ask whether this indeed indicates that these measures are not considered to be important or whether there is an unawareness of the need for specific measures for elderly. In the discussion during the workshop one mentioned that age and gender of the respondents were not asked in the survey and that if the respondents are in general rather young, it could have an effect on the response for the theme of measures for elderly. Although there is some truth in this comment, it may be irrelevant for the conclusions of the survey, since the respondents are the experts involved in policy preparation, support and implementation. If there is no awareness due to the age of these experts, this is still a problem because it will be reflected in the policy and measures implemented.

Another general remark is that it seems that efficient measures are often technically and financially unfeasible or have little public acceptance. Especially for the efficient

measures with low public acceptance one could ask what the underlying problem is. Maybe people don't feel involved? Awareness is important. Young people for example may not be fully aware of the accessibility problems of the elderly. One could think for example of traffic lights not adapted for the crossing time of elderly pedestrians.

A rather high priority is given to stimulating mixed land use in order to stimulate non-motorized transport and to decrease transport needs. It is hard to draw conclusions for the entire country considering the large differences in land use. For example the accessibility of cities (e.g. Brussels) is not comparable to rural areas. Furthermore, from the survey it appears that changing land use is unfeasible and is considered to be unrealistic. Nevertheless, the past few years a lot of things happened with a important impact on the land use.

The measure considered to be the most efficient and feasible is to simplify intermodal ticketing. The recent announcement of the MOBIB chip card, which would make intermodal ticketing easier can be seen as a step in the good direction. Other measures that were found to be rather efficient and technically and financially feasible are the reduction of the benefit of company cars and the provision of dedicated lanes and priority at traffic signs for public transport. Both these measures however, have a much lower public acceptance. Especially the reduction of the benefits of company cars scores very low on public acceptance.

The response to the survey may be biased. People may have given tactical answers, e.g. measures that would lead to higher taxes could be automatically indicated as being inefficient. Although this could be true, the profile of the respondents, namely experts and scientists, should minimise this type of bias. The response may still be biased; respondents may be experts, but focussed on a few aspects, limiting the value of their response on other aspects. This is compensated by: 1) the composition of the respondent group, and 2) the combination of questions on the overall balance between aspects, and questions on efficiency and feasibility per aspect.

### 3 CASE STUDIES

#### 3.1 Case study: Local environment, walkability and the health of the elderly in Brussels

## Local environment, walkability and the health of the elderly in Brussels

Claire Dujardin<sup>a</sup>, Annabelle Aubert, Vincent Lorant<sup>b</sup>, Isabelle Thomas<sup>a</sup>

<sup>a</sup> CORE, UCL

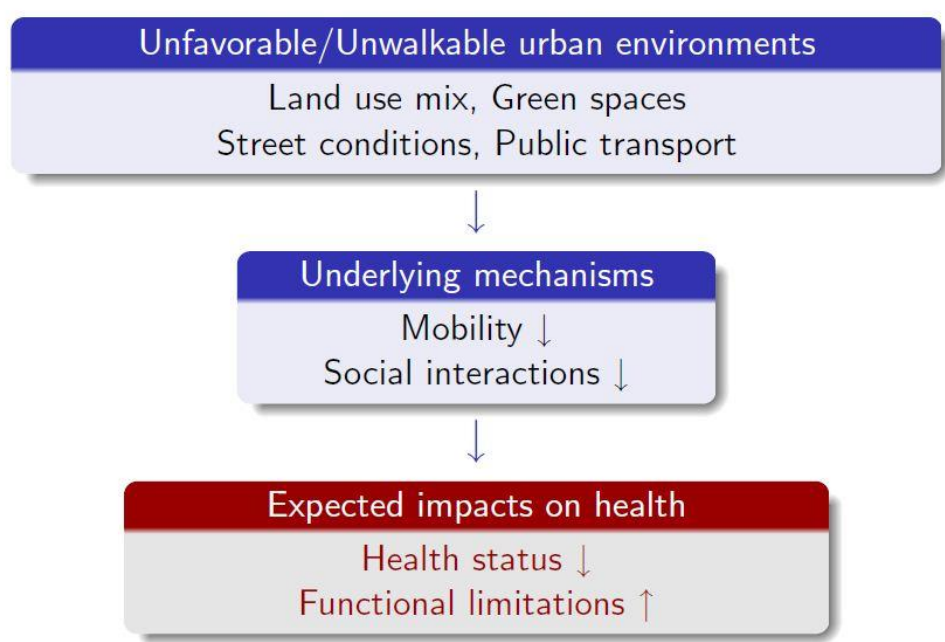
<sup>b</sup> Institute Health and Society, UCL

INTERACT 2nd Workshop - Brussels, November 28, 2011



## Motivation

- Context : ageing society
  - Increasing health risks : chronic disease, disability → dependence
  - Physical activity (walking) can reduce this risk
  - Role of public policies : to preserve the **mobility** and autonomy of the elderly
- Place effects on health
  - $Health_i = f(\text{individual characteristics, neighborhood environment})$
  - Particularly relevant for the elderly : functional and mental decline → reduced mobility and social contacts → greater dependence to the neighborhood environment
- Objectives
  - Does the neighborhood environment influence the health of the elderly ?
  - Case study : Brussels-Capital Region



## Data

- Spatial context : Brussels-Capital region (19 communes)
- Socio-Economic Survey 2001 (from TAHIB)
  - Exhaustive, individual level
  - Self-rated health, functional limitations, etc.
  - Satisfaction with the local environment (sidewalks, public transport, green spaces, etc)
  - Location : statistical ward
- Geographic data (GIS)
  - Land registry data 2009 (from SUSTAIN CITY)
    - Polygons for plots and buildings
    - Land use type ('nature cadastrale')
  - Urbis data 2009 (from SHAPES)
    - Street network (segments and nodes)
    - Green spaces
  - EROS : Land surface elevation

Introduction ○○○	Data and methods ○○●	Some maps ○○○	Results ○○	Conclusion ○○
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## How we measure the built environment ?

- Subjective measures : perceived environment (ESE 2001)
  - 3 measures : % of households not satisfied with sidewalks (+), public transport (+), green spaces (+)
  - Potential problem : people who under-evaluate their health often under-evaluate their environment
- Objective measures : based on GIS data (Urbis, Land Registry, EROS)
  - Green spaces : Area of green spaces in a 500m radius (-)
  - Land Use Mix :
    - % of residential land in total area (+)
    - Shannon index (for 6 categories : residential, employment, commercial, institutions, leisure, other) : 0 : homogenous - 1 : equal mix (-)
    - net retail ratio : retail building area/plot area (-)
  - Street network :
    - Street connectivity : density of crossroads per km<sup>2</sup> (-)
    - Slope : mean slope along street network (+)

(+)/(-) means : expected to increase/decrease poor health

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			Conclusion ○○

## Method

- A model of poor health on the basis of individual data
- Logistic regressions of poor health

$$\text{Log}\left(\frac{P_{ij}}{1 - P_{ij}}\right) = \alpha + \beta \text{Ind}_i + \gamma \text{Built}_j + \lambda \text{Income}_j$$

$P_{ij}$  : Probability of being in poor health for ind. i residing in neighb. j

$\text{Ind}_i$  : Individual confounders (age, gender, education, citizenship, single)

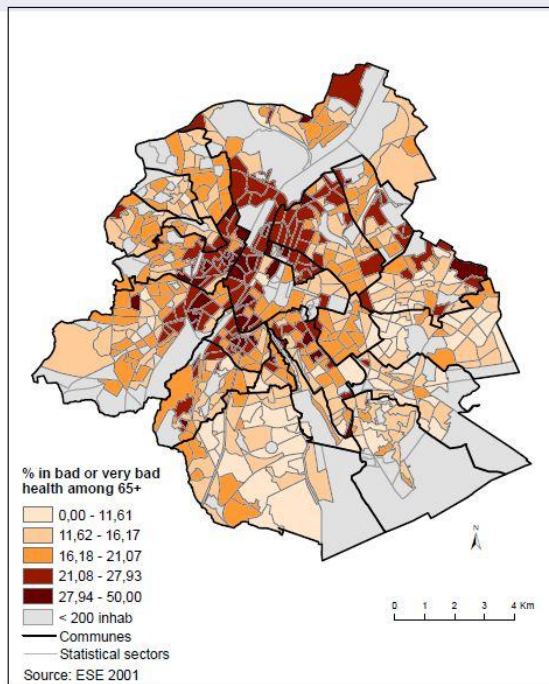
$\text{Built}_j$  : Characteristics of the built environment in the neighborhood  
 (only one at a time!)

$\text{Income}_j$  : Median income in the neighborhood

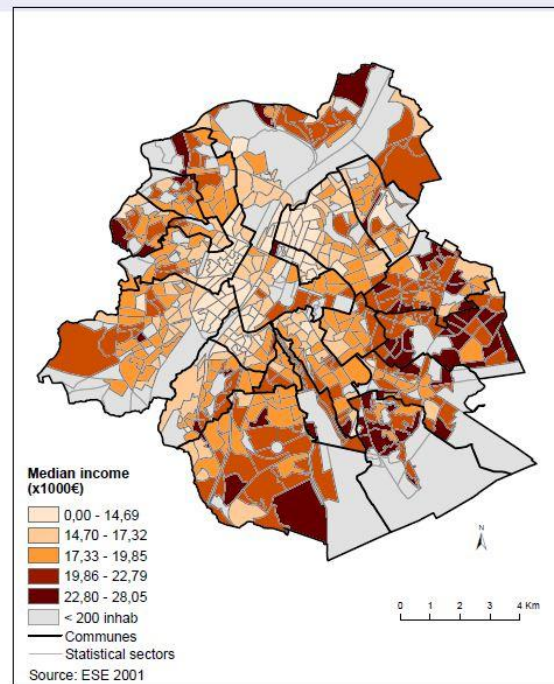
- Separate regressions by income group (3) : to better isolate the effect of the built environment
- Studied population : aged 65+ residing in BCR (+/- 135 000 individuals)

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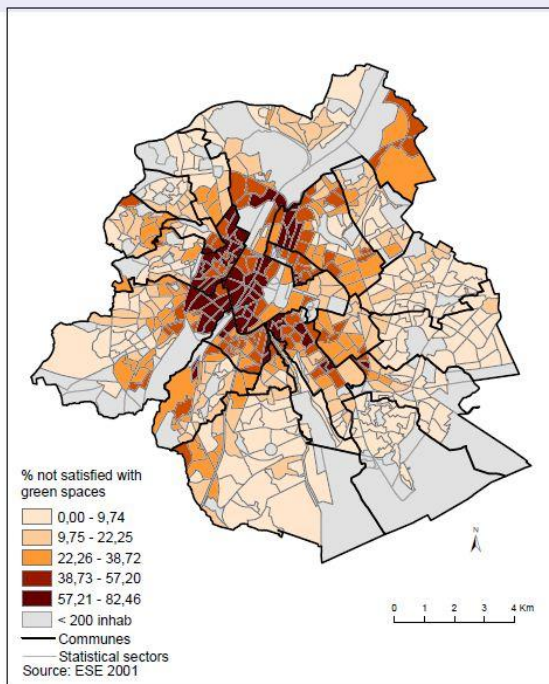
### Health of the elderly



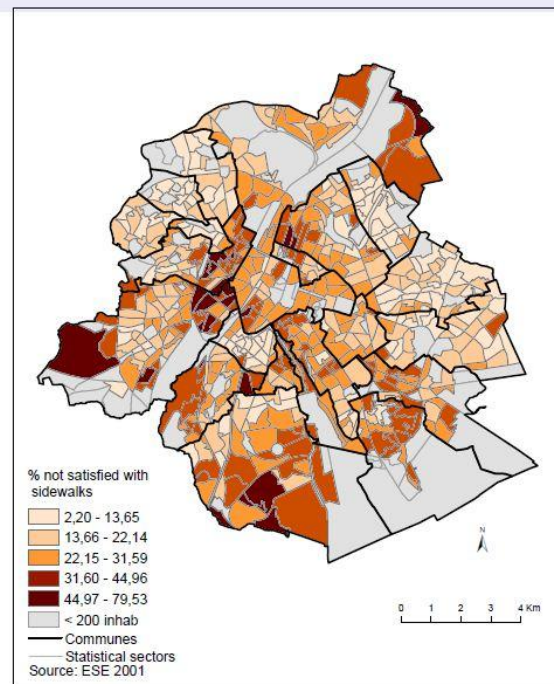
### Median Income

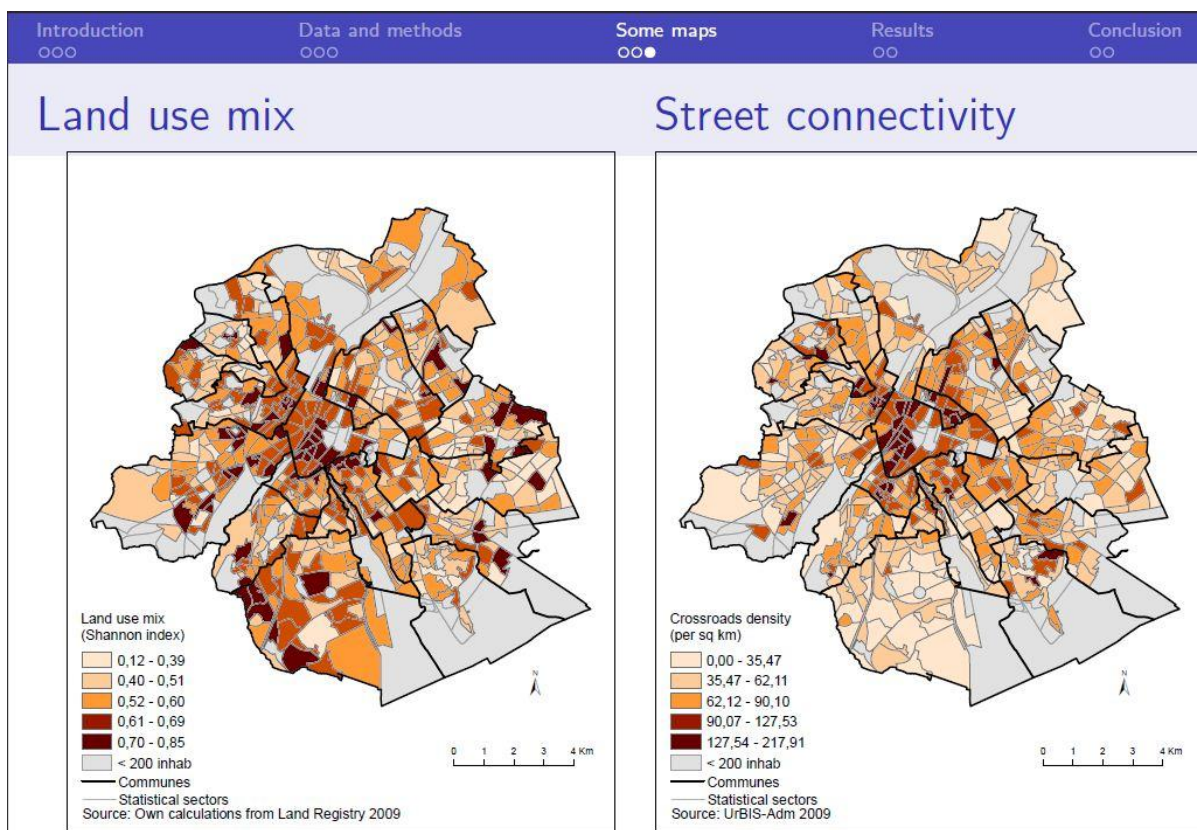


### Green spaces



### Sidewalks





## Results : two detailed examples

### Effect of dissatisfaction with sidewalks (Hyp : > 1.00)

Outcome	(1)	(2)	(3)	(4) Stratified by income		
				Low	Medium	High
P(bad health)				Yes	Yes	Yes
Indiv. controls	No	Yes	Yes	-	-	-
Income	No	No	Yes	-	-	-
Sidewalks	1.007***	1.004***	1.001	1.002*	1.004***	0.997

### Effect of dissatisfaction with public transport (Hyp : > 1.00)

Outcome	(1)	(2)	(3)	(4) Stratified by income		
				Low	Medium	High
P(bad health)				Yes	Yes	Yes
Indiv. controls	No	Yes	Yes	-	-	-
Income	No	No	Yes	-	-	-
Public Transp	0.993***	0.997***	0.999	1.010***	0.995**	0.995**



## Results : main findings

	Poor health				Funct. limitations			
	All	Low	Med	High	All	Low	Med	High
<b>Subjective measures</b>								
Ins. Sidewalks	ns	Y	Y	ns	ns	Y	Y	ns
Ins. Public transp	ns	Y	X	X	ns	Y	X	X
Ins. Green spaces	Y	ns	Y	Y	ns	ns	Y	Y
<b>Objective measures</b>								
Green space area	ns	X	Y	X	X	X	Y	X
Land use mix								
% residential	X	X	X	ns	X	X	X	ns
Shannon index	ns	ns	ns	ns	(x)	(x)	(x)	ns
net retail ratio	X	ns	X	X	X	X	(y)	X
<b>Streets</b>								
Connectivity	(y)	Y	(x)	ns	(y)	Y	(x)	ns
Slope	ns	ns	ns	X	ns	X	X	ns

## Discussion

- Hypotheses only partly verified
  - Poor **sidewalks**, **public transport** ↓ health in low income neighb.
  - Few **greenspaces** ↓ health in med-high income neighb.
  - Low network **connectivity** ↓ health in low income neighb.
  - No effect for land use mix, slope
- Most often, **socioeconomic structure** dominates
  - How to separate income/socio-economic determinants from environmental determinants?
  - Specific structure of Brussels
- **Missing data** : perhaps, effect on mobility and physical activity but not on health?
- **Potential bias** : elderlies quit their neighborhood in case of unfavorable environment?

Introduction ○○○	Data and methods ○○○	Some maps ○○○	Results ○○	Conclusion ○●
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## Further research

Need more specific data

- Longitudinal data on life and residential trajectories for elderlies ...
- Specific surveys on elderlies on their daily moves ...
- ... but at a fine spatial scale (neighborhood)!

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## 3.2 Case study: The analysis of train station environments through video image analysis

### 3.2.1 Data acquisition

In order to analyse the behaviour and interactions of people in a station environment, the use of video images is tested. The advantage of using video, is that the images can be re-examined several times, and interpreted by different observers. The recordings were made at eye-level ( $\pm 1.60\text{m}$ ). While the tracking of paths is easier on bird's-eye images, the eye-level perspective has the advantage of allowing the observer to see the behaviour, reactions and interactions of people.

Simultaneous recordings were made with 3 video-cameras, all three with a different angle and set up to have a minimum of blind spots and overlap areas, in order to correspond to a realistic human eyeshot (figure 22, 23). Afterwards, the images are displayed on three different screens, whereby distortions in the total image are minimized by giving the screens the same angle as the relative camera angles (figure 24). Recordings were made at five locations: three in the Leuven stations area and two in the Antwerp station area. Every recording has a length of approximately one hour.

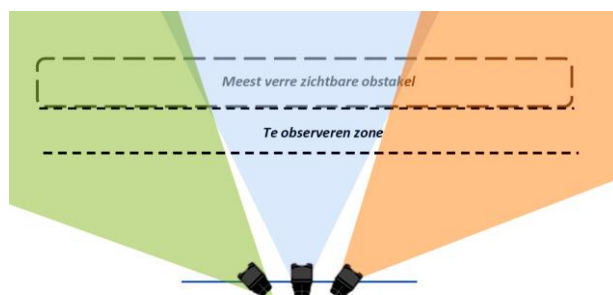


Figure 22: Angles for camera positions minimise blind spots and overlaps



Figure 23: Concatenation of 3 pictures of the Leuven station environment



Figure 5: Panorama of the recorded images, synchronous on three screens.

### **3.2.2 Analysis of the video images**

#### **a) General observations**

In a first phase a general observation gives an overall idea of the major flows and their obvious characteristics (e.g. fluidity, stops, facilities, obstacles, user groups, mixed vs. single use of public space, obvious signs of irritations...). As such an image is formed of what goes well in the situation and what doesn't.

#### **b) Zones**

Once a general image of the environment is formed, zones are demarcated to proceed with a more systematic and quantitative approach. It is hard to give a general description for the demarcation of these zones since every context is different. The demarcated zones should be comparable in size and have specific use or users. Most important is that one can explain why and how the zones were demarcated.

After demarcating the zones, they are described and the description is geo-referenced, for example by linking it to an overview map or areal photo (e.g. the large scale base map of the area, mobile mapping images, aerial photography, ...) This reference is later used to add important infrastructure, obstacles or points of interest. This infrastructure is also described, with particular attention for infrastructure related to activities (signalization, waiting facilities, restaurants, terraces...) as well as infrastructure related to target groups (signalization for blind people, specific parking spots, elevators, modified crossing places...) and can be added to the map.

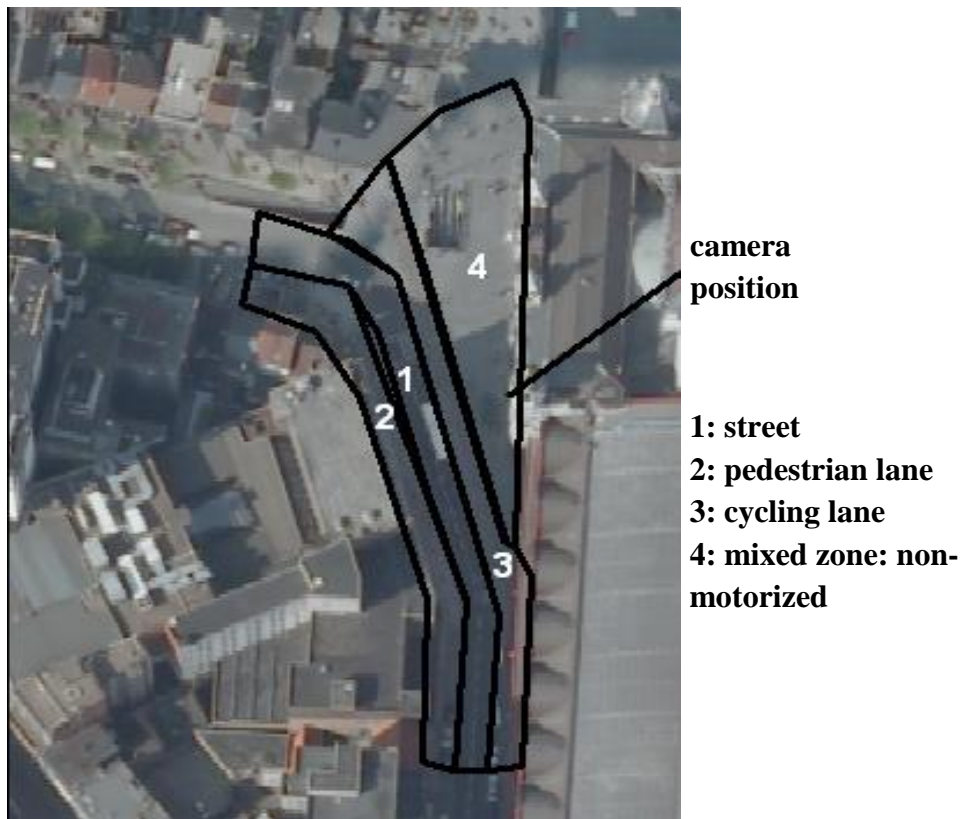


Figure 6: Demarcated zones in the Antwerp station environment  
Source: AGIV – WMS Testbed 2010

### **c) Counting**

After the zones are demarcated, the number and type of road users are counted. Every five minutes the video is paused and an observer counts the different road users in every zone by filling in a spread sheet for every different zone. In another spread sheet all activities of different road users are noted.

<b>Antwerpen: A: Zone: A4</b>										
<b>Road user</b>	<b>0'</b>	<b>5'</b>	<b>10'</b>	<b>15'</b>	<b>20'</b>	<b>25'</b>	<b>30'</b>	<b>35'</b>	<b>40'</b>	<b>45'</b>
<b>Pedestrian</b>	13	13	20	27	13	15	22	27	28	21
Blind & impaired										
Child			1	1	1	1		2	3	
Youngster	1					1				
Adult	12	13	19	25	12	14	22	25	25	21
Adult with stroller					1					
Adult with child			1	1	1	1			3	
Elderly										
Disabled			1							
<b>Wheelchair</b>										
<b>Car</b>										
<b>Van</b>										
<b>Cyclist</b>		1		1	1	2	2	1		2
Child										
Youngster										
Adult		1		1	1	2	2	1		2
Adult with stroller										
Adult with child										
Elderly										
Disabled										
Bike on hand					1					1
<b>Cab</b>										
<b>Bus</b>										
<b>Motor(cycle)</b>										
<b>Truck</b>										
<b>Tram</b>										
<b>Total</b>	<b>13</b>	<b>14</b>	<b>20</b>	<b>28</b>	<b>14</b>	<b>17</b>	<b>24</b>	<b>28</b>	<b>28</b>	<b>23</b>

Table 6: Counting table for different road users in the specific zone

	Antwerp: A4					Type: Pedestrian				
Activity	0'	5'	10'	15'	20'	25'	30'	35'	40'	45'
Sidewalk/walking	13	13	14	22	11	14	20	24	24	18
Sidewalk/standing			6	5	2	1	2	3	4	3
<b>Total</b>	<b>13</b>	<b>13</b>	<b>20</b>	<b>27</b>	<b>13</b>	<b>15</b>	<b>22</b>	<b>27</b>	<b>28</b>	<b>21</b>

	Antwerp: A4					Type: Cyclist				
Activity	0'	5'	10'	15'	20'	25'	30'	35'	40'	45'
Riding		1		1			2	1		1
Walking with bike					1	2				1
<b>Total</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>2</b>

Table 7: Counting table for the activities of different road users in the specific zone

#### d) Density and mixture maps

These counts are used to make density and mixture maps. The density map illustrates the amount of people within a certain zone at a certain time. Sequences of these maps can give an idea of the evolution of the density in particular zones. A mixture map shows the amount of different categories at a certain time. Again, sequences can be made to visualize evolution.



Figure 7: Density maps for the station area of Antwerp. Every map is a snap shot with a time difference of approximately 5 minutes. The gray values increase in darkness with increasing density.

<b>Zone</b>	<b>0'</b>	<b>5'</b>	<b>10'</b>	<b>15'</b>	<b>20'</b>	<b>25'</b>	<b>30'</b>	<b>35'</b>	<b>40'</b>	<b>45'</b>
<b>1</b>	5	6	3	7	21	2	4	1	6	10
<b>2</b>	10	7	14	10	2	10	5	11	6	8
<b>3</b>	6	12	1	2	3	1	5	2	6	1
<b>4</b>	13	14	20	28	14	17	24	28	28	23

Table 8: Amount of road users in every zone in the station area of Antwerp





Figure 8: Mixture maps for the station area of Antwerp. Every map is a snap shot with a time difference of approximately 5 minutes. The colour value increases with increasing density.

<b>Zone</b>	<b>0'</b>	<b>5'</b>	<b>10'</b>	<b>15'</b>	<b>20'</b>	<b>25'</b>	<b>30'</b>	<b>35'</b>	<b>40'</b>	<b>45'</b>
<b>1</b>	3	2	1	3	4	2	1	1	2	4
<b>2</b>	2	1	2	1	1	1	1	1	1	1
<b>3</b>	2	2	1	1	1	1	1	2	1	1
<b>4</b>	1	2	1	2	2	2	2	2	1	2

Table 9: Number of different types of road users in every zone in the station area of Antwerp

**e) Focus on interesting zones/times**

When density and mixture are determined for every time step for every zone, interesting zones or moments are chosen for further analysis. Zones that score high on the density (in our Antwerp example higher than 20) and zones that have some mixture or road users are probably the most interesting.

Antwerp A: Density and mixture										
Zone	0'	5'	10'	15'	20'	25'	30'	35'	40'	45'
1	1	1	0	1	2	1	0	0	1	1
2	1	0	1	0	0	0	0	0	0	0
3	1	1	0	0	0	0	0	1	0	0
4	0	1	0	2	1	1	2	2	1	2

Table 10: Density and mixture for every time step in every zone. 0 means low density and no mixture, 1 means mixture or high density, 2 means mixture and high density. Most interesting zones are zone 1 and zone 4. For zone 1 minute 20 is selected, for zone 4 more choices are available. The final choice can then be based on the original counting sheets.

For the chosen zones and moments an analysis of conflicts of near conflicts is done. If a conflict or near conflict is found, conflict sheets describing the circumstances and the relation with the infrastructure are filled out. Since the interpretation is based on images, only visible causes can be recorded. To avoid subjective interpretation of the situation, several (at least 3) people were asked to interpret the same images and only unanimous interpretations were retained.

Cause of the conflict	
- Careless, reckless or in a hurry	<input type="checkbox"/>
- Mixed user lanes	<input type="checkbox"/>
- Impaired by alcohol	<input type="checkbox"/>
- Inadequate drainage - wet paving	<input type="checkbox"/>
- Obstacles, holes or unevenness of roads or pavements	<input type="checkbox"/>
- Failed judgement of a vehicle's path or speed	<input type="checkbox"/>
- Dangerous actions in carriageway (e.g. playing)	<input type="checkbox"/>
- Failed to look properly	<input type="checkbox"/>
- Vision impaired by temporary obstacle (car, truck, container etc.)	<input type="checkbox"/>
- Absence of necessary facilities (no sidewalk, pedestrian crossings, bicycle lane etc.)	<input type="checkbox"/>
- Maladjusted facilities (high curbs, poor pedestrian crossing, insufficient lightning etc)	<input type="checkbox"/>
- Inadequate information for road users	<input type="checkbox"/>
- Steep slopes	<input type="checkbox"/>
- Wrong use of the facilities	<input type="checkbox"/>
- High motor traffic volumes	<input type="checkbox"/>
- Lack of places to rest, lack of convivial places	<input type="checkbox"/>
- Bad air quality, bad smells, high noise level	<input type="checkbox"/>
- Social insecure place	<input type="checkbox"/>
- Lack of public toilet	<input type="checkbox"/>
- Lack of protection against weathering	<input type="checkbox"/>
- Other:.....	<input type="checkbox"/>

Table 2: Causes of conflict

Source: Adapted from Hector Monterde I Bort et al (2010) COST 358 Pedestrians' Quality Need Final Report – part B1: Documentation – Functional Needs.

#### **f) Focus on interesting target groups**

Based on the previous counting and analysis, apart from interesting moments and zones, interesting road users can be chosen. Interesting meaning that these road users are more likely to have more difficulties in traffic. In our example these were a disabled. These targets were followed during the movie to see if there are any conflict situations.

*The disabled person for example, is dropped off by a taxi and walks to the train station. The target has no conflicts on his way with other road users, infrastructure or (temporary) obstacles; however the taxi had to stop at a location where it is prohibited.*

#### **g) Conclusion on conflicts**

Once interesting zones, moments and target groups are observed. General conclusions on the conflicts in the train station area can be made.

In our example, zone 3 and 4 had most conflicts. In both zones there is a mix of cyclists and pedestrians. There is enough space for both road users and as such, there were only near conflicts. Most near conflicts were near crossing zones. In both zones, pedestrians prevail over cyclists. The most important obstacle is a café-terrace, that creates a bottleneck. Wrongly parked bicycles and a metro information sign didn't create conflicts. Furthermore, there are enough resting places, which don't conflict with the moving traffic.

Zone 1 does not create any conflicts: the crossing of the road by pedestrians is regulated through traffic lights which were followed correctly.

Zone 2 is a sidewalk zone with only pedestrians and as such, no immediate problems could be found.

#### **h) Summary of findings**

In our example the station environment has no major accessibility problems for less mobile road users (disabled persons, adults with children or stroller, wheelchair users etc.). In front of the station two zones (3 and 4) generate conflicts among road users. In both zones there is a mix of cyclists and pedestrians which often leads to near conflicts. A second conflict zone is a pedestrian crossing where pedestrians have waiting for the green light obstruct the passage for cyclists. This leads to irritations for both pedestrians and cyclists.

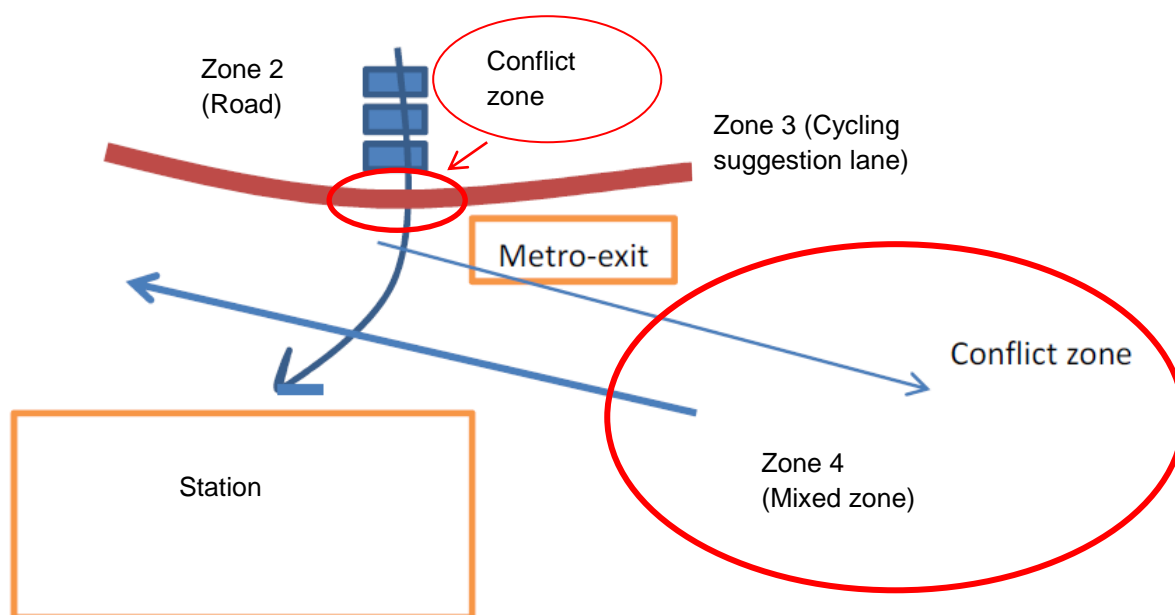


Figure 28: Conceptual drawing with the conflict zones at the Antwerp station environment

### 3.3 Discussion during the second workshop and conclusions

The studies on “Local environment, walkability and the health of the elderly in Brussels” and “The analysis of train station environments through video image analysis” were presented to experts in the final workshop, November 10, 2011 at the premises of the Federal Science policy in Brussels. These presentations were followed by a debate, of which the main issues are summarised here.

Accessibility should be clearly defined. The topic is very vast and needs to be further refined to identify different aspects which can be dealt with through different means. The current research focuses mainly in physical accessibility issues.

Other issues such as perception of safety, comfort and amenity, ... of an environment also affect apprehensions of people and the attractiveness of locations for different target groups. This can be researched through user defined methods, such as surveys and interviews. These are needed for a demand activation approach: how can surroundings be adapted to the wishes of the people?

Privacy issues may be problematic when using video images taken in public places. Although permission was obtained from the cities where the recordings were made, permission actually has to be given on an individual basis. Even if used only for research purposes, individuals need to be unrecognizable on all the images. All identifiable information (license plates, ...) needs to be carefully removed prior to publication.

An important remark made was that this research does not include people who don't use the station environment. Maybe there are people that avoid the station environment and then the question is why they are avoiding it.

This type of video analyses could also be used to assess how well shared space functions in reality, and make recommendations for the design and construction of public spaces. This would still need to be discussed with stakeholders to find a consensus on solutions acceptable to all.

The video images can clearly show problems due to the design of public spaces. The problems may be due to the design, or due to improper behaviour. The potential for the analysis of (unexpected) behaviour of road users based on video images, should be further explored.

This type of micro analysis could be performed near places such as stations, before redesign and building projects.

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